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**Developments in Polish trade with
the European Union and Germany since transition**

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Ph.D. Thesis

**Thesis submitted in partial fulfilment for the
degree of Doctor of Philosophy at the
Faculty of Social Sciences of the University of Glasgow**

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David Christopher Clowes

List of Abbreviations

CE:	Central European Countries
CEFTA:	Central European Free Trade Area
CMEA :	Council for Mutual Economic Assistance
COCOM:	Coordinating Committee for Multilateral Export Controls
DM:	Deutsche Mark
EBRD:	European Bank for Reconstruction and Development
EEC:	European Economic Community
EU:	European Union
FDI:	Foreign Direct Investment
GDI:	German Direct Investment
GDP:	Gross Domestic Product
IIT:	Intra-industry trade
IMF:	International Monetary Fund
NATO:	North Atlantic Treaty Organisation
OECD:	Organisation for Economic Co-operation and Development
RCA:	Revealed Comparative Advantage
SEM:	Single European Market
SI:	Export Specialisation Index
SITC:	United Nations Standard International Trade Classification
UK:	United Kingdom
UN:	United Nations
UNCTAD:	United Nations Council for Trade and Development
UNECE:	United Nations Economic Commission for Europe

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Introduction

In 1989 the people of Poland voted for democracy, rule of law and for substantial economic change. This followed more than forty years of communist rule, which isolated the country from world economic forces and, through the absence of competition, led to industrial backwardness and deteriorating living standards. A change in this position could only be facilitated through their entry into the regional (EU) and world economies. The EU, along with the US-Canadian and Asian trade blocs make up the triad regions of the world and together constitute the most developed areas. These three regions, as a result of their technological achievements, have become the main participants in world trade and the chief suppliers of direct foreign investment. This position has intensified following the integration of new countries into the world economy, such as the Asian economies, Latin America and the former planned economies of Eastern Europe. Each of these has been engaged in negotiations that will eventually lead to membership of their respective regional trade blocs. For the new entrants, this necessitates that measures are taken to liberalise their domestic economies in terms of trade and foreign investment. On the trade side, liberalisation enables new destination markets to be found for a country's exports while, at the same time, facilitating the import of capital goods, which play a central role in a country undergoing economic reconstruction and development. Foreign investment is equally important, since investors introduce new technology, know-how, information, revenue and competition into the recipient countries. This is motivated by certain incentives, which allow investors to gain access to the regional market, the local labour force and, therefore, the opportunity to benefit from increased regional trade opportunities with preferential tariff treatment.

Through the analysis of Poland's trade developments with the EU, our aim in this work is to establish in how far these relations have benefited Poland in terms of its restructuring and development objectives during the 1990's. Given that much of the country's industry was oversized, outdated and, therefore, inefficient at the outset of reform, measures would need to be taken to expose the economy to trade and foreign direct investment (FDI). This was necessary for the country to import more up-to-

date technology and to attract foreign capital into the market. In terms of the former, the initial and most important step taken by Poland was its negotiations with the EU, which have led to greater economic and political relations between the two partners as well as the signing of the Association Agreement. The actual conditions on trade, which come under the heading of the "Interim Agreement," were a significant part of the agreement (Chapter two). In respect of the latter, attracting foreign capital into the market, which is necessary for modernisation reform and the development of exports, would require stable conditions in the macroeconomic, legal and political spheres as well as the provision of incentives to investors (Chapter four). The significance of trade for investors as well as the extent of change in Poland's domestic conditions will be discussed and compared in chapter five.

The central question in this research is to ascertain whether the liberalisation of Polish trade with the EU has proven to be a mechanism for growth and development. To address this question this research is made up of five chapters, which will address the developments in trade and investment from a theoretical and an empirical perspective. Before we can carry out our analysis, we need to first construct a background picture of Poland's initial starting conditions. This is better served through a short introductory chapter, which will provide us with an insight into the operation of the former economic system of planning, its main focus and its weaknesses. Central to this chapter is not only the structure of production in Poland, but also the nature of Poland's trade relations with the East, the West and the developing countries. This chapter is intended to set the stage for our later work and will conclude with a summary of the actual constraints on production as well as the main macroeconomic symptoms suffered by the Polish economy at the end of the 1980's.

In chapter two of this work, which focuses on contemporary Polish-EU trade relations, our aim (part one) is to first establish what measures were taken in Poland to eliminate the main macroeconomic symptoms inherited from the system of planning. This will involve a discussion of the components of the macroeconomic stabilisation programme and, following implementation, what their effects were on the economy in respect of inflation, GDP and employment. In part two, we will then

consider the Association Agreement in force between Poland and the EU in greater detail. The aim of this is to ascertain whether the conditions on trade have been conducive for growth in allowing market access for Polish goods. On completion, through the application of selected trade models, we will then evaluate whether developments in Polish trade with the EU reflect industrial convergence. The results obtained from two of our models will enable us to identify whether the Polish export composition reveals a higher share of medium- and high-technological goods similar to the EU and also if certain branches of Polish industry have become more competitive over time. Our theoretical analysis will also assess the effects of income and distance on trade. This is important in enabling us to identify more closely the role of neighbouring countries, but also in showing how income levels in Poland are reflected in the structure of demand for goods, and what this also implies for a country's export composition. The results of our models will then be considered in light of our empirical evidence, which will form the final part to this chapter. The models that will be applied in this research and their usefulness in explaining the developments in trade patterns are explained in greater detail in the following methodology section.

In chapter three, our work will specialise on Poland's trade relations with its main partner, Germany. Our reasons for this are four-fold. First of all, the weight of both the former East and West Germany in Poland's trade under central planning was substantial and this position was strengthened during the 1990's. Secondly, Germany has a comparative advantage in the production of technologically, advanced, industrial goods, which could play an essential role in the modernisation of Polish industry. Thirdly, countries sharing a common border are expected to trade more intensively and, fourthly, Germany supports Poland's priority of EU membership. We will also apply our theoretical models to measure Polish-German trade developments in order to ascertain the role played by Germany in the supply of technology. This will also enable us to determine whether the composition of trade has changed since the 1970's or continued along the same lines. These results are also important in enabling us to identify the type of capital goods imported from Germany and whether they are intended for the purpose of economic regeneration, processing trade or for consumption. In the later part of this chapter our aim is to

assess Polish-German trade developments from an empirical perspective. This is a good method of proving whether the results of our models are an accurate reflection of the actual developments. It will also enable us to comment on the conditions contained in the Interim Agreement as well as the effects of the macroeconomic environment on trade.

In chapters four and five our analysis will take account of the foreign investment side and its relationship with trade. Chapter four is a short chapter, which is intended to provide us with a basic framework from which we can evaluate foreign investment behaviour in Poland, and those factors which have affected it over time. In part one we will outline some of the theoretical propositions as well as those incentives, which motivate investors into going international in the first place. This will be discussed in the context of developed and developing economies. In developed economies, for example, investors are motivated by incentives such as efficiency and market access. We have based our discussion of these on the EU, given its importance to this research on the trade side. In respect of developing countries, we have used Mexico as an example from which to draw some conclusions concerning the role of labour costs as incentives to investors, but also the importance of a stable and liberal domestic environment. This is useful for our work in part two of this chapter, where we shall discuss the Polish domestic conditions in more detail and whether the environment has been conducive for foreign investment. This will focus on the country's labour costs as well as its changing macroeconomic, political and legislative conditions.

In chapter five of this work we will then analyse the main structure of FDI both in terms of the total level of foreign investment that has entered the country as well as that from German investors. From this, our aim is to then identify more closely those branches of industry in which foreign investment has penetrated and what its effects have been on output and trade. Given the importance of distance on trade flows, we will also include some geographical perspectives on investment in this analysis in order to assist us in explaining those factors, which have been more influential in determining the distribution of capital according to region. This will be followed by a more comparative piece of research that is intended to show how German investment

differs across some of the Central European countries in terms of specialisation. The central aim of this is to ascertain, for example, whether investors have identified each country's broad area of industrial specialisation, such as the chemical industry in Poland, engineering in Hungary or car production in the Czech Republic. This will provide us with a basis for further and more in depth analysis on the structure of German investment in Poland. The purpose of this is to reveal those branches of industry, which investors have identified for the purpose of domestic and/or export market supply. In the final part to this chapter we shall then conclude by showing some of the micro activity of German firms. For this purpose we have taken a sample 750 firms and organised them according to branch structure and geographical location. Central to this exercise is to ascertain whether there is a clear relationship between investment, distance, trade and industrial concentration. At the end of this research our aim is to summarise the main results from each chapter into a form that will enable us to provide a comprehensive account of the developments in trade and, more specifically, to draw some concrete conclusions from our analysis concerning the type of development path taken.

We shall now turn to our methodology section of this work, where we shall explain the theoretical trade models that will be applied in chapters two and three and why they are important to this research. The following section will also contain an outline of the main statistical sources that have been chosen for data analysis.

Methodology

Introduction

The transition of Poland's economy from a centrally planned system to a market driven one has raised a number of questions related to the extent of industrial development and modernisation progress since the beginning of the 1990's. In seeking to shed some light on this theme we have chosen four theoretical models, which have been designed to measure a country's trade flows and, through their application, will enable us to extract valuable information concerning the nature of the developments in Poland. The actual importance of these facts to this area of analysis is directly connected with the reorientation of Polish trade to the EU and the anticipated change in its composition. Such expectations arise from the fact that the exposure of Polish industry to foreign competition should induce an adjustment process which will lead to modernisation, greater efficiency and, as a result, the export of more technologically advanced goods. Over the short- to medium-term, therefore, some convergence between Poland's commodity composition and that of the EU would be expected due to greater liberalisation and the gradual removal of barriers to trade (see chapter two). If this proves to be the case, then this may be indicative of industrial restructuring.

For the models to be of any use in explaining the economic developments it is necessary to use consistent trade data from established institutions and a wide range of international sources, which document the practical developments in the economy as they occur. Given these particular sources of information we will then be able to provide statements not only Poland's development progress, but also whether the trade models used are an applicable form of measurement for a transition economy. Our trade results also need to be considered from an investment perspective. For example, are changes in the volume and/or composition of trade due to foreign investment and is there a relationship? The answers to these types of questions and their implications for future development will be clearer after we have analysed the volume and structure of both total and German FDI in

the country. For the remainder of this methodology section we will now discuss the theoretical trade models that have been selected for this analysis as well as the origination of the statistical sources. An appropriate starting point to our discussion on trade models is via a brief background on the development of trade theory, since some of the old and new schools of thought are applicable to this research.

Trade models

Background

The benefits of trade and what gives rise to it were actually apparent as early as 250 years ago. David Ricardo, for example, explained that trade was driven by international differences in labour productivity and technology.¹ Based on these two factors, the Ricardian theory of comparative advantage, which it became known, was a simple and empirically proven model, which has yet to be disputed. However, while factors such as labour and technology remain key areas of focus in international economics to this day the original model, given its focus, is limited in its applicability. From the late 1900's onwards, however, Neo-classical trade theory began to examine the gains from trade. One of the main assumptions was that the gains from trade will be greater between those countries whose factor endowments and costs are completely different (Brenton & Scott, 1997). This line of thought was further developed by two Swedish economists - Eli Hecksher and Bertil Ohlin (H-O), who used the Ricardian theory of comparative advantage as a basis for their own model (Mikić 1998). The H-O model is not as limited as that proposed by Ricardo, since it also deals with the income distribution effects of trade. For example, the H-O theory of trade predicts that a country will export those goods, which have used that country's most abundant supply of resources.² This prediction, however, has since been contested and there is now evidence against the model, such as the "Leontif Paradox" which has shown that trade does not always run according to Hecksher-Ohlin predictions.³ In other words, a country which has an abundant supply of capital relative to labour, does not necessarily have to export capital intensive goods and vice versa.

New trade theory and the application of models

In contrast to some of these older trade propositions, which seek to explain the effects of trade and how a country's endowments can determine its outcome, modern trade theory actually examines these issues from a reverse angle. In other words, as opposed to taking a country's endowments and making a set of predictions on the type of trade that is likely to result, new trade theory focuses on the actual trade and factor flows with a view to providing information on a country's factor endowments and its industrial structure. Since the main theme of this work is to comment on the progress made in the modernisation and development of Polish industry, the analysis of the country's trade flows is considered a more effective method to providing the results. The models that will be applied in this research are as follows:

- (i) The Grubel-Lloyd index & the Mikić proposition** – measuring Poland's level of inter & intra-industry trade at industry and country level, respectively;
- (ii) Revealed comparative advantage** - measuring industrial competitiveness;
- (iii) Export specialisation index** - used to evaluate a country's export specialisation;
- (iv) The Gravity model** - measuring the effects of income and geographical distance on trade flows between two countries.

We will now define each of these given models in turn and our justification for using them in this research.

The measurement of inter & intra-industry trade (Grubel-Lloyd index)

Intra-industry trade is the exchange of goods between countries from broadly the same industries, whereas inter-industry trade is the exchange of goods from different industries.⁴ The actual measurement of trade flows between two countries, therefore, will reveal the nature of trade conducted between them (inter/intra) and how similar they are

in their factor endowments. For example, if trade is revealed to be more inter-industry in nature, then this would suggest that both countries are endowed with different factors of production, but also implies that each may have a comparative advantage in the production of some good. This would be consistent with the Ricardian and Neo-classical schools of thought. In contrast, intra-industry trade, which is the exchange of goods between countries from industries endowed with similar factors of production, is more characteristic of the exchange of goods that takes place in the world today, especially between the advanced industrialised countries where it has become the dominant form of trade. In the EU, the production and exchange of cars, computers, machinery and chemicals, for example, leads to the transfer of technology and know-how across member countries and, in the case of some industries (discussed later), also stimulates foreign direct investment (FDI).⁵ This enables us to deduce that, for these exchanges to occur, broadly the same levels of income and consumer tastes exist in each of the EU member countries. Income, therefore, is one of the key determinants of intra-industry trade.⁶

These facts are of direct importance to this research, since we aim to develop a picture that will enable us to determine whether the reorientation of Polish trade to the EU has begun to result in the exchange of similar goods. In other words, is Poland's commodity composition beginning to resemble that of its West European trade partners? The method of measurement that will be used in this work to calculate these developments is that proposed by Grubel & Lloyd (1975). This is the original and most common version of the formula and is given as:

$$IIT = \left\{ 1 - \left[\frac{\sum |x_i - m_i|}{\sum (x_i + m_i)} \right] \right\} 100 \quad (1)$$

Where: x_i = exports of industry i & m_i = imports of industry i

A value closer to 100 reflects a higher level of intra-industry trade, and a value closer to 0 suggests that trade is more of an inter-industry nature. In measuring IIT, however, this work proposes the application of two formulas, since there is still some debate as to whether or not a formula needs to be weighted to account for trade imbalances (Mikić 1998). We will, therefore, also use the adjusted formula as proposed by Mikić, which is a modified form of the Grubel-Lloyd version (1) and is given as:

$$IIT = \left\{ 1 - 0.5 \left[\sum \left| \left(\frac{x_i}{x} \right) - \left(\frac{m_i}{m} \right) \right| \right] \right\} 100 \quad (2)$$

Observation of the given formula (2) reveals the inclusion of a 0.5 weight, which upwardly or downwardly adjusts for a trade deficit or surplus. Both of these equations will be applied in chapter two (Polish-EU trade) and in chapter three (Polish-German trade), where the justification for using both of them will be explained further.

Revealed comparative advantage (RCA)

In addition to the anticipated change in Poland's trade composition, as a result of greater liberalisation with the EU, the exposure of Polish industry to foreign competition should also bring about an adjustment process where firms in different sectors adjust to new capacities, production lines and become more competitive.⁷ The application of this model, through the measurement of trade flows between Poland and the EU, will enable us to determine which industries have become relatively more competitive over time. In other words, which of the Polish exporting industries are revealed as having a comparative advantage in production? For example, if greater productive growth has been realised in some of Poland's traditional industries since transition, which would partially indicate the exchange of goods from different industries (inter-industry) with the EU (see chapter two), then comparative advantages may be revealed.⁸ The system of measurement, which will be used for this purpose is based on that of Balassa (1965) and was also used by the

EU for the measurement of trade flows in the “Single Market Review” (1998). The formula is given as:

$$RCA_{it} = \frac{(x_{it}^e - m_{it}^e)}{(x_{it}^e + m_{it}^e)} \times 100 \quad \text{Where: } x_{it}^e = \text{exports of industry } i \text{ and}$$

$$m_{it}^e = \text{imports of industry } i \text{ over time } t.$$

This formula will be applied in chapter two (Polish-EU trade) only of this work. The prime reason for this concerns the formula itself and what it is actually designed to achieve. That is, since the formula’s main objective is to determine the level of competitiveness of Polish industry, it needs to be applied to a multiple number of countries (EU) where the larger share of Polish trade is conducted. Hence, the application of this model to trade flows between Poland and, for example, any other single country is not going to yield significant results on competitiveness, since trade usually takes place between more than two countries. For a comparatively smaller trade volume, therefore, which is the case in chapter three of this work (Polish-German trade), we will apply a formula, which is geared more towards the identification of those industrial branches that reveal export specialisation. This will be carried out through the application of the export specialisation index (SI) and is given as:

$$SI = \frac{(x_i^p / x)}{(x_i^g / x)} \times 100$$

Where, for example:

x_i^p = total exports of industry i from Poland to Germany

x = total exports from Poland to Germany

x_i^g = total exports of industry i from Germany to Poland

x = total exports from Germany to Poland

When $SI > 100$, this suggests relatively high specialization. If $SI < 100$, then this would imply that specialization is low. The usefulness of this model is that it allows the relative standing of a more specialised industry in, for example, Poland to be compared with that same industry in Germany. Our justification for using this model is based on its use in the analysis of the Single Market as well as the industries in the Central European countries.⁹ We shall apply both the RCA and SI models to Poland's trade with the EU for a selected number of years between 1990 and 1998, since change in competitiveness and specialisation need to be measured over time, respectively. With respect to the latter, the application of the SI model will enable us to determine from which industrial sectors Polish trade has become more specialised with Germany during the 1990's. For example, given the fact that Germany is one of the larger and more industrially advanced countries of Europe, has Poland's trade with its Western neighbour become specialised in more technologically advanced goods, or has German demand focused more on those goods which require little industrial sophistication? We will now discuss the last of the models to be applied in this research.

The Gravity Model

In addition to the trade models just described, which will enable us to make an evaluation as to whether Polish trade developments with the EU have led to progress in industrial restructuring and greater efficiency, one of the aims of this work is to also take account of those factors which can directly influence the scale and structure of Poland's trade with European countries. The two factors of interest to this research are income (see IIT) and distance, since countries with higher incomes (per capita) are expected to trade more intensively, whereas distance factors (e.g. transport costs) represent an obstacle to trade.¹⁰ The effects of these factors can be determined through the application of the Gravity model, which is expressed as a single line regression consisting of the following variables:

$$\ln E_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies \quad (1)$$

$$\ln M_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies \quad (2)$$

In addition to Equation (1), Baldwin (1994), which is designed to estimate the effects of income and distance on exports, we have also included a second equation (2) in this work to account for the imports side. In the two equations, therefore, exports and imports will be our dependent variables on which the independent variables (gdp, gdp/pop & distance) will be regressed.¹¹ Dummies have also been included at the end of the regression line to take account of adjacency and preferential relationships. The values of all variables are given in logs.

Variables

E_{ij}/M_{ij} = value of exports / imports between country i and country j, where i represents Poland and j represents seventeen selected European countries.

GDP_j = Gross Domestic Product (at market exchange rates) of each of the seventeen European countries;

GDP_i = Gross Domestic Product (at market exchange rates) of Poland;

GDP/POP_j = GDP capita of each of the seventeen European countries;

GDP/POP_i = GDP capita of Poland;

$Dist_{ij}$ = distance in km between the capital cities of countries i and j;

Dummies = dummy variables representing the adjacency (ADJ) between countries i and j (sharing a national border) and preferential relationships (EU membership);

The Gravity model, which derives its name from the function describing the force of gravity in physics, models the actual flow of trade between two countries as being

proportionate to their income and inversely proportionate to the distance between them.¹² The objective of this model is to determine the effects of income and distance on trade flows between a pair of countries with a view to ascertaining whether there is a potential for more trade.¹³ For the purpose of our work, we shall apply the Gravity equation to Poland's trade with seventeen European countries on the exchange of goods from five different industries (agriculture, raw materials, fuels, machinery & manufactures) as well as on the total level of traded goods. Our application of the Gravity model will be carried out for the year 1998 using trade values and macroeconomic data obtained from the OECD. These values, once converted into logs, will then be used to estimate the importance of the given independent variables using an econometrics, modelling programme called "Microfit". In addition to assessing the relative importance of the five industrial sectors in Poland's trade with the selected countries, our results will also enable us to make some assumptions as to whether or not there is a potential for more trade. We will elaborate on this in chapter two (subsection 2.5) of this work.

Brief summary

The reorientation of Polish trade to the EU is expected to lead firms to modernise, exploit the wider market potential and adjust to new capacities. In terms of trade, the exchange of goods between Poland and the advanced (EU) industrialised countries is expected to result in the gradual development of intra-industry trade. This would imply a greater proportion of medium and high technological goods in Poland's export composition (see subsection 2.6), which may signify a move up the technological ladder. The first three models (Grubel-Lloyd, RCA & SI - index), that have been selected to measure the anticipated change, have been in use for nearly thirty years and are currently being used by the European Union (EU) and other trade institutes around the world. These models are also proven to be empirically sound, since they were also the selected models of measurement used by the EU in the implementation of the Single Market Programme (Single Market Review, 1998). In contrast, the Gravity Model is not a standard form of

measurement used by the EU, but is well supported empirically and is beginning to play an increasingly important role in policy analysis. The application of all selected trade models will enable us to measure not only the changes in trade flows over time, but will also allow us to assess the effects of those factors driving trade. This work will now turn to the main statistical sources that will be used in this research.

Statistical Sources

Through out this research the empirical analysis and the application of three of the trade models (except the Gravity model) will draw on three main statistical sources:

- (i) Eurostat - the official statistics office of the European member states;
- (ii) GUS (Główny Urząd Statystyczny) - the Polish Central statistics office;
- (iii) Statistisches Bundesamt – German Federal statistics office.

We will now discuss each of these in turn, our justification for using them and the areas of this research to which they will be applied.

Eurostat

Eurostat was established in 1953 to meet the requirements of the steel and coal community. However, after the formation of the European Community in 1958, its functions were expanded and, today, Eurostat is the only official centre of statistical information for the EU member states (www.europa.eu.int). Its primary role is to consolidate and harmonise data received from the EU countries for the purpose of later supply to governments and institutions around the world. In maintaining its standards, Eurostat co-operates with the UN, the IMF, the World Bank and the OECD. Additionally, it also runs established programmes, such as PHARE for the transition

economies and TACIS for the newly independent states of the former Soviet Union. These programmes are essential for monitoring and keeping pace with the developments in these countries.

Application of data

The use of Eurostat data, using the SITC system (standard international trade classification), will be the primary form of data used for the measurement of trade flows between Poland and the EU (chapter two). Furthermore, since the change in Poland's export composition is one of the primary areas of focus in the second part of chapter two, the actual value of outflows (Poland's exports) are better measured from the importing countries side. This is because a country measures import flows more accurately than outflows. The data to be measured will be based on those goods traded from the following SITC categories:

- 0 Food and live animals
- 1 Beverages and tobacco
- 2 Crude materials, inedible, except fuels
- 3 Mineral fuels, lubricants and related materials
- 4 Animal and vegetable oils, fats and waxes
- 5 Chemicals and related products
- 6 Manufactured goods classified by material
- 7 Machinery and transport equipment
- 8 Miscellaneous manufactured articles
- 9 Commodities and transactions not classified elsewhere in SITC

The nine categories, which form the structure of the single-digit SITC classification, can also be expanded into two, three, four and five-digit categories. Basically, the higher the number of digits the more disaggregated the goods become. For example, the single-digit

category above (7), which is the main group for machinery and transport equipment, contains products such as electrical machinery (77) and power generating equipment (71) at the two-digit level. In this two-digit group there are 67 divisions of goods, whereas at the five-digit level there are 3,118. The empirical and theoretical analysis in chapter two of this work (Polish-EU trade) will use Eurostat data from the three-digit level (261 divisions), since this level of disaggregation best matches the definition of the term “industry” (Mikić, 1998). This work will now discuss the use of Polish data.

GUS data

Główny Urząd Statystyczny (GUS) is the official central statistics office in Poland. Since the beginning of the 1990's, the methodology and services of this office have been reformed and harmonised with those of the OECD and Eurostat (www.stat.gov.pl) / (OECD, Vol. V, No37, Paris 1997). The statistical information provided by GUS is internationally comparable and now uses a combined nomenclature of foreign trade and the homogenic code system of the EU.

The use of Polish data, given the application of Eurostat statistics in chapter two, will be used as one of the primary sources of data for Poland's macroeconomic developments, since domestic data is a more reliable indicator of a country's performance. Furthermore, we have refrained from the use of both Eurostat and GUS statistics in the application of trade models since, in the absence of accurate exchange rate (conversion) information, this may lead to a misinterpretation of the results obtained and a bias conclusion in terms of the actual trade developments. The use of Polish data will, therefore, serve as the main domestic indicator for macroeconomic and industrial developments through out this research.

Statistisches Bundesamt data

The federal statistics office of Germany, based in Wiesbaden, is the official provider of data for the entire country. The data, which the central office obtains from its republics (die länder), is reliable and is supplied in accordance with the conditions laid down in the statistics law. In other words, German official statistics are in line with the globally recognised standards, which were implemented by the United Nations Economic Commission for Europe (www.statistik-bund.de). Given the universality of German statistics, this will be the primary source of data used in chapter three of this work (Polish-German trade). The focus of this chapter is more on the broad developments in trade between the two countries. Therefore, the analysis of trade flows will be carried out using data at the two-digit level, although some three-digit data will be used for comparative purposes or where more detail of a specific product is required.

Brief summary of models and statistics used**Chapter two**

Intra-industry trade (Eurostat 3-digit data)

Revealed Comparative Advantage (Eurostat 3-digit data)

Gravity Model (OECD 1998 data at market exchange rates)

Chapter three

Intra-industry trade (Statistisches Bundesamt 2-digit data)

Export Specialisation Index (Statistisches Bundesamt 2-digit data)

Notes on the use of sources for chapters four and five

The research analysis that will be carried out in the investment chapters is less mathematical and, therefore, requires a different approach. The nature of the research in these two chapters also necessitates a broader use of local and international sources in order to establish both the investment framework (chapter four) and the information based chapter (five). A list of the main sources that will be used are as follows:

Chapter four

This chapter, after considering some of the main theoretical propositions relevant to this work (investment motivations), aims to establish whether the overall environment in Poland has been conducive for FDI. To aid us in our understanding, reference will also be made to some of the developments in Mexico for comparative purposes. The information used will draw on the following main sources: OECD, EU, UN, IMF, PAIZ, as well as a number of local and other international publications.

Chapter five

The broad focus of this chapter is to establish the structure and location of both total and German direct investment in Poland with a view to showing the relationship between investment, production and trade. This chapter will also contain sections of comparative country and industrial analysis, and this will enable us to measure and assess Poland's position relative to that of other neighbouring countries. The main sources that will be used in this chapter include: Deutsche Bank, IMF, GUS, The Polish-German Chamber of Commerce and PAIZ. To substantiate our findings in this chapter, we will also drawing on a wide range of articles selected from Polish, Central European and international magazines, journals and other periodicals.

Given that the main methodology element to this research is now in place, its actual application necessitates the provision of a background chapter on the Polish economy. In other words we need to first establish the initial starting conditions in Poland at the end of the 1980's. This will enable us to develop a greater understanding of the operation of the Polish economy in its former planned environment and, in particular, the country's structure of production and trade.

Footnotes for Methodology

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- ¹³ Brenton, P., & Di Mauro, F., (Ed. Greenaway, D., & Whalley, J.,) *The World Economy, Is There Any Potential in Trade in Sensitive Products Between the CEECs and the EU?* Vol. 21, No.3, May 1998.

Chapter one

Trade and the context of transition

Introduction

The division of Europe after the Second World War placed East Germany, Central Europe and the remainder of the East under the of Soviet sphere of influence. For all countries under this influence this meant the acceptance of the Soviet political and economic regime, which took no account of their existing economic or political structures. The planned system of economic production, that was transferred, was a centrally and politically driven means of resource allocation, which had remained virtually unchanged since the advent of Stalinism. Attempts were made by the United States to try and prevent the formation of this alliance between the Soviet Union and the countries under its influence. These attempts, however, would not be realised and this was largely confirmed in the Soviet Union's refusal to accept Marshall Plan funding from the United States in 1947.¹ In reaction, the United States imposed a trade embargo, which later included the restriction of all western exports to the entire Soviet bloc. The Soviet Union, as a result, directed all of its trade to the countries under its sphere of influence and, in January 1949, created the Council for Mutual Economic Assistance (CMEA) with Poland, Hungary, Bulgaria, Czechoslovakia and Romania. By mid 1955, the countries of Central and Eastern Europe co-operated politically, economically and, as a result of the developing Cold War, had also established a common system of defence for the region. The restrictions on trade to the East, however, could not be sustained indefinitely owing to Western Europe's trade deficits. At the same time, the East was equally dependent on the West for the supply of capital goods – a feature, which characterised the type of trade between the two of them before the war. By the mid 1960's, the West had removed the restrictions in place on most non-military goods and, thereby, created an opportunity for greater economic co-operation. These measures, however, were not consistent with the overall objectives of central planning.

It is for this reason that we have decided to first provide an introduction on the system of planning in its entirety, before our work on the role of Poland, its production and its trade developments can commence. The system of planning will, therefore, form part one of this chapter. In part two our work on Poland will begin with a background into the country's structure of production and trade, and this is intended to provide us with a platform on which to base later chapters. In addition to these areas of focus we shall also, in the context of the above, discuss how credit politics with the West led to the implementation of a mass modernisation programme in Poland and greater developments in trade outside the Soviet bloc. In the later stages of this chapter our aim is to focus more on those factors, which led to the eventual collapse of the system in Poland. We will achieve this by showing how the expansion of trade and the scale of the modernisation programme were beyond the capabilities of the Polish economy. On completion, our concluding part will centre more on the scale of economic decline in Poland and the main causes and effects of it, which included: economic mismanagement, the quadrupling of oil prices, falling trade, growing shortages, rising prices and subsequent strike action. This will provide us with the main macroeconomic symptoms suffered by the Polish economy at the end of the 1980's, which is particularly important since their diagnosis, aimed towards the stabilisation of the Polish macroeconomic environment in the 1990's, forms the first part of chapter two. Before we can move onto these later developments, however, we need to first be aware of the root causes which led to the collapse of the planning system. This will require some insight into how the system operated as a whole.

I. The system of planning

1.1 The operation and focus of central planning

The Soviet system of central planning became the blueprint for all of the economies under its sphere of influence and was transferred in a broadly unaltered form.² In contrast to the market, where the level of production is determined by demand, which itself is a function of price, the operation of planned production and resource allocation functioned through the execution of a chain of commands which represented output targets to be achieved by industry. These directives, which became the basis for the central plan, were initiated by the political elite (Central Committee of the Communist Party) and then developed into five year economic, social and development plans by the Central Planning Commission. The actual plans, which contained more precise and detailed information concerning output levels to be produced, employment, trade and the budget³ etc, would then be passed down to the ministerial branches, who would then expand them into concrete forms of production instructions for the enterprises. The predominance of centrally driven objectives over enterprise production, as opposed to demand, removed all enterprise autonomy since not only were decisions on output determined in advance, but also on most areas connected with production (Bosworth & Ofer, 1995).⁴ For example, some of the main instructions handed to an enterprise would include:

- (i) The level and type of output to be produced and the time period for completion;
- (ii) The quantity of inputs to be received by the enterprise and from whom;
- (iii) The factors to be employed in the production of the good and wage rates;
- (iv) The price of finished goods;
- (v) The buyers.

These five given instructions virtually removed all enterprise autonomy. This, first of all and in contrast to the market, eliminated competition. Since all factors connected

with production were predetermined, an obvious feature of the system was the importance of quantity over quality. In contrast to the market, therefore, products could not be developed according to demand and the competitive pressures stemming from other enterprises. With respect to the fourth point, the fact that prices were set on finished goods ruled out the role of price as a mechanism (proxy for demand) and profit as a motive in the system as a whole. These key operational factors, which distinguish the planned system from the market, effectively removed all enterprise incentives – except, for the rewards, which were given to those enterprises that successfully met the plan in terms of output and in the given time. Rewards were paid in the form of bonuses to the staff members of those ministries connected with the successful industry and to the enterprise managers (Smith, 1983). This also included the workers of the enterprises. However, just as bonus incentives provided a degree of motivation to produce a given level of output in a set period of time, they also facilitated a degree of plan manipulation. For example, communication between the enterprise manager and the branch ministry would often lead to the setting of those output targets, which were easily attainable. This would occur because the information supplied up the chain concerning the state of an enterprise was not entirely accurate. The setting of lower output targets, therefore, would help to guarantee the realisation of bonuses to the ministerial staff, but would also help to raise the credibility position of the manager in the enterprise and contribute in ensuring that the situation on the production front remained calm. At this point, to gain a clearer understanding of the implications of how the restrictive practice of enterprise operation fleshed-out in practice, we need to introduce the overall objectives of the system to show how the two interact.

1.1.1 The focus of the planning system

In addition to the constrained operational practice within the centrally driven system of planning, one of the main features of the Soviet model was its over reliance on the industrial sector and its emphasis on rapid growth as the central objective.⁵ As a result, investment and resources were directed largely towards heavy industry, since the production of machinery and equipment was regarded as a means of overcoming

backwardness. Apart from the heavy emphasis on investment goods in preference to consumer goods, a central objective connected with the large-scale operation of heavy industry was the continual expansion and development of the military sector. This was in response to the arms race with the United States, NATO and the later problems, which led to the invasion of Afghanistan. The importance of the military sector is reflected in Soviet expenditure and has been estimated as accounting for 25-30% of GDP (Gros & Steinherr, 1995). In facilitating the operation of the overall system, the Soviet Union exported oil, fuels and raw materials to the CMEA countries which, in return, would use them to produce industrial and consumer goods. On completion, these goods would then be exported back to the Soviet Union as well as to neighbouring countries of the CMEA. The very focus of this system and its methodology, enable us to identify two major weaknesses:

- (i) Supplies were transported over huge land masses (e.g. from W. Siberia) to the CMEA enterprises;
- (ii) The over emphasis on heavy industry resulted in oversized enterprises in contrast to those found in market economies.

Dealing with the supply side, first of all, the transportation of supplies across great geographical distances meant that transport costs were about ten times higher per unit of output than in OECD countries. The major downside to this was the irregularity and delays connected with the much greater distance. On the enterprise front, this would lead managers to improvise by obtaining as many supplies as possible, regardless of the cost involved. This would be achieved through informal contact with other enterprises and, in addition, enterprises would also try and produce for themselves. Since the chief aim was to meet the output targets set, the greater the level of supplies the more prepared an enterprise was to deal with any shortcomings connected with production. With respect to the industrial side (ii), the over emphasis on heavy industry meant that other sectors of the planned economy, such as services were given little opportunity for expansion and development. In contrast to market economies, because the size of industry was much greater, this also meant that the scale of inputs required was far higher. This, in centrally planned economies, was

termed “extensive growth” and was carried out by increasing the supply of inputs into a production process in order to achieve higher growth. This was the main model of development (Smith, 1983). The supply of inputs, which included energy, was roughly four times higher than in OECD countries (Gros & Steinherr, 1995). Furthermore, since the mining industry was one of the principal suppliers of energy, the scale used had a detrimental impact on the environment. In contrast to the operation of mining industries in the market economies, therefore, which gradually reduced their usage of coal over time, planned economies were placing greater importance on them and increasing their investment.

In bringing the main points of this together, we have established that in a non-decentralised economic system, production was characterised by high input costs and these were chiefly associated with long distance transportation, the non-cost effective use of supplies and non-efficient use of resources. These were all used in an attempt to ensure that all factors (output, growth & development) were achieved. As a result, the costs of production per unit of output were too high, with quantity being a superior objective to quality. The negative effects of distance were partially visible at the enterprise level, where individual units would pursue their own strategies with respect to ensuring sufficient supplies for production. According to Winiiecki (1992), enterprises engaged in the production of their own inputs in order to guarantee output targets, indicating that import-substitution occurred at an enterprise level.⁶ Managers would also obtain additional and/or more supplies through informal relationships with other enterprises. This is evidence that the rules of the game were not being followed as envisaged by planners, but also that the supply of raw materials and supplies were not constant and on time.

1.2 The effects of restricted trade

The fact that Eastern Europe was initially isolated from the West, as discussed in the introduction of this chapter, meant that trade between the divided region was substantially reduced for some time. The isolation or decision to refrain from engaging in foreign trade is known as import-substitution. However, when the action is taken

from the outside (West), the home government (East) does not get to make the choice on behalf of its industry but, instead, has the choice made for it. The effects of this were two-fold:

- (i) The decision taken by the West prevented the East from earning the hard currency that it required;
- (ii) simultaneously, this decision also constituted the denial of information, technology and ideas developed abroad.

The effects in point (i) occurred because the region was unable to import up-to-date machinery and equipment. The engagement of more modern factors of production in the East may have enabled them to earn the hard currency that was required to purchase more inputs, such as fuels and raw materials (Smith, 1983). With respect to point (ii), the non-supply of new technology, ideas and information into the planned economy removed the principal element of competition. Industry, therefore, remained in its original, post-war form for a considerable period of time both in terms of its quality and its level of technology. Industrial growth, therefore, was not a result of newly formed sub-industrial specialisations, as in market economies, but through the reinforcement and maintenance of outdated and unchanged industrial structures. In contrast, Eastern industrial structures, given their lower levels of technology, were under specialised and became increasingly unable to match the quality and technological sophistication of products being developed in the West (Winiecki, 1992). This not only contributed to a growing technology gap between the East and West, but also resulted in a pronounced difference in the performance of industry. In the absence of competition, therefore, the comparatively poorer range of investment and consumer goods in Eastern Europe led to declining levels of motivation and the incentive to improve the quality of both.

1.2.1 Limited trade development

The inward orientation of Soviet industrialisation, given the deteriorating standards and levels of frustration, could not hold out indefinitely. This concurs with the work

of Köves (1985), who documented that the purpose of establishing economic relations with the West was to import those goods, which were either short in supply or unavailable. The restricted approach adopted by the East to Western imports suggests that it was intended to keep external relations to a minimum. More specifically, it was also thought that the centrally planned economy had a real chance of survival; and that the incorporation of western technology was the key element required to strengthen the system.⁷ The structure of imports (see table), meanwhile, confirms the weight given to the necessity of obtaining more up-to-date machinery. For example, up until 1975 machinery and transport goods were the most dominant inflows, reflecting the constraints on production in the region. By 1980, however, these imports had fallen by almost 10% and were replaced entirely by imports of food, beverages & tobacco.

Table 1a

The structure of Eastern imports from the West between 1965 and 1980 (%)				
Imports / year	1965	1970	1975	1980
Food, beverages & tobacco	21.0	10.2	12.9	21.0
Raw materials	12.2	8.0	5.2	6.5
Mineral fuels	0.4	1.3	0.7	1.5
Chemicals	12.8	12.2	11.3	14.0
Manufactured goods	20.8	26.6	29.4	25.6
Machinery & transport equipment	28.8	35.2	36.0	25.9
Miscellaneous manufactured articles	3.2	6.0	3.7	4.8
Other commodities	0.8	0.5	0.6	0.8

Sources: *Economic Bulletin for Europe, Vol. 36. United Nations, 1984 & OECD.*

In addition to machinery, the heavy focus on the import of manufactured goods reflects the scale of underdevelopment in this sector and the extent in which it was neglected. Part of this was due to the transfer of raw materials and other resources from the manufacturing sector to heavy industry for the purpose of production, which placed more constraint on the operation of the former. The import of all eight, given commodity groups also reflects the continuous need to support rising levels of consumer and producer demand through external means. Part of the problem, however, was that imports from the West were not constant, and this confirms our earlier point that trade relations with the West were not established with a view to any

real development programme, but rather to support and prolong the operation of the old system. This suggests, therefore, that socialist thought on self sufficiency and the actual reality of the system in operation were not consistent. This is supported by the developments on the exports side, which, over time, became increasingly necessary for the purpose of earning hard currency. In contrast to imports, however, the composition of exports to the West revealed a distinctly opposite pattern. For example, the export of machinery and transport equipment only formed an average of 7% of the outflows from the whole region. At the same time, some of these commodities could only be exported and sold in the West if they contained western inputs. Some of the technology imported by the East, therefore, would be installed or would form part of those commodities that would later be exported back to the West. This suggests that processing trade (see chapters two & three) formed a part of the East-West economic relations from as early as the 1970's. Observation of the following table (1b) reveals the comparatively smaller share of machinery and transport equipment in exports, with the more dominant exports being raw materials, fuels and manufactured goods. The export of commodities from these three categories formed an average of more than two-thirds (67.1%) of the outflows to the West through out the period shown on the table.

Table 1b

The structure of Eastern exports to the West between 1965 and 1980 (%)				
Exports / year	1965	1970	1975	1980
Food, beverages & tobacco	21.0	17.0	10.2	5.7
Raw materials	26.1	22.8	17.3	10.2
Mineral fuels	18.1	20.3	36.6	50.2
Chemicals	4.8	5.3	5.3	6.4
Manufactured goods	20.0	20.2	13.8	12.8
Machinery & transport equipment	5.0	7.5	8.5	7.2
Miscellaneous manufactured articles	4.3	5.8	7.6	6.7
Other commodities	0.5	0.9	0.7	0.7

Sources: *Economic Bulletin for Europe, Vol. 36. United Nations, 1984 & OECD.*

Out of these categories, however, the more dominant export over time, which began to replace some of the export shares of raw materials and manufactured goods, was mineral fuels. This was predominantly crude oil, which was supplied via the ДРУЖБА (Friendship) pipeline to Austria, Germany and Italy, and also the supply of gas via the УРЕНГОЙ УЖГОРОД TRIERST (West Siberia-Ukraine-Yugoslavia) pipeline. The supply of gas and oil, given both the quadrupling of oil prices in the West and the subsequent recession towards the mid-1970's, increased substantially and became the chief hard currency earner in the East.

The fact that the supply of mineral fuels could be increased over time reflects the extent to which the East was isolated from changes in world prices. In contrast, however, the lower supply of raw materials, manufactured goods and also food from the East during the recession, is a reflection of how changes in price and levels of demand in the West could affect Eastern production and levels of hard currency earnings. Meanwhile, the low share of these commodities in eastern exports in the second-half of the 1970's was not a result of western demand, but more a consequence of the inability of the planned system to be able to supply them. The overall export picture, therefore, reveals a structure, which, owing to the poor quality and low share of machinery & transport equipment in outflows, was largely dominated by low-end of the scale products and extracted resources. By the 1980's, with the exception of fuels, the ability of the system to continue the supply of these commodities to the West, however, was becoming increasingly impaired.

1.2.2 The constraints to trade

The supply-side problems connected with trade led to growing shortages, since the inability of the system to maintain exports prevented it from earning the hard currency that it required. The initial effect of this was a deterioration in the balance of trade, which needed to be adjusted. This was carried out through a reduction in the level of imports – particularly, machinery and transport equipment, since these were the most expensive imports and the single largest cause of the deficit. The main reason for the adjustment on the imports side was due to the fact that money had no regulatory role

over economic processes.⁸ As mentioned earlier in this work, prices of goods were set, which meant that the role of money was used as a unit of account for the purpose of aggregating material balances only. Therefore, since trade was carried out at world market prices all losses or profits, given the absence of a real rate of exchange, would need to be balanced by adjusting the state budget. This operation, as well as all financial exchanges with the outside world, was facilitated by the Central Bank or one of its subsidiaries, such as the trade bank (Gros & Steinherr, 1995). Therefore, in addition to the actual supply-side problems, the system of planning was not structurally geared to trade with market economies, since it lacked the necessary financial services and a fully operational banking network.

Brief Summary

This work has so far determined that Soviet style industrialisation was a centralised, inward looking, planned system of production and resource allocation. The main focus of the system was to continually expand output production in the heavy industrial sectors in order to fulfil production targets and also to maintain the massive defence sector. Such targets were drawn up in the form of five-year plans, and were then later broken down into annual sets of instructions for enterprise production. Enterprises, in turn, would try and satisfy these instructions because of the bonus and premium incentives that were attached to their successful completion. A number of weaknesses, however, could be identified with the overall operation of the system. These can be summarised as:

- (i) The system was not only planned, but also centralised;
- (ii) Over emphasis on heavy industry;
- (iii) Trade was conducted for the wrong reasons;
- (iv) Infrastructural weakness.

In summarising these four main points, the fact that the system was planned meant that enterprises had little independence or control over their future. Therefore, virtually all aspects of decision-making on production were made on their behalf. This

would include decisions on investment, the level of wages, the size of the labour force, the type of product to be produced, sold, its quantity and its price. Enterprises, therefore, were not autonomous. The fact also that the system was not decentralised meant that supplies were transported over long distances before they could be used in production processes. This resulted in delays and the irregularity of supplies. Enterprises, therefore, would self improvise by producing some of the inputs for themselves and would obtain other supplies from other enterprises. This was not strictly in accordance with the rules of the game. With respect to point (ii), the focus of the system on heavy industry basically resulted in the non-development of industrial sub-branches, which, in market economies, have led to increased specialisation, efficiency and greater domestic competition. Consequently, new technology and ideas on how to improve the efficiency of industry as whole were restricted. In contrast, the main model of development was to increase industrial output through higher injections of inputs. This not only resulted in supply-side constraints, but also poor quality, waste and environmental pollution.

A major component, which is strongly connected with the technological and informational constraints as described in the latter, was also the position with respect to trade with the West. Since trade was only conducted as a means of obtaining technology with a view to reinforcing the system of planning, the exchange of goods was not conducted on a regular basis. This rules out any substantial development plans in the region; and this was connected with the belief that the system would still win through over capitalism. The restricted position of trade essentially starved the Eastern economies of western up-to-date technology, information, research developments and ideas. In the absence of these factors, the East was not confronted with competition and, therefore, did not have any incentive or challenge to rise to. As a result, motivation levels could not be sustained indefinitely. With respect to point (iv), the emphasis on heavy industry, at the expense of the services sector, resulted in the under-development of banking, financial services and communications networks. This made the conduct of trade a particularly complex process, especially since money was not allowed to play a full role as the central means of exchange. In practice, therefore, the growing supply-side constraints, which led to deterioration in the

balance of trade, had to be adjusted through the reduction of machinery imports. This action further hampered the ability of the region to earn hard currency, which consequently led to a fall in other imported goods from Western Europe, but also to growing levels of indebtedness. The centrally planned economy, as a result of its methodology, its focus on heavy industry and its restrictive approach to trade, ended-up as a shortage economy in a technological time warp. We shall now turn to part two of this work where we shall introduce and discuss the position of Poland in terms of its production and trade developments up until the end of the 1980's.

II. Assessing the Polish economic position

Introduction

The transfer of central planning to Poland initially resulted in production being narrowed down and concentrated in a key range of industrial sectors: steel, copper, sulphur, coal and manufactured goods. Poland's industrial structure was, therefore, shaped to meet the requirements of the Eastern bloc. This, because of its restricted trade relations with the West, also made it dependent on the East. The quality and type of goods, which were largely unsaleable in the West, reinforced this position. From the 1970's, however, after Edward Gierek became Poland's First Secretary, greater economic relations were developed with the West, especially in the credit and trade spheres. These particular developments were not only conducive for Poland in facilitating its modernisation efforts, but also for the West during its period of recession and the accumulation of petrodollars in Western banks. Subsequently, Poland along with other Eastern bloc countries took advantage of the available credit for the purpose of importing more up-to-date technology and machinery. Given the background provided in part one of this chapter, therefore, we will now focus on the developments in Polish trade and production from the 1970's. Since these two areas of focus form the main theme of this research in enabling us to determine the extent of industrial restructuring and development in the 1990's, our work throughout the remainder of this chapter will provide us with a platform on which to base our analysis in later chapters. We will begin part two by first establishing the focus of the modernisation and investment programme as well as the type of technology that was transferred to facilitate it. We will then conclude this subsection (1.3) by briefly assessing the effects of the programme on industrial production and levels of output. This will also provide us with some of the key information on the type of goods produced in the Polish economy, and this is required in the following subsection (1.4) where we shall discuss the developments in trade. This will be first approached from a more geographical perspective, since credit relations with the West led to substantial changes in the volume of trade and its orientation. From this, we will then be able to

make some concrete judgements concerning the effects of the modernisation programme on trade, but also in how far trade developments and earnings were affected by the oil price shock and the western recession. We will then take this a stage further (subsection 1.5) by introducing the total structure of Polish trade and how this actually differed geographically in its relations with the East, the West and the developing countries. Furthermore, in addition to showing which commodity groups were more affected by the recession, this particular part of the work is intended to provide a base structure from which we can later measure and compare the developments in trade after the initiation of economic reform in the 1990's. In the closing stages of this chapter we will outline those factors, which led to economic decline in Poland as well as the main symptoms suffered by the economy at the end of the 1980's. We will now turn to our subsection that deals with the focus and effects of the modernisation and investment programme.

1.3 Modernisation and technology transfer

The decision to embark on a modernisation and investment programme was not only accompanied by a change in trade policy, but also by a complete overhauling of the 1971-75 plan in order to facilitate it.⁹ The main changes to the plan included a rise in personal incomes, a wider range of social benefits and stable food prices. In terms of investment, it was decided that modernisation would focus on two broad branches of industry: the chemical industry and the engineering industry. The technology imported into these industries did not only arrive in the form of individual products, but also entire operational plants. In 1972, the imports for these two industries accounted for 56.2% of the technology flows into the country.¹⁰ Once these two industries had been modernised, they were expected to supply not only the domestic market with more modern products, but were also expected to produce for export purposes. Since it was intended to export a share of these products to the West, over 90% of the new technology was obtained from there. In addition to entire production plants, the West also supplied industrial plants, machinery, electronic products and measuring instruments for some of Poland's other branches of industry, such as fuel, power, food, wood and paper (OECD, 1983). A large share of these industrial imports was

bought for specific productive purposes and, therefore, could not all be mis-allocated as some studies have suggested. This is partially evident on the export side and also the level of technology embodied in some of the outflows. For example, between 1976 and 1980, Poland exported around 150 turnkey plants. These were fully operational production plants, which the country specialised in at that time as well as the associated blue prints, designs and licences. The main destination markets for these plants were the CMEA - primarily, the Soviet Union, Czechoslovakia & the GDR, but also China and the Middle East (Algeria, Iraq, & Libya) As fully operational units, these plants were used in the production of concrete manufacturing, sulphuric acid, sugar, coal, electrical power, metallurgy and electro-machinery.¹¹ Since Poland was able to acquire the necessary licences for production from the West, a number of the productive units contained both Polish and Western technology. This meant that some of these units could, as discussed earlier, be produced and then sold on Western markets. According to Maciejewicz (1986), these developments are reflected in the actual orders for these units from the CMEA, the Middle East and also by the registered patents in Western countries.

The effects of modernisation on production

The implementation of the modernisation programme resulted in a 22% increase in the level of investment spending (Smith, 1983) between 1971-75. Throughout the entire 1970's, investment almost doubled, and the effects of this were positive on net material product, which increased by 62% in contrast to the anticipated 38-39%. During the same period, industrial production increased by 73% and this is reflected on the following table, which allows us to identify more closely the branches from which these increases were more pronounced.

Table 1c

Changing levels of output by industrial branch for selected years between 1960 and 1985				
	1960	1970	1980	1985
Coal (millions of tons)	104	140	193	192
Electricity (TWh)	29,3	64,5	122	138
Pig-iron (millions of tons)	6,7	11,8	19,5	16,1
Steel rolled products (millions of tons)	4,4	8,1	13,6	11,8
Electrolytic copper (thousand's of tons)	21,7	72,2	357	387
Metal machine tools (thousand's of pieces)	25,9	36,3	38,3	56,8
Computer systems & accessories (million pieces)	0	1,6	15,2	25,6
Cars (thousands)	12,2	64,2	351	283
Radio sets (millions)	627	987	2 695	2 687
TV sets (thousands)	171	616	900	611
Nitrate fertilisers (thousand's of tons)	270	1030	1290	1253
Phosphorous fertilisers (thousand's of tons)	207	599	834	889
Plastic (thousand's of tons)	40,1	224	549	594
Cement (millions of tons)	6,6	12,2	18,4	15
Paper (thousand's of tons)	495	764	1033	1071
Cotton textiles (thousand's of km)	665	881	903	828
Wool textiles (thousand's of km)	78,9	99	121	105
Knitting - products (thousand's of tons)	18,2	33,4	46,7	40,1
Investment output (1950=100%)	268,3	569,3	1000	862,2

Source: *Encyklopedia Powszechna, suplement, PWN, Warszawa, 1988, p. 335.*

Observation of the period 1970-80 reveals some substantial changes in industrial production by branch of industry. We shall first deal with those increases, which were achieved by the more technologically advanced branches, and then those branches whose output levels increased significantly during the period measured. Dealing with the former, first of all, the production of computers and accessories (measured in pieces) increased more than nine-fold from 1.6 to 15 million. The production of radios was 2.7 times higher (627 → 987 million sets) and televisions had also increased from 600,000 sets to 900,000. The expansion of car production was also significant. At the beginning of the 1970's, the number of cars produced in Poland stood at 64,000. By the beginning of the 1980's, this value had increased more than five-fold to 351,000. Positive increases were also achieved in the production of machine tools. The significance of detailing these changes is more to show the importance placed on the production of these particular items after the modernisation programme had been initiated. This can be observed more clearly through observation of the column containing these items for the 1960's. In contrast to the 1970's, for example, the production of computers was non-existent, and the production of cars and TV sets was also relatively small in comparison.

The developments of the 1970's (see table) reveal that, while some technological developments were evident, the main effects of the modernisation programme were also significant in the heavy industrial branches, chemical & extractive industries and in some of the more labour intensive operations. The most significant of these was copper, which was discovered in Lubin and Głogów, in 1957, and, following the opening of new mining factories ("Lubin", "Polkowice", "Rudna" & "Sieroszowice"), increased dynamically in the second half of the 1970's by more than five-fold from 72.2 to 357 million tons (Zarys Encyklopedyczny Polska, 1979). In addition to domestic market supply, copper was also exported in exchange for hard currency (see next section). Meanwhile, other extractive industries, such as the supply of coal, which was one of the chief forms of energy in Poland and a main source of hard currency income, also increased from 140 to 193 million tons. This is reflected in the supply of electricity, which doubled during this period. Contributing to the high generation of energy was also the significant increases in the output of iron and steel. At this initial stage of the analysis, therefore, our evaluation of the effects of the modernisation programme on production reveals that more importance was placed on the production of consumer goods during the 1970's. At the same time, however, high output volumes from the extractive, steel and iron industries suggest that the emphasis on heavy industry was further maintained and strengthened. To elaborate more on these results and to broaden our picture of these developments, we need to show how the geographical orientation and the structure of trade changed over this period and beyond.

1.4 The orientation of Polish trade

At the beginning of the 1970's, approximately 60% of Poland's total exports were accounted for by the CMEA (Soviet Union + Romania, Bulgaria, Czechoslovakia, GDR and Hungary), 30.7% went to the Western market economies and Japan, and the remaining 9.3% went to "other countries". These values are given on the following table from 1970 to 1989.

Table 1d

The orientation of Polish exports between 1970 and 1989 in percent.								
Export/Year	1970	1975	1980	1985	1986	1987	1988	1989
East	60.0	56.5	52.3	48.2	46.1	41.2	40.1	35.0
West	30.7	33.9	36.5	39.1	37.7	45.1	46.5	52.8
Other	9.3	9.6	11.2	12.7	16.2	13.7	12.4	12.2
Total	100	100	100	100	100	100	100	100

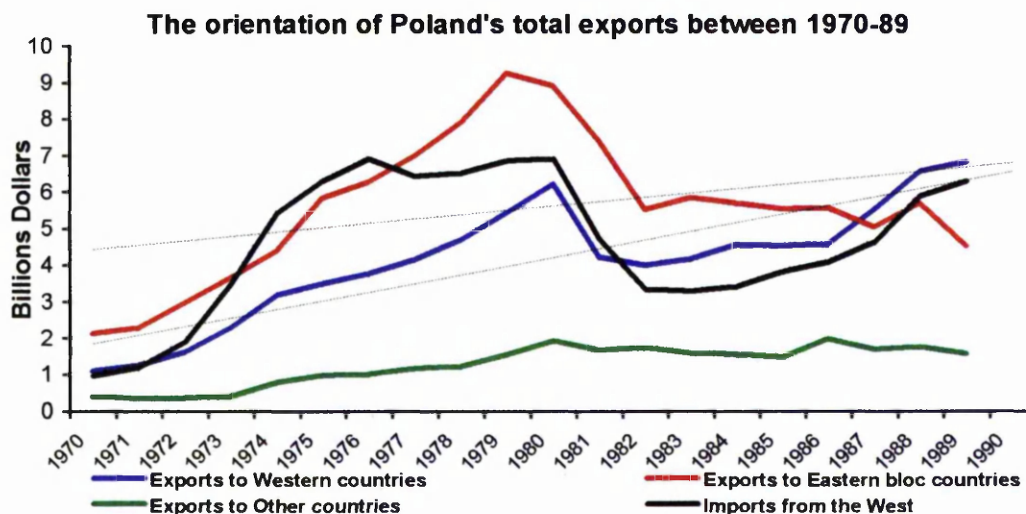
Source: *Calculations based on the UN, Economic Survey for Europe 1989-90*

By 1989, in contrast, the share of exports going to the East (CMEA) had fallen by 25%, while exports to the West had increased by over 22%. The share of "other countries" meanwhile had increased by almost 3%. Observation of the given values reveals that, over this twenty-year period, there was a gradual reorientation of Polish exports from the East to the West. This position was confirmed in 1987 when the West accounted for the larger share of Polish outflows for the first time through out the entire period. In addition to Poland's relations with the West, which were important for hard currency earnings to service its debt and to import, Poland was also quite successful in developing and maintaining its trade relations with other countries outside the Eastern bloc (discussed later). In fact, the share of exports to both the West and other countries was greater than that of the CMEA from the early 1980's. However, although the above percentages tend to reveal a greater geographical orientation of Polish outflows, the actual reality of these developments was not consistent with the country's original expectations. First of all, although trade with the West increased over time, this was not by the margins that were anticipated. Consequently, earnings from exports did not turn out to be sufficient enough to enable the servicing of debt. There are two principal factors, which can be associated with this:

- (i) The oil crisis;
- (ii) Modernisation and credit

The quadrupling of oil prices and the world recession resulted in a depressed level of demand for Polish exports. Hard currency earnings and, therefore, imports from the West were not as high as anticipated.

Graph 1a



Source: *United Nations Data, Economic Survey of Europe in 1989-1990.*

Consequently, Poland's debt to the West increased from approximately \$100 million in 1971 to \$6 billion in 1975.¹² The given graph reveals how exports to western countries (dark-blue curve) increased almost in parallel with its outflows to the Eastern bloc (red curve) between 1972 and mid 1974. However, from 1974 the oil crisis and the associated lower level of Western demand for Polish exports are observable through the dark-blue export curve, which becomes more flat. Outflows to the West did pick up again in 1977 and this continues through until 1980.

The slow down in Western demand for Polish exports from 1974, meanwhile, was compensated for by the East. Observation of the red curve indicates the extent of this increase; and also reflects the East's level of insulation from the negative developments in the world economy. Exports to the East continued to increase at high levels until mid-1979 and then fell sharply (explained later). The effects of the oil price shock are also observable through the slowdown in the flow of imports (black curve)

from the West. These imports, obtained using the credit borrowed from western countries, consisted of investment and consumption goods (discussed shortly). The repayment of credits, however, became increasingly difficult owing to the recession, which raised the debt burden and lowered the level of western demand for Polish exports. With respect to the former, the problem of servicing debt occurred after interest rates on loans increased to 20%; and also following the introduction of the floating exchange rate mechanism, which exposed some of Poland's earlier loans to further price changes.¹³ In terms of the latter, the lower level of western demand was also reinforced by their tendency to protect home markets against Polish exports.¹⁴ From 1974, Polish imports from western countries began to slowdown (see graph), but still remained higher than the country's outflows until 1982. The actual trade deficit with the West, therefore, was a feature of the Polish economy for about ten years (1972-82), with the more negative balances being registered during the first half of this period. This reflected the volume and prices of imported western consumer and capital goods, but also the actual structure and prices of Polish outflows (see subsection 1.5). However, towards the late 1970's the overall deficit position was eased slightly, and this was partly due to the increased level of exports (lower curve) to other countries, especially the Middle East. The main factor contributing to the lower deficit, however, was Poland's slightly improved export performance to the West and the fact that inflows from those countries remained at between six and seven billion dollars from 1975 until 1981. This allowed the bulk of the trade gap to be closed.

For much of this period (1970-80), Polish exports to the remainder of the Eastern bloc continued to increase relatively sharply. This partially reinforces our earlier conclusion that trade developments with the West helped to maintain a strong emphasis on the operation of heavy, extractive and other labour intensive branches of industry. This is supported by the work of Nove (1982), who ascertained that increased output over the 1971-75 period was driven more through higher labour productivity (44%) than capital (8%). To understand Polish increased productivity in light of the lower capital to labour ratio (K/L) we need to introduce point (ii) into our analysis.

Modernisation and credit

The modernisation programme created almost two million positions. This occurred because some of the western credit was sunk into infrastructural development, such as the building of new roads, apartment blocks, educational institutes, factories and other building projects. In terms of imported technology, the building of new factories was a necessary precondition for the development and expansion of new industrial branches. Given these infrastructural goals, some time lag should be expected between the installation of new machinery and the realisation of its output. The copper factories, mentioned earlier, lend some weight to this. With respect to the 1971-75 period, therefore, any substantial increase in the K/L ratio would not be achievable given the focus of the modernisation programme and the length of time required for construction (factories), installation (machinery & technology) and the final operation (output). During this initial period, therefore, the higher demand for labour, which was necessary for the numerous, planned construction projects, was one of the key factors behind the rising labour productivity in Poland. Significant, however, was the improvement in foreign relations with the West and the direct, positive effects on domestic conditions. For example, not only was the period of economic decline in the 1960's reversed, but real income levels rose by 40% and food prices were fixed for the duration of the 1971-75 period (Nove, 1982). In addition, there was a greater range of consumer goods, improved housing conditions and an adequate supply of food. However, rising wages and the improved supply of consumer goods were not the result of new investment and more efficient productivity, but a direct result of the credit expenditure, which was used to finance them.¹⁵ The borrowing of credit, therefore, was used to finance investment projects, higher pay increases and consumption. In addition to the construction projects, investment was sunk into heavy, extractive, chemical and engineering industries and for the purchasing of licences as discussed earlier. However, substantial sums of the credit were not invested directly in the economy for structuring and development purposes but were used, for example, to pay for the import of grain from the United States to support the agricultural sector (Brzeski & Rostowski, 1988, Davies, 1986). Some of the debt disappeared, a part was stolen and some was used to maintain trade

and services with the Soviet Union. With respect to the latter, for example, part of the debt was used to finance the construction of the gas pipeline (see subsection 1.2.1) and was also built by the Polish both in Poland and the stretch running through the Soviet Union. Some of the debt would also be used to import expensive engineering and electronic components from the West to be fitted in Soviet ships, which were still under guarantee in Polish shipyards. However, the supply of western credit intended for the purpose of industrial investment as well as that, which was used to support the operation of the socialist economy, could not be maintained indefinitely owing to the debt servicing burden and the lower than expected export earnings. We will now turn to the final subsection (1.5) of this work where we will consolidate our information on production and trade. That is, through the analysis of Poland's trade structure with the East, West and the developing countries, we will be able to identify the most dominant commodity groups in the country's exchanges geographically as well as revealing the effects of modernisation on trade by region. This particular subsection will also serve as a good basis for later chapters. On completion of this analysis, we will then conclude by summarising the main causes of the decline.

1.5 The structure of Polish trade

For the purpose of our analysis we have selected two individual years during the 1970's for comparison and they are 1975 and 1979. These two years will enable us to assess the actual structure of trade at the end of each planning period, the first being from 1970 to 1975 and the second from 1975 to 1979. The values provided for these years are presented on two separate tables in percentage form according to commodity class and destination. The actual commodity class structure (see methodology section) is made up of SITC categories 0-3, which constitute the non-processed items and SITC categories 5-9, which make up the total industrial products. The first of the given tables (1e) shows the structure of Polish trade for 1975.

Table 1e

The structure of Polish foreign trade in 1975 according to commodity class									
SITC	Commodity Group	Exports				Imports			
		Total	West	Devel	East	Total	West	Devel	East
0, 1	Food	8.5	15.6	6.9	5.0	9.2	10.8	25.4	6.0
2, 4	Raw Materials	3.8	8.7	3.5	1.2	11.8	10.4	46.3	9.7
3	Fuels	20.1	34.8	9.3	13.8	9.2	4.7	9.0	14.0
Total non-processed items		32.4	59.1	19.7	20.0	30.2	25.9	80.7	29.7
5	Chemical Products	7.6	5.4	19.8	7.0	7.4	9.4	1.2	5.9
7	Machinery & Transport	38.2	15.0	35.7	50.8	37.7	38.3	0.5	41.0
6, 8, 9	Other Industrial Products	21.8	20.5	24.8	22.1	24.7	26.5	17.6	23.5
Total industrial products		67.6	40.9	80.3	79.9	69.8	74.2	19.3	70.4
Total		100	100	100	100	100	100	100	100

Source: *Główny Urząd Statystyczny, Handlu Zagranicznego, Warszawa, 1981.*

In 1975, Poland's total export of industrial products accounted for 67.6% of total exports, while non-processed items accounted for the remaining 32.4%. On the imports side, the share of these goods was virtually the same and stood at 69.8% and 30.2%, respectively. In terms of geography, exports of non-processed items were more important in Poland's flows to the West and accounted for almost 60% of the total. The industrial products, which accounted for the other 40%, were made up of predominantly other industrial goods (20.5%), machinery & transport equipment (15%) and chemicals (5.4%). The export of commodities going to the developing countries and the Eastern bloc was dominated by industrial products and accounted for 80% of total exports to both destinations. In each of these cases, machinery & transport equipment accounted for the higher share of the outflows. Poland's total imports were dominated by industrial products (70%) and were supplied by the East and the West with little margin between the two. Developing countries, in contrast, played a more important role as a supplier of raw materials and food. Before drawing any conclusions on these values, we will first introduce the table for 1979 (1f) into this work for comparison. This will allow us to distinguish any significant trade effects connected with the modernisation programme and also takes into account the time lag associated with the installation of machinery.

Table 1f

The structure of Polish foreign trade in 1979 according to commodity class									
SITC	Commodity Group	Exports				Imports			
		Total	West	Devel	East	Total	West	Devel	East
0, 1	Food	7.7	16.1	8.6	3.3	11.5	17.0	37.5	4.0
2, 4	Raw Materials	4.6	9.4	4.7	2.1	10.7	13.2	18.8	7.8
3	Fuels	15.0	27.0	7.9	9.7	15.3	3.5	33.9	20.8
Total non-processed items		27.3	52.5	21.2	15.1	37.5	33.7	90.2	32.6
5	Chemical Products	4.9	4.0	4.6	5.3	7.9	13.9	1.1	4.8
7	Machinery & Transport	43.2	14.6	39.7	58.4	34.3	27.2	0.2	44.1
6, 8, 9	Other Industrial Products	24.6	28.9	34.5	21.2	20.3	25.2	8.5	18.5
Total industrial products		72.7	47.5	78.8	84.9	62.5	66.3	9.8	67.4
Total		100	100	100	100	100	100	100	100

Source: *Główny Urząd Statystyczny, Handlu Zagranicznego, Warszawa, 1981.*

The export of total industrial products increased by over 5% during this four-year period and accounted for 72.7% of exports in 1979. Exports of non-processed items, meanwhile, fell by approximately the same value. Dealing with those outflows going to the West, the most significant increase (8.4%) was that of other industrial goods (SITC 6,8,9). The export of food and raw materials increased marginally. With respect to the East, exports of machinery & transport equipment (SITC 7) increased by 7.6% and raw materials by 0.9%. Exports to developing countries, meanwhile, increased in other industrial products (9.7%), food (1.7%) and raw materials (1.2%). In terms of total exports, the most significant increases were achieved in the export of other industrial products to the West and the developing countries. These goods consisted largely of manufactured goods (SITC 6), such as copper, iron and steel, and miscellaneous manufactured articles (SITC 8), which were largely clothes, footwear and furniture. Our evaluation of the exports side, therefore, reveals that the effects of the modernisation programme and changes in output were more visible in those sectors (SITC 6), which formed an integral part of Poland's trade relations with the Soviet Union, but could simultaneously supply the West. Furthermore, these sectors

were also vital in the supply of metals required for further processing and for the production and supply of machinery & transport equipment to the Soviet Union. To a lesser extent the latter was also supplied to the West. This pattern of supply was also observable in branches requiring little technological sophistication, such as clothes and furniture.

Table 1g

Poland's main exports to the West of SITC products from categories 6, 7 and 8	
68212	Copper
67411	Iron plates
68111	Unwrought silver
67341	Shaped sections of iron and steel
65691	Furnishing articles of textile materials
7321	Passenger cars (excluding buses)
7151	Machine tools for working metal
7115	Internal combustion engines
7353	Ships and boats (excluding warships)
84112	Women's knitted garments
84111	Men's and boys garments
82109	Furniture and parts
85102	Leather footwear

Source: Comecon Foreign Trade Data, The Vienna Institute for Comparative Economic Studies, 1983.

The commodities on the given table (1g), which were exported to the West at the beginning of the 1980's, are those from SITC categories six and eight. These items together with fuels (not included) accounted for the bulk of Polish outflows. With respect to those commodities classified as SITC eight, such as clothes, shoes, leather and furniture, these are items are produced by industries endowed with a low capital to labour ratio and are ranked as items at the lower end of the technological scale.¹⁶ In contrast, Poland was exporting commodities containing a greater level of technology (SITC 7), such as passenger cars, machine tools, combustion engines and ships & boats, although the share of these items in total exports was not substantial.

On the imports side, industrial products, which stood at almost 70% of the total inflows in 1975, accounted for 62.5% in 1979. Therefore, total industrial imports fell

by 7.3% during the second half of the 1970's, which is the period in which total imports fluctuated between six and seven billion dollars (see graph). The supply of western industrial products to Poland fell by 7.9% as percentage of the total. Within this group, machinery & transport imports fell the most by 11.1%, whereas chemicals increased by 4.5%. In percentage terms, the falling share of industrial inflows was replaced by a higher share of food and agricultural products from the developing countries and the West, but even more so through fuel imports. With respect to the former, unfavourable climatic conditions in 1976 (the drought) forced Poland to import more corn and grain for farm animals. The increased share of fuel imports was met by the Soviet Union (6.8%) (planning period - 1975 onwards) and the Middle East (24.9%). Soviet supplies, however, were not sufficient enough to meet Polish needs and could not be increased since volumes had already been predetermined in the plan. This position forced Poland to search for an additional source of supply, which was met by Iraq. This led to bilateral trade relations being established between the two countries, through which Poland would export supplies – especially, steel, iron, cement and other materials for the purpose of infrastructural development both in Iraq and Algeria.¹⁷ There was also a supply of people to help in the development process in the region and also some military goods. These relations enabled Poland to obtain additional supplies of fuel, but also hard currency. Our evaluation of the imports side, therefore, reveals that the inflows of western technology during the early 1970's enabled an increase in the country's productive capacity and exports to be achieved in the second half of the decade, especially in the heavy and extractive industrial sectors. However, the import focus needed to be changed during the second half of the 1970's, since Poland was also not earning sufficient hard currency from exports to service its increased debt burden and to simultaneously purchase more western technology. As a result, the flow of inputs to industry started to fall and shortages occurred. The nature of Poland's trade with the West, as a supplier of raw materials & manufactured items, but also as an importer of technological goods, meant that the resulting balance of trade deficit had to be reduced through imports. This was partially achieved through a reduction in the import of industrial goods, especially machinery & transport equipment. Throughout the 1970's, therefore, the import focus switched from one of investment (first half) to one of support (second half). In terms of the

latter this was observable through the higher imports of fuel, chemicals, food and agriculture. These particular imports are a reflection that increasing support was not only necessary to maintain the operation of industry, but also to meet those shortages, which were affecting living standards more directly. We shall now summarise the main causes of these shortages, the subsequent decline of the economy and the eventual collapse of the entire system.

Causes leading to the collapse

By the beginning of the 1980's the shortage of food and other consumer goods had become quite acute and this was accompanied by hefty and repeated rises in retail prices, especially in the former. This led to growing public discontent and strike action, which was directly connected with the poor social conditions, lack of supplies and the gross mismanagement of the economy. The effects of such action led to massive falls in production and trade (see earlier graph). The credit obtained for modernisation and investment was effective in helping to raise output in the heavy and extractive industrial sectors, but failed to be effective enough in the production of consumer goods. Instead, Poland used some of the credit to actually import them from the West. The actual allocation of western credit into the Polish economy was irrational and badly managed with some of the credit being sunk into needless show factories and the building of national monuments (Davies, 1986). Some of the credit was stolen and other amounts were used to maintain trade and service contracts with the Soviet Union. Capitalist money was being used to support the Socialist economy as opposed to being injected into investment projects. The effects of the modernisation programme were therefore limited, although this is also attributable to the oil crisis, western price increases and the negative effects on debt servicing. Poland, given its high monthly repayments on loans, borrowed more credit to facilitate payments on the previous ones. At the beginning of the 1980's the amount of credit owed by Poland (in real terms) was the equivalent of that borrowed by some European countries under the Marshall Plan (Brzeski & Rostowski, 1988). The supply of credit eventually stopped, and this effectively removed the major component of capitalist support. The result of this was a lower level of imports, since more of the

hard currency earnings were required to service loan repayments. This position worsened further and reached a point where the economy, in spite of its increased exports to the West, was not earning sufficient hard currency to service its debt. The low import levels caused a decline in industrial output and exports due to both the lack of supplies and inputs. Consequently, massive shortages resulted in the domestic economy. At the same time, increases in nominal income together with the rise in retail prices caused further inflationary pressure. Part of this was, however, necessary in order to maintain the illusion over the people and, thereby, minimise the level of discontentment. However, in light of the acute shortages and rising costs, this action failed to work and strike action resulted.

The strike action, which was led by the formation of Solidarity, resulted in a substantial fall in output across many of the enterprises. By December 1981 the scale of social tension led to the intervention of the Army and the implementation of Martial Law.¹⁸ This was the first major blow to the single party system over its ability to manage the economy and the very institutional foundations, which supported it. Attempts were made in the 1980's, following the appointment of Stanislaw Kania to the post of First Secretary, to give enterprises more control and independence over their operations and financial affairs. Greater enterprise autonomy, however, still operated in a virtually unchanged economic system, which did not serve any significant purpose except to extend the decline throughout the 1980's. In the second half of the 1980's Polish exports to the West showed positive signs of recovery and began to replace some of the declining trade with the East from 1987. However, by the end of the 1980's the scale of Poland's industrial problems necessitated not only improved trade with the West, but rather the implementation of a modernisation and restructuring programme which, over the long-term, would raise the quality, efficiency and level of output of the industrial sectors. This is also a necessary precondition for the development and expansion of medium and high-tech exports. For industrial modernisation to occur the appropriate economic conditions need to be created and geared towards the market system.¹⁹ Given the symptoms of the Polish economy, which included high inflation, balance of payments problems, acute shortages and poor credit worthiness the first step is the stabilisation of the

macroeconomic environment. An essential component of this is the liberalisation of the domestic economy through the removal of state controls and an increased reliance on the price mechanism.²⁰ Once stabilisation has been achieved, the growth and development of the Polish economy, which will require the liberalisation of import and export trade, will become more dependent on efficient performing industry. In 1989, the Polish population voted favourably for these changes as well as for democracy and rule of law.

Conclusion

In part one of this chapter we learnt that the planned economic system was a centrally driven means of resource allocation, which was co-ordinated at the expense of the consumer through the underdevelopment and shortage of consumer goods, and this was directly a result of the over emphasis on maintaining high levels of output in the heavy industrial sectors. The ability of the system to meet its output requirements, however, was limited due to the excessive size of enterprises and the fact that cost considerations were not taken into account in the fulfilment of plans. Central to this were the restrictions on enterprise operations which, through the setting of prices, supplies, output and wages, limited the extent of development and specialisation through the absence of competition. A further constraint on enterprises was the fact that inputs were transported over long geographical distances, causing delays and often shortage. As a result, enterprises would attempt to compensate for this factor through communication with other potential suppliers or by improvisation. Input costs per unit of output, therefore, rose over time leading to inefficient production. The increasing use of resources in an attempt to maintain targets was connected with monetary incentives, but actually resulted in waste, an excessive use of energy and environmental damage. The planning system was further limited by its overall policy of import-substitution, which effectively starved the region of competition, new technology, ideas and information. This is one of the key features in market economies, which enables the growth of industrial sub-specialisations and the development of more efficient and cost-effective production methods.

The role of Poland within the system of planning was chiefly as a supplier of iron, steel, extractive resources, machinery and transport equipment. The country's economic decline in the 1960's, however, led to the development of limited trade with the West, and this was initiated at the beginning of the Gierek period in 1970. The purpose of these relations was to obtain western credit in order to purchase western technology and to carry out extensive investment and modernisation. Poland's exports to the West, however, which were intended to earn sufficient hard currency for the purpose of debt servicing and for further import expansion, were greatly limited by the world oil shock. The development of exports was further inhibited by volume and the relative quality of the goods that the country produced. For example, although Poland expanded its production of certain consumer goods in the 1970's, the economy could not produce enough of these for both domestic consumption and export supply. Much of this was directly due to the focus of the modernisation programme and its failure to effect sufficient change in these areas of production. Instead the programme focused more on reinforcing heavy industrial production and those branches directly connected with it. With respect to the latter, some of these developments (metals industries) were positive in enabling the country to boost capacity and export to the East, West and the Middle East. Other aspects of the modernisation programme, which could not be detected through trade, concerned the construction of roads, buildings and factories etc. Not all of the credit obtained, however, was used to import new technology from the West for the purpose of improving the efficiency of industry, but was also used to fill the consumer goods gap, to finance shortages and to maintain trade and service contracts with the Soviet Union. Some of the credit was also wasted or stolen. In light of such mis-allocation and management, therefore, the modernisation and investment programme of the 1970's was limited. This was eventually reflected in the country's ability to produce, especially after the limits on credit had been reached. Therefore, in an attempt to service the substantial debt burden and to maintain import supplies, Poland placed more pressure on the constrained heavy industrial sectors. This was carried out through the import of additional oil supplies from the Middle East, which were then used to boost production and export goods to the Soviet Union, but also to the Middle East and the West in order to raise hard currency earnings. Import earnings,

however, turned out to be insufficient to satisfy both spheres. With respect to the West, in particular, even though Polish exports grew positively, the low prices associated with the type of commodities supplied led to concerns over the trade deficit. The result of this was a restriction of imports, which exacerbated shortages further. Parallel to this was the unpopular rise in retail prices, which, in an economy characterised by acute shortages, was the central cause behind the wave of strikes. Attempts to calm the situation through increased nominal income only served to increase the inflationary overhang and cause even further shortages. At the end of the 1980's, the Polish economy, as an exporter of chiefly labour and resource intensive goods, was characterised by high inflation, acute shortages, poor credit worthiness and balance of payments problems. We will, therefore, now turn to chapter two of this work where we shall ascertain in how far this position has changed since the initiation of market reform.

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Chapter Two

Macroeconomic change and the developments in Polish trade and industry

Introduction

Our primary aim in this chapter is to determine the extent of the developments in Polish trade since the transition to a market economy began in 1989 and whether the results obtained are indicative of restructuring progress. Our method of achieving this will be through the application of recognised trade models (see methodology), which have been used by the European Commission in the past to measure development and convergence processes in reforming economies. However, industrial progress is not only dependent on improved trade alone, but also requires a stable macroeconomic environment to facilitate it. Therefore, before we can move on to the more specialised component of this work, we need to establish the overall conditions in which Poland's trade developments have taken place. This will require a brief examination of the stabilisation programme that was implemented to rectify the imbalances of the old system and, more specifically, what the main effects were on the domestic economy, especially in respect of inflation, gross domestic product (GDP) and employment. This will form section one of this work. In section two of this work, which focuses on Polish-EU trade developments, our first subsection deals with the actual conditions set on trade in the Interim Agreement. This is an important part of the framework document (Association Agreement), which was signed between Poland and the EU at the beginning of the 1990's and aims to increase the level of political, legal and economic cooperation between the two partners. Of interest to our work is whether the agreement can be regarded as mechanism for growth, and we shall question this through the extent of trade liberalisation and the level of market access for Polish goods (subsection 2.2). The remainder of part two will then deal with the measurement of trade. In subsection 2.3 we shall apply the Grubel-Lloyd formula to Poland's trade flows with the EU in order to determine whether the values obtained on IIT (intra-industry trade) are indicative of industrial

convergence and restructuring. In the following subsection (2.4) we will apply the RCA model (Revealed Comparative Advantage) in order to measure the competitiveness of Polish industrial branches relative to those of the EU. Subsection 2.5, meanwhile, through the application of the Gravity model, seeks to estimate the effects of income and distance on Poland's trade with a selected number of European countries. This model will be applied to total imports and exports as well as to the exchange of goods from five other industrial sectors. On completion, we will then consider how the results obtained from these trade models compare with our empirical results (subsection 2.6). This will enable us to determine whether theoretical models are an appropriate form of measurement for transition economies and, in addition to our analysis of empirical data, will help to provide a more conclusive set of results. At the end of this chapter our aim is to be able to comment on the whether the reorientation of Polish trade to the EU has revealed progress in industrial restructuring and a shift towards the production of those goods higher up on the technological scale. At the end of this chapter our aim is to be able to explain not only the extent of these developments, but also in how far the Polish macroeconomic environment as well as the actual conditions on trade (Association Agreement) have facilitated them. We shall now turn to part one of this work, where we will first discuss the implementation of the stabilisation programme and its effects on the macroeconomic environment.

I. Macroeconomic Stabilisation

2.1 The Balcerowicz programme and its effects

Poland was the first and only country in the Central European region to implement a programme of radical reform. The programme, known as “shock therapy,” was designed to bring about stabilisation in the Polish economy and was drawn up by the IMF and the country’s deputy Prime Minister, Leszek Balcerowicz. The plan was initiated in January 1990 with a view to radically reducing Poland’s serious problems of foreign debt, hyperinflation and excess demand through the implementation of the following five components:

- (i) The deregulation of prices, which aimed at cutting subsidies and price controls;
- (ii) The internal convertibility of the zloty, which was to act as an anchor of the stabilisation programme. The zloty was pegged against the dollar and imports were regulated by customs;
- (iii) The introduction of a new tax on wage increases above the officially fixed level;
- (iv) A real interest rate, which would be adjustable on a monthly basis and aimed at encouraging savings;
- (v) Greater tax discipline i.e. balancing the central budget and cuts in public spending.

One of the important features of the stabilisation programme was the internal convertibility of the zloty and its devaluation against the dollar. The actual rate of the zloty stood at 1,339 in September 1989, but by January 1990 had been devalued to 9500.¹ At this rate the zloty was fixed against the dollar and this acted as a nominal anchor, which in turn allowed all administrative controls over foreign exchange to be lifted. This was particularly important for trade in providing accurate price information to import and export firms as well as creating stable conditions for the liberalisation of trade. In a demand constrained economy, however, the burden of

hyperinflation was the main downside feature, which first of all needed to be controlled for and reduced. We will now discuss how this was achieved and what the main effects were on the economy. This will be carried out through a brief evaluation of the following macroeconomic indicators:

- (i) inflation;
- (ii) exchange rate policy;
- (iii) gross domestic product;
- (iv) employment.

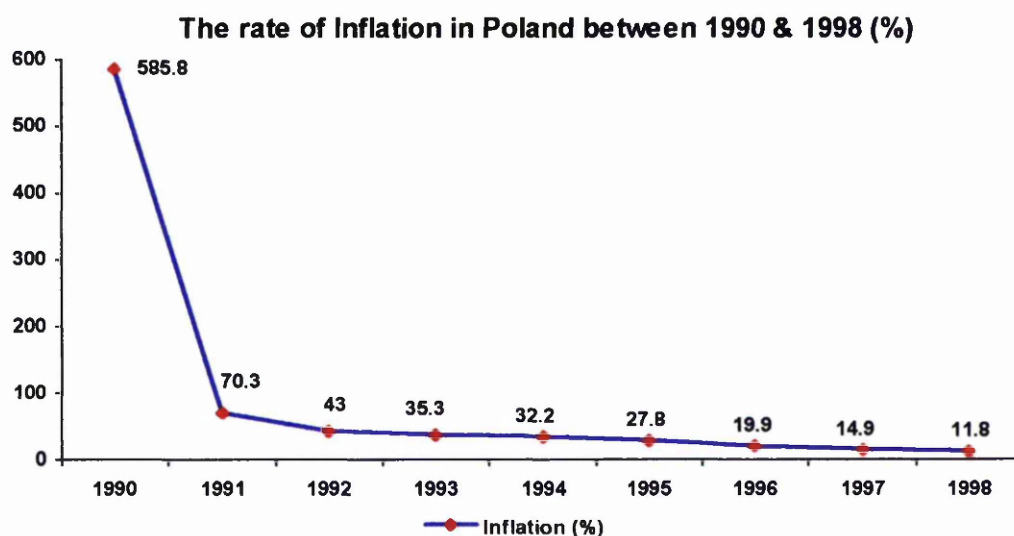
2.1.1 Inflation

One of the main downside features at the outset of reform was the burden of accelerating inflation, which from October 1989 was increasing at a monthly rate of 55% (IMF, 1994). This was one of the main targets of the stabilisation programme and a factor, which was controlled and reduced through the implementation of a fixed exchange rate (discussed later), a restrictive incomes policy and also through the use of fiscal and monetary tools. These two latter points, first of all, deserve further elaboration. On the fiscal side, the government needed to restore equilibrium to the government accounts and this could only be achieved by reducing the state budget deficit. At the end of 1989, this stood at 8% of GDP and the aim was to reduce it to 1% during 1990. This was carried out through the virtual elimination of all (except housing and passenger transportation) subsidies, with additional reductions in public expenditure on defence and investment. The elimination of subsidies was also further reinforced through the limited supply of bank credit to the government and this was done in order to improve fiscal discipline. That is, the increase in government revenues should be obtained through a reduction in tax relief and via an increase in corporate taxes.

On the monetary side, inflation was tackled through a direct reduction in demand (Gołębiowski, 1994). Because demand was excessive at the beginning of the 1990's, credit and money supply restrictions needed to be introduced. The raising of interest rates was the main monetary policy instrument through which this was achieved. The

interest rate was adjusted monthly initially and was done so with a view to attracting higher deposits in zlotys as opposed to foreign currencies. This particular strategy is effective in terms of stimulating savings, but needs to be backed up by a restrictive policy (ceiling) on commercial bank lending if spending is to be reduced. Such measures were taken during the final quarter of 1990. Having ascertained how fiscal and monetary policies were applied within the context of the Balcerowicz programme, we should show what the outcome was on the behaviour of inflation.

Graph 2a



Source: GUS, *Mały Rocznik Statystyczny*, 1999.

Observation of the given graph reveals two distinct phases in the behaviour of inflation. The first phase, in which inflation fell considerably from 585% to 70%, points to the initial success of the stabilisation programme in bringing the aggregate price level down quite rapidly. The second phase reveals a more gradual reduction from 1991, which continued throughout the entire period measured. More fundamentally, however, these two phases are explained not only through the implementation of fiscal and monetary policy, but rather through the types of exchange rate policy that were chosen.

2.1.2 Exchange rate policy

Through out the 1990's three different types of exchange rate policy were implemented in Poland. The first of these was the fixed exchange rate, where the Polish zloty was set at 9,500 per US dollar. This represented an initial 31.5% devaluation in the currency from 6,500 zlotys and was carried out with a view to achieving equilibrium in the supply and demand for foreign currency. In May 1991 the zloty was further devalued by 8.5% against the dollar and this, together with a sharp rise in interest rates, reduced inflation by approximately 500% during the first phase.² This combination also proved successful in raising the relative attractiveness of the Polish zloty as a currency for savings (Balcerowicz, 1995). At the end of 1991, Poland left the fixed exchange rate system and applied the flexible exchange rate mechanism. This initially took the form of the crawling peg, where the Polish zloty was pegged against a basket of currencies, but later became substituted for the crawling band in order to enable a greater margin (+/-10%) for fluctuation. These policies were implemented during the second phase. It serves at this point to elaborate on why the fixed and flexible exchange rate mechanisms were chosen at these points in time. This will involve a brief insight into their main theoretical differences.

Fixed and flexible exchange rate regimes

The fixed exchange rate is an anti-inflationary policy tool, which is implemented with a view to achieving stabilisation in a domestic economy. By fixing the rate between two currencies, this type of policy provides stable price signals, which is a crucial factor for the government of a transition economy that has chosen to restructure via trade- and investment-driven growth strategies. At the same time, this strategy also serves to simultaneously prevent speculation in the money market, which is another potential source of inflation.³ In terms of gaining credibility, the adoption of the fixed exchange rate regime also forces governments to be disciplined in terms of their economic policies. For example, should a country's balance of payments deteriorate, whether this be generated from the visibles side of the account (trade) or from the invisibles side (sale and purchase of services), it could be

necessary to raise interest rates or apply deflationary measures in order to safeguard the currency. This type of policy, therefore, does signal good intentions to international institutions and also helps to raise public confidence.

In contrast to the fixed system, flexible exchange rates, which Poland implemented in 1991, allow greater control over the reduction of inflation through the use of fiscal and monetary policy tools (Orlowski, 1998). First of all, this eases pressure on governments, since the task of devaluation or revaluation of the domestic currency is eliminated. That is, the value of the currency is determined by the interaction of export supply and import demand as well as market forces. According to Corden (1991), who investigated the approaches to exchange rate policy in developing countries, the flexible regime is a policy for governments who want to achieve real economic objectives and describes this regime as the “real-targets” approach.⁴ This stems from the fact that, through the implementation of the flexible system, governments have the freedom to pursue other policies such as those designed to achieve growth and full employment.

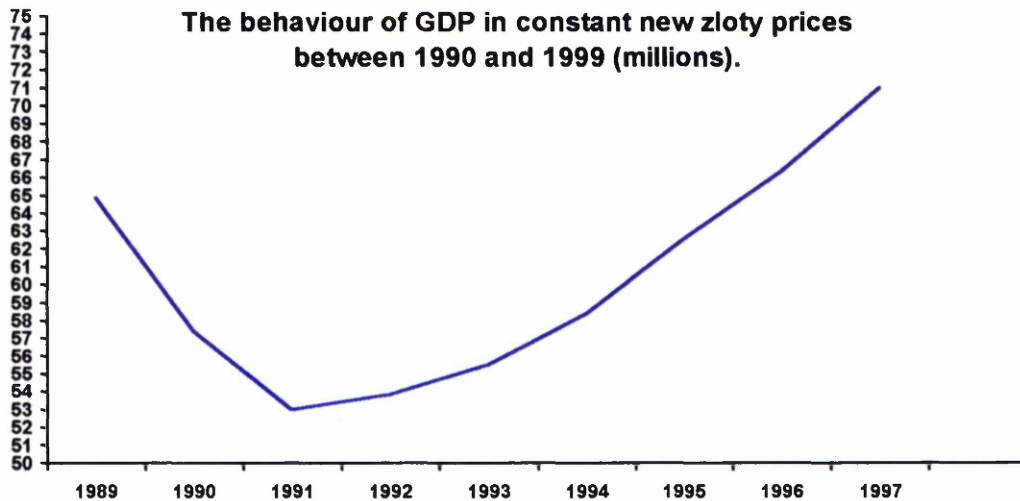
In running a brief comparison between the two types of exchange rate policy, the downside to flexible exchange rates is that they are exposed to changes in the international market and, therefore, changes in their daily value. This type of regime also opens up an economy to an inflow of speculative money, which may also alter the value of the exchange rate. In contrast, a fixed exchange regime does eliminate this problem and also provides investors with clear, positive signals concerning a government’s intentions with respect to inflation. The downside, however, is that it leaves governments little scope to make policy decisions, which are central to achieving price stability and monetary discipline. This is a central issue to both transition and developed economies.

Combining the above theory with the developments in Polish exchange rate policy suggests, that the initial implementation of the fixed exchange rate was an appropriate course of action to take given the scale of inflation and the need to achieve stability. Reference should be made to the fact that setting the exchange rate in an environment of expected inflation is a difficult problem, since the price of the

zloty could have been overvalued (too few zlotys per US dollar) or undervalued (a high zloty value in relation to the dollar). For example, in the case of the former, there would have been no pressure to keep prices from rising, whereas in the case of the latter it may have been necessary to use a considerable portion of the IMF loan to defend the currency. After the initial devaluation of the zloty in May 1991, interest rate policy was one of the main instruments used to defend the fixed exchange rate at the beginning of the 1990's, and this was also the main policy tool used throughout the remainder of the period. In phase two (1991-98), following the substantial fall in the rate of inflation, it was also necessary to create a macroeconomic environment conducive for growth and development. This would involve the more frequent adjustment and greater control over fiscal and monetary instruments, which could only be achieved through a flexible exchange rate strategy (Corden, 1991). The question at this point is: did the exchange rate strategy together with the use of fiscal and monetary instruments stimulate and promote growth or did it hinder it?

2.1.3 Gross domestic product

The effects of the Balcerowicz programme on GDP were initially negative. This was an outcome that was anticipated, especially since the exchange rate along with fiscal and monetary instruments were implemented with a view to radically reducing the level of aggregate demand in the economy. Hence, macroeconomic policy needed to be tough enough to bring inflation down but, as the following graph indicates, this also worked against domestic growth.

Graph 2b

Source: Calculations based on GUS & Rocznik Statystyczny information.

For the Polish government, at the outset of reform, the effects of the stabilisation programme were expected to result in a recession, which would last no longer than six months and, simultaneously, cause GDP to fall between 3% and 5%.⁵ Observation of the given graph, however, reveals that the depth along with the actual period of time in which the Polish economy spent in recession was much more severe than originally anticipated. According to GUS estimates, GDP fell by more than 11% during 1990 and by a further 7% in 1991. This is indicated on graph (2b) by the two-part downward spiral, which shows that the period of time in which the Polish economy spent in recession was also more than two years. The period of recovery was also longer, since 1989 levels of output were not actually realised until after mid 1995. This behaviour, however, is not confined to just the Polish economy, since almost all transition economies of Central Europe exhibited these patterns in varying degrees (Rosati, 1994). For example, the depth of the recession experienced in Hungary and the Czech Republic, following the “gradualist approach”, was not as extensive as in Poland, but was longer. In contrast, Poland’s “shock therapy” programme resulted in an earlier recovery, but only after a much deeper recession. This suggests that the initial starting conditions in each of these economies were an important factor, but also the macroeconomic instruments applied. On the Polish side, this can be best understood through the response of supply and demand.

During the initial two years of the recession the Polish economy recorded a trade surplus, which suggests that the recession in the country was not supply-side driven. More specifically, lower aggregate demand in the economy resulted in reduced exports and a positive trade balance. This is supported by the policy combination contained in the Balcerowicz programme – particularly, price liberalisation, zloty devaluation as well as restrictive fiscal (ceilings on excessive wage levels) and monetary policies (high interest rates). The implementation of these instruments effectively wiped out the monetary overhang inherited by the former system. That is, the massive rise in consumer prices together with a fall in the level of domestic purchasing power caused a demand shock, which would continue until equilibrium had been achieved. According to Chawluk (1994), this may have been avoided if households had been partially compensated for the fall in their balances through the issue of government savings, bonds or equity shares in state enterprises.⁶ According to Berg & Sachs (1992), assessing the scale of real money loss would have presented a complex problem if measured using the fall in the level of output, since only estimations were known. The unknown variable was the role of the unofficial black market, which we shall discuss later in this work. We shall now outline the main effects of the stabilisation programme on the structure of GDP.

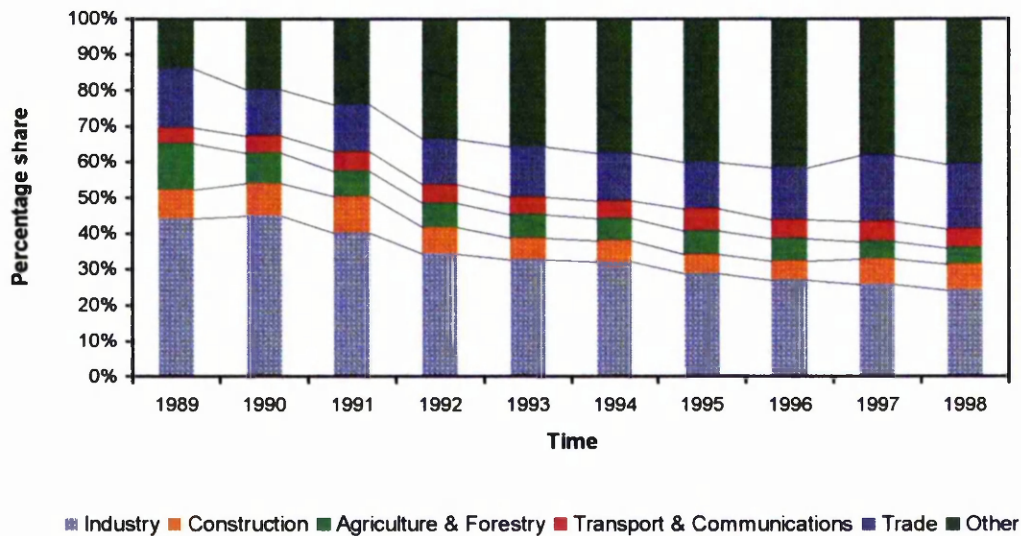
The changing structure of GDP

In 1992 positive levels of GDP (see graph 2b) were experienced for the first time since the initiation of market reform. By 1993 Poland's GDP was rated as one of the best performing in Europe.⁷ The following graph (2c) depicts the structure of GDP in share terms, using seven main branch sectors of industry over the period 1989-98.

The share of GDP by sector reveals some distinct changes (%) over time. The most significant change, in terms of declining shares, can be found in the lower segment on graph 2c, labelled industry. The term "industry" is used to include the traditional branches of industry, such as mining & quarrying, iron, steel, chemicals and other manufacturing industry (clothes, wooden products, textiles etc).

Graph 2c

The share of branch sectors in GDP (%)



Source: *Own calculations based on GUS, 1997, 1998 & 1999.*

Over the period measured the share of industry in GDP fell by almost 20% (44.1-24.4%). This was initially due to the direct effects of the demand shock not only in Poland, but also in other countries of the former Soviet Union. After 1992, however, the fall in the share of industry was slight when compared with the initial two-three years of reform. The more stable position of industry was a result of an increase in real industrial output, although the comparatively lower share of this sector over time can be explained by developments in other areas of economic activity. The upper green segment, for example, on the given graph (marked "other") represents the growing share of private services in GDP (banking, finance, insurance, pensions & communications etc) which were previously under developed. The share of these services in GDP increased from 14 to 41% over the period measured and this can be attributed to the increasing number of privatisation projects and the associated foreign direct investment activity that they attracted (discussed in chapters 4 & 5).

Those sectors whose changing share in GDP was comparatively less significant were agriculture, construction & communications. The most resistant of these to any

structural change was, and continues to be, that of agriculture, which accounts for 27% of the total labour force (4.3 million people) and is strongly represented, politically.⁸ The existence of intensive farming methods in the country, however, which is partly due to the continual operation of small family farms, explains why output relative to the share of people employed in this sector remains comparatively small. Significant in the given GDP structure is the behaviour of trade and its effect on the shares of the other sectors. The effects of the Russian crisis serve as a good example in revealing the exposure of Polish industry and trade to external developments. This is evident by their lower shares in 1998, which was the result of a fall in demand for Polish exports of commodities and intermediate goods.⁹ A part of this export loss was compensated for by increased spending on the domestic market, which helped to maintain levels of industrial output as well the demand for services (ECE, 1999). We shall now outline the effects of the stabilisation programme on employment.

Employment

One of the obvious results of the demand shock in the Polish economy, and the subsequent fall in the level of output, was an increase in the level of unemployment. By the end of 1990, unemployment had reached 6.5% of the labour force, which equated to approximately 1.1 million people. These values are indicated on table 2a. By 1992 this value had doubled and continued to increase until 1994 where it peaked at 2.8 million people, or 16% of the labour force. Over the following three years unemployment fell by 5.7% and then increased marginally in 1998. Poland's double-digit rates of unemployment were also observed in most other (except Romania & Czech Republic) countries of the region, reflecting the scale of over-manning under the previous system. The Polish case reveals that, after economic reform was initiated, some of the excess employment in the country began to diminish. This position then began to intensify following plant closures, which resulted in mass lay-offs. This was due to the fact that a number of enterprises were no longer viable and needed to be closed, although some of the unemployment was also due to the initial privatisations in the country (ECE, 1994). The effects of this were greater in industry where the focus of central planning was maintained. Between 1989 and 1998, for

example, the share of employment in industry fell from 29% of the labour force to 24%. This parallels the falling share of this sector in GDP.

Table 2a

Unemployment in Poland between 1990 and 1998 in % & thousands of people									
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
%	6.5	12.2	14.3	16.4	16.0	14.9	13.2	10.3	10.4
000's	1126	2156	2509	2890	2838	2629	2360	1826	1831

Source: GUS, *Central Statistics Office, Warsaw, 1990-1999*.

Parallel to these changes, however, has also been the growth of private industry, the expanding financial services sector and trade. In terms of the latter the share of labour employed in trade increased from almost 9% of the labour force in 1989 to over 14% in 1998 (GUS, *Rocznik Statystyczny, 1999*). This suggests that the falling share of industry in GDP was accompanied by a fall in industrial employment, while the growth of the private sector, financial services and trade have had a positive effect on employment creation. Some of the unemployed have, therefore, been absorbed into these sectors.

Brief summary

The Balcerowicz stabilisation programme, through the liberalisation of prices, the removal of subsidies and a devaluation of the exchange rate, was effective in terms of bringing about price stability. The period of time in which the economy spent in recession (see graph 2b), however, suggests that the programme had its weaknesses. For example, although the switch to a flexible exchange rate mechanism was consistent with greater management of the economy, subsequent decisions with respect to monetary policy prolonged the period of industrial recession. On the one side this was necessary in order to curb aggregate demand, although the frequent raising of interest rates, which became a source of contention between the National Bank of Poland and the Monetary Policy Council (RPP- Rada Polityki Pieniężnej), restricted industrial potential and, instead, facilitated a high level of portfolio growth and foreign exchange activity. This also led to inflationary pressure and currency

appreciation. It was, therefore, necessary to introduce a creeping devaluation formula, which was initially applied monthly at a rate of 1% and then later reduced to 0.8% (PlanEcon Report, 4/1998). This suggests that decisions over the use of policy instruments have been problematic, but also points to the complexity of managing an economy with a high level of aggregate demand on the one side, while aiming to promote growth on the other.

In light of this we can argue that, although positive developments have been observed in GDP and employment during the 1990's, these have taken place in a macroeconomic environment that, at least for the first half of the 1990's, worked against potential industrial growth and, thereby, would not have facilitated any extensive industrial change. During the second half of the decade, however, the level of unemployment started to fall and this was consistent with greater growth across all sectors. This was particularly evident through the expanding services sector, the growth of the private industry and the higher share of the labour force employed in trade. These developments suggest that the restructuring and modernisation of the country's industrial branches did not really begin to gather pace until the second half of the decade. We shall now turn to part two of this work where, through the measurement of Polish trade developments with the EU, we shall ascertain whether this was the case.

II. Developments in Poland's foreign trade

Introduction

After 1989, the domination of the Comecon countries in Poland's trade came to an end as the country reorientated more of its trade to the West. Much of this has been accounted for by the EU, which has been Poland's main trade partner for the past decade, accounting for over 63% of its total exports and supplying almost 66% of its imports.¹⁰ The country ranks as the EU's seventh largest trade partner and, as the largest market of the CEECs, also accounts for the largest share of EU trade. In contrast to the other main CEEC partners, however, Poland has the lowest share of intra-industry trade (IIT) with the EU.¹¹ As discussed in the methodology section of this work, IIT is the exchange of goods from the same industry. Therefore, a higher recorded level of IIT in Poland's trade with the EU over time is suggestive that change is occurring in the country's commodity composition. This may indicate broad industrial convergence with those structures of the EU. Our analysis of IIT will form subsection 2.3 of this work. In the following subsection, through the application of the model for RCA (revealed comparative advantage), our aim is to determine whether any branches of Polish industry reveal a comparative advantage in production relative to those of the EU. Of interest in this work is whether this has occurred in the traditional branches of industry or more in the developing private sectors. In the final subsection (2.5) of this work, we will apply the Gravity Model to Polish trade with seventeen, selected, European countries with a view to assessing the effects income, distance, adjacency and the importance of EU membership. The application of all of the given trade models will enable us to extract different types of information from each and this will be of greater value for our overall evaluation of Poland's progress. Before carrying out this analysis, though, we need to be aware of the trade agreements in force between Poland and the EU since the beginning of the 1990's. This is particularly important in providing us with the main framework conditions by which trade has so far been governed. It will also enable us to comment on Poland's level of market access and whether the agreements have been a mechanism for growth.

2.2 Conditions on Polish trade

The main agreement, which was drawn up between the European Union and Poland is known as the Association Agreement. This was initiated on November 22, 1991 and signed in Brussels on December 16, 1991. The agreement was established between the member states of the EU on the one part and Poland on the other. It was ratified by the parliaments of both parties - that is, all parliaments of the EU (referred to as the Community) and the Polish Sejm. In article 1 of the Agreement, the Community recognises that Poland's final objective is to become a member of the EU. For Poland, this is an important area of the framework document and the following agreed terms aim to assist Poland in achieving this objective:

- (a) To provide an appropriate political framework aimed at developing political relations between the parties;**
- (b) To promote trade and good economic relations aimed at the rapid development of the Polish economy;**
- (c) To provide a basis for the Community's financial and technical assistance to Poland;**
- (d) To provide an appropriate framework for Poland's integration into the Community;**
- (e) To promote co-operation in cultural matters.**

Through the five given sections in the agreement, the aim is to create an environment in which new links of solidarity between the two parties can be established and, thereby, enable the Community to provide Poland with economic, political and legal support. Through this, the agreement aims at achieving a closer working relationship and a more mutual understanding between both parties.¹² The provisions of the document related to trade and its commercial part are contained in the Interim Agreement.

2.2.1 The Interim Agreement

The Interim Agreement was signed in March 1992 and aims to establish a free trade

area for industrial goods over a period of ten years. This involves the gradual lowering and the eventual abolishing of all customs duties payable on goods traded between Poland and the Community. In this regard, the Community began its own reductions on customs duties before Poland and, with the exception of products from the sensitive sectors (agricultural, coal, steel and textiles), had abolished all tariffs by January 1995. Sensitive products are defined as those products, which the member states of the Community may consider to be a threat or are reluctant to import. The products of these four sectors are subject to special protocols and their trade arrangements have been laid down in the Agreement as follows:

Protocol No1 (Article 15)

Lays down the arrangements applicable to textile products.

Protocol No2 (Article 16)

Lays down the arrangements applicable to products covered by the Treaty establishing the European Coal and Steel Community.

Protocol No3 (Article 19) Lays down the trade arrangements for processed agricultural products. All other agricultural products, however, remain outside this protocol and outside the conditions set in the Agreement on free trade.

By 1997, the Community had lifted customs duties on a large number of products where tariffs/quotas had been in force for the first five years of the agreement and this enabled the free trade of certain products from the following groups:

- | | |
|-----------------------|-----------------------------|
| (1) Steel Products | (6) Cement |
| (2) Metal Products | (7) Leather Products |
| (3) Chemical Products | (8) Chinaware |
| (4) Copper Products | (9) Radio's and Televisions |
| (5) Wooden Products | (10) Lighting Equipment |

One of the main aims of the Community, with the exception of sensitive goods with special protocols, was to gradually remove all barriers to trade and to establish a free

trade area.¹³ The purpose of this is to provide Polish producers with more access to the Community during its phase of economic development through lower or no customs tariffs. The agreement, as well as providing greater trading opportunities for Polish firms, also allows foreign producers into the Polish market. This exposes Polish firms to greater market competition and also forces them to adapt to the changing climate. For this reason, certain safeguard and restructuring clauses have been written into the Agreement and are designed to prevent foreign competition from exerting pressure on Polish firms, which could lead to loss or closure. These are as follows:

(i) The Anti-dumping (GATT - Article 30) & Safeguard clauses (GATT - Article 31): Article 30 exists to allow Poland or the Community to act against dumping and the safeguard clause (article 31) allows safeguard action to be taken. These articles are written in to the agreement in order to protect producers from material losses following an increase in their country's imports. For example, should Polish or Community producers experience loss following a shift in demand then the parties concerned can appeal to have new import restrictions introduced.

Note: Before action can be taken with respect to articles 30 and 31, parties must conform to **article 34** of the agreement: parties taking action must consult the Association Council with a view to seeking a solution. In the event that no decision has been reached within a period of thirty days then action may be taken.

(ii) The Restructuring clause: serves to protect infant industry and those firms, which are restructuring. For example, should foreign imports to Poland pose a threat to developing industry, impede the restructuring process and result in heavy social costs then, Poland, under **Article 29**, is allowed to introduce protective tariff measures for a limited period.

The car package, for example, which under the restructuring clause has its own arrangement, both limits the import of motor cars from the Community while Poland develops its manufacturing base and this also serves to encourage investment into car production. This was set in motion in 1992 when unified rates were introduced and

set at 35%. The aim was to gradually reduce these rates by 5% annually and, thereby, create a free trade area by the end of the decade. On the Community's side, a quota on the level of duty free car imports from Poland was set at 150 million ECUs, which equates to 40-50,000 cars (Europe Agreement 1992).

Assessment of the Interim Agreement

Fundamentally, the Interim Agreement should be regarded as beneficial to Poland since, first of all, it represents a regionally driven initiative. The upside to this is that new reforms and changes in policy can be carried out more swiftly and meetings can be held on a more regular basis. Furthermore, one of the initial benefits of the agreement was the fact that Poland could begin its own reductions on barriers to trade later than the Community. This began in 1992 when Poland lifted customs duties on approximately 27% of all industrial products from the Community. These were largely investment goods and raw materials. In 1995, further tariff reductions were introduced and, thereafter, on an annual basis with duties on all remaining industrial goods from the Community being reduced by 20% each year (Europe Agreement, 1992). This was intended to provide Poland with an initial trade advantage over the Community and the time to carry out reform. Given this, we need to assess whether the initial trade arrangements have benefited Poland in terms of enabling it to boost its capacity to produce and export to the Community.

Market Access

The initial conditions set on trade indicate that access to the EU market for Polish exports has been rapid. In contrast, Gołębiowski (1994), states that the Interim Agreement has revealed ambiguity on the Community's side with regards to its trade policy, especially during the first two years.¹⁴ A part of this is connected with the Community States strict levels of protection, particularly against sensitive products from the Polish agricultural, clothes, textiles, steel and metallurgical sectors.¹⁵ Of importance to Poland is the collective share of these industries in its GDP – more specifically, these industries represent the backbone of Polish industry and, during the early stages of reform, the most capable of exporting. Of further consequence to

Poland is the fact that some of these sectors also employ a considerable share of the labour force like, for example, the agricultural and industrial sectors as discussed earlier. From a Community perspective the cheaper labour employed in these sectors could constitute one of the main threats and may be central in explaining the selective treatment of Polish sensitive products. In effect, although this is within the boundaries of the framework agreement, Community markets are protected as a result. The Community's treatment of non-sensitive goods in contrast is less restrictive, with lower or no tariffs in force. One of the main problems for Polish producers in these sectors, however, was the capacity to supply and to be able to fully utilise the quotas, which were set. The supply side constraint stems chiefly from the fact that, during the early stages of reform, sufficient industrial restructuring (see part one) and private sector development would not have been carried out, which suggests that the share of the labour factor in production is still going to be relatively high in relation to capital. In addition, it is necessary to consider whether, initially, the quality of non-sensitive goods supplied by Poland would find markets in the EU. Some of these products, for example, would be competing against established brand names. The initial position, therefore, reveals that, during the early stages of transition, export earnings would accrue chiefly from the traditional sectors, which would reflect a continuation of pre-1989 trade. We will now consider the effects of the EU non-tariff barriers.

Contingent protection

The three main instruments of protection commonly used in the EU are the content rule and the anti-dumping and safeguard measures. Beginning with the content rule, the conditions on rules of origin are strict and were set at 60%.¹⁶ This implies that the local content of a product has to be either equal to, or above this predetermined level. This makes it difficult for exporters to obtain cheaper external supplies, such as raw materials or other supply sources. However, according to Enders and Wonnacott (1996), the rules of origin allowed Poland to include not only Polish and EU content in its exports, but also that from any other Visegrad country.¹⁷ In terms of the two latter instruments in force, meanwhile, the enforcement of anti-dumping and safeguard measures has been the most controversial. Since 1990, Poland has been

charged with nine cases of dumping, which were largely set against exports from the chemical, wood, iron and steel sectors. The main controversy surrounding the anti-dumping charges concerns the EU version of their enforcement and whether they are in line with those contained in the GATT agreement.¹⁸ At the same time, there is little to suggest, theoretically, that EU contingent protection is not GATT consistent. In practice, though, there is also little to prevent anti-dumping authorities from claiming that dumping has occurred, when in fact there has been no dumping at all. Authorities can achieve this through the provision of inflated or bias trade information. In the actual agreement, there is also nothing to prevent the EU from applying these measures of protection in a hostile manner against Polish exports, or with the intention of curbing trade (Hindley, 1993). The economic rationale behind anti-dumping is questionable and, in the case of Poland, it would be more in their interest to avoid costly legal proceedings and to consider the option of either raising the appropriate export prices and/or reducing supply. At the same time, the EU has faced sharp criticism from a number of countries including Japan and North America, particularly over its anti-dumping practices. The WTO trade policy review on contingent protection, which followed, set out to assess the situation and found that anti-dumping investigations carried out by the EU have actually fallen during the second half of the 1990's. In addition, the report emphasised that trade between the EU and the Central European countries had increased and was interpreted positively as a result of tariff elimination, preferential agreements and harmonisation with respect to the rules of origin. However, the WTO review, according to Tharakan (1999), was typically cautious with regards to its approach on anti-dumping and could have given the evaluation side greater content and more importance.¹⁹

Brief Summary

The initial conditions set on trade have been facilitating in so far that they have allowed for the expansion of Polish trade to the EU. The agreement has, however, been criticised for its selective approach, although the EU especially in allowing products that Poland could not supply sufficient of in order to take advantage of the liberal tariffs. This, according to the EU, is due to either quantitative or qualitative problems.²⁰ Meanwhile, some of those industries, which were in a position to supply

were treated as sensitive or confronted with EU measures of protection. One positive aspect of this is that it does in fact force adjustment at a micro level. This import of investment goods is indication that this is beginning to occur while, at the same time, Polish-EU cooperation within the legal, political and economic boundaries of the framework agreement is gradually improving the operational environment, which is essential both for local business and for potential foreign investors. In terms of contingent protection, meanwhile, it is still too early to tell whether EU dumping practices will continue to fall given the fact that their action has become more exposed to the international public eye. Some of this will depend on the future pace of trade liberalisation and also on the level of support from foreign investors - particularly, those producing in Poland for both the domestic and foreign markets. We will be able to develop a clearer picture of this after we have obtained the results from the application of our trade models, as well as through a closer examination of the volume and structure of foreign investment in chapters four and five. We will now turn to the application of these models by first investigating the developments in Poland's intra-industry trade with the EU.

2.3 The extent of intra-industry developments in Poland's trade with the EU

The exchange of goods between the developed countries of today is largely in the form of intra-industry trade (IIT). This is defined as the value of exports of an industry, which is exactly matched by the imports of the same industry.²¹ The import and export of cars, machinery and electronic goods between Britain, France, Germany, Italy and Spain serve as a good example. A country's trade sheet, however, is not made up purely of IIT goods and those, which fall outside this category are known as inter-industry trade goods (IT). This type of trade occurs when countries specialise in the production and exchange of goods, which belong to different industries. In terms of measurement, therefore, both of these categories make up the value of total trade and can be expressed as $IIT+IT=100$. A value closer to 100 would indicate a larger share of IIT goods in a country's trade composition and closer to 0 would suggest a higher level of IT. The exchange of similar commodities throughout the EU, for example, which is driven by broadly similar levels of technology and tastes, results in a higher share of IIT in the trade between

these countries. This suggests that EU countries have comparable sets of factor endowments. IIT, therefore, can be described as a mechanism, which promotes competition and the transfer of information and technology between countries. In the EU the growth of IIT can be attributed to enterprising entrepreneurs, a more liberalised trading environment and the continual institutional reform, which has been carried out by EU member states. This has brought about greater integration in the EU and has played a key role in both its economic and political convergence. Of interest to this work is whether the liberalisation of Polish trade with the EU reveals similar developments. In other words: is Poland on a convergence path with the EU in terms of technology? To determine if this is the case, we need to apply the Grubel-Lloyd index to ascertain whether this is reflected in the level of IIT.

Measurement

In compiling the statistical information for this analysis, three select years have been chosen to measure the developments in Poland's trade with the EU: 1990, 1996 and 1998. The reason for this is that convergence needs to be measured over a wider spread in order to record any significant change. Furthermore, changes in export patterns are not going to occur instantly, since industrial adjustment will take some time. The three years, which have been chosen provide the base year (1990) to reflect the structure of trade at the beginning of transition and two select years (1996 & 1998) to record any changes in IIT after pre-1989 levels of GDP output had been achieved - i.e. post-1995. The data, which will be used for this analysis is the 3-digit SITC (standard international trade classification) category of Eurostat. With respect to methodology, the following two equations have been chosen for this analysis and will be used to measure IIT for 266 traded commodities.

$$IIT = \left\{ 1 - \left[\sum |x_i - m_i| / \sum (x_i + m_i) \right] \right\} 100 \quad (GL-1)$$

$$IIT = \left\{ 1 - 0.5 \left[\sum \left(\left| \frac{x_i}{x} \right| - \left| \frac{m_i}{m} \right| \right) \right] \right\} 100 \quad (GL-2)$$

GL-1 and GL-2, as proposed by Mikić (1998), are the abbreviated forms of the Grubel-Lloyd equations. The main difference between the two equations is that GL-1 is the unadjusted form and GL-2 the adjusted. Basically, GL-2 adjusts for the possibility of trade imbalances (surplus/deficit) by upwardly or downwardly adjusting the end value according to the degree of imbalance. In the absence of this weight in GL-2 (0.5), there is a possibility that the performance of a particular industry can be over or under estimated. There is still some debate on this issue (see Mikić, 1998), however, with question marks next to whether the equation needs to be adjusted or not. For the purpose of this work, therefore, the results of our trade calculations will be plugged into both equations for comparative purposes.

Results

For each of the three years analysed, a table has been provided for each individual year. On the left-hand side of each table the first column shows the actual SITC category, which ranges from 0 to 9. These categories represent the following groups of commodities:

SITC 0 = Food & live animals

SITC 1 = Beverages & tobacco

SITC 2 = Crude materials, inedible, except fuels

SITC 3 = Mineral fuels, lubricants & related materials

SITC 4 = Animal & vegetable oils, fats & waxes

SITC 5 = Chemicals & related products

SITC 6 = Manufactured goods classified chiefly by material

SITC 7 = Machinery & transport equipment

SITC 8 = Miscellaneous articles

SITC 9 = Commodities & transactions not classified in the SITC

*** Please refer to appendix 1 of this work for a more detailed list of the commodities contained in each of the above categories.**

On each of the following tables provided, the second column contains the value of exports from each of the above categories and, in the third, the percentage share of

each category in total trade. The next two columns (4 & 5) show the value of imports and their percentage share of total trade, respectively. This is followed by the trade balance of each category (6) and, in the far-right column, the respective levels of IIT. All total values, with the exception of total IIT, can be found in the last row at the foot of the table. The values of all exports and imports have been calculated in millions of Ecu.

The position in 1990

As discussed earlier in this work, Poland experienced a marginal trade surplus in 1990, which lends weight to the fact that the recession in Poland was largely demand driven. The surplus trade value for this year (831.6 million ECU) can be found in column 6 at the foot of the table. The highest trade surplus out of all of the given sectors on the table was recorded in the agricultural sector (SITC 0) and this is shown in the column marked (xi-mi). Slightly lower surpluses were also achieved in crude materials (SITC 2) and mineral fuels, (SITC 3). On the deficit side, the bulk was largely due to the import of machinery and transport equipment (SITC 7), which totalled more than one billion Ecu.

Table 2b

Developments in trade between Poland and the EU in 1990						
Industry	x_i	%	m_i	%	$x_i - m_i$	IIT _i
STTC 0	959.495	18.98	464.309	10.99	495.18	20.065
STTC 1	5.733	0.11	87.737	2.077	-82.004	12.267
STTC 2	477.347	9.44	96.142	2.27	381.20	18.919
STTC 3	507.417	10.03	130.565	3.09	376.78	27.138
STTC 4	9.787	0.19	29.834	0.70	-19.597	48.696
STTC 5	437.369	8.65	491.399	11.63	-53.97	33.402
STTC 6	1180.934	23.36	822.614	19.47	358.32	36.342
STTC 7	578.108	11.43	1615.924	38.26	-1037.8	38.143
STTC 8	859.864	17.01	449.739	10.64	410.12	32.004
STTC 9	38.525	0.76	35.204	0.83	3.321	49.02
Total	5054.509	100	4222.957	100	831.6	

Source: Own calculations based on Eurostat, 3-digit data, 1990.

The main thrust of Poland's exports, however, came from SITC 6, which consists of manufactured goods, such as wooden products, articles of apparel - clothes, textiles and other goods classified by material. These goods accounted for 23.36% of the export total.

The position at the end of 1990 is consistent with our research in chapter one of this work and reveals that the Polish economy was chiefly a producer and exporter of labour and resource intensive goods and an importer of largely more technical (machinery & transport) and manufactured goods. The levels of intra-industry trade, which were calculated for each individual SITC category, also reveals that trade in each of these categories was characterised by the exchange of different products. This is indicated by the low-levels of IIT in the far right-hand column of the previous table. These results are further reflected in the level of IIT, which was obtained through the measurement of Poland's total trade with the EU for all 266 commodities. The sum of our trade values were plugged into the unadjusted and adjusted formulas, which gave:

$$\text{IIT} = 31.5 \quad (\text{unadjusted})$$

$$\text{IIT}^* = 32.0 \quad (\text{adjusted})$$

The small difference between both values is due to the fact that Poland achieved a marginal trade surplus in 1990 and, therefore, little adjustment would be necessary in IIT*. To determine whether there has been any change in the composition of Poland's trade with the EU during the 1990's, we need to compare these values with those of 1996 and 1998.

Intra- or inter-industry trade?

In contrast to 1990, both 1996 and 1998 reveal that Poland's trade was in deficit. This was -8.7 and -8.9 billion ECU for 1996 and 1998, respectively. Dealing with 1996, first of all, the calculation of export values indicated that Polish trade was driven predominantly by three main categories of exports: SITC 6, 7 and 8. The bulk of these exports, as in 1990, were driven by manufactured goods (6) (various types of

non-ferrous metals, cork & wooden products) and miscellaneous manufactures (8), which consisted of articles of apparel, clothing and furniture. Together, these goods accounted for over 52% of total exports to the EU. With respect to transport and machinery, exports increased almost five-fold over this period.

Table 2c

Developments in trade between Poland and the EU in 1996						
Industry	x_i	%	m_i	%	$x_i - m_i$	ΠT_i
STTC 0	884.774	7.28	1161.335	5.56	-276.561	35.71
STTC 1	8.287	0.06	77.948	0.37	-69.661	16.555
STTC 2	481.393	3.96	480.912	2.30	0.481	45.662
STTC 3	860.566	7.08	808.829	3.87	51.737	8.055
STTC 4	11.718	0.09	88.644	0.42	-76.926	23.351
STTC 5	654.140	5.38	2655.507	12.7	-2001.37	25.599
STTC 6	3229.677	26.59	4339.945	20.79	-1110.27	42.804
STTC 7	2769.908	22.80	9151.038	43.84	-6381.13	40.975
STTC 8	3161.557	26.03	2043.299	9.79	1118.258	35.46
STTC 9	81.970	0.67	63.395	0.30	18.575	59.49
Total	12143.99	100	20870.85	100	-8726.86	

Source: *Own calculations based on Eurostat, 3-digit data, 1996.*

This reflects a continuation of pre-1989 trade, which was conducted in electrical and mechanical machines, combustion engines and machine tools. Within this category, however, there are also a substantial number of items, which can be termed more as component parts (see appendix two) and, therefore, do not constitute complete machinery exports as such, but rather equipment that will be installed in machinery that is yet to be assembled. Some of the items are produced from steel and from other types of metals, such as taps, valves and railway equipment, for example. The more advanced exports from this category can be attributed to the growing level of direct foreign investment in the country, especially the car industry (discussed later).

On the imports side, machinery and transport equipment accounted for almost 80% of Poland's trade deficit (-6.3 billion Ecu) and accounted for almost 44% of all imports from the EU. This is also confirmed by Eurostat analysis, which recorded a

surplus in EU exports of road vehicles, general industrial machinery and machinery specialised for particular industries.²² Further surpluses were also recorded in textile yarns, fabrics and related products (SITC 6). This, given the high share of clothing, articles of apparel and various metal items in Poland's export structure, reflects the importance of outward processing trade (OPT). This is confirmed by the marginal increase in IIT for SITC categories 6 and 7, which increased to 42.8 and 40.9, respectively. The largest increase in IIT, however, (excluding non-classified items), was achieved in SITC 2 (45.6), whose commodities consist of crude materials, such as synthetics, man-made fibre and minerals. Therefore, while the results obtained suggest that trade in machinery & transport equipment (SITC 7) has increased, Poland's trade with the EU in 1996 was dominated by predominantly low-end (labour, resource & human capital intensive) of the scale commodities. According to Kaminski (1998), products of a low industrial development still account for a sizeable share of Polish exports, but on the basis of trade developments between 1993-95 concludes that significant industrial restructuring has occurred.²³ We shall clarify this point after we have analysed the position for 1998. Our reason for this concerns the macroeconomic conditions in the Polish economy up until 1995, which, as we explained earlier, did not really facilitate extensive industrial change. The results obtained from our 1996 calculations are:

IIT = 37.09

IIT* = 41.09 (upwardly adjusted to take account of the -8.7 billion deficit)

In comparison, Eurostat's own calculations reveal Poland to have an IIT level of 48 with the EU-15 for this particular year. The primary reason for this is due to the data measured. That is, Eurostat carried out their own analysis based on 2-digit data, which consists of 97 divisions of commodities. This implies a lower resolution in measurement and, therefore, a higher level of IIT. However, if we compare the value calculated by Eurostat for Poland with those of other Central European countries, then we find that Poland is specialised in the exchange of commodities from different industries (inter-industry trade). For example, the value calculated for Slovenia was 70, Slovakia (61), Hungary (66), Estonia (48) and the Czech Republic (66) (Eurostat, 1998/3). With the exception of Estonia, therefore, the trade of the remaining CEECs

is characterised more as IIT (intra-industry trade). We will now compare our 1996 values with those calculated for 1998.

Poland's commodity composition for 1996 & 1998 compared

The results obtained for 1998, reveal Poland to have a slightly lower (unadjusted) IIT value for 1998, compared with 1996. However, when the results calculated for all 266 commodities are plugged into the weighted formula, IIT* is marginally higher than the value calculated for 1996:

$$\text{IIT} = 32.33$$

$$\text{IIT}^* = 45.12$$

Poland's trade deficit for 1998 stood at almost nine billion Ecu. This explains the greater adjustment that was required in the weighted formula to calculate for the higher imbalance. Both of the given results, however, reveal conclusive features concerning Poland's trade position with the EU in 1998.

Table 2d

Developments in trade between Poland and the EU in 1998						
Industry	x_1	%	m_1	%	$x_1 - m_1$	IIT ₁
STTC 0	1031.209	6.42	1275.811	5.10	-244.602	41.785
STTC 1	13.178	0.08	99.595	0.39	-86.417	23.37
STTC 2	549.295	3.42	474.563	1.89	74.732	48.957
STTC 3	931.569	5.80	520.390	2.08	411.179	10.026
STTC 4	13.430	0.08	140.144	0.56	-126.714	17.49
STTC 5	775.824	4.83	3774.536	15.10	-2998.71	22.774
STTC 6	4282.166	26.66	6249.639	25.00	-1967.47	48.465
STTC 7	4311.134	26.84	1184.202	47.38	-7530.89	46.847
STTC 8	3947.447	24.58	285.232	1.14	3662.215	41.382
STTC 9	201.293	1.25	328.825	1.31	-127.532	52.167
Total	16056.55	100	24990.76	100	-8934.22	

Source: *Own calculations based on Eurostat, 3-digit data, 1998.*

Taking the lower, unadjusted value first of all suggests that Polish-EU trade has remained characterised by the exchange of goods from different industries. The adjusted value (45.1), which also confirms an inter-industry exchange of goods, reveals a slight increase on the 1996 value.

The results for 1998 reveal that export trade has expanded in manufactured goods (SITC 6), machinery & transport equipment (SITC 7) and miscellaneous articles (SITC 8). The export of these items together accounted for 78% of the total to the EU-15. Out of this value, items from SITC 7 accounted for 26.8% of the outflows, while those from SITC 6 and SITC 8 together accounted for 51.2%. Poland's high import of machinery & transport equipment, which constitutes 47.3% of its inflows from the EU, remains the central cause of the country's high deficit accounting for 84.2% of the total.

Table 2e

The dominance of SITC categories 6, 7 & 8 in Poland's upper fifteen traded commodities with the EU			
Poland's Exports		Poland's Imports	
321 COAL NON-AGGLOMERATED	R	533 PIGMENTS/PAINTS/VARNISH	HK (M) CAP
635 WOOD MANUFACTURES N.E.S.	R	542 MEDICAMENTS INCLUDE VET	HK (H) LAB
676 IRON/STEEL BARS/RODS/ETC	R	582 PLASTIC SHEETS/FILM/ETC	HK (M) CAP
682 COPPER	R	641 PAPER/PAPERBOARD	R
699 BASE METAL MANUFACTURES NES		653 MAN-MADE WOVEN FABRICS	R
761 TELEVISION RECEIVERS	HK (M) LAB	699 BASE METAL MANUFACTURES NES	R
773 ELECTRICAL DISTRIBUTION EQUIPMENT	HK (M) LAB	728 SPECIAL INDUSTRIAL MACHNINES NES	HK (M) LAB
778 ELECTRICAL MACHINERY	HK (H) LAB	741 INDUSTRIAL HEATING/COOLING EQUIP.	HK (M) LAB
781 PASSENGER CARS ETC	HK (M) CAP	752 COMPUTER EQUIPMENT	HK (M) CAP
782 GOODS/SERVICE VEHICLES	HK (M) CAP	764 TELECOMMS EQUIPMENT NES	HK (M) LAB
784 MOTOR VEHICLE PARTS/ACCESS		772 ELECTRIC CIRCUIT EQUIPMENT	HK (M) LAB
821 FURNITURE/STUFF FURNISHING	L	775 DOMESTIC ELECTRICAL EQUIPMENT	HK (M) LAB
841 MENS/BOYS WEAR, WOVEN		781 PASSENGER CARS ETC	HK (M) CAP
842 WOMEN/GIRL CLOTHING WOVEN	L	784 MOTOR VEHICLE PARTS/ACCESS	L
845 ARTICLES OF APPAREL NES	L	893 ARTICLES NES OF PLASTICS	L

Source: *Own calculations based on Eurostat, 3-digit data, 1998.*

R: Resource-intensive

L: Labour-intensive

HK (L): Human capital-intensive – low technology

HK (M) LAB: Human capital-intensive (medium technology) & labour-intensive processes

HK (M) CAP: Human capital-intensive (medium technology) & capital-intensive processes

HK (H) CAP: Human capital-intensive (high technology) & capital-intensive processes

HK (H) LAB: Human capital-intensive (high technology) & labour-intensive processes

Table 2e allows us to observe the dominance of SITC categories 6, 7 & 8 in Poland's

upper fifteen exports and imports with the EU for 1998. These have been listed in ascending order according to category. To the right of each commodity the given abbreviations represent the factor content embodied in their production and are explained at the foot of the table.

Dealing with the exports side first of all, ten out of the upper fifteen commodities consist of labour- and resource-intensive products. These are also items that were produced and exported by Poland under central planning and consist of commodities, which are largely from SITC categories 6 and 8. Observation of the given commodities on table (1g) in chapter one enable some fairly accurate comparisons to be made, indicating that the dominance has been maintained in these industries. The increased export of medium technological products (electrical equipment, television receivers and vehicles) and electrical machinery (high-tech) reflects the growing role and some development in these outflows, especially in motor and goods & service vehicles (see chapter five). On the imports side, inflows of technological items (SITC 7) are dominant. However, these items also contain a number of products for domestic consumption, such as cars, electrical goods and computers, which can be sold for industrial or private use. Some of the imports for industry consist of specialised industrial machinery (see chapter three) and heating equipment. The imports side also reveals a number of labour- and resource-intensive goods, such as paper, base metals, fabrics and plastics. These, together with consumption goods, are revealed to be quite substantial in Poland's inflows (see subsection 2.6). These initial findings are confirmed by Smith (2000) who found, that the EU recorded substantial trade surpluses in goods for personal consumption with Poland and the Czech Republic. In contrast, Hungary, with a lower trade deficit than its two neighbours, revealed a higher inflow of capital geared more for economic regeneration.²⁴

Brief Summary

The measurement of Poland's trade flows with the EU has revealed a low, but developing level of intra-industry trade throughout much of the 1990's. These initial findings suggest that, although some positive developments have been made in the export of certain medium and high technological products (SITC 7), the expansion of

Polish exports in the 1990's has been driven predominantly by the country's traditional labour and resource-intensive sectors (SITC 6 & 8), which supplied West European markets before reform was initiated. The reinforcement of these operations in the 1990's suggests that developments in production and increased output have focused largely on the country's existing factor endowments, which is consistent with Hecksher-Ohlin thoughts on production and specialisation. We should also add that the nature of some industrial branches (wood, furniture, textiles & clothes) limits the amount of technology that can be used in production, especially when compared with the sophisticated computer-driven robots used in the production of motor vehicles or certain electronic products. However, before we draw any firm conclusions from these results, we need to find out whether the dominance of Poland's traditional branches in trade has in fact resulted in their becoming more competitive. To achieve this we need to ascertain whether Poland, relative to the EU, is revealed to have a comparative advantage in the production labour and resource-intensive goods. This will involve the application of our model for revealed comparative advantage.

2.4 Revealed Comparative Advantage

The growth of trade between Poland and the EU has so far revealed little change in the composition of exports as indicated by our results on IIT, which indicate the exchange of goods from different industries. The dominant exports include commodities produced by the traditional sectors, such as articles of apparel, clothes, textiles, shoes, chemicals, wooden items, iron & steel products and furniture. Brenton & Di Mauro (1998) document that these broad industrial sectors in the CEECs, as a whole, are treated as sensitive because of their abundant supply of cheap, unskilled labour, which has resulted in a loss of comparative advantage to countries of the EU.²⁵ Could this EU loss of comparative advantage, therefore, imply a shift and a possible gain to countries like Poland? RCA (revealed comparative advantage) seeks through the measurement of exports to determine whether a particular industry has a comparative advantage in production. The formula used to calculate RCA was used by the European Commission for the purpose of assessing the extent of convergence following the implementation of the Single Market

Programme. This is defined as:

$$RCA_{it} = \frac{(x_{it}^e - m_{it}^e)}{(x_{it}^e + m_{it}^e)} \times 100 \quad \text{Where: } x_{it}^e = \text{exports of industry } i \text{ and}$$

$$m_{it}^e = \text{imports of industry } i \text{ over time } t.$$

Before providing our own results we should first consider other related research. For example, Hoekman and Djankow (1997) measured all CEEC exports at the 2-digit and 4-digit levels of disaggregation for the years 1990, 1993 and 1996 and concluded that, with the exception of the Czech Republic, little change had occurred in the broad structure of trade.²⁶ Corado (1993) found that, at the 3-digit level, Poland only revealed a comparative advantage in the production of clothes. We shall now assess whether our own results are consistent with some of those observed by other authors.

Results

The results obtained for our research were based on the same 3-digit data for 1990, 1996 and 1998. On table 2f the upper 28 RCA values are shown for each individual year.

A complete list showing the value for all commodities can be found in appendix 3 of this work. When interpreting these results, it is useful to remember that the net value of a traded commodity (x-m) is divided by the value of total trade in that commodity (x+m) and then multiplied by 100. Therefore, a value between 50 and 100 would indicate a relatively high degree of competitiveness. The three tables provided reveal the dominance of labour and resource intensive industries for each individual year, which concurs with the findings of Hoekman and Djankow (1997) indicating little structural change. If our earlier assumption is correct concerning the focus on traditional sectors, then it may occur that production in certain resource- and labour-intensive commodities has become more efficient and competitive. However, some time needs to be allowed before this position is more apparent, since many of the industries producing coal, steel and iron are still in the hands of the state or are only partially controlled by the private sector.

Table 2f

RCA in 1990 (1-28)					
1	289 PRECIOUS METAL ORE/CONC.	100	15	672 PRIMARY/PRODS IRON/STEEL	96.792472
2	333 PETROL./BITUM. OIL, CRUDE	100	16	001 LIVE ANIMALS EXCEPT FISH	96.707836
3	961 COIN NONGOLD NON CURRENT	100	17	248 WOOD SIMPLY WORKED	96.334422
4	245 FUEL WOOD/WOOD CHARCOAL	99.914749	18	054 VEGETABLES,FRSH/CHLD/FRZ	96.249374
5	321 COAL NON-AGGLOMERATED	99.904739	19	634 VENEER/PLYWOOD/ETC	96.184848
6	045 CEREAL GRAINS NES	99.697885	20	682 COPPER	96.104032
7	562 MANUFACTURED FERTILIZERS	99.541546	21	061 SUGAR/MOLLASSES/HONEY	96.035452
8	282 FERROUS WASTE/SCRAP	99.407074	22	223 OIL SEEDS-NOT SOFT OIL	95.375723
9	677 IRON/STEEL RAILWAY MATL	99.258885	23	971 GOLD NON-MONETARY EX ORE	94.707317
10	274 SULPHUR/UNROASTD PYRITES	99.155973	24	681 SILVER/PLATINUM ETC	94.607144
11	325 COKE/SEMI-COKE/RETORT C	99.095183	25	635 WOOD MANUFACTURES N.E.S.	93.685069
12	322 BRIQUETTES/LIGNITE/PEAT	98.876404	26	272 FERTILIZERS CRUDE	92.1875
13	972 NON CLASSIFIED SITC 9	98	27	222 OIL SEEDS ETC - SOFT OIL	91.901103
14	247 WOOD IN ROUGH/SQUARED	97.379531	28	661 LIME/CEMENT/CONSTR MATL	91.376782
RCA in 1996 (1-28)					
1	121 TOBACCO, RAW AND WASTES	100	15	288 NF BASE METAL WASTE NES	95.272529
2	122 TOBACCO, MANUFACTURED	100	16	322 BRIQUETTES/LIGNITE/PEAT	91.309255
3	325 COKE/SEMI-COKE/RETORT C	100	17	059 FRUIT/VEG JUICES	89.514274
4	343 NATURAL GAS	100	18	686 ZINC	87.408032
5	351 ELECTRIC CURRENT	100	19	842 WOMEN/GIRL CLOTHING WVEN	87.150503
6	961 COIN NONGOLD NON CURRENT	100	20	682 COPPER	85.614079
7	321 COAL NON-AGGLOMERATED	99.915097	21	635 WOOD MANUFACTURES N.E.S.	85.075118
8	245 FUEL WOOD/WOOD CHARCOAL	99.731034	22	666 POTTERY	84.562082
9	274 SULPHUR/UNROASTD PYRITES	99.402661	23	272 FERTILIZERS CRUDE	83.540023
10	289 PRECIOUS METAL ORE/CONC.	98.711019	24	248 WOOD SIMPLY WORKED	80.289651
11	282 FERROUS WASTE/SCRAP	98.40604	25	971 GOLD NON-MONETARY EX ORE	76.343466
12	681 SILVER/PLATINUM ETC	96.712924	26	247 WOOD IN ROUGH/SQUARED	75.089511
13	793 SHIPS/BOATS/ETC	95.827097	27	821 FURNITURE/STUFF FURNISHG	73.968309
14	264 JUTE/BAST FIBRE RAW/RETD	95.348837	28	562 MANUFACTURED FERTILIZERS	73.585605
RCA in 1998 (1-28)					
1	351 ELECTRIC CURRENT	100	15	246 WOOD CHIPS/WASTE	81.11023
2	325 COKE/SEMI-COKE/RETORT C	99.84616	16	635 WOOD MANUFACTURES N.E.S.	79.47804
3	289 PRECIOUS METAL ORE/CONC.	99.65657	17	562 MANUFACTURED FERTILIZERS	78.5126
4	282 FERROUS WASTE/SCRAP	99.21261	18	666 POTTERY	78.47535
5	321 COAL NON-AGGLOMERATED	99.15114	19	677 IRON/STEEL RAILWAY MATL	77.72416
6	011 BEEF, FRESH/CHILLD/FROZN	98.42763	20	247 WOOD IN ROUGH/SQUARED	77.65869
7	245 FUEL WOOD/WOOD CHARCOAL	98.31528	21	017 MEAT/OFFAL PRESVD N.E.S	76.67538
8	681 SILVER/PLATINUM ETC	97.32401	22	248 WOOD SIMPLY WORKED	76.66372
9	972 NON CLASSIFIED SITC 9	96.58849	23	682 COPPER	75.10216
10	274 SULPHUR/UNROASTD PYRITES	95.8816	24	058 FRUIT PRESVD/FRUIT PREPS	73.08583
11	672 PRIMARY/PRODS IRON/STEEL	85.2878	25	686 ZINC	71.32208
12	288 NF BASE METAL WASTE NES	84.42358	26	841 MENS/BOYS WEAR, WOVEN	71.21265
13	059 FRUIT/VEG JUICES	83.56002	27	821 FURNITURE/STUFF FURNISHG	66.41872
14	842 WOMEN/GIRL CLOTHING WVEN	81.99728	28	001 LIVE ANIMALS EXCEPT FISH	65.52573

Source: Own calculations based on Eurostat 3-digit data, 1990, 1996 & 1998.

According to Smith (2000), transition economies have been slow to remove subsidies

on energy producers. Therefore, the trade of some Polish commodities is either financed by the state, or artificially restricted by the EU, which suggests that a number of the observed RCA values are not a true reflection of industrial competitiveness.

Out of Poland's upper commodity exports (subsection 2.3), we identified five industries in which Poland revealed high RCA values, indicating that these areas of production have become more competitive over time relative to those same industries in the EU:

SITC 635	Wood manufactures	(resource-intensive)	RCA-79.4
SITC 682	Copper	(resource-intensive)	RCA-75.1
SITC 821	Furniture	(labour-intensive)	RCA-66.4
SITC 841	Men's clothing	(labour-intensive)	RCA-71.2
SITC 842	Women's clothing	(labour-intensive)	RCA-81.9

The five export commodities are all confirmed to be among Poland's main exports to the West during the 1970's. They are also within Poland's upper ten exports to the EU in 1998 (see subsection 2.6). The export of clothes is one of Poland's main export branches and one of the most competitive (Osteuropa-Institut, 1999). This is also one of the largest branches in which OPT (outward processing trade) trade occurs. The copper industry was privatised in 1997 and, at the time, Poland was ranked as the fifth largest producer of copper in the world.²⁷ The production of furniture and wooden products has also been one of the most dominant branches trading with the EU in the 1990's and, together with clothes, have become among the most important outflows in Poland's trade with Germany (see chapter three). In the later part of the 1990's, furniture making in Poland also attracted some FDI (see chapter five).

In bringing this part of the analysis to a close, it is possible to conclude that the RCA values calculated do not reflect any significant industrial change or shifts in production between 1990 and 1998. The commodities for which we obtained relatively high RCA values were commodities produced by labour and resource-

intensive industries. Observation of appendix three also confirms the dominance of these industries higher up on the RCA scale. However, some caution should be exercised when applying the term “competitive” to some industries owing to the operation of restrictions and subsidies in the EU and Poland, respectively. Also, there are some question marks next to the applicability of the model. For example, if Poland is importing largely technological goods from the EU in exchange for mainly primary products, then Poland’s primary products could be revealed to be competitive relative to similar goods in the EU. Thus, the model cannot take account of the levels of efficiency or the working conditions under which goods are produced. This suggests that certain, high RCA commodities need to be also evaluated in the context of their overall production and trade conditions in order to avoid premature estimates on levels of industrial convergence. It could be argued that the model does actually perform better under intra-industry conditions where more information is known concerning product type and quality. We should further recognise that the time period over which these changes have been measured is short in terms of allowing significant progress to be made in terms of efficiency and competitiveness. This particular model has, however, allowed us to identify industries, which may be potentially competitive in time. We shall now turn to our next subsection where we shall extend our analysis to take account of the more direct effects of income and distance on trade.

2.5 The Gravity Model

The Gravity model, which is more commonly associated with the function describing the force of gravity in physics, is used by economists and policy makers to model the flow of trade between two countries as being proportionate to their income and inversely proportionate to the distance between them (Rose, 1999). This was first carried out by Tinbergen (1962) and later by Linneman in 1966.²⁸ The model is more complex than those presented in previous subsections in so far that the equation has been designed to estimate the effects of income and distance on trade flows between two partners. For the purpose of our analysis, we have chosen 17 European countries (EU and Non-EU), whose import and export trade with Poland will be the dependent variables on which GDP, GDP-Capita and distance will be regressed. We have also

included certain dummies in the regression equation to take account of whether a country belongs to the EU and/or shares a national border with Poland. For both the export (1) and import side (2), the equations are written as:

(1)

$$\ln E_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies$$

(2)

$$\ln M_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies$$

In equation 1, for example, Poland's exports (left-hand side of the equation) will be the dependent variable on which GDP, GDP-Capita (gdp/pop) and distance will be regressed for Poland (j) and European countries (i).

All variables are defined as follows:

E_{ij} = value of Polish exports to countries i; i = 17 selected European countries.

M_{ij} = value of Polish imports from countries i;

GDP_j = Gross Domestic Product (at market exchange rates) of Poland;

GDP_i = Gross Domestic Product (at market exchange rates) of European countries;

GDP/POP_j = GDP per capita of Poland;

GDP/POP_i = GDP per capita of European countries;

$Dist_{ij}$ = distance in km between the capital cities of countries i and j;

Dummies = dummy variables representing the adjacency (ADJ) between countries i and j (sharing a national border) and preferential relationships (EU membership).

Interpretation of results

The values obtained from this regression will be analysed with a view to establishing the effects of income and distance on the following:

- (i) Total imports and exports
- (ii) Agricultural imports and exports
- (iii) Raw material imports and exports
- (iv) Fuel imports and exports
- (v) Machinery imports and exports
- (vi) Manufactured imports and exports

The results of the above will be presented in tabular form with the coefficient values representing Poland's exports and imports being given on the left- and right-hand side of the table, respectively. The results for each import and export category will appear in the form of a coefficient value, a standard error value, a T-ratio, a probability value and an R-squared value. Statistically, we are concerned with the R-squared value, the T-ratio and the probability value.

R-squared: This tells us whether the regression has successfully provided an accurate fit of all variables. A value close to 1 indicates that the regression was successful, and closer to 0 indicates the opposite.

T-ratio: Statistically, a value greater than 2 indicates that the corresponding variable is significant and less than 2 suggests that it is not.

Probability: Likewise, this value also refers to the degree of significance. A value less than 0.05 indicates that the variable is significant and greater than 0.05 the opposite. We will now present our tables of values and analysis of the results.

Exports side

GDP_i coefficient and T-ratio values are a measure of income size in European countries.

GDP_j coefficient and T-ratio values are a measure of output in Poland.

Imports side

GDP_i coefficient and T-ratio values are a measure of output in European countries.

GDP_j coefficient and T-ratio values are a measure of income in Poland.

Note: GDP coefficient values should be positive and T-ratio values >2 for them to be significant.

Results

Table 2g (1-6)

Poland's total Imports and Exports with 17 European Countries						
Polish Exports				Polish Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	3.1722	3.8522	0.82349 [.432]	3.8219	2.8574	1.3375 [.214]
GDP _i	0.86411	0.13633	6.3384 [.000]	0.83460	0.10113	8.2531 [.000]
GDP/POP _i	0.15947	0.21272	0.74967 [.473]	0.067023	0.15779	0.42476 [.681]
GDP _j	0.22665	0.15242	1.4870 [.171]	-0.071494	0.11306	-0.63234 [.543]
GDP/POP _j	-0.28588	0.19154	-1.4925 [.170]	0.070313	0.14208	0.49489 [.633]
DISTANCE	-0.24236	0.36685	-0.66066 [.525]	-0.18654	0.27212	-0.68550 [.510]
EU	-0.61779	0.48764	-1.2669 [.237]	-0.074406	0.36172	-0.20570 [.842]
ADJ	0.018192	0.45005	0.040422 [.969]	0.077697	0.33384	0.23274 [.821]
R-Squared	0.91495			R-Squared	0.94402	

Imports and Exports of Agricultural Products						
Exports				Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	1.2046	7.4098	.16257 [.874]	-1.8308	3.6780	-0.49777 [.631]
GDP _i	0.98035	0.26224	3.7384 [.005]	0.90130	0.13017	6.9243 [.000]
GDP/POP _i	-0.051719	0.40917	-0.12640 [.902]	0.0050662	0.20310	0.024944 [.981]
GDP _j	0.021698	0.29319	0.074006 [.943]	-0.13974	0.14553	-0.96026 [.362]
GDP/POP _j	-0.29120	0.36843	-0.79036 [.450]	0.23759	0.18288	1.2992 [.226]
DISTANCE	-0.55062	0.70565	-0.78031 [.455]	0.016054	0.35026	0.045836 [.964]
EU	0.22765	0.93800	0.24269 [.814]	0.27222	0.46559	0.58467 [.573]
ADJ	-0.52275	0.86569	-0.60386 [.561]	0.23885	0.42970	0.55586 [.592]
R-Squared	0.79425			R-Squared	0.93185	

Imports and Exports of Raw Materials						
Exports				Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	14.9479	5.3404	2.7990 [.021]	3.5369	3.1017	1.1403 [.284]
GDP _i	0.40360	0.18900	2.1354 [.061]	0.68603	0.10977	6.2497 [.000]
GDP/POP _i	-0.13155	0.29490	-0.44607 [.666]	-0.091393	0.17128	-0.53360 [.607]
GDP _j	0.50903	0.21131	2.4090 [.039]	-0.088652	0.12273	-0.72236 [.488]
GDP/POP _j	-0.45668	0.26554	-1.7198 [.120]	0.038105	0.15422	0.24708 [.810]
DISTANCE	-0.37284	0.50857	-0.73310 [.482]	0.090147	0.29538	0.30519 [.767]
EU	0.39577	0.67604	0.58542 [.573]	0.78671	0.39264	2.0036 [.076]
ADJ	-0.21333	0.62392	-0.34192 [.740]	0.39856	0.36237	1.0999 [.300]
R-Squared	0.78969			R-Squared	0.93670	

Imports and Exports of Fuels						
Exports				Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	8.4005	6.5911	1.2745 [.234]	6.3968	3.6071	1.7734 [.110]
GDP _i	0.43656	0.23326	1.8715 [.094]	0.73912	0.12766	5.7898 [.000]
GDP/POP _i	0.0021839	0.36396	.0060005 [.995]	-0.28826	0.19918	-1.4472 [.182]
GDP _j	0.24221	0.26079	0.92876 [.377]	0.085962	0.14272	0.60230 [.562]
GDP/POP _j	-0.93569	0.32773	-2.8551 [.019]	0.14049	0.17935	0.78330 [.454]
DISTANCE	0.31123	0.62768	0.49584 [.632]	-0.15854	0.34351	-0.46154 [.655]
EU	0.52666	0.83436	0.63121 [.544]	0.043177	0.45662	0.094557 [.927]
ADJ	0.30842	0.77004	0.40053 [.698]	0.18658	0.42142	0.44275 [.668]
R-Squared	0.77714			R-Squared	0.88668	

Imports and Exports of Machinery						
Exports				Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	-0.78484	6.0862	-0.12895 [.900]	3.2510	3.1066	1.0465 [.323]
GDP _i	1.0000	0.21539	4.6651 [.001]	0.80820	0.10994	7.3511 [.000]
GDP/POP _i	0.18252	0.33608	0.54308 [.600]	0.089703	0.17154	0.52292 [.614]
GDP _j	0.23942	0.24082	0.99421 [.346]	-0.047909	0.12292	-0.38976 [.706]
GDP/POP _j	-0.24897	0.30262	-0.82273 [.432]	-0.032015	0.15447	-0.20727 [.840]
DISTANCE	-0.38304	0.57959	-0.66088 [.525]	-0.16456	0.29584	-0.55623 [.592]
EU	-0.72787	0.77045	-0.94473 [.369]	-0.0093863	0.39326	-0.023868 [.981]
ADJ	0.19672	0.71105	0.27665 [.788]	0.13640	0.36294	0.37581 [.716]
R-Squared	0.84731			R-Squared	0.93529	

Imports and Exports of Manufactured Goods						
Exports				Imports		
Regressor	Coefficient	Standard Error	T-Ratio [Prob]	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	1.2574	3.4184	0.36782 [.722]	2.1198	2.9401	0.72102 [.489]
GDP _i	0.88157	0.12098	7.2870 [.000]	0.87629	0.10405	8.4218 [.000]
GDP/POP _i	0.17884	0.18876	0.94742 [.368]	0.12518	0.16235	0.77107 [.460]
GDP _j	0.18906	0.13526	1.3978 [.196]	-0.096290	0.11633	-0.82773 [.429]
GDP/POP _j	-0.078223	0.16997	-0.46022 [.656]	0.12541	0.14619	0.85785 [.413]
DISTANCE	-0.18972	0.32554	-0.58278 [.574]	-0.28693	0.27998	-1.0248 [.332]
EU	-0.88442	0.43273	-2.0438 [.071]	-0.26526	0.37218	-0.71271 [.494]
ADJ	0.038516	0.39937	0.096442 [.925]	-0.021659	0.34349	-0.063055 [.951]
R-Squared	0.92662			R-Squared	0.94234	

The R-squared value given at the foot of each table first of all indicates that the regression of all exports and imports provided an accurate fit of all variables with values ranging between 0.77 and 0.94 < 1.

GDP_i /GDP_j (Coefficients measuring income and output)

The coefficient results for GDP_i (European countries) reveal that, with the exception of Polish exports of fuels, all coefficient and T-ratio values were positive for both

imports and exports across all sectors. The T-ratio on fuels was $1.8715 < 2$, which would suggest their relative unimportance in European demand. This is further supported by the probability value ($0.94 > 0.05$), which also reflects the degree of insignificance. This particular outcome, however, could be attributed to the Russian crisis. In contrast, the T-ratio value ($7.2870 > 2$) on Polish exports of manufactured foods reflects the relative importance of these goods. Positively signed GDP_i values on both of these variables (coefficient & T-ratio), with respect to Polish exports, indicates that income in European countries is a positive factor driving Polish outflows. According to Huang (1993) this is also due to the fact that GDP on the importing country's side reflects size. We should, therefore, expect a rise in the level of income in European countries to result in a higher level of demand for certain Polish goods. In terms of Polish imports (see GDP_i value on the right-hand side of the tables), coefficient and T-ratio values were also positive and significant. This suggests that output levels were a positive factor in European countries, but it also reflects the importance of Poland as destination market, especially for the export of manufactured goods and machinery.

The Polish side (GDP_j) reveals some interesting results with respect to income and output. The coefficients on Polish exports were all positive, but were not all revealed to be significant. For example, the T-ratio value, which reflects the significance of output, was positively signed in the case of the following: total exports ($1.4 < 2$), raw materials ($2.4 > 2$) and manufactured goods ($1.39 < 2$). This suggests that output levels in Poland correlate significantly in the case of raw material exports only, while the lower values on total exports and manufactured goods indicates that there is still more potential for trade in both. These results reflect the relative importance of these items in Poland's export structure, but also the limitations on their capacity to supply some of them. However, these implications need to be considered in the context of the effects of the Russian crisis in 1998, which affected EU, Russian and Central & East European demand for Polish goods.²⁹ On the import side GDP_j , which is the coefficient reflecting income size in Poland, only correlated positively in the case of fuel imports and this was not revealed to be significant (see T-ratio & prob. values). The comparatively smaller size of Poland's level of GDP relative to those levels of the European countries suggests, first of all that income levels need to rise. Affecting

these results was also the fall in demand for Polish goods in 1998, which had a negative effect on export earnings and, therefore, the demand for EU and other CE imports.

GDP-Capita (GDP/Population)

Apart from giving us an idea of the average level of income in each of these countries and taking more account of population size, GDP per capita also reflects the importers income demand elasticity. According to Huang (1993) the coefficient on the importers GDP per capita should be equal to unity if the demand is for luxury goods and less than unity if the demand is for necessities. Observation of the coefficients column reveals that for the European countries (GDP_i exports) and for Poland (GDP_j imports) all coefficient values were below unity indicating that income demand elasticity on both sides was geared towards necessity items. In terms of the coefficient on the exporters GDP per capita, this should be positively correlated in the case of capital-intensive goods as well as for certain necessities and negatively correlated for labour and resource-intensive resource goods. This line of thought applies more to developed market economies. In the case of developing countries, we would expect the opposite to apply. This is consistent with the Heckscher-Ohlin line of thought and holds that countries specialise in the production of those goods, which use that country's most abundant factor more intensively. In the case of the European countries the coefficients on GDP/POP_i (see imports columns) reveals that GDP per capita was positive for exports of manufactured goods (0.12), machinery (0.08), and agriculture (0.005), but negative for raw materials and fuels. These results are, therefore, broadly in line with theoretical expectations. In terms of Polish exports, the GDP per capita coefficients (GDP/POP_j) (see exports columns) are negatively correlated for each category. These can be ranked according to their least negativity: manufactured goods (-0.07), machinery & transport equipment (-0.24), agricultural goods (-0.29) raw materials (-0.45) and fuels (-0.93). We would expect Poland to have a comparative disadvantage in those goods, which are capital-intensive in production and a comparative advantage in the production of more labour and resource-intensive goods. This assumption holds in the case of machinery and transport equipment, which should be negative. The coefficients on the remaining

categories, while close to positive values, suggest that no comparative advantage is held in them, indicating a negative correlation between income and the export of goods from these categories. This may partially be explained through tariffs and/or, the given large share of labour and resource-intensive items in Poland's export trade and the associated high costs of transportation (Schumacher & Trübswetter, 2000). We shall first discuss the effects of the latter.

Distance

Distance is an important factor as it influences the relative prices of goods.³⁰ Countries in close proximity, therefore, are expected to trade more intensively. In this regard, the expected coefficient on the distance variable should be negative, since bulky and manufactured goods are more difficult to transport (Brenton & Di Mauro, 1998). For countries sharing a common border, therefore, distance, due to lower relative transport costs, is an additional source of comparative advantage.³¹ Observation of the distance variable in the coefficients column reveals that, with the exception of Polish fuel exports, all coefficient values are negative and of the expected sign. In the case of Polish exports, the coefficient was more negative in the case of agricultural goods & food (-0.55), followed by machinery (-0.38), raw materials (-0.37), fuels (-0.31) and then manufactured goods (-0.18). The lower comparative coefficient on the latter reflects the shorter distance over which these commodities are transported. This would be consistent with outsourcing operations and also positive arrangements between Polish and European logistics firms. At the same time, if transport costs were initially high, this could have led to the relocation of firms to Poland where labour costs are lower.³² In contrast, the relatively higher coefficient on agricultural exports reflects the negative impact on the costs of transportation and the requirement for closer producer-user relationships. In the case of European exports to Poland, negative coefficient values were more dominant in the case of manufactured goods (-0.28) and machinery (-0.16), which emphasises their role in European export structures.

EU and adjacency

The reason for including EU membership and adjacency in the regression line is to determine whether preferential trading arrangements and cross border trade, respectively, have a positive effect on trade. A value of 1 was assigned to countries belonging to the EU and sharing a national border with Poland, and the value 0 if countries were not. Coefficient and T-ratio values indicated that EU membership was a positive factor driving the import and export of Polish agricultural goods, fuels and raw materials, but negative for all other exports. At the same time, positive EU coefficients on Polish agricultural goods and raw materials relates to those products for which there are fewer restrictions and feature positively in EU demand. However, a number of items from these categories are still treated as sensitive items. With respect to countries sharing a border with Poland (ADJ), the adjacency coefficient was positively signed in the case of Polish exports of manufactured goods, machinery & transport equipment and fuels. This reflects the importance of these items in Poland's trade with neighbouring countries (see chapter 3), while adjacency coefficients on the imports side were negatively signed in the case of manufactured goods. This confirms the dominance of the EU as a supplier of commodities of the machinery & transport category and the comparatively lesser importance attached to certain manufactured imports from all seventeen European countries.

Brief Summary

Our approach to the gravity model was to determine the effects of income and distance on Polish import and export trade with 17 European countries. Both the coefficients and T-ratios on GDP for the European countries correlated positively for the import and export of all categories of goods with Poland. This suggests that income and output levels were positive factors driving trade in those countries. In contrast, Polish GDP values revealed that output levels correlated positively with exports in the case of raw materials, but not in the case of manufactured goods even though these play an important role in outflows. The negative exchange rate impact on the demand for goods in 1998 was one of the factors influencing the results of this regression. This also highlights the role of labour- and resource-intensive goods in

Polish production, while at the same time revealing their exposure to negative external developments. Significant were our results on GDP-Capita (income demand elasticity) especially with regards to the export of machinery and transport goods to Poland. These correlated positively, while Poland's outflows of these items revealed a negative correlation. The importance of this is supported by research carried out on Hungary by the Osteuropa-Institut (1999), which revealed that technology transfer has led to higher productivity growth and positive developments in income and foreign trade.³³ This reinforces the view that capital-intensive production increases per capita income. In terms of all Polish outflows the most positive (coefficient) and significant (T-ratio) items were identified as raw materials and manufactured goods. These two groups constitute a substantial share of the labour and resource-intensive industrial output. The distance coefficients, with the exception of fuels, all showed the expected negative sign and were more negative in the case of machinery & transport items, raw materials and agricultural goods for Polish exports. This suggests that transport costs have been more favourable on exports of manufactured goods. With respect to European exports to Poland, we found that the distance coefficient was least negative in the case of machinery, raw materials and products from agriculture. Our results on EU membership and adjacency, meanwhile, enabled us to determine the effects of the trade arrangements and countries sharing a national border. On the EU side, this was revealed to be positive in the case of Polish exports of raw materials, fuels and agriculture, while adjacency indicated the importance of manufactured goods, machinery & transport equipment and fuels. This provides a more geographical perspective on the distribution of Polish exports. Our overall results of the Gravity model support our earlier conclusions in so far that the operation of Polish labour and resource-intensive sectors has been reinforced through its trade relations with the EU. Based on our results both from subsection 2.3 (intra-industry trade) and our gravity results, this also suggests a relationship between low per capita income in Poland and inter-industry trade. Meanwhile, our results further indicate that, as per capita income rises, this should induce the production of more capital and human-intensive goods. Developments in these areas are already evident as indicated in subsection 2.3 of this chapter, but are not so significant in the context of the entire export structure and do not reveal comparative advantage. During the 1990's, therefore, Poland's low income related trade with the EU was characterised

by the increased supply of labour and resource-intensive commodities revealing a distinct Polish-EU inter-sectoral division of labour. Our evaluation of these results reveals that, given the current results on GDP per capita income, there is greater potential for higher productivity and trade, which will lead to the exchange of more intra-industry goods, but this will take some time.

2.6 Empirical observations

Our last three subsections have together revealed some conclusive facts concerning the structure of Polish import and export trade. Our subsection on intra-industry trade has revealed that, between 1990 and 1998, Poland's trade with the European Union has remained of a predominantly inter-industry nature. The actual levels of IIT, however, have increased gradually over time, which is consistent with a changing commodity composition. These developments have occurred in the production of cars, high-tech machinery and certain products embodied with a medium level of technology. The production of these items has led to their occupying a much higher position on the exports table, but Poland does not reveal any comparative advantage in their production relative to those of the EU. Our results show that comparative advantage has been revealed in some of the country's labour and resource-intensive sectors, such as clothes, wooden products and copper, suggesting that developments have focused on the traditional sectors. However, since higher per capita income and output are more consistent with higher human and capital-intensive production, further developments need to occur in the country's medium and high technology industries. This suggests that per capita income levels need to rise, but also the levels of investment and research expenditure.

At this point, we need to briefly confirm whether the results obtained from our models are broadly in line with our empirical findings. This will be particularly useful in enabling us to identify more closely where the main changes have occurred in Poland's export and import structures. To achieve this, we shall list Poland's upper forty imports and exports in tabular form for both 1990 and 1998. Those commodities, which are highlighted in red, in the column for 1998 are those items,

Table 2h

Poland's top forty exports to the EU for 1990 and 1998 compared			
	1990		1998
321 COAL NON-AGGLOMERATED	350450	821 FURNITURE/STUFF FURNISHG	1322017
682 COPPER	308957	842 WOMEN/GIRL CLOTHING WVEN	859888
001 LIVE ANIMALS EXCEPT FISH	233086	781 PASSENGER CARS ETC	764358
842 WOMEN/GIRL CLOTHING WVEN	215439	321 COAL NON-AGGLOMERATED	570809
841 MENS/BOYS WEAR, WOVEN	199497	841 MENS/BOYS WEAR, WOVEN	507375
821 FURNITURE/STUFF FURNISHG	172382	635 WOOD MANUFACTURES N.E.S.	469257
054 VEGETABLES,FRSH/CHLD/FRZ	166601	761 TELEVISION RECEIVERS	444341
034 FISH,LIVE/FRSH/CHLD/FROZ	129764	682 COPPER	431935
676 IRON/STEEL BARS/RODS/ETC	112992	699 BASE METAL MANUFAC NES	379920
248 WOOD SIMPLY WORKED	106427	773 ELECTRICAL DISTRIB EQUIP	328443
012 MEAT NES,FRESH/CHLD/FROZ	103373	784 MOTOR VEH PARTS/ACCESS	321801
562 MANUFACTURED FERTILIZERS	96190	845 ARTICLES OF APPAREL NES	304877
773 ELECTRICAL DISTRIB EQUIP	91485	778 ELECTRICAL EQUIPMENT NES	278158
334 HEAVY PETROL/BITUM OILS	83355	782 GOODS/SERVICE VEHICLES	271655
851 FOOTWEAR	83001	676 IRON/STEEL BARS/RODS/ETC	258913
058 FRUIT PRESVD/FRUIT PREPS	80377	691 IRON/STL/ALUM STRUCTURES	249336
222 OIL SEEDS ETC - SOFT OIL	76297	325 COKE/SEMI-COKE/RETORT C	219538
635 WOOD MANUFACTURES N.E.S.	68887	658 MADE-UP TEXTILE ARTICLES	210347
781 PASSENGER CARS ETC	66808	058 FRUIT PRESVD/FRUIT PREPS	198140
592 STARCHES/GLUES/ETC.	65725	562 MANUFACTURED FERTILIZERS	184009
699 BASE METAL MANUFAC NES	59686	248 WOOD SIMPLY WORKED	179720
274 SULPHUR/UNROASTD PYRITES	57810	641 PAPER/PAPERBOARD	176214
059 FRUIT/VEG JUICES	50309	776 VALVES/TRANSISTORS/ETC	172316
282 FERROUS WASTE/SCRAP	48765	681 SILVER/PLATINUM ETC	162004
691 IRON/STL/ALUM STRUCTURES	45293	634 VENEER/PLYWOOD/ETC	159194
634 VENEER/PLYWOOD/ETC	45149	772 ELECTRIC CIRCUIT EQUIPMT	157004
673 FLAT ROLLED IRON/ST PROD	42981	625 RUBBER TYRES/TREADS	146763
713 INTERNAL COMBUST ENGINES	42759	893 ARTICLES NES OF PLASTICS	146726
845 ARTICLES OF APPAREL NES	42056	001 LIVE ANIMALS EXCEPT FISH	142588
288 NF BASE METAL WASTE NES	41624	851 FOOTWEAR	137915
515 ORGANO-INORGANIC COMPNDS	40796	844 WOMEN/GIRL WEAR KNT/CRO	127173
325 COKE/SEMI-COKE/RETORT C	39387	771 ELECT POWER TRANSM EQUIP	125063
665 GLASSWARE	38194	786 TRAILERS/CARAVANS/ETC	122787
679 IRON/STEEL PIPE/TUBE/ETC	38024	661 LIME/CEMENT/CONSTR MATL	119842
641 PAPER/PAPERBOARD	37028	651 TEXTILE YARN	118112
573 VINYL CHLORIDE ETC POLYM	36587	775 DOMESTIC EQUIPMENT	111537
661 LIME/CEMENT/CONSTR MATL	34577	684 ALUMINIUM	111173
017 MEAT/OFFAL PRESVD N.E.S	32965	012 MEAT NES,FRESH/CHLD/FROZ	105828
061 SUGAR/MOLLASSES/HONEY	30855	642 CUT PAPER/BOARD/ARTICLES	104708
335 RESIDUAL PETROL. PRODS	30446	764 TELECOMMS EQUIPMENT NES	103796
522 ELEMENTS/OXIDES/HAL SALT	30426	931 SPECIAL TRANSACTIONS NES	103733

Source: Own calculations based on Eurostat data for 1990 and 1998.

which did not feature in the corresponding list for 1990. We shall first discuss the exports side.

Table 2h reveals the overall dominance of commodities produced by traditional labour and resource intensive industries for both 1990 and 1998. This is particularly evident in the case of natural resources, manufactured items and raw materials exports. The commodity exports for 1998, however, include a slightly higher proportion of technological goods. For example, observation of the upper fifteen commodities for 1990 reveals that Poland had no medium or high-technology items in its export composition whereas, in contrast, the corresponding list for 1998 revealed the inclusion of motor cars, accessories, television receivers and electrical equipment. Those commodities marked (red) lower down in the table for 1998 also reveal the presence of electrical circuit equipment, electrical transmission equipment and telecommunications equipment. Our results indicate that, between 1990 and 1998, the share of machinery & transport goods (SITC 7) in Poland's upper forty exports to the EU has increased almost four-fold. This suggests, that products embodied with more medium technology have started to play more of a role in the upper part of the exports table. However, we should also take note of the fact that a large number of the listed commodities, such as manufactured, raw materials and resources have more than tripled in volume during this period, which is indicative of improved efficiency across a number of these branches. This assumption is consistent with those results obtained from our IIT and RCA models.

Imports

The upper forty import commodities listed for 1990 and 1998, in contrast to exports, includes a larger proportion of machinery & transport items, such as industrial machinery, electrical equipment, telecommunications & computer equipment and motor vehicles (including heavy goods vehicles). This tends to support the negative balance of trade position, but also the results of our trade models. However, observation of the commodities listed in the column for 1998 also reveals a sizeable share of consumer goods and imports of raw materials.

Table 2i

Poland's top forty imports from the EU for 1990 and 1998 compared			
	1990		1998
728 SPECIAL INDUST MACHINES	183710	784 MOTOR VEH PARTS/ACCESS	1635871
653 MAN-MADE WOVEN FABRICS	142852	781 PASSENGER CARS ETC	923912
041 WHEAT/MESLIN	129759	764 TELECOMMS EQUIPMENT NES	882357
334 HEAVY PETROL/BITUM OILS	124793	728 SPECIAL INDUST MACHN NES	846712
781 PASSENGER CARS ETC	103867	641 PAPER/PAPERBOARD	695561
741 INDUST HEAT/COOL EQUIPMT	99394	542 MEDICAMENTS INCLUDE VET	687804
731 MACH-TOOLS REMOVE MTRIAL	96317	653 MAN-MADE WOVEN FABRICS	544098
724 TEXTILE/LEATHER MACHINRY	81215	741 INDUST HEAT/COOL EQUIPMT	509715
542 MEDICAMENTS INCLUDE VET	77779	772 ELECTRIC CIRCUIT EQUIPMT	479324
652 COTTON FABRICS, WOVEN	77338	752 COMPUTER EQUIPMENT	468868
745 NON-ELECTR MACHINES NES	70119	893 ARTICLES NES OF PLASTICS	453009
874 MEASURE/CONTROL APP NES	69760	699 BASE METAL MANUFAC NES	446649
752 COMPUTER EQUIPMENT	58502	533 PIGMENTS/PAINTS/VARNISH	395571
778 ELECTRICAL EQUIPMENT NES	56812	582 PLASTIC SHEETS/FILM/ETC	390568
764 TELECOMMS EQUIPMENT NES	55535	775 DOMESTIC EQUIPMENT	390405
112 ALCOHOLIC BEVERAGES	55411	745 NON-ELECTR MACHINES NES	366500
784 MOTOR VEH PARTS/ACCESS	53240	334 HEAVY PETROL/BITUM OILS	358516
057 FRUIT/NUTS, FRESH/DRIED	51212	743 FANS/FILTERS/GAS PUMPS	346588
761 TELEVISION RECEIVERS	50747	778 ELECTRICAL EQUIPMENT NES	340888
733 MTL M-TOOLS W/O MTL-RMVL	50213	679 IRON/STEEL PIPE/TUBE/ETC	323167
743 FANS/FILTERS/GAS PUMPS	49667	652 COTTON FABRICS, WOVEN	316133
654 WOVEN TEXTILE FABRIC NES	48063	657 SPECIAL YARNS/FABRICS	302131
657 SPECIAL YARNS/FABRICS	47648	713 INTERNAL COMBUST ENGINES	298897
744 MECHANICAL HANDLING EQUI	46167	747 TAPS/COCKS/VALVES	290861
737 METALWORKING MACHINE NES	45153	782 GOODS/SERVICE VEHICLES	290057
851 FOOTWEAR	43415	776 VALVES/TRANSISTORS/ETC	288769
893 ARTICLES NES OF PLASTICS	42161	081 ANIMAL FEED EX UNML CER	284179
727 FOOD PROCESSING MACHINES	40906	874 MEASURE/CONTROL APP NES	280634
553 PERFUME/TOILET/COSMETICS	40745	744 MECHANICAL HANDLING EQUI	278461
533 PIGMENTS/PAINTS/VARNISH	37822	999 TRANSACTIONS	277563
695 HAND/MACHINE TOOLS	36443	642 CUT PAPER/BOARD/ARTICLES	271608
775 DOMESTIC EQUIPMENT	35316	821 FURNITURE/STUFF FURNISHG	266767
591 HOUSEHOLD/GARDEN CHEMICAL	33886	575 PLASTIC NES-PRIMARY FORM	258938
673 FLAT ROLLED IRON/ST PROD	33323	598 MISC CHEMICAL PRODS NES	258414
611 LEATHER	32515	662 CLAY/REFRACTORY MATERIAL	230222
541 PHARMACEUT EXC MEDICAMNT	32458	553 PERFUME/TOILET/COSMETICS	222478
782 GOODS/SERVICE VEHICLES	32321	684 ALUMINIUM	221503
598 MISC CHEMICAL PRODS NES	32304	892 PRINTED MATTER	214890
679 IRON/STEEL PIPE/TUBE/ETC	30098	691 IRON/STL/ALUM STRUCTURES	211389
872 MEDICAL/ETC INSTRUMENTS	29521	775 ELECTRICAL DISTRIB EQUIP	202285
676 IRON/STEEL BARS/RODS/ETC	29396	726 PRINTING INDUSTRY MACHNY	198505

Source: Own calculations based on Eurostat data for 1990 and 1998.

The commodities highlighted in red are those items, which have grown in importance and did not feature in the upper forty in 1990. With the exception of printing machinery, electrical distribution equipment, combustion engines and other electrical equipment, the bulk of all remaining items highlighted in red consist of basic raw materials (e.g. cut paper & furniture stuff) and metals (aluminium & base metals). This highlights the role of outsourcing and supports our earlier assumptions concerning the importance of processing trade (see chapter three). A good example of this can be found in the motor vehicle industry, where inflows of vehicle parts and accessories have increased more than thirty-fold between 1990 and 1998. These were the top commodity imports in 1998 and were followed by the import of passenger cars, which had also increased more than nine-fold during the same period. Meanwhile, observation of the non-highlighted commodities for 1998 reveals that more than half of them consist of various raw materials and/or items for processing and consumer goods. At the same time, although the listed forty imports include a sizeable share of machinery & transport items (SITC 7) we were able to identify that only a small proportion of them could be installed and used in actual productive purposes. The remainder consisted of components/parts for later installation or various raw material supplies. Poland's trade deficit with the EU in the late 1990's was, therefore, a result of not only certain machinery items and components, but also consumer goods and raw materials.

Conclusion

The implementation of the Balcerowicz programme had a positive effect on inflation and introduced a relatively greater level of price stability into the economy. This was initially achieved through a fixed, anti-inflation, exchange rate policy. The use of this instrument, however, needed to be changed, so as to simulate growth and to allow the government greater control over the management of the economy. A floating exchange rate, therefore, was implemented to facilitate this, and the appreciating currency (see section one) was partially controlled through a monthly devaluation formula. Intervention, though, became a constant phenomenon and this was reflected in the frequent use of monetary policy, which the government would apply (through higher interest rates) when the currency appreciated beyond a certain level. As a

result, high interest rates negatively affected potential industrial growth owing to the high cost of borrowing. This also led to short-term speculation in the money market, which caused further inflationary pressure and raised the value of the zloty. The effects of the unstable macroeconomic environment, which characterised the Polish economy more during the first half of the 1990's, were evident in the level of GDP as indicated by the time taken for the economy to achieve 1989 levels. GDP growth, was, however, positive across all sectors from 1992 and, this together with the growth of the service sector, was positive in reducing the initially high rates of unemployment. In part two of this chapter we were able, through the introduction of the Interim Agreement, to identify in which sectors the liberalisation of trade was more rapid and, therefore, where growth was more likely to occur. Our evaluation of this was that, although viewed to be initially selective on certain "sensitive" items (see subsection 2.2.1), the Interim Agreement was more facilitating on the liberalisation of trade in Polish industrial products. The implications of this were that export growth would largely occur through the continual operation of Poland's traditional labour and resource-intensive sectors, which subsequently became the areas of specialisation on which export development would be based under developing market conditions. We were able to confirm this through the application of our trade models. The first two of these models (IIT & RCA), which have been applied in the past to measure convergence processes in reforming economies, revealed that the broad structure of Polish trade had not changed significantly during the 1990's. First of all, although levels of IIT had gradually increased in the 1990's, this was not reflected so much through the gradual trade in goods produced by more medium and high technological industries, which would have been indicative of convergence with those structures of the EU. Instead, trade in the 1990's was more characterised more by a growing exchange of raw materials, resources and labour-intensive goods. This does not, however, exclude that some positive developments have occurred in the production and export of some medium and high technology goods (see chapter five). In terms of the entire export structure, though, these goods were not significant at the time of writing. This was partially confirmed in our empirical work (see subsection 2.6), where we confirmed the dominance of labour and resource-intensive commodities in outflows, but also their high share, together with consumer goods, on the imports side. Our results on RCA support these

conclusions and revealed that a number of traditional industries were revealing signs of competitiveness, but only four industries revealed a comparative advantage: copper, furniture, men's clothing and women's clothing. The overall weight of Poland's traditional industries in exports, while consistent with the Heckscher-Ohlin proposition, raises points on income. Our Gravity model results revealed that per capita income in Poland has not risen sufficiently (negatively correlated) to increase the level of demand in the country for a more diversified range of goods, which, in turn, would be expected to stimulate local production and specialisation. Part of the problem is connected with the type of goods produced and the fact that the demand for them is greater in the EU where, owing to their low price, they will not threaten price stability or EU industries. Therefore, Polish production has focused on foreign demand, while EU exporters have maintained the supply of materials to Poland as well as meeting the country's growing demand for consumer goods. In Poland, this has led to negative trade and current account balances and a consumer goods market, which still remains partially dependent on foreign supply. Some of these observations were characteristic of the Polish economy in the 1970's. This reflects the lack of investment and research into the development of new products and the industry necessary to produce them. Much of this brings us directly back to the macroeconomic environment, where we have ascertained that high interest rates have hampered industrial potential and deterred investment. Parallel to this, high interest rates have also attracted short-term speculative inflows into the country, which have raised the price of the zloty and negatively affected exports. Earnings potential has, therefore, been limited across a range of predominantly low-income exports. Throughout most of the 1990's, this suggests that negative internal and external macroeconomic conditions, as well as a number of other domestic factors (see chapter four) have not facilitated substantial change in the development of the micro economy.³⁴ Given these factors, as well as the period of time taken to achieve 1989 levels of output, Poland's trade developments with the EU have been positive in terms of raising the competitiveness of some of Poland's labour and resource-intensive industries and in providing a degree of employment stability. Germany, as the neighbouring country, plays a substantial role in this.

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Sources for tables and graphs

Table 2a, GUS, Central Statistics Office, 1990-99.

Table 2b, Eurostat foreign trade data, 1990.

Table 2c, Eurostat foreign trade data, 1996.

Table 2d, Eurostat foreign trade data, 1998.

Table 2e, Eurostat foreign trade data, 1990 & 1998.

Table 2f, Eurostat foreign trade data, 1990, 1996 & 1998.

Table 2g, (1-6) OECD macroeconomic and foreign trade data, 1999.

Table 2h, Eurostat foreign trade data, 1990 & 1998.

Table 2i, Eurostat foreign trade data, 1990 & 1998.

Graph 1a, GUS, Central Statistics Office, Mały Rocznik Statystyczny, 1999.

Graph 2b, GUS, Central Statistics Office, Mały Rocznik Statystyczny, 1998-99.

Graph 2c, GUS, Central Statistics Office, 1997, 1998 & 1999.

Chapter Three

Contemporary Polish-German Trade Developments

Introduction

The united Germany of today has a population of eighty million, which is one of the largest in Europe. Since the Second World War, the structure of its foreign trade has changed quite substantially from one, which imported food products and exported raw materials. In 1998, Germany was exporting a wide range of consumer and producer goods, which totalled almost 950 billion Deutsche Marks. During the same year it also imported goods to the value of 821 billion Deutsche Marks. After the United States, Germany is the world's second most important trade partner.¹ Out of the German import total the EU countries supply half of the country's total inflows and account for approximately half of the German export total (Statistisches Bundesamt, March 1999). In Europe, Germany has become one of the engines driving trade and the exchange of technology across national boundaries. Its own technology is embodied largely in the export of motor vehicles, machinery, electronic products, chemicals and iron & steel products. Meanwhile, its main imports include electronic products, motor vehicles, chemical products, machinery and iron & steel products. Germany has a large economic interest in Poland (CEER, 11/1997) and supports the country's main priority of EU membership.² The aim of this chapter is to ascertain the nature and the extent of Polish-German trade relations since transition. More specifically, our interests are directed at those industrial branches in which trade has become more dominant and whether, through the import of German technology, Poland is revealing early signs of industrial development in more medium and high technological sectors. To achieve this aim, the structure of this chapter has been divided up into three main sections. Section one establishes Poland's trade position with East and West Germany before 1990 with a view to primarily ascertaining the extent and importance of these relations and the types of goods traded. This brief historical background (3.1) will be extended in subsection 3.2, where we will analyse total Polish-German trade after the implementation of market reform. The purpose of this is to show how a more liberalised trading

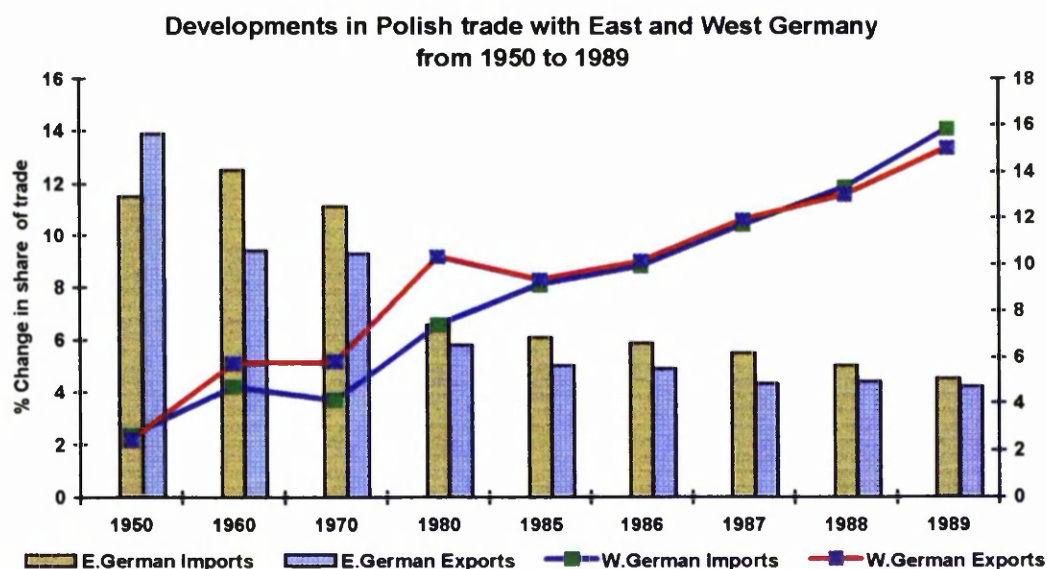
environment and a unified Germany have affected Poland's level of trade over a nine-year period. In addition to Poland's trade volume, some of the other important aspects under consideration in this subsection concern the balance of trade and the effects of macroeconomic policy on interest rates and on the performance of the currency. Having determined how Poland's trade with Germany has been broadly shaped during the 1990's, we will then turn to section two where, through the application of trade models, we will consider the theoretical implications of these developments. The two key areas of investigation will be the development of intra-industry trade, and export specialisation (see methodology section). With respect to the former, our aim is to establish whether IIT has increased over time and, if so, whether this is due to increased trade in labour and resource-intensive goods as revealed in chapter two, or whether this is reflective of developments in the exchange of more technological goods. On completion, we will then extend this analysis to include the application of our model on export specialisation index, which will enable us to determine which branches of industry are more dominant in trade. The final part to this chapter (III) considers these developments in light of the empirical evidence. In this part of the work we will concentrate more specifically on trade flows in primary, consumer and capital goods with a view to showing where the main developments have occurred and, through the analysis of product performance, which commodities have become the most dominant. Having established a fairly comprehensive view of these developments, we will then discuss whether these results are consistent with some of our theoretical observations.

I. Polish-German trade developments before and after transition

3.1 Developments in trade with East and West Germany before 1989

The position of East Germany (GDR) in Poland's foreign trade was much more dominant than that of West Germany (BRD) before 1970. The introduction of the Gierek modernisation programme, however, resulted in West Germany gradually reversing this position following Poland's decision to take advantage of the available Western credit and technology. By 1989, West German trade with Poland was almost three times higher than that of its Eastern neighbour. Significantly, both German sectors together (see graph) accounted for over 20% of Poland's trade by the end of the 1980's. It is possible, therefore, given the role of both sectors in Poland's trade, to speak of a firm "German anchor", which has existed for forty years.³

Graph 3a



Source: *Rocznik Statystyczny Handlu Zagranicznego, 1991-92.*

The growth of Poland's trade with the BRD grew, initially, unevenly from the early 1970's, since high value technology goods were a central part of the Gierek modernisation plan. This is revealed by the red curve (West German exports), which

climb's sharply to reach the East German level (blue bar-curve) of exports over a ten-year period. In terms of credit, Polish imports from the BRD were financed with funds, which Poland had borrowed from that country. Consequently, not only did Poland's trade deficit with the BRD increase, but also did its debt.⁴ Poland needed, as discussed in chapter one, to apply the breaks on the problem of debt and did by reducing its imports, although the overall relative share of the BRD increased between 1970 and 1980.

The imposition of Martial Law in Poland at the beginning of the 1980's caused BRD exports to Poland to fall from 10.3% (1980) to 9.3% (1985) during the first half of the 1980's. This can be described as marginal when considered in terms of the effects on Poland's total trade (Ch.1, graph 1a). During the same period BRD imports from Poland increased (1.7%) from 7.4% to 9.1%. This suggests that, while Polish exports to the West fell during the first three years of the 1980's, the importance of the BRD continued to grow. From 1985 Polish-BRD trade was virtually balanced with Poland experiencing a marginal surplus in 1989. In contrast the share of the GDR in Polish trade almost halved between 1970 and 1985, and this was due to changes in its relationship with Poland. From 1980 onwards Polish-GDR trade declined gradually through until 1989. The overall developments in trade between Poland and both German sectors can be summarised into periods:

E. Germany

- (1) Gradual, upward development between 1950 and 1970;
- (2) Decline from the 1980's, which lasted for almost three years;
- (3) Post 1980 characterised by slowly declining, but stable GDR-Polish trade.

W. Germany

- (1) 1950-70 - reduced trade due to political considerations;
- (2) From 1970 onwards diplomatic relations and credit politics led to trade expansion and bilateral co-operation in production (discussed shortly);

- (3) Martial Law in Poland resulted in a slight reduction in imports from the BRD, but positive export growth;
- (4) From 1983 onwards Polish-BRD trade entered a new stage of dynamic development.⁵

3.1.1 The importance and main features of trade

The constraints of the planned system and their negative effects on the resources and management of the Polish economy (Chap.1) meant that trade with East and West Germany was of great importance, especially as poor communication and supply were causing the non-fulfilment of output targets.⁶ Both German sectors together became important sources in the supply of consumer goods, food and the necessary technology to keep sizeable areas of industry operational. On the exports side, East and West Germany represented two of Poland's most important destination markets, which, by the end of the 1980's accounted 5.6% of GDP. The BRD accounted for 4.5% and the GDR, 1.1%.

The exchange of commodities between Poland and both German sectors consisted of largely electrical and mechanical engineering goods, chemicals, building materials, processed metals, raw materials, coal, clothes, textiles, wooden products, paper and products from the food industry. The GDR dominated in the supply of mechanical engineering goods, which accounted for 63.4% of its exports to Poland. However, with the exception of these, Poland had the above commodities supplied in greater quantity by the BRD.⁷ On the exports side, the development and growing role of trade with the BRD resulted in the employment of between 1.2 and 1.4 million Polish workers (7.2 - 8.4% of the work force). Part of this, as mentioned in chapter one, was facilitated through the issue of licences as well as the growing importance of the *Lohnfertigungs-* (job contracting) and *Lohnveredlungsabkommen*.⁸ The latter refers to the actual contract agreement, which facilitates the temporary admission of German goods into Poland for the purpose of assembly or completion. This is better known as *outward processing trade* (OPT) and was beneficial to both countries, since it allowed West Germany to take advantage of the lower production costs, but would also provide

Poland with new technology, know-how and an additional source of hard currency. In contrast to the BRD, fewer workers (300-350 thousand) in Poland were employed in the production and export of goods to the GDR. Therefore, trade with both German sectors provided stable positions for almost 10% of the Polish work force (GUS, 1991). Much of the labour force connected with GDR trade were employed in the production of mechanical engineering goods and, to a lesser extent, in the building, metal, wood, paper, food and agricultural industries. The comparatively smaller scale of production, employment and trade associated with the GDR, however, was not only a result of the growing role of the BRD, but also due to the changing role of the GDR in its co-operation with Poland. This deserves some elaboration.

3.1.2 The changing nature of Poland's relations with the GDR

The declining economic role of the GDR was fundamentally a result of a co-operation treaty, which was signed by the GDR and Poland in the 1950's. Primarily, this was established for the purpose of enabling joint work on the development of new scientific and technical production methods. This was not only confined to the purely developmental aspects as described, but also extended to co-operation in related science and technology programmes.⁹ Developments in these fields led to the GDR becoming more important as a partner in terms of co-operation and international specialisation. The greater bilateral co-operation between East Germany and Poland on methods of production and industrial development, together with West German financing, enabled some of the larger project work to be undertaken. The brown coal mines in Poland, for example, became one of the beneficiaries and this later extended to other members of Comecon. By 1976, the resulting, higher volume of production activity led to a ministerial arrangement, which permitted the entry of mixed companies with foreign capital. This arrangement was later broadened and led to the inclusion of partners from the BRD, such as Krupp, Hoechst, BASF and Bayer.

By the 1980's, Poland's co-operation with the GDR not only involved co-operation between enterprises, but also between technical high schools (GDR) and institutes specialised in similarly related fields (Poland). With respect to the BRD, Poland also

expanded its links to facilitate the transfer of technical know-how and research. This was carried out by some of the academic institutions in both countries, which co-operated on joint research efforts – for example, die Universität Duisburg and the Warsaw Central School of Trade.¹⁰ In relation to this, joint co-operation programmes were also, but to a lesser degree, developed in the service sectors such as transport, tourism, banking, finance and telecommunications.

Brief summary

In summing up the main points of this subsection, it is possible to describe Poland's relations with East and West Germany as broad and firmly established by the end of the 1980's. Owing to the nature of central planning, however, the extent of this co-operation was directed largely towards the modernisation of industrial production, which was in line with the Gierek plan. The role of the BRD as a supplier of credit and technology, and given its geographical location, was overall in the best position to facilitate these objectives. Along with the GDR, the BRD capitalised on this position by broadening its links to include joint programmes and co-operation in academic and technical fields. The focus of planning and the modernisation programme, however, did not allow for new technology, know-how and expertise to be channelled into some of the service sectors (banking, finance & telecommunications), since trade from the West was restricted by Cocom (Coordinating Committee for Multilateral Export Controls). By the same token, although foreign entry was permitted in Poland, the operational constraints were such that only a small number of West German firms (joint ventures) entered the country (see chapter four). Trade, therefore, became the single most important means of acquiring more up-to-date technology and consumption goods. For Poland, the growing debt burden meant that these links with Germany needed to be maintained for repayment purposes but, more importantly, because growing access for Polish commodities had been achieved to one of Western Europe's most important markets. We shall now examine how these relations developed under market conditions.

3.2 Contemporary German-Polish trade relations

In 1989, Poland's import and export trade with the whole of Germany totalled 7.58 and 6.64 billion Deutsche Marks, respectively.¹¹ This accounted for approximately 20% of the country's total trade flows. In 1990 the effects of the stabilisation programme caused Polish imports to Germany to fall to 4.6 billion (39%) and exports to 5.1 billion (23%). From 1991 trade increased gradually throughout the remainder of the period. This suggests that both Polish and German industrial sectors were able to maintain and develop their links after market reform was initiated. For example, according to the Statistisches Bundesamt (1999), Poland, in 1997, had become Germany's tenth most important trade partner on the export side and ranked thirteenth on the import side. By 1998, 34% of the Polish export total was accounted for by Germany, which, in turn, supplied about 25% of Poland's total inflows.

Graph 3b



Source: *Statistisches Bundesamt, 1997-99.*

On the imports side (blue curve), Poland's demand for German goods was overall positive and increased from 4.6 to 24.112 billion DM between 1990 and 1998. This represents an overall increase of 19.4 billion DM, which increased at an average of 2.15 billion each year. Polish exports (red curve) increased from 5.16 billion in 1990 to 16.44 billion DM in 1998, representing an increase of 11.279 billion DM over the entire

period. This equates to a yearly average of 1.25 billion DM. The yearly trade values and the balance of trade are shown on the following table.

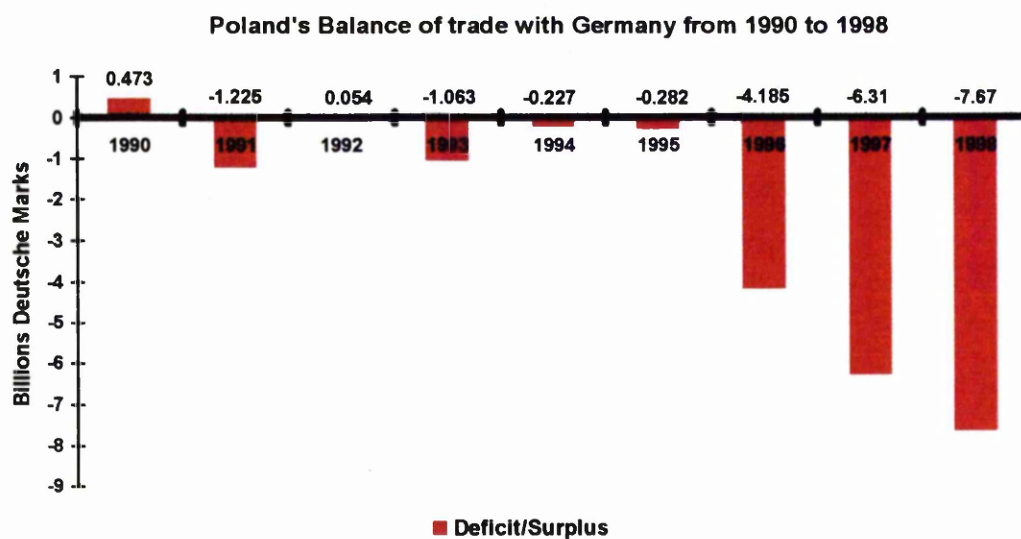
Table 3a

Poland's total trade with Germany from 1990 to 1998 (Billions Dmks)									
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Exports	5.163	7.250	8.287	8.638	10.125	12.413	12.181	14.356	16.442
Imports	4.690	8.475	8.233	9.701	10.352	12.695	16.366	20.666	24.112
Balance	0.473	-1.225	0.054	-1.063	-0.227	-0.282	-4.185	-6.310	-7.670

Source: *Statistisches Bundesamt, 1997-99.*

Poland's balance of trade fluctuated marginally until 1995 and then becomes increasingly negative with time. This can be observed on the last graph by the diverging inflows and outflows and also on the following graph (3c), which reveals the extent of the deficit by 1998. The much higher import values can be attributed to Poland's later tariff reductions on certain sensitive and industrial goods from the EU (Europe Agreement, 1992), but more so to the negative effects associated with the appreciation of the zloty (discussed shortly).

Graph 3c



Source: *Statistisches Bundesamt, 1997-99.*

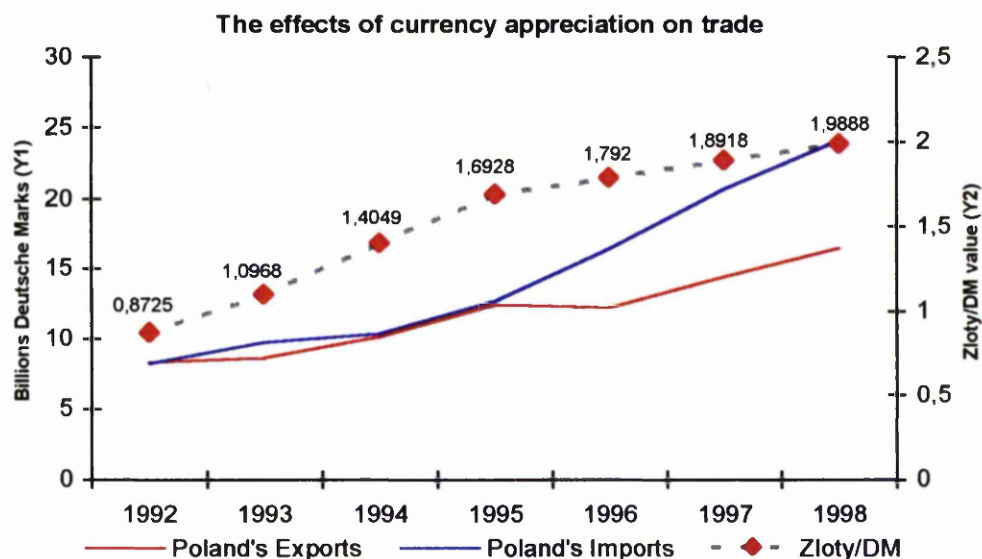
In explaining this picture, it is also useful to take into account some of our results of chapter two, especially with respect to the time taken to achieve 1989 levels of growth and the government's management of fiscal and monetary instruments. First of all, government policy has focused more on price stability, which is in line with the criteria for EU membership, than on the development of the micro economy.¹² Hence, interest rate policy has not been conducive to industrial expansion, but has rather attracted speculative investments into the economy, which contributed to the appreciation of the zloty. German consumer and producer goods, therefore, became more attractive in price terms, leading to an increasing trade deficit. Poland's deficit with Germany from 1996 was approximately one-third of the country's total deficit.¹³ Poland's deficit with Germany would have been almost 40% lower if informal cross border trade were taken into account. For example, thousands of Germans cross the border each year to buy cheap Polish petrol, food and many other products. In 1994, it was estimated that German people alone spent around DM 3 billion in this manner.¹⁴ According to the Bank of Poland, if these figures were included in official statistics the country would have been experiencing its first overall trade deficit in 1996. We shall now consider a few further points related to changes in the value of the currency.

3.2.1 Exchange rate impact

In order to adequately show the effects of the currency (zloty) appreciation on trade with Germany, we have plotted the zloty/Deutsche Mark currency relationship against imports and exports. Theoretically, and under market conditions, we would expect that an appreciation of the Zloty against the Deutsche Mark to result in a fall in the level of German demand for Polish exports. This is because the price of Polish products would become relatively more expensive.

On graph 3d the value of trade is given on the left-hand y-axis (Y1) and the value of the Zloty against the Deutsche Mark is on the right y-axis (Y2). Imports and exports are represented as blue and red curves, respectively and the rate of exchange is shown as a dotted line.

Graph 3d



Source: *Narodowy Bank Polski, 2000.*

Between 1992 and 1995 the Zloty appreciated by 51.5% and was accompanied by a rise in both imports and exports. Under market conditions, a fall in exports would be a normal reaction along with a simultaneous increase in imports. In contrast, however, graph 3d reveals that both imports and exports continued to increase with the appreciation of the zloty. This suggests that demand considerations were not being determined by price. This position did, however, change from 1995 onwards. At this point, (1995-96) even though the rate of appreciation was approximately half of the previous years level, the behaviour of import and export trade became more responsive to price and other external effects. This is particularly evident on the imports side (see graph 3d). Central to this was the fact that, in 1996, consumer price inflation had fallen to less than 20% for the first time since market reform was initiated. Therefore, interest rates on zloty deposit accounts were lowered by 5% to 20.5%.¹⁵ This raised the propensity to spend and the demand for credit, which then raised fears that the economy was beginning to overheat due to the widening trade deficit and credit creation.¹⁶ Subsequently, interest rates were raised to 22.8% in 1997 (GUS, 2000). However, this action led to short-term flows of speculative money in the money market, which also proved to be inflationary. By 1998, the rate of appreciation was

slowing down, indicating that the upward pressure on the currency was being tightened. However, the demand for German consumer and producer goods continued to increase and widened the trade deficit further with Germany in 1998 (-7.6 billion DM). This equated to over 32% of Poland's total trade deficit. Parts two and three of this work seek to ascertain whether this deficit can be attributed to modernisation and improved efficiency in some of the Polish industrial branches or, as noted in chapter two, whether this is more connected with imports of consumer goods and outward processing trade (OPT). We shall now turn to part two where, through the application of IIT (intra-industry trade) and the Export Specialisation Index, we shall first consider the convergence and specialisation aspects, respectively.

II. Developments in intra-industry trade and export specialisation

3.3 Intra-industry trade

The measurement of IIT, as explained in the methodology section, will be carried out at the 2-digit level for 1990, 1994 and 1998. Measurement will also involve the application of both the unadjusted and adjusted formulas as given in the last chapter and they are:

$$IIT = \left\{ 1 - \left[\sum |x_i - m_i| / \sum (x_i + m_i) \right] \right\} 100 \quad (IIT)$$

$$IIT = \left\{ 1 - 0.5 \left[\sum \left(\left| \frac{x_i}{x} \right| - \left| \frac{m_i}{m} \right| \right) \right] \right\} 100 \quad (IIT^*)$$

The statistical tables in this subsection show the broad industrial sectors in the order that they appear in the statistics. The presentation of German statistics at the two-digit level contains commodities that have been grouped together, such as agriculture, forestry & fisheries or food & tobacco, for example (see table 3b). For this reason, the calculation of IIT and IIT* will be based purely on the total number of 2-digit commodities. From left to right, each of the given tables contains a column showing the broad industrial sector (1), the volume exports (2) and their percentage share (3). The imports side will appear in columns four and five and the balance of trade is given in the far-right column. All totals can be found in the bottom row.

The position in 1990

Dealing first with exports, we can identify three of the listed sectors, which dominated as a share of the total outflows to Germany. These are the primary (32.7%), consumption (26.5%) and capital goods sectors (14.9%) and together accounted for

74.1% of all exports. Observation of the imports column also reveals that these sectors were also the most important inflows and together accounted for 83.8% of the total.

Primary goods include: iron & steel, chemical products, paper, mineral products, rubber products and timber.

Capital goods include: road vehicles, mechanical products, agricultural machinery, electronic products, office equipment and steel & metal products.

Consumer goods include: clothes, textiles, wooden products shoes, leather and ceramic products.

Table 3b

Broad industrial sectors used for the measurement of Polish-German IIT in 1990 (millions DM)					
Industrial sector	x_i	%	m_i	%	$x_i - m_i$
Agriculture, Forestry & Fisheries	441.568	8.5	368.781	7.8	72.787
Food & Tobacco	519.411	10.0	277.032	5.9	242.379
Electricity, Gas & crude oil	0	0	0	0	0
Mining	315.238	6.1	1.149	0.02	314.089
Primary goods	1690.959	32.7	932.301	19.8	758.658
Capital goods	771.432	14.9	1987.545	42.3	-1216.113
Consumption goods	1369.659	26.5	1018.469	21.7	351.190
Other	55.315	1.0	105.406	2.2	-50.091
Total	5163.583	100	4690.683	100	472.900

Source: Own calculations based on 2-digit data obtained from the Statistisches Bundesamt.

The actual trade balance in the far-right column reveals the position of each sector and the broad industrial focus at the beginning of reform. Poland's highest surplus (758 million DM) was achieved in the export of primary goods, especially non-ferrous metals, chemical products and iron & steel. The import of capital goods, meanwhile, accounted for the highest deficit (-1.2 billion DM) and this was largely associated with the demand for machinery (tools & products for building), electronic products and cars. Poland also achieved a surplus in the export of consumption goods (351 million DM) and this was particularly due to trade in clothes, textiles and wooden products / furniture. Outside these three main sectors, the export of coal &

coke (mining) also achieved a sizeable surplus and, to a lesser extent, certain food & tobacco products.

The position for 1990 reveals Poland as chiefly an exporter of primary and consumer goods to Germany and largely an importer of capital goods. The application of our model to Poland's commodity trade with German, across 97 divisions of goods, reveals that trade was predominantly of an inter-industry nature.

IIT = 48.03 (unadjusted)

IIT* = 35.18 (adjusted)

The actual margin between both results takes account of Poland's trade surplus in 1990 (472 million DM), which was downwardly adjusted to account of the trade imbalance across a range of commodities. The adjusted value, which is more consistent with the structure of Polish trade, is almost the same as that obtained for Polish-EU trade in 1990 (see chapter two). This would be comparable with that Ireland (34).¹⁷ We shall now develop this picture and ascertain how this initial position has changed for 1994 and 1998.

The position in 1994

Poland's trade with Germany in 1994 revealed a small deficit (-226 million DM). However, during this period (1990-94) the export of primary, consumer and capital goods expanded quite considerably. Exports of primary goods increased in value terms by over 1 billion DM, while its share of total exports was actually over 7% lower. In contrast, the share of capital and consumer goods increased by almost 6% and 13%, respectively. The actual value of exports from these two sectors also increased three-fold and this is attributable to the dominance of clothes, wooden products, electronic products, cars and machine products.¹⁸ With the exception of road vehicles (cars), these items were the dominant outflows in 1990 (discussed in part three).

Table 3c

Broad industrial sectors used for the measurement of Polish-German IIT in 1994 (millions DM)					
Industry	x_1	%	m_1	%	$x_1 - m_1$
Agriculture, Forestry & Fisheries	305.756	3.0	154.369	1.5	151.387
Food & Tobacco	565.317	5.6	682.239	6.6	-116.922
Electricity, Gas & crude oil	0.026	0	0	0	0.026
Mining	447.027	4.4	35.482	0.3	411.545
Primary goods	2619.721	25.8	2208.245	21.3	411.476
Capital goods	2074.283	20.4	4358.250	42.0	-2283.967
Consumption goods	3983.352	39.3	2836.375	27.3	1146.977
Other	130.512	1.3	77.590	0.7	52.922
Total	10125.994	100	10352.550	100	-226.556

Source: *Own calculations based on 2-digit data obtained from the Statistisches Bundesamt.*

On the imports side, the share of primary, consumer and capital goods constituted 83.8% of the total inflows, which represented little change in their share on the level calculated for 1990. The value of these imports more than doubled in each of the three sectors, although only a deficit was recorded in capital goods imports (-2.2 billion DM). This was due to the comparatively higher import of machinery, machine-tool/building products, electronic goods and, to a lesser extent, motor cars (Statistisches Bundesamt, 1998). Out of all three sectors, the most sizeable increase occurred in the share of consumption goods, which increased by almost 7%. The dominant import in this sector was textiles and accounted for 56.9% of all consumer imports. Poland's export of textiles to Germany is also the third most important consumer goods item after clothes and wooden products. This reflects the continuation and importance of OPT in the clothes industry, but also Poland's expanding textiles industry, whose total exports increased from 1.9 dollars in 1993 to 3.3 million dollars in 1997.¹⁹ In contrast to 1990, the difference between IIT and IIT* in 1994 was marginal and this was due to the overall smaller, Polish-German trade imbalance:

$$\text{IIT} = 44.77 \quad \text{IIT}^* = 46.69$$

During this initial period the higher levels of IIT can be explained more through the structure of German demand, which has focused largely on Polish labour and resource-intensive products. This has been driven by Germany's own supply of materials and other inputs (see next section). However, the fact that trade was predominantly of an inter-industry nature (< 50) revealed that Polish-German trade was still characterised by the exchange of different goods in 1994. This is supported by the Polish surplus in consumer goods and its deficit in capital goods. We shall now establish the position for 1998 and then we will draw some firm conclusions concerning these developments to date.

The position in 1998

Poland's exports to Germany increased by 61.5% between 1994 and 1998, while its imports increased by 42.9%. The trade deficit widened further to -7.6 billion DM, which was largely due to the import of machinery, chemical products, textiles and motor cars. The much higher deficit can be partially attributed to changes in the macroeconomic environment, which led to lower lending rates as well as certain political and legislative changes, which led to a sharp rise in the level of foreign direct investment (see chapter four).

Table 3d

Broad industrial sectors used for the measurement of Polish-German IIT in 1998 (mln DM)					
Industry	x_1	%	m_1	%	$x_1 - m_1$
Agriculture, Forestry & Fisheries	238.750	1.5	230.416	0.9	8.334
Food & Tobacco	991.726	6.0	1108.935	4.5	-117.209
Electricity, Gas & crude oil	45.085	0.2	3.782	0.01	41.303
Mining	393.256	2.4	39.833	0.1	353.423
Primary goods	2949.394	17.9	5728.484	23.7	-2779.090
Capital goods	4613.551	28.0	11022.031	45.7	-6408.480
Consumption goods	7030.914	42.7	4878.265	20.2	2152.649
Other	179.790	1.0	1100.715	4.5	-920.925
Total	16442.466	100	24112.461	100	-7669.995

Source: *Own calculations based on 2-digit data obtained from the Statistisches Bundesamt.*

Poland's main surpluses in 1998 were achieved in the export of consumption goods (2.1 billion DM), products from agriculture, forestry & fisheries (8.3 million DM) and mining (353 million DM). The share of capital goods has increased by almost 50% since 1990 and these outflows made up 28% of the total in 1998. After consumption goods, which accounted for 42.7% of the total, capital goods now form the second most important outflows. These developments are partially reflected in the higher value of IIT:

$$\text{IIT} = 55.59$$

$$\text{IIT}^* = 57.55$$

The application of both formulas revealed Polish-German trade to be more intra-industry in 1998, indicating a greater exchange of goods from the same industry. To aid us in our understanding of this we have included the following table, which contains the upper ten Polish commodities with the highest IIT values and their percentage share in total exports to Germany.

Table 3e

Polish commodities revealing high levels IIT and their percentage share in total exports		
Commodities	xi/X	IIT
Glass, ceramic, worked/processed stone and earth	0.034	97.7
Agricultural products and livestock animals	0.013	96.9
Other vehicles	0.006	95.8
Food products	0.06	94.7
Metal products	0.066	93.7
Electrical products & distribution	0.062	93.1
Iron & steel products, non-ferrous metals & products	0.091	89.9
Leather & leather goods	0.013	89.4
Crude oil & natural gas	0.0003	86.4
Motor vehicles & parts	0.072	74.1

Source: *Own calculations based on Statistisches Bundesamt data, 1999.*

The listed ten commodities are those, which revealed the highest IIT values in Polish-German trade for 1998. However, although this signals where the exchange of similar goods is greater, none of these Polish exports actually exceed 1% of the total (see column xi/X). Oppositely, German demand was higher for clothes and furniture, which accounted for 13% and approximately 12% of Polish exports, respectively. The IIT value for clothes was 29.8 and 31.1 for furniture. This suggests that demand is actually greater for certain items in which Poland has a revealed comparative advantage or in products that have become more competitive (see subsection 2.4). At the same time, the fact that the above table does not only contain certain labour and resource-intensive items, but also more medium technological goods indicates that foreign direct investment is beginning to play a greater role in the transfer of technology. One example is confirmed by the growing number of international car producers in the country, such as Fiat, Daewoo, Isuzu, GM/Opel, Volvo and VW.²⁰ Meanwhile, the expansion of certain primary, consumer and capital goods in Polish exports indicates that the transfer of technology has not been limited to purely capital goods, but also the traditional and developing service sectors. This is partially supported by Poland's much higher import of technological goods (machinery & data processing equipment) between 1994 and 1998 (Statistisches Bundesamt, 1999). However, before we can confirm these findings, we need to extend this analysis to Poland's branches of export specialisation in order to determine whether our initial assumptions are correct.

3.4 Export specialisation

In contrast to chapter two of this work, which used revealed comparative advantage to measure the competitiveness of industry, we shall be applying the specialisation index in the case of Poland's exports to Germany, since our main focus is to determine those industrial branches in which export specialisation has been greater. This will be achieved through the application of the following formula and is given as:

$$SI = \frac{(x_i^p / x)}{(x_i^g / x)} \times 100$$

Where,

x_i^p = **total exports of industry *i* from Poland to Germany**

x = **total exports from Poland to Germany**

x_i^g = **total exports of industry *i* from Germany to Poland**

x = **total exports from Germany to Poland**

A value > 100 would indicate a relatively high specialisation. Meanwhile, if $SI < 100$, then this would imply that specialisation is low. To compare the changes in specialisation over time, we shall apply the model for the years 1990 and 1998, since little will be gained through the analysis of each individual year. The results for both years are given on table 3f for the upper-thirty exported commodities.

The most immediate feature when both years are compared is the fact, that export specialisation is concentrated on fewer commodities in 1998. The export of coal, coke, briquettes and turf were calculated to be the exports with the highest degree of specialisation in 1990 and 1998, which is consistent with the fact that Poland hardly imports any of these commodities. These sectors are also partly controlled and supported by the state (see chapter two). Observation of the values (> 100) for 1990 reveals the dominance of labour and resource-intensive goods in exports along with certain medium technological goods, such as trams ($SI = 400$) and ships ($SI = 100$). However the main export branches of specialisation were in the traditional sectors, such as clothes wooden products/furniture, iron & steel and metal products. The picture for 1998 reveals that the export of clothes and wooden products/furniture were the most specialised and this concurs with their relative share in exports. After these, export specialisation is revealed in those commodities for which we obtained high levels of IIT and relatively low export shares (see table 3e). The exception to this was motor cars, whose SI value was $85.7 < 100$. This is consistent with the fact that German direct

investment into car production in Poland was not significant until 1998.²¹

Table 3f

Developments in Poland's export specialisation with Germany for 1990 and 1998 compared			
	1990		1998
Coal, briquettes, coke, tar & benzene	71,429	Coal & turf	47,500
Cut, waste & other processed wood	5,094.3	Clothes	856.3
Non-ferrous & semi-finished metal products	3,125	Furniture, Jewellery, Musical instruments, sports equipment, toys	840
Iron & steel	2,450	Wood, wooden products, cork products, woven and basket goods	711.1
Non-ferrous metals & pyrite	2,375	Forestry products	500
Wooden products	1,650	Ore	400
Clothes	1,100	Stone, earth & other mining products	400
Prefabricated buildings	700	Crude oil & natural gas	300
Formed steel products	454.5	Iron & steel products, non-ferrous metals & products	182
Steel products & trams	400	Agricultural products & livestock animals	162.5
Leather goods	400	Coke & mineral products, fissure- & spawn materials	153.8
Shoes	375	Other vehicles	150
Iron, steel & cast iron	370	Glass, ceramic, worked/processed stone & earth	141.7
Glass & glass products	325	Food products	133.3
Stone	250	Metal products	129.4
Stone, earth & asbestos goods	250	Electrical products & distribution	129.2
Non-ferrous metal casts	250	Leather & leather goods	118.2
Food industry & tobacco	200	Motor vehicles and parts	85.7
Grinded wood, cellulose, paper & paper board	200	Rubber & art goods	42.6
Agricultural, Forestry & fisheries	114.3	Textiles	42.2
Iron, steel & sheet metal products	105	Paper	40.6
Motor craft & ships	100	Fish & fish products	37.5
Aircraft and spaceships	100	Chemical products	33.6
Mineral products	96	News-, Radio- & television-equipment & electronic components	31.3
Rubber goods	66.7	Machinery	28.7
Products from foundaries & steel mills	62.5	Published & printed products	28.6
Chemical products	59.3	Other goods	22.2
Other	50	Medicine, measurement, steering, regulation & optical products	20.8
Fine ceramic goods	47.6	Tobacco products	10
Electronic products	47.3	Office machines, data processing equipment	4.5
Musical instruments, toys & sports equipment	30	Energy	0

Source: Results based on statistical data obtained from the Statistisches Bundesamt, 1997 & 1999. 1998.

* Items highlighted in blue do not reveal export specialisation < 100

Our overall results for 1998, however, suggest that Polish export specialisation in its trade with Germany has, with the exception of electrical products and "other" vehicles, concentrated predominantly on labour and resource-intensive goods. This is consistent with our results on Polish-EU trade and, in the absence of a higher share of human and capital intensive goods, implies that export earnings will be low. Some weight is lent to this by the values on total exports per head, which for Poland amounts to \$709

compared with \$2,200 and \$2,800 for the Czech Republic and Hungary, respectively.²² In contrast, those exports embodied with a greater level of technology, such as motor vehicles, radio & television equipment, machinery, measurement & optical equipment, office machinery and data processing equipment all featured lower down (< 100) in the index. This position may, however, change with time. Our empirical analysis will assess the development of Poland's medium and high technology exports with a view to ascertaining whether this is likely to be the case.

Brief summary

The theoretical approach to this section has shown that Poland's trade with Germany has moved from a predominantly inter-industry structure in 1990 to trade in commodities revealing a more intra-industry pattern in 1998. Such developments were more a feature of the second half of the 1990's, which is consistent with greater macroeconomic stability and higher levels of German and other foreign investment (see chapters four & five). Interestingly, while higher levels of IIT are consistent with convergence, which would reflect restructuring and development, Poland's higher observed levels have resulted from trade in predominantly labour and resource-intensive goods. We further observed that export specialisation has also largely occurred in goods produced by the traditional branches. The high import of capital goods, therefore, requires some explanation.²³ First of all, large imports of machinery and electronic goods including data processing equipment did not feature extensively in Poland's inflows until the second half of the 1990's. This may suggest that more time should be allowed for greater developments to occur in the production and export of more medium and high technological goods. Secondly, not all imports of capital goods from Germany will automatically or even later result in a more diversified Polish export composition, since some of the technology will flow to the traditional sectors and also the developing service sector where German investors have been among the most active (see chapter five). At the same time, as indicated, medium technological goods do feature in Poland's exports to Germany, but do not play a significant role, comparatively. This can be partially attributed to the fact that German FDI was not significant until after 1995. We shall now turn to part three of this work where we shall

ascertain whether our theoretical assumptions concur with our empirical results on Polish-German trade developments.

III. Developments in composition from an empirical perspective

3.5 The extent of the changing commodity composition

The values of the Poland's export categories are presented on the following table for a selected number of years ranging from 1990 to 1998. The values given confirm the dominant positions of Polish primary, capital and consumer exports and reflect the focus of German demand. The remaining categories, in contrast, (except agriculture) can be best described as stable exports, since no substantial gains or losses are evident in their volumes. For 1998, it should be noted that the increased export of food items also included tobacco. Likewise, the increase in "other" items was also due to the inclusion of crude oil and natural gas.

Table 3g

Poland's export performance by sector from 1990 to 1998 (Billions of Marks)					
Sector / Year	1990	1992	1994	1996	1998
Agricultural	0.441	0.347	0.305	0.282	0.238
Food	0.519	0.653	0.565	0.652	0.991
Mining	0.315	0.412	0.447	0.411	0.393
Primary	1.690	2.664	2.619	2.587	2.949
Capital	0.771	1.402	2.074	3.157	4.613
Consumer	1.369	2.677	3.983	4.946	7.030
Other	0.055	0.127	0.130	0.140	0.224

Source: *Statistisches Bundesamt, 1997-99.*

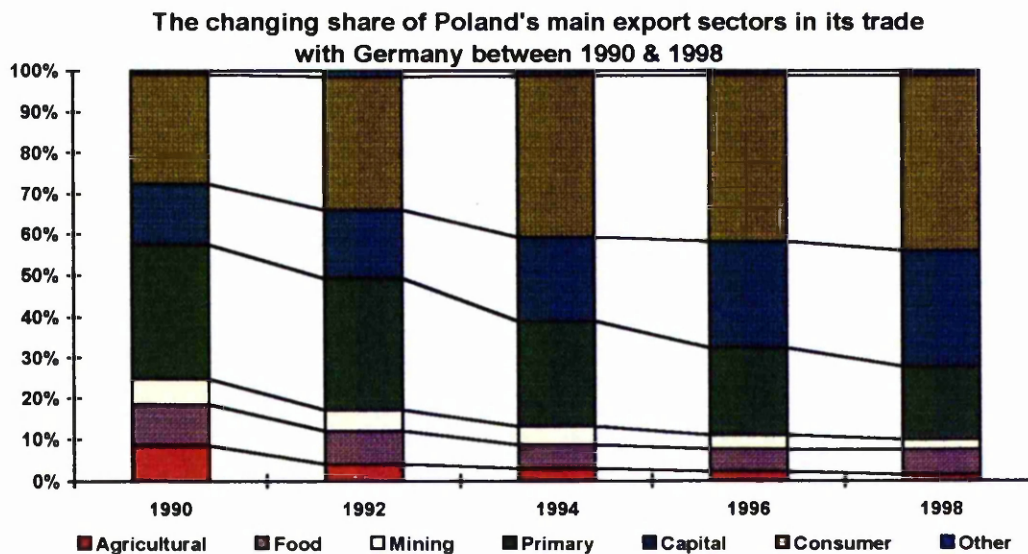
The definitions for each of the given categories are provided below for reference. Out of the seven groups, the production of capital goods consists of those industries, which are endowed with relatively greater levels of technology. The extent of this will be taken up later.

- (i) Agriculture, Forestry, and Fisheries (products from all three areas combined)
- (ii) Food (products from the food processing industry) (incl. Tobacco in 1998)
- (iii) Mining (all resources which have been quarried, mined or excavated)

- (iv) Primary (first stage products)
- (v) Capital (capital/industrial goods)
- (vi) Consumer (consumption/non durable goods)
- (vii) Other goods (incl. Crude oil & natural gas in 1998)

Before we carry out our analysis of Poland's developing commodity trade, it is appropriate to show how the share of each sector in exports has changed during the 1990's. This indicated on the following graph (3e).

Graph 3e



Source: *Own calculations based on Statistisches Bundesamt data, 1997-99.*

The most obvious feature on the graph (lower three sectors) is the overall shrinking share of agriculture, mining and food, whose combined share of exports fell from 25% in 1990 to 9.8% in 1998. Out of the three dominant sectors the share of primary exports fell from 32% in 1990 to 17.9% in 1998. Although substantial in share terms, this was not due to a decline in the export of primary exports (see table), but more a result of the expanding shares of capital and consumer exports, which have depressed its share over time. This was more evident in the share of capital goods, which increased from 14.9% in 1990 to 28% in 1998. Therefore, while theoretical results do

not reveal capital goods to be playing a significant role in trade, their share in Polish outflows has almost doubled over time. These developments were greater after 1994 (see graph), which, in turn, resulted in a relatively stable share of consumer exports. Having gained a brief insight into how these sectors have performed in share terms, we shall now determine which commodities are dominant in driving these developments. This will be carried out with respect to the three most dominant sectors.

3.5.1 Primary goods

The following list contains the main 2-digit primary goods traded with Germany:

- | | |
|--|-------------------------------|
| (1) Metal and half fabricated metal goods (*) | (7) Metal/Iron mould castings |
| (2) Stoneware, peat and asbestos goods | (8) Paper |
| (3) Chemical products (*) | (9) Cast Iron |
| (4) Iron and Steel (*) | (10) Mineral products |
| (5) Different forms of timber | |
| (6) Rubber Goods | |

(*) = Goods / products which are listed in the Association Agreement as sensitive items.

The majority of these products, which were traded with East and West Germany before 1990, are first stage or low-tech products that do not require substantial processing or a sophisticated structure of production. The following table reveals that Poland's export of these commodities was more negatively affected over time than its imports. German statistics at the three-digit level indicate that almost 50% of their raw material exports to Poland consisted of chemical products, which include chemicals for industry, agriculture, pharmaceuticals and health care products (Statistisches Bundesamt, 1999).

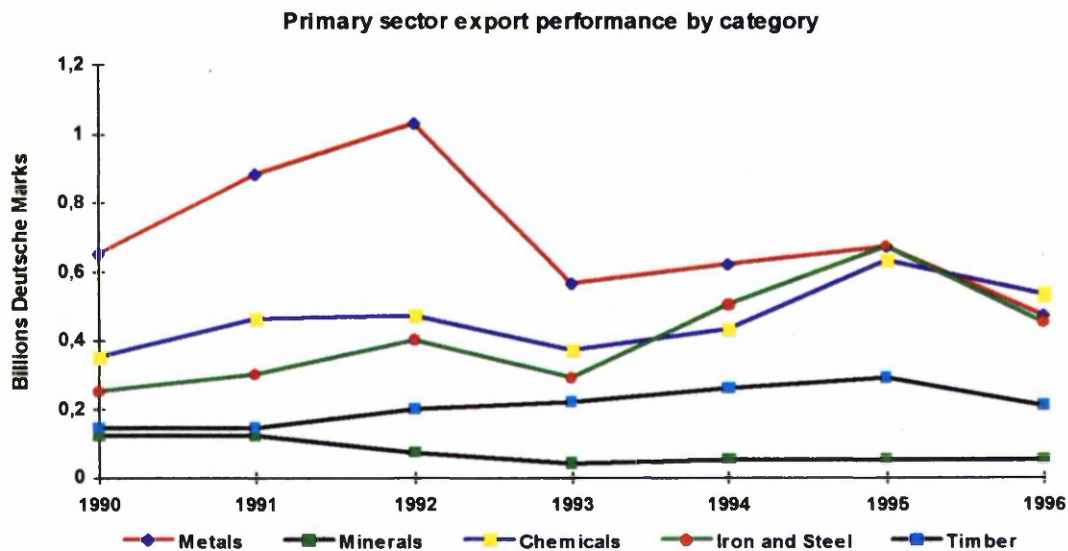
Table 3h

Poland's import and export of primary goods between 1990 & 1998 (billions DM)					
Year	1990	1992	1994	1996	1998
Exports	1.69	2.66	2.61	2.58	2.94
Imports	0.932	1.67	2.2	3.45	5.72

Source: *Statistisches Bundesamt data, 1997-99.*

In terms of Polish outflows, the first fall occurred between 1992 and 1993, where the export of these items fell by approximately 600 million DM (28.5%). During this particular period the zloty appreciated by 9.6%, which indicates that exchange rate behaviour was not the only attributable factor associated with this much lower level. In seeking to determine the causes, the following graph is useful in enabling us to identify which exports were most affected.

Graph 3f



Source: *Statistisches Bundesamt, 1997*

The largest fall (46%) occurred in the export of metals and metal goods (red curve), then iron and steel (green curve), which fell by 26% and then chemicals (blue curve), 20%. This is consistent with EU restrictive practice as discussed in chapter two of this work – particularly, since these exports are the only sensitive items in this category. In

contrast, the behaviour of non-sensitive items (minerals and timber) tends to support this conclusion. The export of timber increased between 1992 and 1993, while mineral exports were in steady decline from 1991. Sensitive exports began to increase again from 1993 and, by the end of 1995, total exports from this category had increased by 35.5% from 2.07 to 3.21 billion DM.

The second fall occurred in 1996, when the total level of primary exports fell by 20% from 3.2 to 2.5 billion DM. Observation of the last graph reveals that, with the exception of mineral exports, which remained relatively constant, all other primary exports fell during this period. The zloty appreciated by around 3% between 1995 and 1996 and this appears to affect the export of iron & steel and metals more than timber and chemicals (see graph). A further factor concerns the actual recession experienced by the European economy at this time, which may have resulted in a slow down in the level of German demand for some of these commodities. We shall return to this point in later sections. At this particular time, there was also a considerable surge in FDI into Poland, which could have led to the temporary redirection of these goods to the home market. The growing number of German building, construction and other firms in Poland at this time (see chapter five) lends some weight to this assumption.²⁴ After 1996, primary exports continued to grow and reached 2.9 billion DM in 1998. This may be partially connected with the greater international awareness over the EU's increasing number of anti-dumping cases, which began to fall in the late 1990's (Lloyd & Milner, 1999) and also greater liberalisation. We shall now discuss the performance of consumer goods exports.

3.5.2 Consumer goods

In contrast to primary goods, a greater number of the consumer goods come under the heading of "sensitive" in the Associated Agreement. These are highlighted with an asterisk.

- | | |
|--------------------------------------|------------------------|
| (1) Fine ceramic products (*) | (7) Works of Art |
| (2) Glass and glass products | (8) Leather (*) |

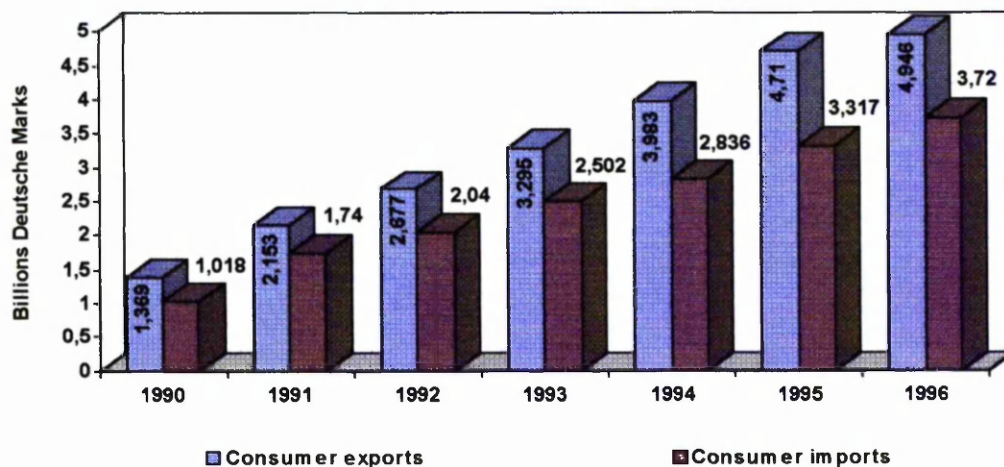
- | | |
|---|---------------------------------|
| (3) Wooden products (*) | (9) Leather products (*) |
| (4) Musical instruments and sports equipment | (10) Shoes (*) |
| (5) Paper goods | (11) Textiles (*) |
| (6) Printed products | (12) Clothes (*) |

(*) = Goods / products listed in the Association Agreement as sensitive items.

The export of consumer goods has risen during the 1990's from 26.5% of the outflows to 40.6% in 1996 and 42.7% in 1998. The items listed, with the exception of musical instruments, are classified as predominantly labour-intensive according to the UN commodity index. The growth of consumer exports (see graph 3g) indicates that external factors, such as those affecting the supply of primary goods, have not been an obstacle.

Graph 3g

**Poland's import and export of consumer goods
between 1990 and 1996**



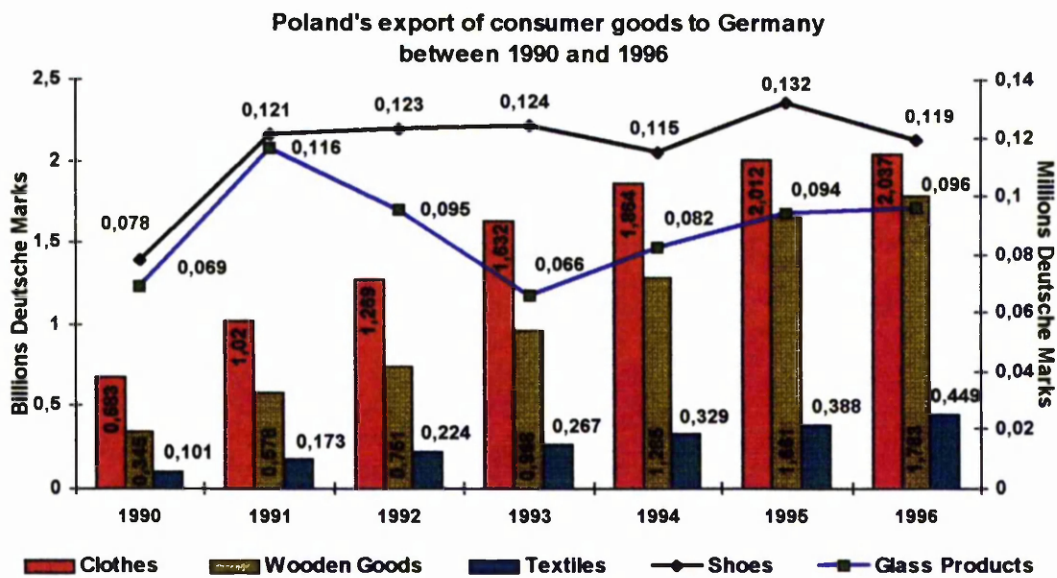
Source: *Statistisches Bundesamt, 1997-99.*

Of significance, is the fact that consumer imports increase in line with exports throughout the entire period, which reflects the importance of outward processing trade especially in wooden products/furniture, clothes, knitted goods and shoes.²⁵

Product behaviour

Poland's main consumer exports have been plotted on graph (3h). Those exports, which have fluctuated the most over time have been plotted as line curves and graphed against the right-hand y-axis. These are shoes (green curve), glass and products made from glass (blue curve). The remaining products, which are clothes, wooden products and textiles have all been plotted as vertical bars and their corresponding values have been graphed against the left-hand y-axis. With the exception of glass & glass products, all of the remaining exports on the given graph are listed as sensitive products in the Interim Agreement.²⁶

Graph 3h



Source: *Statistisches Bundesamt, 1997-99.*

In contrast to the fluctuating behaviour of certain sensitive primary goods, outflows of sensitive consumer goods continues to grow over time. The main reason for this concerns not only the level of German demand, but also the trade arrangements on goods in transit for processing (OPT) operations. For example, duties are exempt on Polish imports of textiles from Germany intended for clothes production (Association Agreement, 1992). However, similar to outflows of primary goods, consumer items

were also affected in 1996. This is reflected in the year-on-year percentage increase in total consumer exports. For example, up until 1995 these exports increased by more than 15% each year, whereas in 1996 this value had fallen to 4.8%. This can be more attributed to the performance of the zloty as indicated by the slow down in the export of clothes and wooden products and also the fall in shoes. This is also consistent with the behaviour of primary exports.

Clothes and wooden products

The export of clothes and wooden products requires a brief and separate discussion owing to the importance on these commodities and their share in total exports as discussed in our theoretical part to this work.

Table 3i

The export of clothes and wooden products from 1990 to 1998					
Year	1990	1992	1994	1996	1998
Total Consumer exports (billions DM)	1.36	2.67	3.98	4.94	7.03
Clothes & Wooden Products (billions DM)	1.02	2.02	3.14	3.82	5.40
C&W % share of total consumer exports	75.0	75.6	78.8	77.3	76.8_a

Source: *Calculations based on Statistisches Bundesamt information, 1997-99.*

a = value for 1998, which is an estimation owing to the grouping of some commodities.

The export of clothes has become Poland's most important export to Germany increasing from 683 million DM in 1990 to 2.2 billion in 1998. Over 80% of these exports come under the heading of outward processing trade. Essentially, Germany sends large quantities of textiles to Poland for further processing and the end produce, which is largely clothes, is then exported back to Germany. More specifically, this particular type of trade, although generally referred to as OPT, is better known as IPT (inward processing trade), since Poland actually receives the materials necessary for production. These goods are then either sold in Germany or re-exported at world prices. The German clothes industry as a result is able to take advantage of the exemption from customs duties (*Zollgebühren*) reflecting lower input costs to

production (*Fertigungskosten*). With respect to the latter, for example, the average industrial wage / hour in Germany (1995) was 44 DM, while in Poland the average was 3.70 DM.²⁷ The industrial wage/hour in Poland, although slowly rising, was eleven times lower during this particular year. For the Polish clothes industry, however, which is predominantly labour intensive, this type of work secures jobs and provides the industry with one of the largest destination markets in Europe for its exports.

Wooden items have become Poland's second most important export. Observation of Polish-German three-digit data reveals that the bulk are classified as wooden goods (incl. Furniture), although a sizeable volume from other SITC classifications (607 & 608) indicates that various wooden items (incl. timber, cut & waste wood, cellophane & wood-pulp) are also exported for a number of purposes, such as building, for example (Statistisches Bundesamt, 1995-96). Between 1990 and 1996 the export of wooden goods alone had increased by more than five-fold from 345 million to 1.783 billion DM. A substantial proportion of this trade also comes under the heading of processing trade, since Poland also receives a high volume of waste and shaped wood from Germany, which is used both in the domestic market and for re-export. This type of trade has been stable and consistent through out the 1990's. We shall now discuss the last of these three export categories.

3.5.3 Capital goods

In contrast to those goods listed in the primary and consumer categories, the items listed under the heading "capital" goods can be classified as more medium and high-tech exports. In advanced industrialised economies this would imply that some of these goods are produced by more human and capital-intensive production processes, which in some cases would also include the operation of a research department. However, although we have observed that the share of capital exports has increased during the second half of the 1990's, we need to determine whether this is indicative of industrial restructuring. According to Tüselmann, for example, the high value-added aspect of production is kept on German soil in order to safeguard jobs.²⁸ We shall first discuss the main exports from this category:

- | | |
|-------------------------------|--|
| (1) Electronic products | (7) Ships and other sea-going vessels |
| (2) Mechanical products | (8) Aircraft |
| (3) Road Vehicles | (9) Office equipment |
| (4) Rail Transport | (10) Fine mechanical + optical instruments |
| (5) Steel/Metal/Iron products | (11) Agricultural machinery |
| (6) Formed steel products | |

The total value of these items along with their share of total exports has increased each year, indicating that capital exports are beginning to play a greater role in outflows. The import of these goods, however, (see table 3j) has been much higher, especially during the second half of the 1990's. This is evident by the growing deficit, which equated to – 6.4 billion DM in 1998.

Poland's inflows of capital goods have consisted largely of machinery and products for machine building, mechanical engineering equipment, motor vehicles (incl. lorries & vehicle parts) and electronic products.

Table 3j

The export and import of capital goods between 1990 and 1998					
Year	1990	1992	1994	1996	1998
Total Capital exports (billions DM)	0.771	1.402	2.074	3.157	4.613
Total Capital imports (billions DM)	1.987	3.5	4.358	7.879	11.022
Balance	-1.216	-2.098	-2.284	-4.722	-6.409

Source: *Calculations based on Statistisches Bundesamt information, 1997-99.*

Observation at the 3-digit level reveals that the machinery imports include machine tools, textile & leather- industrial machinery, agricultural machinery (incl. vehicles), craft machinery and pump & hydraulic machinery (Statistisches Bundesamt, 1996-98). On the export side, the dominant outflows have been motor vehicles and electronic components, although the export of machinery has played a greater role in the second half of the 1990's. This is due to the continued liberalisation of trade, which has resulted in a greater volume of outward processing trade in electrical machinery and

instruments. This has resulted in the transfer of technology; and has led to the gradual integration of other machinery branches as well as those producing transport equipment into the same process (Brandmeier, 1999). The export of machinery formed 4.9% of the Polish total outflows in 1997 and 5.4% in 1998 (Statistisches Bundesamt, 1999). This indicates that these developments are still in their initial phase and that growth is gradual.

In contrast, export growth in electronic components & products and motor vehicles has been more rapid. This is directly attributable to the increased presence of foreign firms in the country, which are producing both for the domestic market and for export. Some of the larger German concerns in Poland, for example, include Siemens, which produces a range of consumer and producer goods such as computers, domestic appliances, televisions, video-recorders etc and industrial machinery & sub-stations. German Opel, Audi and Volkswagen, meanwhile, are all present in Poland and engaged in either the full production of motor vehicles (Opel) and the assembly or manufacturing of engine parts (see chapter five). In 1990, electronic products/components and motor vehicles accounted for 35.9% of capital exports. By 1996, they accounted for half of them. In terms of all Polish exports to Germany, motor vehicles and component parts accounted for 7% in 1998 (DM 1.2 billion approx.) and the export of electronic products/components accounted for a similar share (DM 1.2-1.5 billion).

At this point, having outlined the main developments in Polish-German trade during the 1990's, our aim is to now consolidate this information by showing how such trade developments have shaped Poland's export composition overall. This will form the final subsection of this work.

3.6 The extent of compositional change

A country's trade composition provides us with key information concerning its areas of specialisation and also reveals something about its industrial structure. Before we can be more conclusive about those areas, which have characterised Polish-German

developments we need to first consolidate the overall results of our trade analysis into a form that will allow us to compare it over time. For this purpose we have listed the upper twenty export commodities for both 1990 and 1998.

Table 3k

Poland's export composition for 1990 and 1998 compared			
1990		1998	
Clothes	683,997	Clothes	2.263,482
Non-ferrous & semi-finished metal products	650,093	Furniture, Jewellery & other	2.078,179
Food industry & tobacco	519,411	Iron & steel products, non-ferrous metals & products	1.499,110
Agricultural, Forestry & fisheries	441,568	Electronic components/products *	1.200,000
Chemical products	355,035	Motor vehicles and parts	1.192,652
Wooden products	345,278	Metal products	1.091,135
Coal, briquettes, coke, tar & benzene	304,246	Wood & wooden products etc	1.059,580
Iron & steel	255,658	Electrical products & distribution	1.026,096
Electronic components	232,178	Food products	991,296
Machine products	217,199	Machinery	895,859
Cut, waste & other processed wood	140,168	Chemical products	661,099
Mineral products	128,139	Textiles	576,146
Iron, steel & sheet metal products	109,363	Glass, ceramic, worked/processed stone & earth	563,379
Textiles	101,449	Coke & mineral products, fissure- & spawn materials	407,985
Formed steel products	79,543	Rubber & art goods	381,200
Shoes	78,747	Coal & turf	317,323
Glass & glass products	69,750	Paper	225,487
Steel products & trams	66,081	Leather & leather goods	221,081
Other	55,316	Agricultural products & livestock animals	215,201
Stone, earth & asbestos goods	52,726	Other goods	179,790

Source: *Own calculations based on Statistisches Bundesamt data, 1997-99.*

* *Electronic components: values needed to be estimated due to grouping.*

The above table reveals that, while labour and resource-intensive goods were the more dominant exports for both 1990 and 1998, some developments are evident in 1998 by observation of those commodities highlighted in blue. The upper three of these exports, which are embodied with a more medium level of technology, are directly a result of foreign direct investment (motor vehicles and electrical products) and greater trade liberalisation (machinery), which has led to outward processing trade following the removal of customs duties (except agriculture) on sensitive goods. In terms of the lower three, these developments are connected both with FDI (rubber goods) and restructuring progress (leather goods). With respect to the former, this is associated with FDI into the production of tyres (Gazeta Wyborcza, 7/98), while the latter is a

result of improved efficiency in the leather industry.²⁹ Developments in the paper industry, meanwhile, are a reflection of both foreign investments and restructuring progress. Therefore, based on the overall results of the table, our results indicate that Poland's traditional industries have remained dominant in Polish exports throughout most of the 1990's. A number of them have also become more efficient over time and this supported by their higher output volumes, the higher inflows of capital imports and the growing level of interest by German and other foreign investors (see chapters four & five). In the later 1990's, these developments were also accompanied by the growing share of capital goods exports, which is a direct result of investment and also a greater share of machinery in OPT operations. In both cases this indicates that technology transfer is evident. At the same time, while the overall share of capital goods has increased in exports over time the actual share of products embodied with more medium and high levels of technology is not significant. This may change with time, but this process may be dependent on Germany and other countries, since the production and export of Polish capital goods could be in direct competition with some of those produced in the EU.

Conclusion

In this chapter we have established that Polish economic relations with both East and West Germany have been relatively well established since the 1970's. This was largely a result of the initiation of the Gierek modernisation programme which, through the supply of credit, led to West Germany becoming more important as a trade partner than East Germany and this position remained until reunification. At this point both German sectors together accounted for 20% of Poland's total trade. During the 1990's Germany has reinforced this position and extended its share of trade to above 30% of the Polish total, accounting for almost 50% of the country's trade with the EU. We ascertained at the beginning of this work, that the overall weight of Germany in EU trade terms, its comparative advantage in the production of technological products and its geographical proximity to Poland places it in a strategic position to expand its trade. From the Polish perspective, the growth of trade and the import of new technology is crucial for the country as it pursues the restructuring and development of its industrial

sectors. Not all, however, has developed according to these lines of thinking. Our analysis of Polish-German trade flows, has revealed that Poland's trade with Germany has moved from a predominantly inter-industry pattern to trade, which can be broadly characterised as more intra-industry in nature. This has been driven predominantly by the exchange of more labour and resource-intensive goods, which characterised trade up until 1996-97. This position, however, began to change after this point owing to the removal of duties on all sensitive goods (except agriculture) and the increased levels of German direct investment, which was a result of the improved investment climate. The effects of these developments were evident by the much higher trade in capital goods, especially on the imports side in machinery. Meanwhile, the observed increase in Poland's capital outflows was also identifiable by their increased percentage share in total exports. Our evaluation of this was, that intra-industry trade in capital goods has been due to both the effects of investment in Poland and the growing share of capital goods engaged in outward processing trade. In both cases this has resulted in the transfer of technology to Poland, and this is also beginning to have a positive effect on other associated branches. However, the fact that these developments occurred in the later part of the 1990's indicates that the weight of capital exports in the overall export composition was only just beginning to make its mark. This is also confirmed by the dominance of labour and resource-intensive goods in Poland's export specialisation. Our overall analysis, therefore, reveals that greater adjustment and growth has so far been achieved in the traditional sectors. Our empirical results support our theoretical observations, while at the same time reflecting the extent of export growth and the greater role of capital goods during the later part of the 1990's. This suggests that changes in the domestic environment (next chapter) as well as greater trade liberalisation on sensitive goods were important factors in facilitating the more positive developments in the trade of capital goods. The picture towards the end of the 1990's, therefore, reveals that there is potential for Polish-German trade to further develop in the medium and possibly high technological branches of industry in the future. Initially, however, progress towards these goals will be dependent on the developments in outward processing trade in capital goods and greater German and other foreign direct investment in Poland. Much of this will depend on whether Poland has taken the necessary steps to create a domestic environment conducive for investment and greater

trade developments. We shall now turn to chapter four of this work where we shall ascertain why the Polish investment environment actually deterred FDI during the first half of the 1990's, and this will also serve in providing a basis for our final chapter, which will look more closely at the structure of FDI in Poland, its geographical orientation and its relationship with trade.

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Source for tables and graphs

Tables 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 3i, 3j, 3k:

Statistisches Bundesamt, Deutsch-polnischer Handel, two-digit data, 1997 & 1999.

Graph 3a, GUS, Rocznik Statystyczny Handlu Zagranicznego, 1991-92.

Graphs 3b & 3c: Statistisches Bundesamt, Deutsch-polnischer Handel, two-digit data, 1997 & 1999.

Graph 3d, Narodowy Bank Polski, 2000.

Graphs 3e, 3f, 3g, 3h: Statistisches Bundesamt, Deutsch-polnischer Handel, two-digit data, 1997 & 1999.

Chapter Four

Theoretical considerations and the importance of the investment environment

Introduction

In chapters two and three of this work we ascertained that, since the beginning of the 1990's, the expansion of Polish trade has developed largely along regional lines. The EU, therefore, given its level of development, GDP and geographical proximity is playing an influential role in the future restructuring and modernisation of Polish industry. In addition to being one of the world's largest trade blocs the EU is the largest provider of global FDI flows and receives well over one-third of the total stock. In 1995, for example, the EU accounted for over 55% of the total flows received by developed countries.¹ The member states of the EU have grown in importance as markets for FDI following the establishment of the Single European Market (SEM) at the end of 1992. The effect of this was the creation of a free trade environment for the member states inside the bloc, which in turn erected an external tariff wall against the countries outside it. As a result, Japanese, American and other investors, who seek to avoid the higher tariff on their exports to the EU, have chosen to invest in the region directly.² Through their investment in any of the EU States, investors leap the tariff wall and gain free trade access to the entire bloc. Since the formation of SEM, therefore, the EU environment, through greater European and international investment (merger & acquisition) activity, has become more competitive. This suggests that, in addition to having relatively developed market structures, the countries of the EU have provided an environment that is conducive for investment. Having ascertained in previous chapters, that trade and investment developments in Poland were constrained by the negative effects of the domestic environment, our aim in this chapter is to determine where those main constraints were. We have divided this chapter into two parts so that we can construct a basic framework in part one from which we can evaluate Poland's developments in part

two. The entire chapter is structured as follows. We will begin part one by summarising the main incentives that motivate investors into going international in the first place and, with respect to the EU, how investment activity has developed since the establishment of SEM. In the following subsection (4.2), our aim is to highlight the importance of a conducive and stable investment environment as well as the role that government can play in creating some of the conditions necessary for growth and stability. To achieve this aim we have illustrated the case of Mexico as an investment environment that became more open to FDI. This is because the country, through its changes in legislation on foreign direct investment and import substitution policy, attracted high flows of FDI, new technology and promoted wage competition. These points are of direct relevance to the Polish developments and will be taken up in part two of this chapter. Our aim here (part two) is to establish the incentives, constraints and changes in the Polish investment environment during the 1990's. We will begin by first providing a brief background on the incentives connected with the Polish labour force (4.3). On completion, we will then explain the nature of the conditions under which FDI in Poland has developed over time. Our focus here will be predominantly on other main macroeconomic constraints, as well as certain political and legal factors. These points are also of direct relevance to our final subsection (4.5), where we will focus on the importance and progress made with respect to the privatisation of state enterprises. We shall now turn to part one of this work where we shall discuss why investors go international in the first place and what lessons can be learnt from other countries concerning the importance of a stable and liberal domestic environment.

I. Motivations and observations

4.1 Motivations connected with investment

Since the beginning of the 1960's a growing volume of literature has been presented on what motivates the firm into producing from more than one location. So far, however, no single theory has been able to explain all foreign investment scenarios, since firms are motivated by different incentives. However, as opposed to providing a catalogue of the numerous theoretical propositions connected with FDI, it is possible to identify three broad types of investment, which adequately summarise the main motivations. These are as follows and shall be discussed in the order that they appear:

- (i) Market-seeking investment,
- (ii) Efficiency-seeking investment,
- (iii) Asset-seeking investment.

Market-seeking investment

Market-seeking investment occurs when a multinational firm locates in a foreign country with a view to supplying the local market (Cross, 1999, Eiteman, 1992). This type of investment occurs because location in a particular country may also be for the purpose of exporting to other markets in the region. One of the key incentives connected with this type of investment is the fact that product and factor imperfections exist in all markets. This is the Hymerian proposition of 1960 (by Stephen Hymer), which became the foundation for other theories to follow. Later contributions were made by Charles Kindleberger (1969) and by economists from the UK in the 1970's (Peter Buckley, Mark Casson and John Dunning).³ Market imperfections can also be created and this may lead to a source of competitive advantage and opportunities for potential investors. For example, the establishment of the EEC (1957), the EFTA (1958) and the SEM (1992) are all examples of market imperfections that have been created. Multinationals, through

their investment into an established trade bloc, place themselves in a more viable position to serve local markets while simultaneously defending their position more effectively. Japanese motor vehicle and electronics companies, for example, through their investment in the EU, avoid external EU tariffs and place themselves in a more advantageous position to defend their name and market standing, than would be if they were to license-out or export to the EU. Such competitive advantages are known as the multinationals *ownership-specific* advantages (management, brand names & technical know-how etc) and it is the presence of these, which enables the investor to compete against the more *location-specific* advantages enjoyed by domestic firms.⁴

Efficiency-seeking investment

For efficiency-seeking investors, on the other hand, *location-specific* factors play more of a role, especially for those who have different aspects of their production processes spread out across markets. In the EU, for example, the research, design, engineering, testing, assembly, sale and distribution of a motor vehicle is seldom carried out in one location these days, but is rather the result of a process which has combined and concentrated the comparative advantages of multiple markets into its production. Such advantages would include lower costs of labour, access to resources, or where factor prices, transport costs and/or trade barriers are comparatively lower.⁵ The key factors determining the location of production for efficiency-seekers, therefore, are predominantly resource and factor cost considerations. The use of labour-intensive operations in the production of electronic goods in Taiwan and Mexico (Eiteman et al, 1992) and the location of Minicomputer manufacturers in Singapore and Ireland (Krugman et al, 1994) serve as examples of this process in practice. Efficiency-seeking firms, therefore, reorganise and relocate parts of their production process with a view to achieving economies of scale, lower costs of production and a more competitive operating position (Cross, 1999).

Strategic asset-seeking investment

This type of investment is defensive in nature, since it is carried out by multinationals in order to advance their position relative to that of other international competitors.⁶ Multinationals engaging in this type of investment are seeking to update various aspects of their operations, such as their level of technology, production and management techniques and additionally to gain access to new knowledge (Eiteman, 1992, Robock, 1993). The most effective means of achieving this is through the acquisition of a firm, which is relatively more advanced in one or more of these factors. The multinational undertaking the acquisition not only stands to gain access to the target firms technology and knowledge, but also gets to access its markets. The acquisition of American electronics firms in Silicon Valley and EU pharmaceutical companies by Japanese investors are key examples of asset-seeking investment.⁷

These theories provide the three main incentives connected with foreign direct investment. However, although each of these are specific and have been discussed separately, investors are often motivated by a number of incentives simultaneously. For example, EU firms, which contribute over 60% of the FDI flows in the EU, have engaged in both efficiency- and asset-seeking investment.⁸ This has been due to the impact of the Single Market (Cross, 1999), which has stimulated a wave of merger and acquisition activity (EU Commission, 1996). For a regional bloc such as the EU, therefore, with a developed set of markets, investment identifies existing regional comparative advantages and links with them in order to achieve scale economies and a more competitive operating position. This enables us to formulate the question: what comparative advantages exist in countries where market structures are not so well developed? The main advantage can be identified in factor costs, since developing countries have an abundant supply of low-cost labour. The advantage of lower labour costs in India, for example, attracted British Airways into relocating some of its administration to the country.⁹ This is an example of efficiency-seeking investment. However, the topic of labour costs becomes a much more debated issue in the case of those multinationals that produce and sell expensive high quality brand-name products

that do not take account of local prices and income.¹⁰ We shall extend this argument to the case of Mexico.

4.2 Learning from some of the observations and developments in Mexico

In the case of Mexico, the debate and controversy over labour costs is connected with the Maquiladora economy in the North of the country, which is situated close to the US border. Since the 1970's the attractiveness of the region has grown considerably for US and Asian assembly operations, and this is primarily due to the fact that wages and protection are comparatively lower. Some of the related research has also indicated that increasing levels of productivity in Mexico have not been matched by increases in real earnings.¹¹ This is partially linked to the work of Ellingstad (1997), who documents that Maquiladora production has tended to promote low-wage production.¹² As a result, manufacturing has been geared towards export markets owing both to the lack of consumer demand and government policy. The issue of low-wage production and low consumer demand have been directly a result of the government's restrictive policies on trade and investment. Given our focus in part two of this chapter, therefore, it serves to briefly summarise on the main points connected with Mexican wage developments, the later changes in government policy and their effects on the economy.

Location, wages and the environment

The level of employment in Mexican assembly operations began to rise as a direct result of government policy, which actually confined foreign investment to the northern part of the country. As a result, this stimulated the growth and concentration of foreign production facilities, which led to the area becoming an attractive production site for investors. Northern Mexico has continued to remain attractive to investors even though restrictions on investment were later lifted. This firstly suggests that efficiency-seeking investors have identified with Mexico's comparative advantage in labour, but also the distance factor given the close geographical proximity of maquiladora operations to the

United States border. This enables scale economies to be achieved through lower costs of production and transportation.¹³ Northern Mexico has, therefore, developed over time as a supply base from which to serve North America.

The maquiladora wage issue has been linked to the “sweat-shop” proposition, which numerous sources have identified as characterising the operation of assembly plants in Northern Mexico. Comparative wage research, however, reveals that average wage levels in maquiladora operations exceeds that of other manufacturing plants.¹⁴ During the 1990’s, the demand for skilled labour in maquiladora plants has also risen in comparison. One of the main effects of this has been a sharper increase in the real wage level of skilled workers relative to the unskilled wage level. Therefore, while positive wage developments have been observed in both skilled and unskilled levels, the actual ratio between the two has actually increased.¹⁵ Driving these developments was the country’s decision to liberalise its economy in 1990, which was stimulated by the growing competition between Mexico and Eastern Europe for risk capital.¹⁶ Qualification for capital, however, would involve the introduction of an economic reform and stabilisation plan as well greater privatisation of the country’s formerly run state businesses. In contrast to the pre-1990’s, where foreign production was geared purely to export markets, greater liberalisation and changes in government policy have now led to domestic market supply. At the same time, although production for export is still dominated by foreign firms, spill-over effects (domestic firms engaging in trade) have been observed. On the investment side the implementation of Mexico’s new Foreign Investment Act of 1993 has established a framework designed to promote greater competitiveness in the country. The new act provides clearer signals to foreign investors and is slightly less restrictive in so far that it allows greater investment into sectors previously restricted, such as telecommunications, railroad and banking. (Vargas, 1994, Jiménez, 1997). Some of these sectors are among those that have been privatised and include steel, airlines, telecommunications, banking and copper (Rhodes, 1991). The steps take by the government have helped to reduce internal interest rates and have led to a wider presence of foreign investors. What can be learnt from this is that, while some

debate still exists concerning unskilled wage levels in Mexico, the initial steps towards achieving a more competitive environment have been taken. More fundamentally, developing countries stand a better chance of stimulating wage competition and promoting growth in an unrestricted environment.

Brief summary

In part one of this work we have ascertained that investors are motivated by three main types of incentives: Market-seeking, efficiency-seeking and asset-seeking. In an established and developed regional bloc such as the EU, where investors are motivated by any or all of these incentives, merger and takeover activity has been one of the predominant forms of activity since the formation of SEM. However, in the case of developing countries, where market structures are not so well established, labour is one of the main comparative advantages available to investors. In the case in Mexico, efficiency-seeking investment identified the abundant supply of labour as the main comparative advantage to achieving scale economies. However, owing to import substitution policy, production was geared purely to export markets which, in turn, denied the country of modern technology, greater investment and, therefore, restricted competition. Mexican policies with respect to liberalisation, legislation and privatisation were, therefore, the main obstacles to modernisation and development in the country. Since the introduction of these reforms higher levels of foreign investment have been recorded and the effects on wage developments have been partially reflected in the changing structure of demand for goods. This brief subsection has revealed the importance of government policy in shaping a country's operational environment necessary to attract greater FDI and technology, which play a large role in competition, growth and modernisation.

In chapters two and three of this work we outlined that FDI did not play a significant role in the Polish economy until after the mid 1990's. This was confirmed by some of the developments in the trade of capital goods, which were beginning to play a greater

role in the share of total trade. Therefore, having gained a brief insight into the Mexican developments, our aim in part two of this work is to ascertain why the Polish economy was relatively unattractive to foreign investors during the first six years of reform. We will begin this with a background into the incentives connected with the Polish labour force and this will then be followed by a discussion of those areas of domestic environment, which have been identified as the most significant obstacles.

II. Changes in Poland's investment environment

4.3 Labour force incentives

Poland's relatively cheap labour costs and its highly skilled and well-educated labour force (see table 4a) are two of the most important incentives attracting foreign investors into the country. Around 62% of the labour force is under the age of forty, which is positive both in terms of flexibility and from a retraining perspective (PAIZ, 2000). A sizeable portion of the labour force has been attracted to the growing private sector – particularly, foreign firms where the benefits are often greater. As a result, there has been a continual growth in the provision of schools that provide training and language courses to both employers and those wishing to make themselves more attractive to potential employers.¹⁷ The following table, which has been constructed on the basis of OECD research, shows the percentage of males and females from 20 to 55+ years of age who have completed a secondary/grammar school level of education

Table 4a

Percentage of the Polish population aged between 20 and 55+ with a secondary / grammar school level of education.					
Age Group	20-24	25-34	35-44	45-54	55 +
Male	80.5	74.1	62.4	44.3	27.1
Female	83.2	73.3	58.8	35.4	16.6

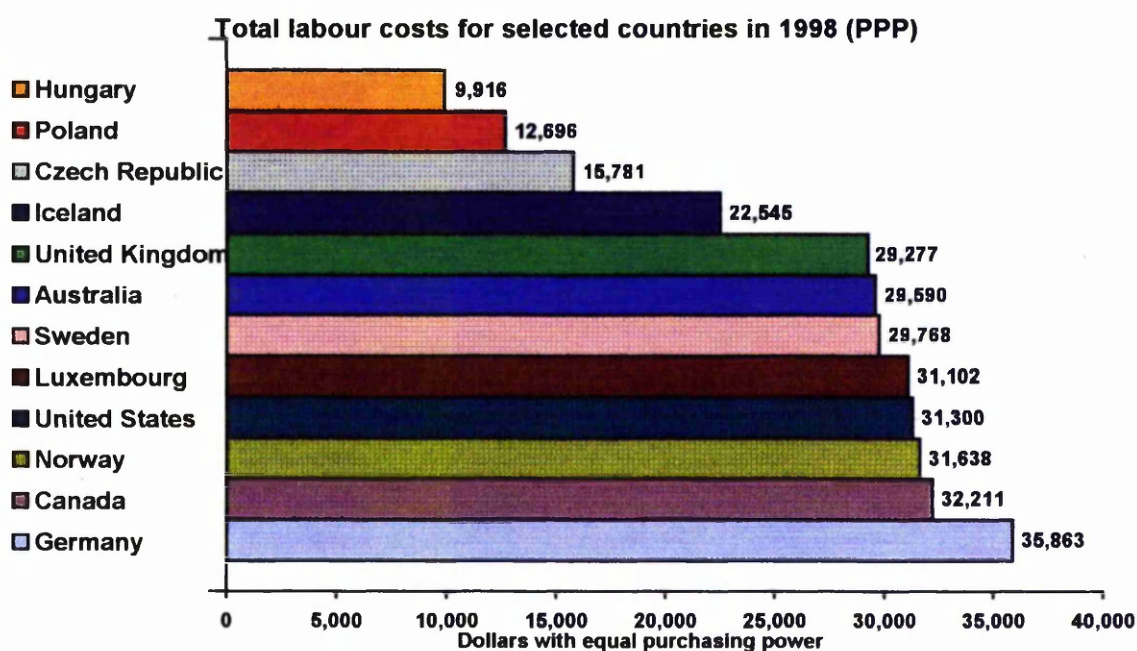
Source: OECD, *Report on Education and Training in Poland*, 1992.

With the exception of those in the 55+ age category, well over half of all males and females (62.4% & 58.8%) up to the age of 44 have been educated to a secondary/grammar school standard. The same OECD source also reveals that 8.9% of those aged between 25 and 34 have attended an institute (polytechnic/university) of higher education. In terms of the entire population, approximately 30% of all students go onto higher education, and this places them as one of the most educated in Europe (PAIZ, 2000).

Labour costs

The comparatively lower costs of labour in Poland have been highlighted in numerous publications as one of the most competitive and significant factors attracting foreign investors to the country. Based on OECD research the following graph shows the position of Polish total labour costs in comparison to those of other countries in 1998.

Graph 4a



Source: *OECD, Taxing wages in OECD countries, 1998/99.*

(Labour costs include gross wages plus employers compulsory social security contributions)

* PPP = Purchasing power parity

Poland, whose total labour costs (incl. all contributions) have been calculated to reflect equal purchasing power in Dollars, ranks after Hungary as having the lowest rates among all OECD countries. These costs also include employer contributions, which in 1998 accounted for 33%.¹⁸ Research carried out in Poland by the Polish agency for foreign investment (PAIZ), revealed that the average, monthly, gross salary was approximately 1,350 zlotys in 1998, which is approximately eleven times lower than

the German level. The following table (4b) provides a breakdown of the gross monthly salaries according to branch of industry for the same year.

Table 4b

Average gross monthly salary for selected branches of industry in 1998 (PLZ)	
Industrial total	1,676
Agriculture, hunting & forestry	1,209
Mining & quarrying	4,052
Manufacturing	1,365
Electricity, gas & water supply	2,049
Construction	1,426
Financial intermediation	1,911
Education	1,097
Health & social work	954

Source: PAIZ, *Polish agency for foreign investment*, 2000.

In addition to the lower relative rates paid in the public sectors (Health & Education), the lower costs of labour can also be found in agriculture, manufacturing and construction. The monthly salary in these branches of industry was marginally above or just below the average given value (1,350 zlotys) for 1998. This makes manufacturing industry, which is dominant in Polish-EU trade, a potential low-cost source for production for potential foreign investors (see chapter five). This raises the question: why, given its low-cost and well educated labour force, did Poland fail to attract any sizeable flows of FDI until 1995 compared with Hungary and the Czech Republic? For example, between 1989 and 1994, FDI per capita in Poland was approximately \$108 million compared with the levels in the Czech Republic and Hungary, which were \$301 and \$660 million dollars, respectively.¹⁹ To determine why this was the case, we need to establish what the initial conditions were in Poland.

4.4 The initial investment conditions

The comparatively lower levels of FDI in Poland before 1995 suggest that low labour costs and a well educated labour force were not supported by domestic conditions favourable enough to attract investors. These conditions come under the following broad headings:

- (i) macroeconomic;
- (ii) political;
- (iii) legislative.²⁰

Although some consideration has already been given to some of the macroeconomic changes in chapter two of this work, one of the associated factors, which has proven to be an obstacle to investment was the country's international credit rating. More specifically, this refers to Poland's foreign debt. In September 1994 the London Club consortium of private banks agreed to reduce the debt owed to them by Poland by 49.2% (14 billion US\$). This agreement was actually a condition, which had been previously set by the Paris Club consortium of public banks in April 1991. The Paris Club agreed to a 50% reduction of the outstanding 33.5 billion US\$ owed to them, but in two stages. The first stage of the reduction was initiated in 1991, but the second stage would only come into effect after a reduction on London's part. The simultaneous reduction in London and Paris eased Poland's debt burden from 79.3% of its GDP in 1990 to approximately 37% in 1995.²¹ In the year 2000, Poland's foreign debt was further reduced by 289.5 million USD.²²

Graph 4b



Source: Polish Agency for Foreign Investment (PAIZ), 1999.

The effect of this was a much steeper rise in the level of FDI (graph 4b), which suggests that the debt issue was one of the key negative factors hampering FDI into the country. Observation of the FDI curve reveals a sharp increase from 1995 onwards, where investment more than doubles from 6.8 to 14.0 billion dollars during the first year. It should be noted that some discrepancy exists between institutions on the value of FDI. For example, in the year 2000, the value of FDI according to PAIZ was 10 billion USD, in contrast to NBP (National Bank of Poland) estimates (9.3 billion USD).²³ Significant for foreign investors was Poland's ranking out of 135 countries for credit worthiness which, as a result of the debt agreement, was substantially improved from position 76 in 1990 to 58 in 1994. This result was based on a survey of between 75 and 100 banks through out the world (Reith, 1995). The Polish National Bank subsequently lifted its restrictions on the issue of bank licenses and this allowed for the operation of more foreign banks in the market. This also meant that existing ones could open up additional branches. From this perspective, therefore, changes in

the country's foreign debt position in 1994 can be characterised as one of the first significant "break-through" points in Poland's investment climate. It also highlights the importance of financial stability to foreign investors.²⁴

The political environment

The low level of FDI during the first half of the 1990's cannot only be attributed to certain negative macroeconomic elements, such as poor credit worthiness and low aggregate demand, but also to the level of political instability in the country.²⁵ More specifically the level of trust and support in the competence of Lech Wałęsa and his Solidarity government to manage the economy was beginning to weaken. This can be partially attributed to the government's rapid approach to economic reform, especially privatisation (see subsection 4.5) and the period of time in which the economy had spent undergoing shock therapy. However, reinforcing this mood was also the growing gap in living standards, which created resentment and distrust from the majority towards the developing wealthier minority and the government, respectively. Some of this was supported by reports of corruption and fraudulent behaviour.

In 1992, patterns of voting behaviour summarised these frustrations when the electorate voted the Post-Solidarity government out of office. The appointment of Hanna Suchocka in July of that year to the post of Prime Minister alleviated some of the political tension and restored investor confidence (Etcheverry, 1993). After the debt agreements in 1994, the presidential elections in November the following year managed to raise investor confidence when the candidate of the SLD, Aleksander Kwasniewski became the President of Poland with a 51.7% share of the votes. Kwasniewski, who managed to mobilise a much broader level of support, promised to keep Poland on a continuous reform path and was more supportive of Poland's membership in NATO and the European Union.²⁶

Legislative change

The unstable political environment during the first half of the 1990's also meant that some changes in investment legislation would be affected. A part of this was directly related to the pace of the privatisation programme and the disputes over methodology (subsection 4.5). Investor opinions, on whether legislation has facilitated investment and improved the operational environment, have tended to be non-conclusive and ambiguous. For example, opinions range from disappointing and slow to progressive (Etcheverry, 1993), and also that legal changes and regulations have occurred frequently.²⁷ We shall, therefore, briefly summarise on the more significant changes to Polish investment legislation in the 1990's.

The Polish economy, whose legislative and regulatory reforms have been based on EU models, has been open to foreign investors since the introduction of the Foreign Investment Act in 1991.²⁸ The Act on Companies with Foreign Participation [Joint Venture Law], which was also introduced in June of that year, allows Polish-Foreign firms to be established without the permission of the government. At the beginning of 1993 well over 8,000 joint ventures had been established. This can be partially attributed to the Government's Procurement Law, which provides domestic firms with a 20% price advantage over foreign ones. A foreign firm that enters into a joint venture, however, automatically qualifies the partnership for "domestic" status. Certain sectors, however, such as seaports, airports and the defence industry are restricted. Joint Venture Law in Poland, which previously never allowed full foreign control, has been amended and now allows up to 100% ownership (EC-Phare, 1995). The law has also been amended (Art.191/3) to allow partnership members to agree for themselves on the distribution of profits. Foreign investors are also guaranteed damages (Art.22 JVA) by the Polish government in the event of expropriation.

Changes in Joint Venture legislation has had a positive impact on partnerships, although the overall comparatively lower level of total FDI suggests that legislative change during

the early 1990's had not been sufficient. However, this position began to change from 1994 when Poland introduced the law on Special Economic Zones. This exempted investors from both local and income taxes. Three zones were established initially (Mielec, Silesia & NE Poland) and a further three (Łódź, Legnica & Wałbrzych) followed shortly after (see chapter five). One of the significant turning points in legislative reform occurred after Poland became a member of the OECD in 1996. In June of that particular year, a change in the law governing the purchase and ownership of private property was introduced. Foreigners (individuals & firms) are now allowed to buy up to 0.4 hectares of urban land and up to 1 hectare of agricultural land without a permit. The significance of this law can be measured in relation to the area of land sold to foreigners, which totalled 2,438 hectares in 1996 (Trade Compliance Center, 1998).

A survey carried out of 570 firms with foreign involvement by the Friedrich Ebert Foundation in 1993, which examined the very important factors attracting FDI into Poland, ranked the legal system in the tenth position out of twenty-one, although opportunities for investment into private property were noted as anticipated.²⁹ One of the main reasons for the middle-scale position of the legal system was the fact that the majority of respondents (91%) regarded it as incoherent, unstable and rather discouraged FDI. The survey also revealed a number of other negative factors including: high foreign indebtedness, technological backwardness, poor telecommunications and inefficient banking & insurance services. According to the results of the survey, the most important factors attracting FDI were the supply and costs of labour, expected income growth and market size. The modernisation of the country's infrastructure required foreign involvement, which meant that greater changes in legislation would have to be carried out, especially in the sphere of privatisation.

4.5 Privatisation

The work carried out thus far indicates that foreign investment not only requires the provision of stable economic, political and legal conditions, but also an operational

environment in which production, exchange and communication can take place. The fact that these key areas were either non-functioning, inefficient and/or obsolete meant that restructuring in Poland required foreign involvement. For foreign investors the reform and modernisation of the economy represents a good opportunity to secure a place in a preferred sector of the economy. The privatisation of state enterprises, therefore, would not only provide investors with the right incentives, but would simultaneously enable the government to carry out its modernisation and restructuring goals. In addition to the anticipated transfer of new technology, privatisation would also be expected to result in the transfer of management skills, new production techniques and know-how. Industrial policy in Poland, therefore, linked the modernisation of the economy to the success of the privatisation programme.³⁰

Developments and constraints

At the end of 1990, 6015 out of 8441 state enterprises, which accounted for 86% of the labour force, were listed for privatisation. By the middle of the 1990's the private sector accounted for 60% of GDP, although this was not due to the success of the privatisation programme but rather to the rapid growth of individual proprietorships and grass root firms. This was confirmed by the fact, that over 80% (6752) of the total number of all enterprises were still in state hands at this time.³¹ The development of new firms, which had become more active in trade, were forced, due to certain macroeconomic constraints, to link with other firms in the same industry and this resulted in a phase of industrial concentration, especially in manufacturing. This is confirmed by the rising number of partnerships, which increased in 1995 by almost 10% from 95,017 to 104,922 firms.³² According to individual proprietors, the main constraints leading to these fusions included the availability of credit, the high cost of borrowing and competition from similar firms. The overall, continuously growing number of new firms and their comparatively larger share in GDP, however, raises an important question concerning the ownership transfer of enterprises from state-to-private hands: what constraints have negatively affected the pace of privatisation in Poland?

Government

Many of the constraints associated with government are directly a result of the instability that surrounded it (Financial Times Survey, 1995). The privatisation of state enterprises in Poland was initially constrained by a weak government with lack of clarity over the direction and methodology of the programme. Much of this was due to the fact that privatisation was managed by four, different ministers during the first four years of reform. Each of the ministers also had different plans concerning the course of the programme.³³ Consequently, the passing of privatisation law and the framework necessary for the introduction of the programme was delayed. However, while instability did surround the progress of the programme, some understanding is also required of its scale. Undoubtedly, the scale of privatisation in Poland is considerably larger than that which has ever faced any West European country. Getting a government, therefore, with little prior experience to agree on methods of transfer for a multiple number of industries is going to require time, especially given the lack of local capital. Meanwhile, the actual scale of the task as well as the numbers of people employed in some state enterprises suggests that consideration should be given to the pace of the programme, while in sectors such as banking, it should be more rapid.³⁴

Social

Privatisation began in a pro-reform environment, although the large numbers of people employed in state enterprises indicated that constraints to any plans for rapid privatisation were present from the outset. Some of this was revealed in opinion polls, which indicated that 58% of the public voted for large industry to remain in state hands. A further 35% indicated that privatisation was proceeding too quickly.³⁵ In contrast, the Polish Finance Minister, Leszek Balcerowicz, argued that old state enterprises should not be stabilised, but privatised rapidly.³⁶ Theoretically, this could bring about a more rapid increase in efficiency, although the reality of the situation suggests that this could

be met by opposition, especially since some of the older enterprises are those which employ larger numbers of people. This was confirmed by the resistance of employees, workers councils and trade unions, who singled out the threat to job security (Baczko & Jarosz, 1996). Carrying out the privatisation of enterprises, therefore, in light of these conditions meant gaining considerable support for it. One of the tactical methods chosen was to privatise with the involvement of insiders. This gave enterprise managers and workers councils a greater say over the process as well as the right to veto.³⁷ Furthermore, privatisation was not subject to any time constraint. This was a more logical approach – particularly, since the future success of a given enterprise would ultimately depend on the level of co-operation with the workforce. The success of this approach is borne out in some of the results. For example, at the end of 1993 almost 26% of the state enterprises had been assigned to a privatisation path (IMF, 1994). The potential for opposition after this point had eased and the programme had gained some momentum following improvements in the political situation after the 1994 elections. This improvement, together with the later change in Poland's financial status, gave investors greater confidence in the country's investment climate. This is reflected in the much higher level of investment from the mid-1990's.

Conclusion

The purpose of this chapter was to provide a brief background picture on the importance of the domestic environment to attracting foreign investment. Part one of this work focused on investor incentives and how these differ between developed market structures and developing ones. With respect to the former, we found that investment activity was characterised by market-, efficiency- and asset-seeking incentives, which motivate investors into seeking out the comparative advantage of other firms/operations in their respective specialisation. In the EU, for example, this has occurred because some firms are adjusting to European scale operations and are therefore seeking to achieve scale economies in production. Firms from outside Europe, meanwhile, invest in order to leap the external trade tariffs and to access the

market. Since the formation of SEM, therefore, the presence of both European and international operations in the EU has led to a more competitive environment, which has been observed through greater merger and takeover activity. This has been facilitated by comparatively well established market structures and an environment conducive for investment.

In the case of countries where market structures are not so developed, labour costs are one of the single most important comparative advantages to investors. However, as the case of Mexico showed, if government goals are focused more on attracting foreign investors for the purpose of wider domestic modernisation and restructuring, as opposed to allowing foreign assembly operations to locate in a designated part of the country, then policy needs to radically change with respect to the government's position on trade and FDI and the operation of state enterprises. This is necessary in order to facilitate a greater transfer of technology and to promote wage competition across sectors, which is necessary to increase the level of demand for a more diversified range of goods. In terms of the Polish environment, our research revealed that, although Poland possesses a well-educated work force that is attractive in cost terms to investors, these incentives alone were not initially sufficient enough to attract sizeable volumes of FDI into the country until 1995 onwards. Certain key changes occurred around this time, however, which enabled us to deduce that the unattractiveness of the Polish economy to foreign investors was due to the instability and lack of reform associated in the country's macroeconomic, political and legislative spheres. More specifically, we found that Poland's foreign debt, its incoherent legal system and the related delays associated with the privatisation of state enterprises were the main factors, which deterred foreign investors. This position began to change following the election of a new government as well as the Presidential elections (1994 & 1995), which provided greater political stability and led to more significant change in the area of privatisation and investment law. After 1995 foreign direct investment increased sharply in Poland, which lends some weight to the significance of these factors in contributing to the improvement of the country's domestic conditions, but

also of the importance of incentives (privatisation projects) to investors. This suggests that investor interest in the Polish market has been motivated by the low cost labour force and opportunities leading to the acquisition of assets. We shall now move onto our final chapter of this work, where we shall discuss the actual structure of foreign investment in Poland, how it is geographically orientated and the relationship of these with trade.

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Chapter Five

The structure and location of foreign direct investment in Poland

Introduction

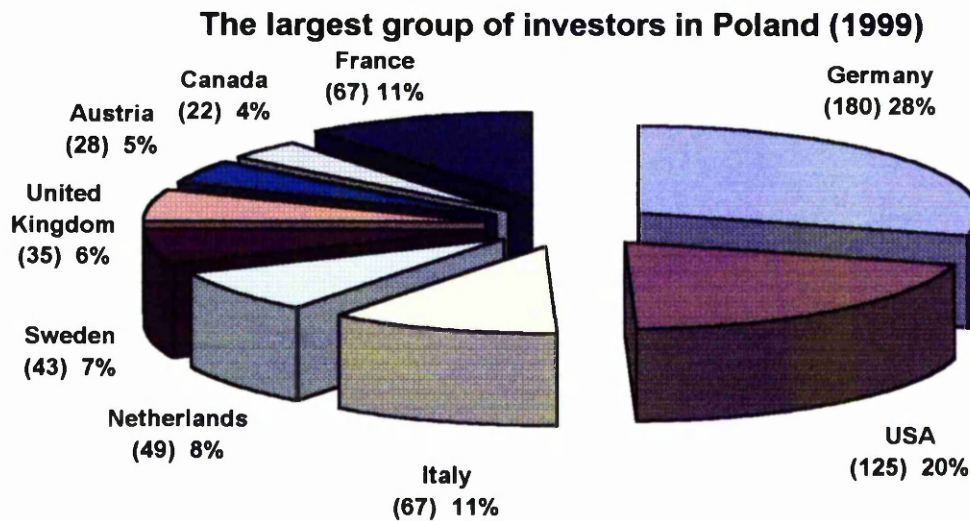
The absence of domestic capital in the Polish economy at the start of reform meant that foreign investment would play a crucial role in the restructuring and development of industry. Before the initiation of reform foreign investment was practically non-existent in the Polish economy, and those investors active in the country during socialism were largely from neighbouring countries, such as Austria, Germany and Sweden.¹ We showed in chapter four of this work that, due to certain economic, political and legislative constraints, this position did not change substantially until the second half of the 1990's. After this point in time the investment climate became more favourable and this is supported by the levels of investment, which increased from less than \$100 million in 1990 to \$8.2 billion in 1999 (PAIZ, 2000). Approximately 90% of this investment came from the OECD countries with the European Union countries injecting almost 65% of the total. The EU, therefore, accounts for approximately two-thirds of Poland's total trade (chapter 2) and supplies almost two-thirds of the country's investment. Given the proximity of the EU to Poland, therefore, investment will also be considered from a geographical perspective and its relationship with trade. Our opening subsection to this chapter (5.1) will first concentrate on total investment in Poland according to the country of origination in order to show which investors play a larger role. This will be followed by the actual structure of investment according to branch of industry and how this has affected output over time and trade. We will then conclude this subsection by showing investment from a more geographical perspective. The point of this is to identify whether investors have located in areas where there is a greater concentration of industry. Given the dominance of Germany on the trade side, our aim in this section is to determine the extent and distribution of German capital flows between

Poland and other Central European countries. This will first involve a comparison of the conditions in each of the economies in order to distinguish why, for example, the Czech Republic and Hungary were relatively more successful in attracting FDI from the beginning of the 1990's. We will then extend this analysis by comparing the main structure of German investment in each of these countries together with Mexico. Our reason for including Mexico in this analysis is to reveal how German direct investment compares in terms of structure and size in liberalising economies in close proximity and of greater geographical distance. In subsection 5.3, we will then analyse German direct investment in Poland in greater detail with a view to ascertaining whether there is a strong link between Polish-German trade and the distribution of investment according to branch of industry. The point of this is to determine the importance of trade in German investment motivations. In subsection 5.4, our analysis will focus on some of the micro activity of German firms and their geographical location. For this purpose, we have taken a sample 750 firms and analysed their activities according to branch of industry and then shown where they are located in the country, geographically. This particular part of the work is useful in enabling us to say more about the relationship between German investment motivations and location in Poland. Our reason for including this element into the subsection is that, while official statistics provide a broad outline of the main investments according to branch of industry, much of the micro activity is not considered in great enough detail. This will form the final part to this chapter. Before we can adequately explain the German side, however, we need to first be aware of the overall developments in FDI in the Polish economy, how it is structured and where it is geographically located. This is intended to provide us with a basis for later comparison.

5.1 Investment and geographical location

According to the Polish agency for foreign investment there were almost 800 investors in Poland from 35 countries in 1999, who had invested into projects exceeding one million dollars. From the wide international interest in the country the largest group of investors included: Germany, the United States, Italy, France, the Netherlands, Sweden, the United Kingdom, Austria and Canada. These are depicted on the following graph in numbers of investors from each country and in share terms.

Graph 5a



Source: Own calculations based on information obtained from PAIZ, 2000.

In terms of investor numbers the above graph can be divided up into three groups to reflect the level of interest from each country. The largest group includes Germany (180) and the United States (125), which together form the most active investors. The second group consists of Italy and France with 67 investors each, and the third group is made up of the five remaining countries with a comparatively smaller number of firms. In value terms the United States has injected the most capital into Poland (6.4 billion dollars), followed by Germany (6.2), France (4.1), the Netherlands (3.7), Italy (3.3), Great Britain (2.6), Sweden (1.3) and Russia (1.2). First of all, this confirms the level of interest in the

Polish market and, secondly, reflects the importance of projects to foreigners. More specifically, this is connected with the privatisation of state enterprises. Investors, therefore, through the acquisition of assets are able to access the market and take advantage of the associated lower input costs to production. This mirrors some of the patterns observed in the EU (see chapter 4), which suggests that investors have been motivated both by market- and efficiency-seeking incentives. Investors, have, therefore, located in Poland to produce for the home market and to export (see table 5b).

Branch distribution

Out of a total 31.9 billion dollars invested into all areas of economic activity by mid 1999, 16.4 billion (51.3%) was accounted for by the manufacturing sectors (m). The second largest share went was received by the financial services sector (22.4%), trade & repair (9.7%) and construction (5.9%). The dominance of the manufacturing branches in attracting foreign capital supports our work in chapters two and three where we ascertained that adjustment and export growth had largely occurred in the traditional industries. The share of financial services, meanwhile, is consistent with the growth of the service sector and some of the observed shifts in employment as discussed in chapter two.

In terms of individual branches, the financial services sector (7.1 bn) attracted the most foreign capital. In this branch, the largest investor was UniCredito Italiano, which purchased 50.09% of Pekao, Poland's largest bank. Bayerische Vereinsbank of Germany followed second with shares in Bank Przemysłowo-Handlowy and Wielkopolski Bank Rolniczy (Kalisz). Allied Irish Bank was the third largest financial investor with a 60.1% share in Wielkopolski Bank Kredytowy (Poznan). Other major investors engaged in financial services include the EBRD, the Polish-American Enterprise Fund, the ING Group, Commerzbank, Citibank and Deutsche Bank (PAIZ, 2000).

Table 5a

Foreign capital invested by June, 1999 in millions of dollars		
Manufacturing total (m)	16419.3	51.32%
Food, drinks & tobacco (m)	4564.3	14.27%
Transport equipment (m)	3962.2	12.39%
Other non-metal goods (m)	1924.1	6.01%
Pulp, paper, publishing & printing (m)	1359.6	4.25%
Chemicals & products (m)	1291.2	4.04%
Electrical machinery & apparatus (m)	1199.4	3.75%
Machinery & Equipment (m)	461.2	1.44%
Rubber & plastics (m)	444.2	1.39%
Metals and products (m)	366.8	1.15%
Furniture & consumer goods (m)	361.4	1.13%
Wood & wooden products (m)	240.0	0.75%
Fabrics & textiles (m)	229.0	0.72%
Leather & products (m)	15.9	0.05%
Financial Intermediary	7185.4	22.46%
Trade & Repair	3120.7	9.76%
Construction	1910.6	5.97%
Social services	1508.3	4.72%
Transport, storage & communication	734.9	2.30%
Power, gas & water	476.8	1.49%
Hotels & restaurants	414.9	1.30%
Real estate & business activities	126.0	0.39%
Quarrying & mining	61.8	0.19%
Agriculture, hunting & forestry	30.1	0.09%
Total	31988.8	100%

Source: *Polish Agency for Foreign Investment, 1999.*

The growth and development of the banking sector has progressed more rapidly since 1994 following the London and Paris club agreements. Over the following five to six-year period, foreign investment played an active role in the bidding for Polish banks during privatisation, which Poland had managed to virtually complete by the turn of the century.²

Manufacturing sector

The level of foreign interest in the Polish manufacturing sectors is confirmed by the overall share of investment as a percentage of the total (table 5a). The highest share was accounted for by the food, drinks & tobacco sectors (14.2%), which largely reflects the increasing levels of investment made by Austrian, British, French and German

supermarkets.³ Investment has also penetrated the capital goods sectors, such as transport equipment, electrical machinery & apparatus and to a lesser extent machinery & equipment. This concurs with our work in previous chapters, especially with respect to the greater role played by capital goods in exports during the second half of the 1990's. The Polish chemical and pharmaceutical industries have also been relatively successful in attracting sizeable investments (\$1.2 billion) from well-known multinationals including Glaxo Wellcome, Pliva, Solco Basel, Bayer, Novartis, Novo Nordisk and BASF.⁴ The more labour-intensive industries, such as clothes, fabrics, textiles, leather and wooden products have attracted a proportionately lower share of investment, which is due to the nature of these operations and the type of commodities produced.

We can gain some idea of the extent of foreign interest in Polish companies by their growing share between 1990 and 1998 (table 5b). The values given (second & third columns) reveal the number of companies with foreign participation and the changing percentage share over time.

Table 5b

Companies with foreign participation between 1991 and 1998					
Year	Number of companies	% share in companies	Investment / GDP	Industrial production (%)	Exports / GDP
1991	5583	4.1	0.128205	-8.0	16.41026
1992	10817	6.9	0.357143	2.8	16.66667
1993	15814	8.6	1.994186	6.4	15.81395
1994	20324	10.4	2.016129	12.1	18.49462
1995	24635	11.7	2.903968	9.7	18.17460
1996	29157	12.2	3.629371	8.3	17.06294
1997	33459	12.8	4.615385	11.5	18.04196
1998	37355	12.6	5.031847	3.5	19.17197

Source: *Mały Rocznik Statystyczny*, 1999, *Biuletyn Statystyczny*, 1/1999 GUS, 1999, OECD, 1999.

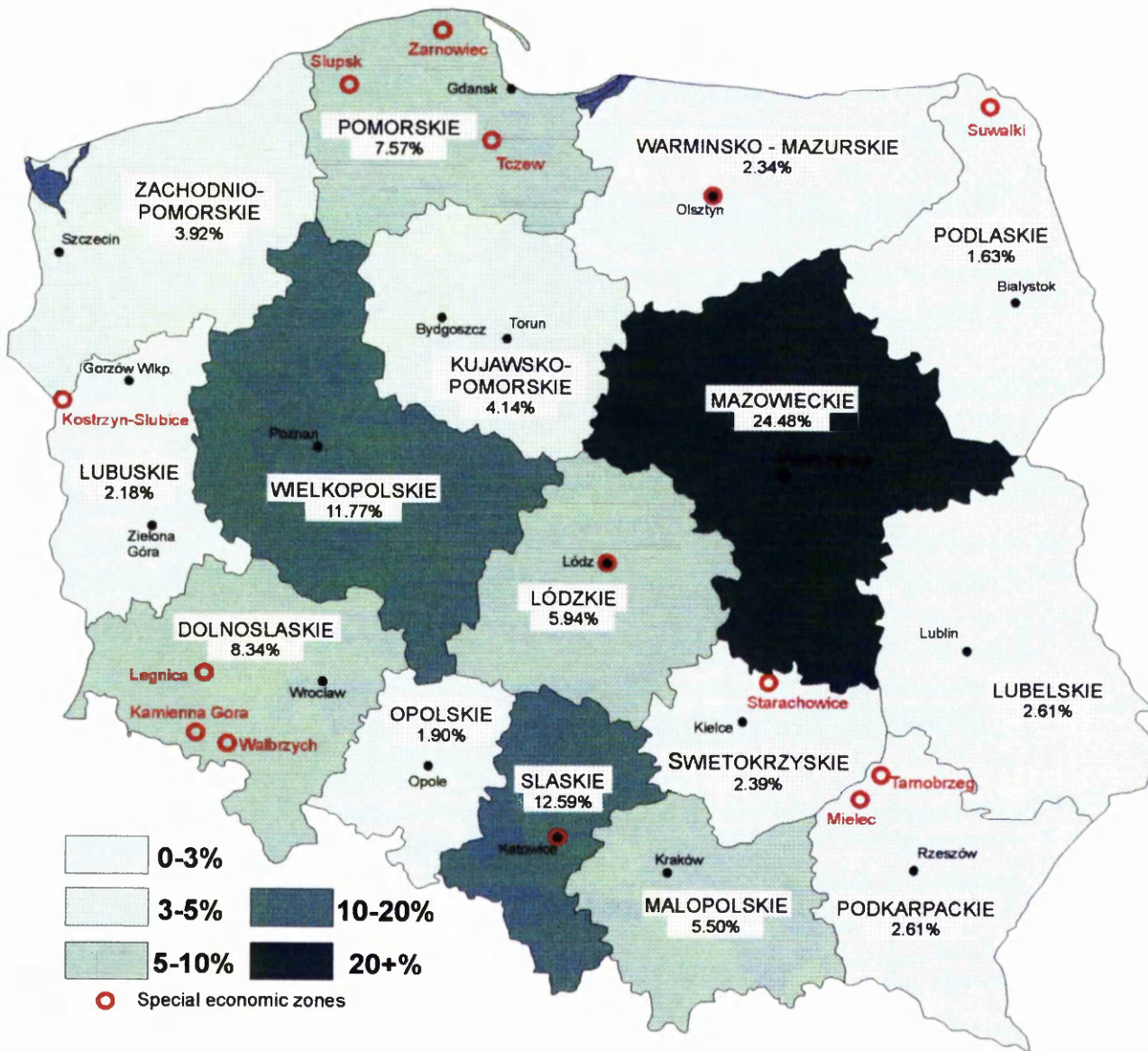
This not only reflects the level of foreign interest in the Polish market, but also the scale of privatisation projects in the manufacturing and services sectors. These observations reflect the country's relative success in attracting foreign capital, while at the same time lending some weight to our assumption in chapter two concerning the traditional sectors as the initial focus of development.

Significant is the fact that, although the number of companies with foreign participation has risen by almost 4000 each year between 1996 and 1998, the foreign share in the total number of Polish companies has remained constant at 12%. This is a good indication that there has also been a parallel growth of new Polish companies. The values given in the fourth column, which increased from 0.1 to 5.0%, represent the ratio of foreign investment to GDP. From 1996, this value increases each year and reflects the increasing role of foreign participation in Polish economic activity. This is also supported by the values on industrial output in the fifth column, which have increased on average by 5.8% each year. In relation to our work in chapters two and three, the importance of investment for the purpose of foreign trade can also be observed in the changing level of industrial output, which fell by 8% in 1998.⁵ This was directly due to the Russian crisis and the subsequent devaluation of the rouble. The former resulted in a lower level of demand for Polish exports in Russia and neighbouring countries, while the latter raised the zloty price of goods and reduced their competitiveness. The presence of investors and the positive rates of industrial output have had an overall positive effect on the country's capacity to export. This is indicated in the increased export/GDP ratio, which suggests that some branches of industry have restructured and become more efficient over time. Before we can add more weight to these results, we should extend this analysis to take account of the geographical location of foreign investors and what factors have been influential in determining it.

Geographical location

Some of the answers concerning the location of foreign investors have partially been answered, especially in view of the fact that privatisation has been carried out with the aim of restructuring Polish industry by attracting foreign capital. In this regard it can be argued that industrial concentration will to a large extent determine the location of investment. Other factors, however, need to be taken into account, such as the creation of special economic zones, which have been set up to attract FDI to areas of high unemployment or where little industry exists.⁶ One of the major incentives for foreign investors to invest in these zones is their exemption from income tax for up to ten years. To assist us in our analysis the following map of Poland has been included, which shows the orientation and intensity of investment by region.

The geographical distribution of foreign capital in Poland in 1998



Immediately noticeable is the large intensity of foreign investors located in and around the capital city (24.8%) in the region of Mazowieckie. This is the only province, which accounted for more than 20% of the total capital injected into the country. This is partially consistent with Knickerbocker theory of "follow the leader" (Eiteman, 1992). It also confirms that foreign direct investment first targets capital cities due to factors connected with risk, but also because of better communication and transport links. Significant also in the case of Mazowieckie, however, is the scale of industry located around Warsaw, such as those engaged in the production of steel, metals, electrical machinery, chemicals, food, light industrial products and minerals.⁷ In terms of actual location the industries in this region are also located close to the main motorway, which runs West and links Poland with Germany and the remainder of Europe. In terms of investment intensity between 10% and 20% (see map), Śląskie (12.6%) in the South of Poland and Wielkopolskie (11.8%) on the East-West axis were the recipient counties. In the case of Śląskie, this area, where Katowice is located, is both an area of industrial concentration (steel, metals, lead, zinc, electrical machinery, chemicals, light industrial products, coal and energy) (Atlas, 1999) and has also been designated as a special economic zone. Investment over two million ECU in this area exempts the company from full income tax contributions (PAIZ, 2000). Wielkopolskie is one of the other major industrial locations in the country, which has industries engaged in the production of machinery, chemicals, light industrial products and food. This area is significant not only because of its industries, but also because of its link with the main motorway and its close proximity to the West. In contrast, Lubuskie, which borders Germany, was among those provinces attracting some of the lowest levels of investment (2.18% of the total) in the country. This can be explained by the comparatively fewer firms and the fact that the area is more rural (Atlas, 1999). Kostrzyn-Słubice, which is located in the North-West of Lubuskie, was designated as a special economic zone and offers exemption from income tax payments for investments over one million ECU. To the South of Lubuskie, in the province of Dolnośląskie, three special economic zones have been set up in Legnica, Wałbrzych & Kamienna Góra. The level of investment here accounted for 8.3% of the total and is higher than in Lubuskie due to the associated tax

incentives and also because there are a greater number of industries, especially in Wrocław. The relevance of the latter is related to population size and investor access to an abundant skilled workforce. In Legnica, for example, investment has been injected into the production of pre-fabricated houses, high volume water heaters, car engines, sportswear, building materials and health food.⁸ This behaviour also holds for the county of Pomorskie on the Baltic coast (7.5% intensity), which also has three economic zones (Słupsk, Żarnowiec & Tczew).

Observation of the outermost Eastern parts of the map reveals that fewer investors have located in these parts of the country (investment intensity < 3%). In contrast to some of the main areas of industrial concentration, Podlaskie, Lubelskie and Podkarpackie are considerably more rural and agricultural. The area of Suwałki in Podlaskie, is more farming intensive (cattle, pigs & sheep), but also has some wood and paper producing industries. This part of Poland is a special economic zone, which exempts investors from income tax payments for investments over 0.35 million ECU. In the South-East of Poland, meanwhile, Mielec and Tarnobrzeg (Podkarpackie) tax exemptions are granted on investments, which exceed two million ECU. Mielec, as a result, has begun to grow as an industrial centre and has attracted investment into aviation products and automobile components. In addition to these production sites, Mielec, which produces light industrial goods (clothes) and food, has also opened a business and school of economics, which is specialised in the training of college and university graduates. Similar training schools have also been opened in other academic centres such as Kraków, Lublin and Rzeszów.

The geographical perspective to foreign investment in Poland reveals first of all that a greater level of investment intensity has been realised in the West of the country. This can be explained by the fact that much of the East of Poland has traditionally developed as a more rural and agricultural region. Since much of the country's industrial regions are concentrated in the West, these parts are also more populous and contain the bulk of the workforce. This presents an incentive to invest from both a workforce perspective,

but also in terms of accessing sizeable markets. A further factor concerns privatisation. The main industrial centres of the country will be those with a greater number of enterprises and, therefore, areas where privatisation activity is greater. Investors, therefore, are able to access the market, the workforce and, through privatisation, are able to gain control of assets, simultaneously. This suggests that the government's creation of special economic zones has been successful in attracting investors, although the more successful of these (Pomorskie, Śląskie & Dolnosląskie) are those with comparatively more industry or those in close proximity to sizeable markets. Investors have targeted Poland, therefore, with a view to accessing new markets (market-seeking investment) and with a view to reducing input costs to production for the purpose of domestic market and export supply (efficiency-seeking investment). Given, therefore, the dominance of Germany in Poland's trade and its close geographical proximity, we shall now examine how German direct investment compares with its activity in other neighbouring countries.

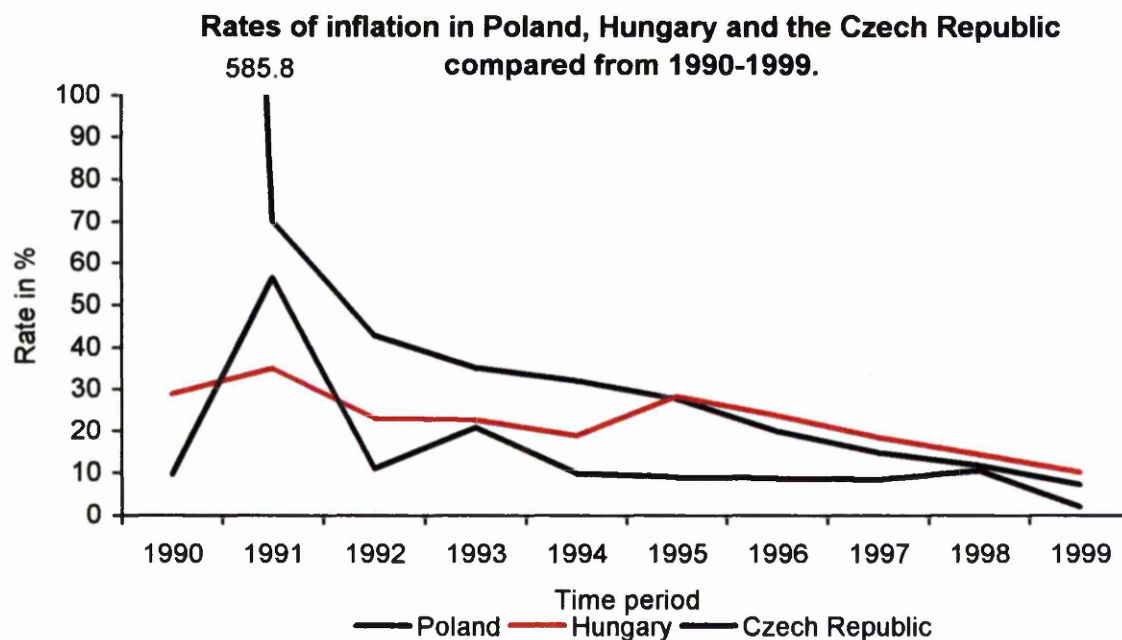
5.2 German direct investment in Poland compared

The level of German interest in Poland as a location to produce from has grown substantially in the 1990's. Much of the investment injected, however, became more apparent after 1995. This is consistent with the positive changes in Poland's domestic environment and, to some extent, the number of privatisation projects being offered. Between 1995 and 1998 German investment increased more than four-fold from 2.03 to 8.28 billion deutsche marks (DM).⁹ According to PAIZ sources (Polish agency for foreign investment), out of 492 registered foreign companies with investments exceeding 1 million dollars in 1996, 82 of them were German. During the same year, although statistics vary across sources, German companies were also participating in over six thousand joint ventures. Before this time, however (1990-95), German and other foreign investors chose the Czech Republic and Hungary in preference to Poland as a location to produce from. We should first clarify why was this the case.

Environmental conditions compared

In contrast to Poland, the Czech Republic and Hungary both began economic reform with an industrial structure, which was generally more advanced than that of Poland. This was chiefly due to the structure of demand during the Communist period and the role of these two countries with respect to supply. The infrastructures, therefore, as well as the smaller size of the two markets were positive factors in enabling reform to be achieved more quickly.¹⁰ In addition to the speed at which economic and political reform was achieved in these countries, the incentives offered to investors were also greater than those of Poland.¹¹ Economic and political stability, therefore, were two of the main decisive factors influencing foreign investors. The following graph (5b) shows the rates of inflation in all three countries from 1990-99.

Graph 5b



Source: *The Economist, Business Central Europe, December 2000.*

The y-axis, which shows the rate of inflation in percentage terms, has been adjusted down from 600 to 100 in order to make the differences more visible over time. This is

due to the fact that the rate of inflation in Poland was over 585% in 1990. The rates for all three countries are given the following table.

Table 5c

Rates of inflation in Poland, Hungary and the Czech Republic compared from 1990-99										
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Poland	585.8	70.3	43.0	35.3	32.2	27.8	19.9	14.9	11.8	7.3
Hungary	28.9	35.0	23.0	22.5	18.8	28.2	23.6	18.3	14.3	10.0
Czech-Rep.	9.7	56.6	11.1	20.8	10.0	9.1	8.8	8.5	10.7	2.1

Source: *The Economist, Business Central Europe, December 2000.*

Poland's rate of inflation is significant when compared with that of Hungary and the Czech Republic during the first half of the 1990's. In 1990, for example, Poland's rate was more than 20 times higher than Hungary's and more than 50 times higher than that of the Czech Republic. Although inflation in Poland does fall substantially over time, it is not until 1995 (graph 5c) that it was actually less than the rate in Hungary, and 1998 before it had reached the same level as that in the Czech Republic. In contrast to Poland, which experienced macroeconomic and political problems during the first half of the 1990's (see chapter 4), the other two transition countries managed to establish stable economic and political conditions from the outset. These factors, in addition to some of the incentives offered by these two governments, created a more conducive climate for investment.

Hungary

Out of all three countries, Hungary was initially the most successful country in achieving rapid economic and political stability, which partially explains why more investment was channelled into the country during the reform process.¹² Supporting this has also been the country's ten-year tax-free holidays, which were being offered as an incentive to foreigners. This ceased to exist as of the end of 1993. In contrast to Poland,

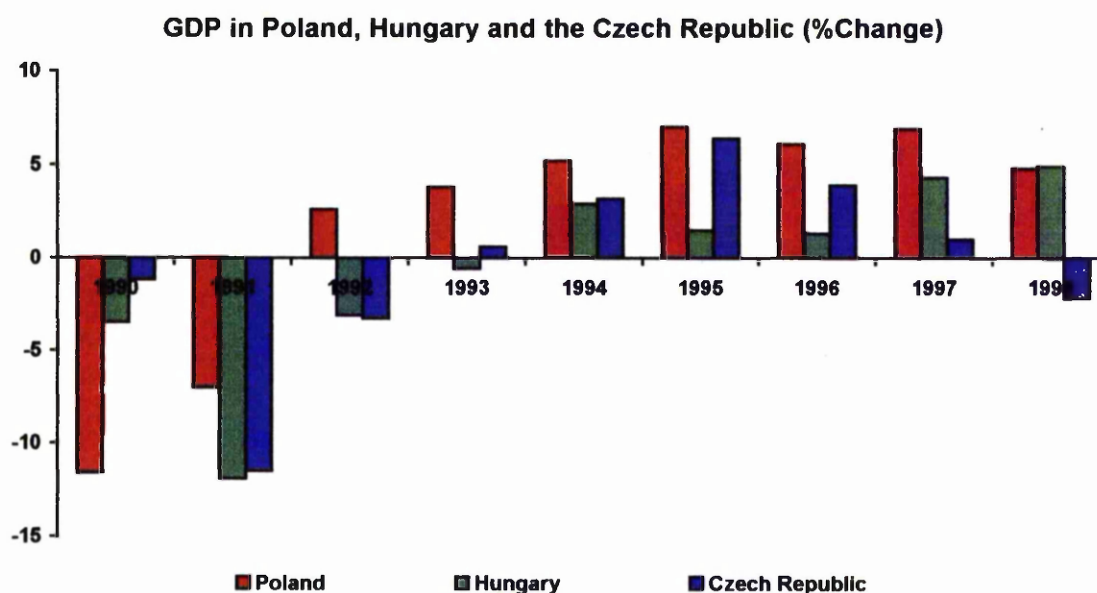
Hungary's economy was much more open to foreign investment from the outset and its laws were also more attractive, especially in allowing 100% ownership. A foreign company, for example, may purchase land, property and capital equipment, providing that the purchase is for business purposes. These changes were not initiated in the Poland until during the second half of the 1990's.

The Czech Republic

The Czech Republic also achieved rapid economic and political stability during its early stages of reform. Significant was the restructuring of its banking system and the granting of 100% ownership of its businesses to foreign investors. This latter part, therefore, indicates that acquisition of assets was one of the key incentives to both German and other foreign investors. By the end of 1992, most of the remaining barriers to foreign entry had been lifted and the country's privatisation programme enabled almost 300,000 enterprises to be privatised.¹³

Reflecting back on the points made in chapter four of this work allows us to deduce that Poland lost largely on the grounds of economic and political stability, but also because its economy was not as open. The case of Hungary and the Czech Republic has also indicated that the comparatively lower flow of German plus other FDI into Poland can be attributed to the initial lack of reform in the spheres of legislation and privatisation. In contrast, although the governments of Hungary and the Czech Republic were comparatively further ahead with reform in these areas, they were not, compared to Poland, confronted with either the scale of privatisation projects or the opposition (see chapter 4). The slow pace of privatisation in Poland, however, together with its financial (foreign debt), economic (fiscal & monetary policy, & currency devaluation) and political (changes of government) constraints, were not so significant when considered in terms of relative GDP growth.

Graph 5c



Source: *The Economist, Business Central Europe, December 2000.*

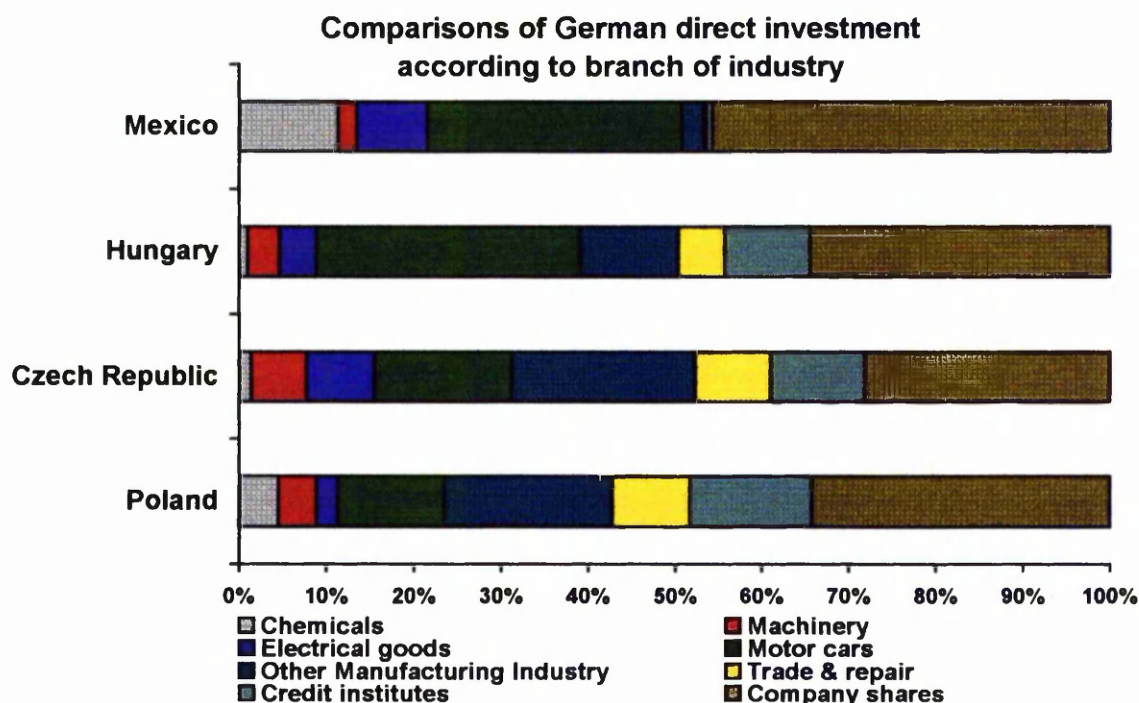
In comparative terms (graph 5c) Poland was the first country to achieve positive rates of growth. This position has been maintained overall throughout the 1990's and can be attributed to the country's expanding private sector. During the first two years of reform in particular, producers were forced to seek out foreign markets following the insufficient level of demand, domestically. Some of these links had already been established from the 1970's onwards, especially with German partners (see chapter three) in the supply of predominantly traditional goods, which have continued to dominate the main body of trade between the two countries during the 1990's. The pre-1995 domestic situation in Poland made German and other potential investors reluctant to locate in the country. In the case of Germany, however, their close geographical proximity proved to be initially more beneficial in terms of trade and could easily be served through exports.¹⁴ Poland's initial domestic situation, therefore, along with its history of trade with Germany largely explains why the country's relations developed more predominantly along trade lines compared with the investment relations, which

characterised the German relationship with Hungary and the Czech Republic. The geographical location of Poland was also more advantageous in enabling it, via German partners, to serve other bordering countries through trade, such as Russia, Lithuania, Belarus and Ukraine. Later improvements in Poland's domestic environment (see chapter four), which led to growing volumes of investment from other foreign countries, stimulated greater competition in the Polish market and necessitated direct investment from the German side in order to defend their markets (see subsection 5.3).

Compared investment in 1998

In 1998 the volume (billions DM) of German direct investment (GDI) in Poland was comparable with that of the Czech Republic (8.59) and Hungary (9.2) (Deutsche Bundesbank, 2000). The population size of Poland (38.7 million), however, automatically lowers the value of GDI per capita by a factor of approximately four. Interestingly, the level of investment in each of these three countries in 1998 was almost the same as that which German companies had channelled into Mexico (8.56). The focus of these investments, however, differed in terms of value injected into each branch of industry. More specifically, GDI has targeted the same industries in each of these countries, but with different degrees of emphasis. The extent of this is depicted on the following graph, where the level of investment in seven different branches of industry is expressed in percentage share terms.

Graph 5d



Other manufacturing industries include: food processing, textiles, clothing, wood, paper, publishing and the production of non-metallic products, basic metals and metal products.

Source: *Own calculations based on Deutsche Bundesbank information, 2000.*

(Kapitalverflechtung mit dem Ausland)

The similar levels of German investment into each of the four countries in 1998 enable us to draw a few conclusions concerning investment specialisation and the relative levels of industrial penetration. The areas of investment specialisation are colour-coded below the graph. The key priority for German investors has been investment in company shares in all four countries. The similarity between all of the countries is the fact that they are all reforming and modernising their industrial structures with the help of foreign capital. The sale of state and other assets, therefore, provides investors with the opportunity to enter the market through the acquisition of shares of a company's production facilities. The second priority for German investors is more country-specific. For example, in the case of Hungary and Mexico, investment into car

production has been the second most important industry. Of some significance is the fact that neither of these countries share a common border with Germany. In contrast, both Poland and the Czech Republic (bordering countries) have received a greater share of GDI in "other manufacturing industry" as the second most important area for investment. There also been a greater emphasis on investment into credit institutes and trade & repair in these countries. The latter refers to investment into retail/internal trade as well as the maintenance and repair of motor vehicles and consumer goods. In contrast to Central European countries, German investment in Mexico has been more specific and, as shown in percentage terms, spread out across fewer branches. Observation of the last graph, for example, reveals that GDI has focused largely on company shares, car production, electrical products and the chemical industry. This is an indication that trade relationships are, given the importance of regional arrangements, weaker over greater geographical distances (Brühlhart, 1998). Secondly, that greater market size and distance together necessitate a greater investment commitment and, arguably, a greater transfer of technology if the market is to be supplied. The exception to this depends on whether the multinational already has established branches in the region from which to obtain technological or other material sources.

In contrast to Mexico, GDI in Central European countries has penetrated a greater range of industries as revealed on the last graph by the comparatively lower investment shares. This reflects the greater activity of joint ventures, which are more easily established regionally and, given the proximity of all three countries, the ease in which goods can be outsourced and traded across national borders (see chapter three). In addition to the dominant German acquisition interests in the region, therefore, GDI has penetrated each market both for trade and for domestic market supply purposes. This is evident from the fact that investment has penetrated the same industries in all three countries but, at a country level, reveals a more industry-specific focus, which is closely associated with traditional structures. For example, GDI in the Czech Republic is more dominant in electrical products and machinery production. In Hungary, over

25% of total investment in manufacturing has gone into the engineering sector which, in turn, has been partially driven by the expansion of car production.¹⁵ The German affiliate of General Motors, Opel, uses a 60-70% local content in production and also plans to obtain its engines locally.¹⁶ This strategy is arguably driven by a combination of Hungary's engineering tradition, its comparative advantage in skilled labour, but also the level of competition from Suzuki, Ford and Audi. German investment in Poland follows a similar pattern. For example, a greater focus of GDI in Poland has gone into the chemical industry. Out of the three countries, Poland was the dominant supplier of chemical products during socialism and this was and still is due to its rich, raw materials base, which consists of sulphur, rock-salt, coal, lime and the access to petroleum and natural gas.¹⁷ Not included in this are also the country's silver and copper mines. According to PAIZ sources, the chemical industry, which supplies largely organic chemistry products, articles of plastics, pharmaceutical products, cosmetics and rubber products, accounts for around 10% of GDP.

Multinational activity

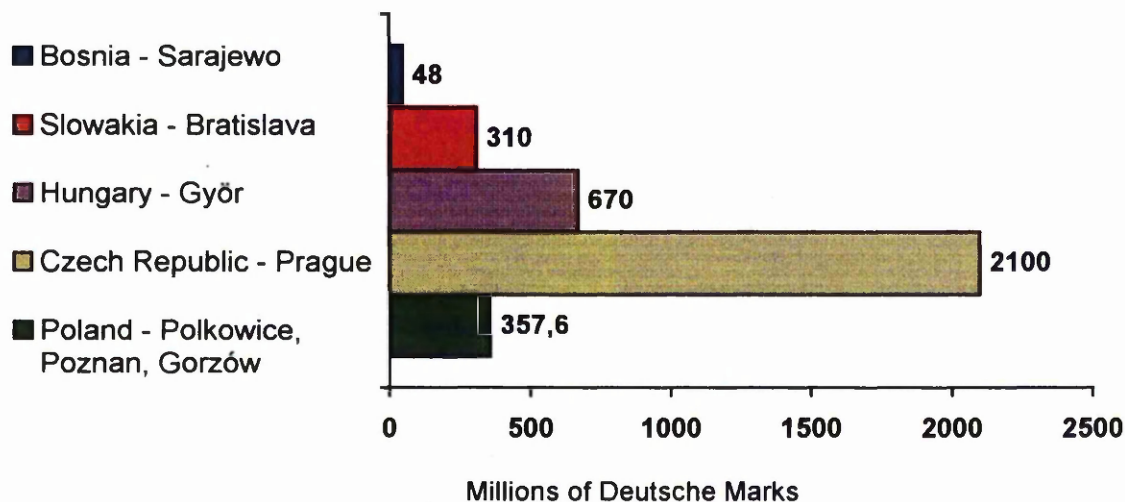
The injection of GDI into the same industries in all three Central European (CE) countries enables us to say something more about the location factor. For example, given CE market sizes and the fact that all three countries are in close proximity, why is German multinational investment locating in each country? Part of the answer to this, as discussed in chapter four, is connected with restructuring and adjustment for European scale operation. More specifically, investment is linking each country's relative comparative advantage (resources, labour and technology) into one single production process. In effect, the result of this is the creation of the multinationals regional productive network. Some of the following examples lend weight to this.

Motor manufacturing (VW)

The level of German interest as a producer of motor vehicles in the region is considerable. In order to give our point on production some meaning, we will consider the investment activity carried out by Volkswagen in the region. First of all, the importance of the region is confirmed by the geographical spread of the company's investments, which include the three CE countries as well as Slovakia and Bosnia. Dealing with Poland, VW-investment, in contrast to the Czech Republic and Hungary, has targeted three different locations (Polkowice, Poznan and Gorzów). In Polkowice, for example, which is part of the larger special economic zone, Legnica, Volkswagen has built two factories under the name of VW-motor-Polska. The first investment (150 million DM) went into a factory, which produces approximately 500,000 diesel (1.9 litre) engines per year and employs 720 people. The second investment by VW (124 million DM) was injected into a factory by the name of Sitech, which produces car seats and employs 300 people. The Volkswagen group, which consists of Skoda, Seat, Audi and VW are all situated in Poznan. The company, here, employs 2000 people and produces 240 cars per day.

Graph 5e

Investment in Central Europe by Volkswagen (DM)



Sources: *Paiz, VW, Czechinvest, 1998.*

Approximately 66% of the cars produced each day are the Skoda Felicia model and the remaining 33% are made up from the other three groups of cars. The third location for VW-investment in Poland is Gorzów, Wielkopolska. The initial investment totalled 12.6 million Deutsche Marks and was made by both VW and Siemens, who together will produce the electrical systems for the VW group.

In the Czech Republic, VW bought over 50% of the car manufacturer, Skoda, in 1991 and since that time has increased its share of the company. The initial investment cost 2.1 billion DM and VW plans to invest a further 2.4 billion DM by the end of 2002. In Hungary (Győr), Audi produces six and eight cylinder engines for the entire VW group. The investment in Bratislava (310 million DM) has gone into the building of gear boxes for the VW group as well as into the production of the four-wheel drive version of the Volkswagen Golf. At the time of writing, a further investment of 48 million Marks was planned for the building of an assembly plant in Sarajewo, where up to 30,000 Skoda Felicia's will be produced each year.¹⁸

Chemical investment (Henkel)

The German chemical company, Henkel, now has subsidiaries which include Poland, Hungary, the Czech Republic, Slovakia, Slovenia, Romania, Serbia-Montenegro and currently has Bosnia-Herzegovina on the drawing board. The company produces largely detergents and was one of the first western firms to form a joint venture in Central Europe. In 1993, Henkel bought an 82% stake in Pollena Racibórz in Poland. The company also has marketing companies established in the Czech Republic as well as three subsidiaries in Hungary (Henkel Magyarország), which employ over 530 employees.¹⁹

Electrical & Electronic investments (Siemens)

The company, Siemens, produces a diversified selection of electrical, electronic and engineering products, which range from consumer products for the local home to power generation systems for industry. In 1996, Siemens opened its first Central European head office in order to coordinate its subsidiaries and joint ventures through out the region. In Poland, Siemens began in 1992 as Bosch-Siemens with a service centre in the city of Łódź. In 1995 the company invested 30 million Deutsche Marks in a factory, which can produce 250,000 washing machines per year. Siemens is also established in the Czech Republic and has also acquired ten companies in Hungary. The company is also a partner in fourteen joint ventures in Russia and has also paid \$320,000 for a 20% stake in Elektosila - a company, which produces power generators.

Implications

The number of production plants and subsidiaries in each of these countries lends weight to the notion that German companies, at a multinational level, are establishing more of a regional presence. The examples given suggest that acquisition is one of the primary methods of entry. Once the investment has been initiated, other sites are then located in neighbouring countries from which certain aspects of the production process can be carried out. This is motivated by a variety of factors, such as gaining a presence in the market, access to resources, labour, or a particular industry or area where overall costs to production will enable scale economies to be achieved. With respect to the latter, this may include labour, the cost of materials or even tax incentives as offered by special development zones. Siemens of Bohemia, for example, as a result of the lower wage rate (differential = 1:8), manages to achieve an approximate 25% reduction in total input costs to production.²⁰ VW in Poland, on the other hand, which produces car seats and engines in different parts of the country, has established both of its operations in a special development zone. The capital to labour ratio, therefore, is greater in the latter, but both operations are part of a regional-wide production strategy. This may suggest

that local firms are becoming integrated on the supply side. It also lends weight to the fact that know-how and technology are accompanying German investments into these economies. We shall now examine the structure of GDI in Poland in greater detail.

5.3 The structure of GDI in Poland

For the purpose of this analysis we shall use the statistical data provided by the Deutsche Bundesbank on German investment activity in Poland. The values provided by this source, however, do not include the micro activity of German firms in the country, since it is not included in statistics. Furthermore, question marks need to be placed next to the accuracy and supply of Polish data, especially before the mid-1990's. Therefore, given this factor as well as the fact that greater investment flows were realised in the country in the second half of the 1990's, this subsection will focus on the structure investment from 1995 to 1998.

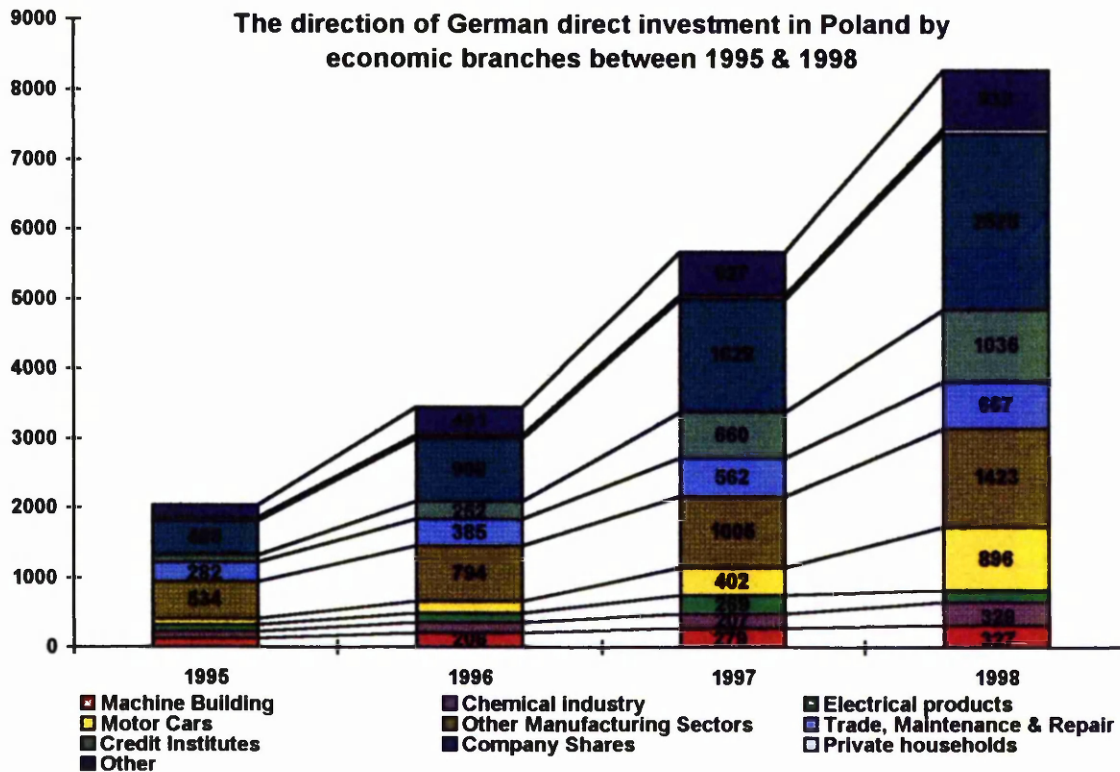
The growth of German investment activity in Poland can be described as targeting four key areas of economic activity:

- (1) company shares;
- (2) other manufacturing activity;
- (3) credit institutes;
- (4) production of motor cars and parts.

Company shares

Through out the four-year period the purchase of company shares has been the most dominant area of German investment activity. Before the mid-1990's, investment into this area of the economy had been hampered due to the country's credit worthiness. The potential for taxes to be raised in order for debts to be serviced was therefore one of the main risk factors.

Graph 5f



Source: *Deutsche Bundesbank, Kapitalverflechtung mit dem Ausland, Mai 2000.*

After the London and Paris Club agreements had been signed, transaction costs became substantially lower and Poland's credit worthiness was improved. The results of this were reflected in the increased trading volume on the Warsaw Stock Exchange. German and other investors have been attracted into portfolio investment, especially following the floating of new companies on the stock exchange and those, which were privatised. For example, out of over 60 companies which were privatised with the participation of foreign capital at the end of 1995, 28 of those companies were acquired by German investors, the United States (14), Holland (8), France and the United Kingdom each getting five. According to PAIZ sources, around 50% of the enterprises in Poland with foreign capital participation are engaged in export activities and 20% are purely export orientated. The dominant exports of these enterprises have so far been clothing, metal

products, chemicals, machinery, motor vehicles and parts.²¹ The main destinations of these exports were back to the countries from which the investment capital originated.

This type of activity mirrors some of our recent conclusions in so far that German interests have focused initially on the acquisition of existing assets. This places them in a position to obtain a greater share of the company at a later point in time and possibly full control. The dominant focus of these investments has also been in the manufacturing branches of industry for the purpose of both domestic market supply and trade. With respect to the latter, this concurs well with some of the observed patterns of keeping the design and the value added stage (see chapter three) of production at home, while contracting out other aspects of the production process. The resulting, lower total input costs to production reflect the firms search for increasing efficiency and can be described as one of the key priorities driving both trade and investment.

Other manufacturing activity

German investment into Polish manufacturing industry has largely targeted the following industrial sectors:

- (1) Consumer goods
- (2) Food processing
- (3) Textiles, leather and clothing
- (4) Wood, paper, furniture
- (5) Non-metallic products
- (6) Basic metals and metal products

The listed industries from 1-6 come under the heading of “other manufacturing” sectors on the last graph. The most preferred branches for GDI have been in textiles, wood and furniture products and food processing (Handelsblatt, 1995/105). These three broad areas include food production (2), the production of leather & clothes (3) as well as paper and printing products (4). This correlates with the Polish-German trade patterns as

observed in chapter three of this work and also with the investment (merger & acquisition) activity of EU firms since the introduction of the SEM. German direct investment into Poland's traditional branches of industry, therefore, reinforces these operations and also provides a destination market for exports. Many of the firms engaged in trade are Polish-German joint ventures, which include both small family units from Germany as well as the "mittelstand" (medium-sized) companies. This suggests that the level of technology transfer is going to vary according to the size of the firm (i.e. financial strength) and the Polish branch of industry to which the investment has been directed. For example, while the flow of technology may be quite substantial into the production of cars (Fiat, Daewoo & Opel, for example), the scope for a complete automation of the furniture and clothes industries is much more limited. The performance of the German economy, therefore, is much more important for employment stability in some of these traditional branches. This places an added pressure on unions to keep wages low. A further negative factor concerns the nature and purpose of the work. For example, some of the Polish firms without a foreign partner are also producing items (clothes & furniture, for example) purely according to foreign specifications. Some of these firms, therefore, both independent or merged, are exporting nothing in the way of items, which they can call their own.²²

Credit Institutes

The value of investment from German credit institutes has increased four-fold between 1996 and 1998 from 252 million to 1.03 billion DM. This is a strong reflection of the growing number of German companies in Poland, the increasing number of joint ventures (minimum of 3,500 in 1995)²³ and the associated need for financial services. In response, some of the well-known German names in the banking industry are now firmly established in Poland, such as Bayerische Vereins Bank, Berliner, BHF, Commerz, Deutsche Bank and the Deutsche Genossenschafts Bank. Deutsche Bank, for example, opened its first branch in Warsaw in 1993 and by 1997 had six branches in the country.²⁴ The expansion is a defensive form of investment, which is better described as

“follow the customer”. Some of the more established German banks, therefore, have located in areas of firm concentration to serve the growing number of German firms, but this will also place them in a strategically good position to serve investors from other countries as well as local Polish firms. This particular strategy mirrors that of Citibank (US), whose operations have followed this type of investment pattern in Germany, and is also currently developing such a network in Poland. Germany, along with other foreign banks, has a strong and growing banking presence in Poland, although the demand for financial services (credit) outstrips the level of supply. Part of this can be attributed to the fact that companies are only obliged to register their investment if it exceeds \$1 million.²⁵ The high volume of micro-activity from smaller firms entering the country, as well as the formation of joint ventures, are not so easily identifiable on the demand side for credit. According to the Economist (Business Central Europe) magazine, German banks are also cautious with respect to lending.²⁶ However, the level of debt repayable to German credit institutes, which exceeds that of any other financial establishment in the region and the developing network of branches, does not fully support this conclusion.

Production of motor cars and parts

In addition to some of the points in the last subsection concerning German investment in Central European car manufacturing, we should elaborate on those developments, which are more specific to Poland. German investment in Poland's car industry has increased more than ten-fold from 86 million to 896 million DM between 1995 and 1998. Since the mid-1990's, some of the largest transactions in Poland have been connected with this industry.²⁷ For example, Fiat and Daewoo, have invested over 1.5 billion dollars each (PAIZ, 2000) into car production in the country. The German subsidiary of General Motors, Opel, which lost out to Daewoo in a bid for the Polish car manufacturer, FSO, has since built a green-field plant in Gliwice (special zone) with plans to produce 100,000 cars each year. This confirms both of our earlier conclusions regarding the desire to acquire assets, but also of keeping input costs to production low. The values given for GDI in the car industry represent those investments carried out by all German car producers. In contrast to Fiat and Daewoo, therefore, the comparative size of

German motor investment in Poland confirms its more regional approach to production. The exception to this is Opel, which obtains in excess of 60% of its supplies and resources locally. This type of investment is defensive and more country-specific in nature, which suggests that the overall extent of technology transfer to Poland varies between producers, depending on the level of competition and future strategy.

In terms of the growing level of investment in Polish car manufacturing, this raises the question as to whether Poland has a chance of becoming the regions centre for car production.²⁸ This fact combines not only the large value of total investment in the industry, but also the increasing output of passenger cars and commercial vehicles. For example, in 1990 Poland was producing 266 thousand passenger cars per year. By 1997 this value had increased to 520 thousand.²⁹ The production of commercial vehicles stood at 42.9 thousand in 1990, but by 1997 had reached 59.3 thousand. Table 5d compares the production of passenger and commercial vehicles in Poland, Germany and Spain for the years 1990 and 1997.

Table 5d

Production of motor cars in Poland, Spain and Germany compared for 1990 & 1997				
Passenger/commercial vehicles	1990		1997	
Poland (population = 40 mln)*	266,000	43,000	520,000	59,000
Spain (population = 40 mln)*	1,696,000	302,000	2,334,000	200,000 ^a
Germany (population = 80 mln)*	4,779,000	349,000	4,754,000	279,000

Source: *Rocznik Statystyczny, Central Statistics Office, Warsaw, 1999.*

^a = output of commercial vehicles in Spain for 1995, since the value for 1997 was not present in the statistics

* = population values rounded off

Poland's production of passenger vehicles, while doubling from 266,000 to 520,000 over the eight-year period, is well below production levels in Spain. Observation of the given values reveals that the Polish level of passenger car production for 1997 was still three times lower than that of Spain in 1990. Germany, which has double the population of Spain or Poland, was producing (in 1990) twice the output of Spain in 1997 and more than nine times the level of Poland. If we take Poland and Spain together to match population sizes, we still find that Germany produces almost two million cars more per

year. For comparative purposes, if we take the output of cars in each country for 1997 and divide it by the population (output per head) we find that Spain (0.058) and Germany (0.059) produce almost the same levels. Poland's value (0.013) suggests that output per head needs to quadruple for it to match those levels of Spain and Germany. This supports our earlier findings that, although Poland has attracted a great deal of investment into the industry, not all of it is necessarily geared towards pure production, but also the many sub-branches which are connected with it. This picture is likely to change, however, since greater competition in the industry has led to higher levels of investment. The Opel-Daewoo scenario is an example of this. This work will now turn to subsection 5.5 where we will show German direct investment in Poland from a more micro and geographical perspective.

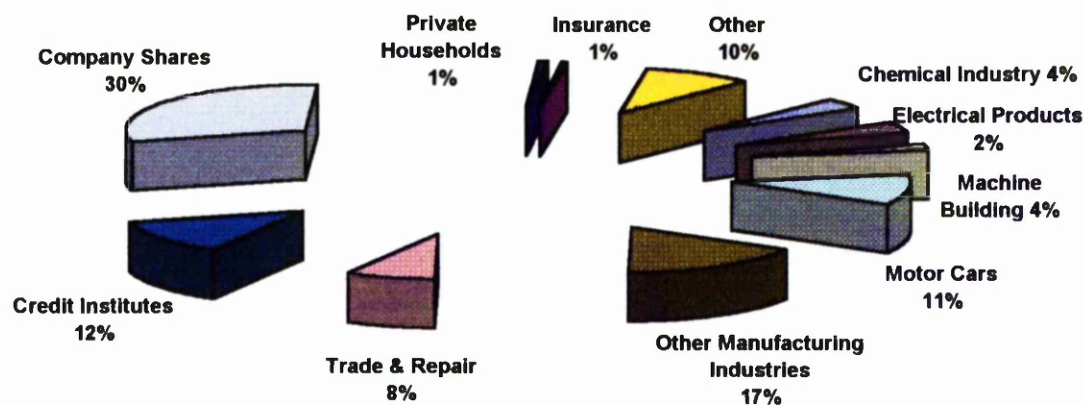
Share of investment

Based on Bundesbank information, which provide us with a record of the investments made by German firms over 1 million Deutsche Marks, we can depict in share terms how this has been distributed across sectors in 1998.

The distribution of German capital in 1998 totalled 8.2 billion DM. Approximately 30% of this investment went into company shares, which we analysed earlier to be purchases of shares in manufacturing industry. Our own estimates suggest, therefore, that 65-70% of the total investment penetrated manufacturing industry. The remainder went directly into credit institutes, trade & repair, private households, insurance services and other.

Graph 5g

The distribution of German capital according to industry in percentage terms for 1998.



Source: *Own calculations based on Deutsche Bundesbank information, May 2000.*

However, while these percentage values provide us with an outline as to some of the larger investment activity, it cannot be considered as representative until we have at least gained some idea of the micro activity, which has been carried out in Poland. This is difficult to estimate in any certain form, since the investment picture is changing constantly and firms are not obliged to register. For the purpose of this work, therefore, we have taken a sample number of the firms, which have registered their branch of industry and address details at the Polish-German Chamber of Trade and Commerce in Warsaw. From this, we have been able to construct a basic picture concerning the structure of investment and geographical location.

5.4 Micro activity and geographical location

The calculations carried out were based on information obtained from the Polish-German Chamber of Commerce in Warsaw for 1998. From this information, which was essentially the industry and the address of German registered firms, we took a sample 750 of them and first organised them first of all according to branch of industry. Our calculations revealed that, out of a total 750 firms, 471 (62.8%) were

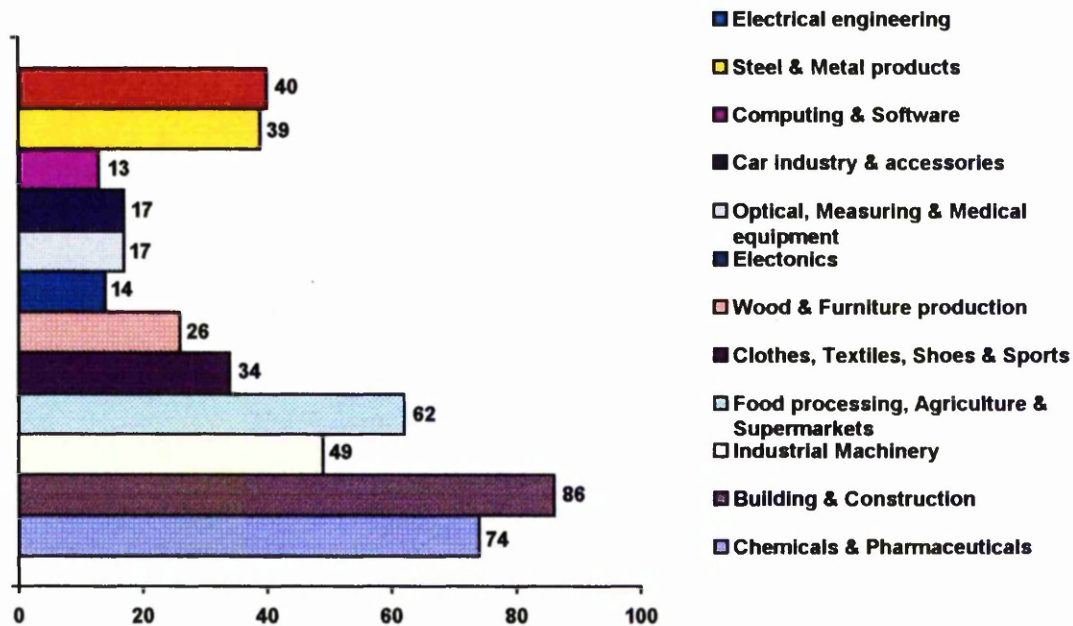
engaged in the manufacturing sector. The remaining 279 firms were registered in non-manufacturing activity. We shall discuss these in turn.

Manufacturing activity

The firms engaged in manufacturing, although purely a sample of some of the micro activity, provide us with some indications concerning German investment preferences. Graph 5h reveals that four industries can be identified as more dominant in terms of the number of German firms that they have attracted: building and construction, chemicals & pharmaceuticals, food processing and industrial machinery. With the exception of building & construction, all of these branches are producing for both the domestic market and for export supply. In terms of firm numbers we found that the building and construction sector attracted the largest number of firms (86). In addition to those already present in Poland at the end of socialism, other firms anticipated the restructuring requirement and found Polish partners. For example, Hochtief AG entered Poland in 1990 with a contract to work on the construction of a new terminal at Warsaw airport. It also works closely with Polish construction firms such as Budokor SA and KPIS Cracowia SA of Poland (CEER, 1997). The second sector to attract the largest number of firms (74) was the chemical and pharmaceutical industries. This supports our earlier conclusions concerning Poland's comparative advantage over the Czech Republic and Hungary in chemical production, but also that investment is identifying with each country's area of specialisation and channelling capital directly into them. German interests are also evident in Poland's other traditional sectors, such as in industrial machinery (49), electrical engineering (40), steel & metal products (39), clothes, textiles, shoes & sports gear (34) and wood & furniture production (27). These industries all play a large role in Polish German trade, which indicates that investors have entered them in order to produce those goods that are demanded in the home market. This is evident in the case of clothes and wooden products, which feature highly in the Polish export structure. German firms are not only exporting back to their home market, but also to other destinations in the region.

For example, Assmann Polska is a German-owned office furniture producer located on the outskirts of Warsaw, which produces both for the domestic market and for export to other Central European countries (CEER, 1997).

The division of German firms in Poland's manufacturing sector



Source: Own calculations based on information obtained from the Polish-German Chamber of Commerce in Warsaw, *German firms in Poland, 1998*.

The number of firms registered in the production of motor vehicles and accessories (18) lends some weight to the more regional approach to car production, but also the role of Poland as a supplier of accessories to other German production facilities in neighbouring countries. We shall now consider the numbers of German firms active in the non-manufacturing sectors.

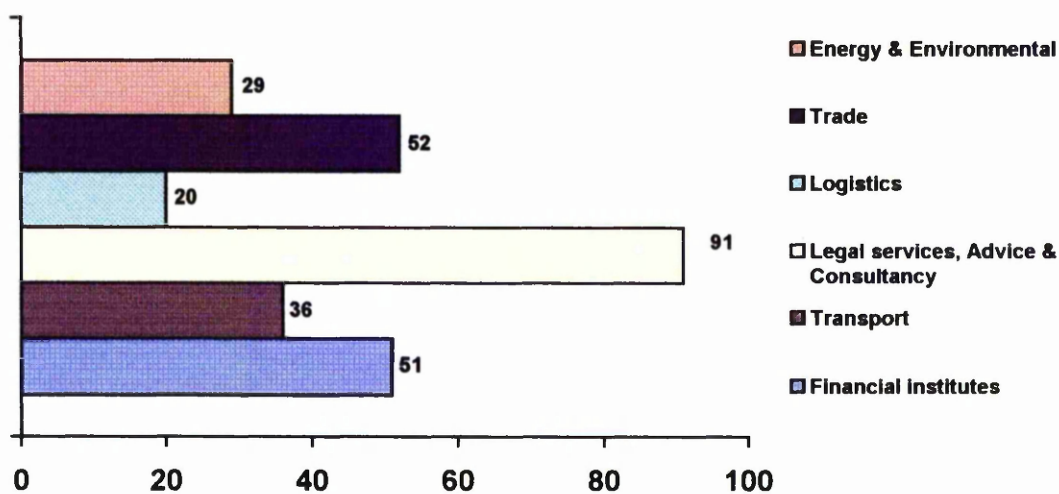
Non-manufacturing sectors.

Out of 750 firms, 279 (37.2%) were registered in non-manufacturing sectors. Out of these, 91 were engaged legal services, insurance and consultancy. This is consistent

with the “follow the leader” approach, which implies that German firms have invested with a view to serving the growing and potential number of German and other manufacturing operations. In a number of cases these would already be established customers in their home market.

Graph 5i

The division of German firms in Poland's non-manufacturing sector



Source: Own calculations based on information obtained from the Polish-German Chamber of Commerce in Warsaw, *German firms in Poland, 1998*.

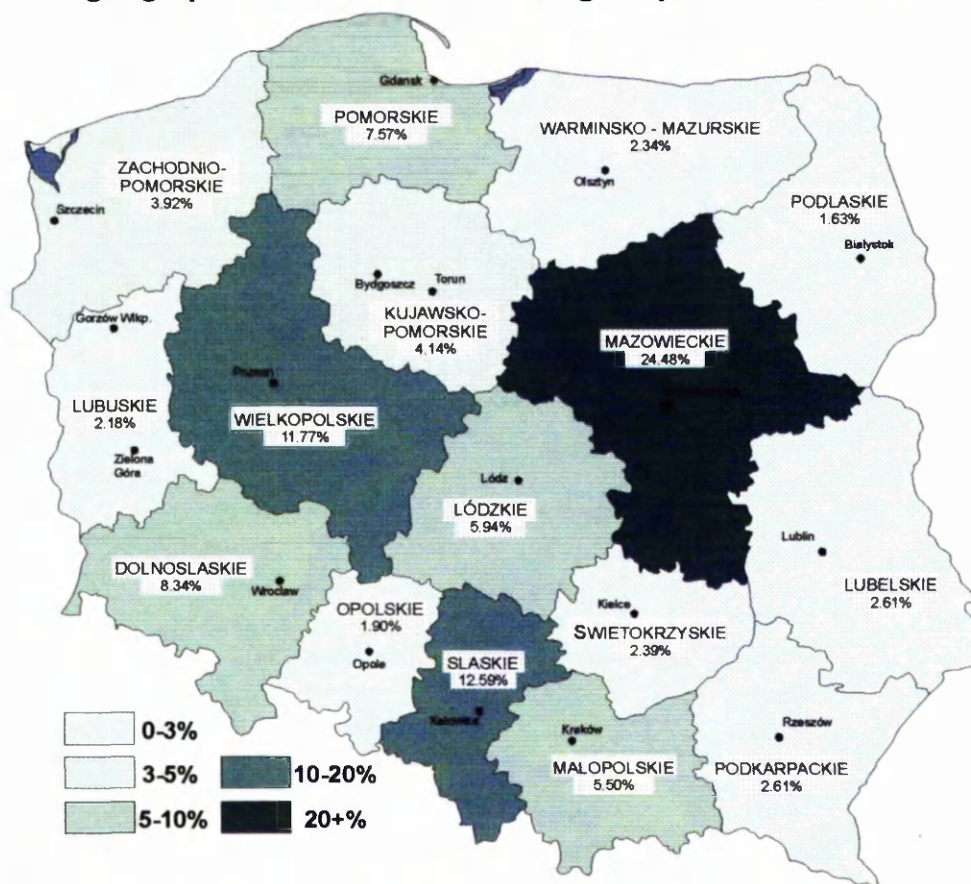
Fifty-two of the registered firms were engaged in trade. This, more specifically, refers to those firms facilitating retail, import and export trade. For example, Kulczyk Holding S.A., which is based in Poznan, deals with the import of Volkswagen and Audi motor vehicles & accessories. Plus-Tengelmann, based in Katowice, deals in supermarket trade, while the export of certain wooden products is facilitated by firms such as Paged-Westphalen of Warsaw. The number of financial institutions (51) includes not only German banks and their subsidiary operations, but also other credit institutions such as those connected with the sale of motor vehicles (the Opel and Volkswagen banks, for example) as well as other credit lending institutions. Included in this category are also a number of financial consultancy firms and those dealing in

tax matters. The inclusion of logistics firms (20), meanwhile, is confirmation of the importance of firms engaged in the transportation of goods to destinations in Poland as well as import/export trade. We shall now present some of this micro activity in a geographical form in order to show the relationship between investment, industry and trade. This will be carried out for Wielkopolskie and Śląskie.

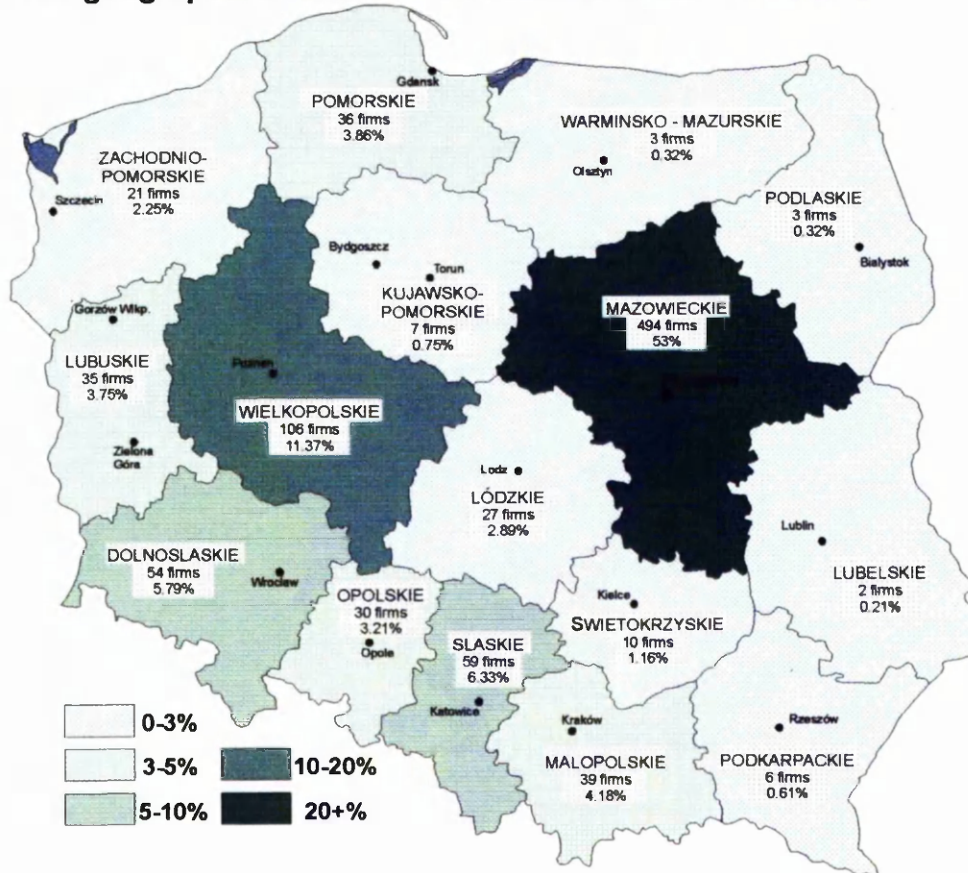
Geographical location in respect of Wielkopolskie and Śląskie

The following page contains two maps, which allow us to first compare the geographical orientation of both total and German firms located in the country. On completion, we shall then consider the German firms in Wielkopolskie and Śląskie that have invested directly into the local branches of industry and what conclusions can be drawn from this in terms of their motivations. A comparison of both maps reveals first of all that both German and major investors have located in Mazowieckie (1st), Wielkopolskie (2nd) and Śląskie (3rd). This is consistent with the fact that the concentration of industry and, therefore, the privatisation projects are greater in these parts of the country. This suggests that both major and German investors have been motivated by similar incentives. More specifically, investment has been driven by the desire to access the market through the control of assets, which will enable scale economies to be achieved in production for the purpose of domestic market supply and/or for trade. To develop this further, we shall now consider whether German firms in Wielkopolskie and Śląskie support this line of thinking.

The geographical distribution of foreign capital in Poland in 1998



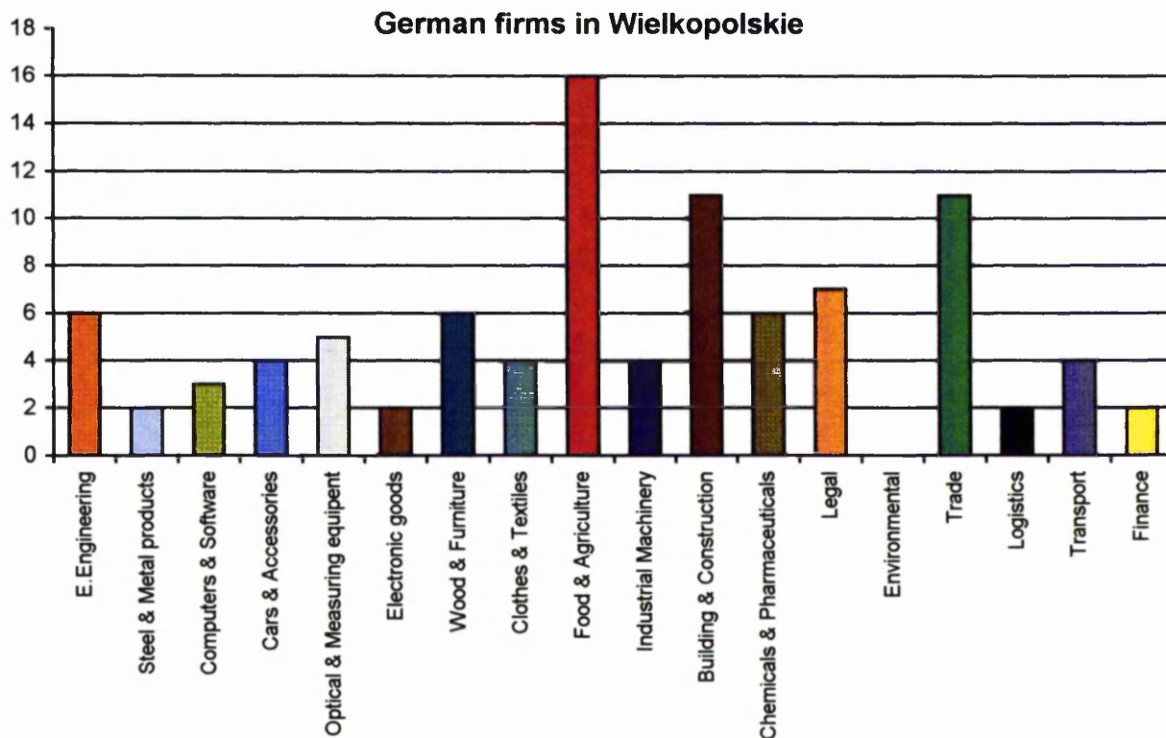
The geographical location of German investors in Poland



Wielkopolskie

We determined earlier in this work that Wielkopolskie, where Poznań is located, is one of the main industrial areas of the country – particularly, in the production machinery, chemicals, light industrial products (clothes) and food. To what extent, therefore, are German investors active in these branches of industry? Observation of the following graph reveals the number of German firms that have invested in Wielkopolskie and were operational in 1998. Out of the eighteen main branches of industry in the area, German firms were active in 17 of them.

Graph 5j



Source: *Own Calculations based on information obtained from the Deutsch-Polnische Industrie und Handelskammer, 1998.*

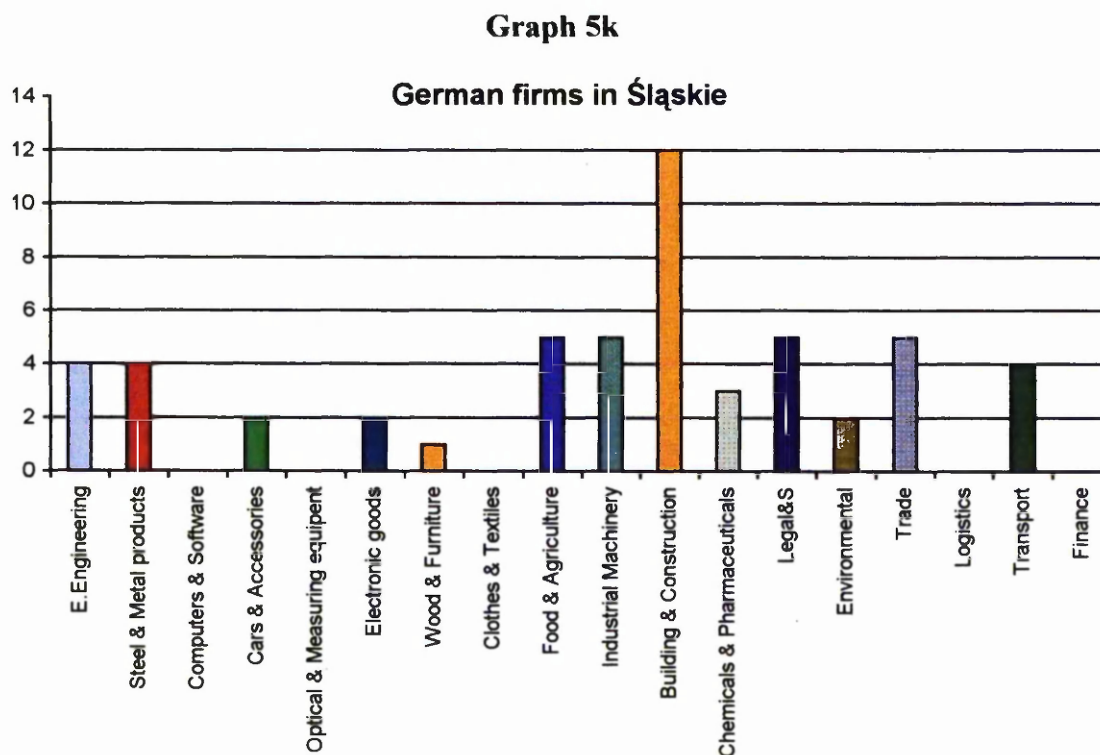
The number of firms can be divided up into three main groups according to the level of interest. For example, in the first group (firm numbers over 10) German firms have

invested directly into food production, trade and building & construction. In the second group (4-8 firms), investment has focused on legal services, chemicals & pharmaceuticals, wood & furniture, optical & measuring equipment and electrical engineering. In the third group (< 4), German firms were active in nine other branches of industry. However, out of the main industries listed for Wielkopolskie, food has been the dominant industry of interest, which is also consistent with the total level of investment in this industry as discussed earlier in this work. At the same time, the number of German trade firms (11) together with those active in branches of industry producing for export (furniture, clothes, machinery etc), reflects the importance of this region in terms of its close geographical proximity to Germany.

Śląskie

Śląskie, whose main industries include food, steel, metals, lead, zinc, electrical machinery, chemicals, light industrial products, coal and energy, has received less investment in terms of firm numbers. German firms are also active in fewer branches of industry.

The heavy industrial branches (steel, electrical engineering & other metals) of the region have attracted a relatively large number of related German firms into building and construction as well as firms specialised in the production of transport equipment, electrical engineering products, electronic goods, industrial machinery, steel & metals products and motor vehicles. The number of German firms actually engaged in these branches of industry (33) constituted 60% of the total located in the region. The main factors attracting German investors to this region not only concern the concentration of industry and access to the work force, but also because the main areas of industrial specialisation are closely related to those industries in which Germany has a comparative advantage.



Source: *Own Calculations based on information obtained from the Deutsch-Polnische Industrie und Handelskammer, 1998.*

This may also imply that, given the production of transport equipment and machinery in the region, German firms and/or German-Polish joint ventures could be among the main firms engaged in the outward processing trade of capital goods back to destinations in Germany. Furthermore, since German firms in these particular branches are producing both for the domestic market and for export supply, this suggests that the production and supply of capital goods to industries in Poland is also playing a large role in their restructuring and development plans.

Conclusion

Our aim in this chapter has been to determine the overall structure and geographical location of foreign direct investment in Poland. After almost five years of economic and political instability in the country, investment grew sharply reflecting the importance of

a stable environment as well as the importance of incentives, such as privatisation projects and low taxes associated with special economic zones. The privatisation of state enterprises has been among one of the most important incentives to foreign investors and this has been confirmed by their growing role in the manufacturing and service sectors. Significantly, investment values for 1999 reveal that manufacturing industry has been the largest recipient of capital injections accounting more than half of the total. Poland's traditional industrial sectors, which we identified earlier as dominant in the country's export structure, have reinforced their position as a result of the foreign investment that has gone into them. This has also forced some Polish firms to restructure and become more competitive. This, in a number of cases, has been achieved through greater merger activity, which was crucial for smaller firms owing to the negative macroeconomic effects on their operations and growing foreign competition. The effects of foreign activity in Poland have been reflected in the country's increasing investment/GDP ratio as well as in the overall higher levels of industrial output. In addition to domestic market supply, the impact of investment is also evident through the higher export/GDP ratios. Investment for the purpose of trade has been an important motive for a large number of investors. Poland's geographical location, therefore, has played a strategic role in location and has been a significant factor in attracting foreign investment to the country. The dominance of European investors, which account for approximately 65% of the investment inflows, lends some weight to the importance of investment for the purpose of trade. German investors are significant on both the trade and the investment side. A number of the German investors have, therefore, identified the structure of demand in Germany for Polish goods and have located in Poland in order to play a greater role on the supply side. These developments, however, have become more apparent during the second half of the 1990's. As discussed earlier in this work, Poland's unstable domestic environment meant that the Czech Republic and Hungary were initially preferred destination markets for German investors owing to their more favourable investment conditions. This was also because their industrial structures were also more compatible with Germany's own main areas of specialisation and that related privatisation projects were also more rapid. Market access and asset acquisition, therefore, were among the

key incentives motivating both German and other investors to Central Europe. This mirrors the type of investment behaviour observed in Western Europe since the formation of SEM. A number of Polish firms have, therefore, have gained access to the EU market via a Western partner. Germany, therefore, given its dominance in Polish economic life, plays a large role in the integration process.

German investment in Poland has targeted company shares (1), manufacturing industry (2) credit institutes (3) and car production (4). We have confirmed that a number of the shares in Polish companies acquired by German firms are engaged in export activities. The importance of Poland as a production base for German firms was supported by our analysis of 750 firms located in the country. Over 62% were registered in manufacturing, particularly in key export branches such as food, industrial machinery, steel and metal goods, clothes and textiles and wood & furniture production. The level of investment in some provinces, meanwhile, reflects the importance of location and good road access for the purpose of trade. For example, 53% of German firms were located in Mazowieckie and a further 11% in Wielkopolskie. Almost two-thirds of the firms from the sample, therefore, had access to the main motorway, which linked them with Germany. Central to the observed relationship between location and trade is the fact that the concentration of industry is the main factor, which links location, trade and privatisation together. At the same time, the attraction of special economic zones to investors has also proven to be successful, especially on account of their tax incentives and also because more of them are located in the West close to the main industrial centres.

Foreign investment in Poland, although more significant in the later 1990's, is beginning to play a greater role in Polish economic life and in the country's restructuring and development efforts. This is evident in Poland's increased levels of output and improved trade performance. Observation of the German side, later in this chapter, also reveals that investment is also becoming more diversified as indicated by the growing number of firms across different sectors. The wider investment picture, meanwhile, also shows that

investment in the service sectors (finance, banking, transport & communications) is a good sign that Poland has also taken the initial steps towards developing its infrastructure to meet the demands of business and industry.

Footnotes for Chapter 5

- ¹ Wallace, W., *Restructuring Economies, Poland and Scotland*, pages 67-72, 1997.
- ² Wprost, *Sto największych banków Europy Środkowej*, Nr.13, page 37, 1.4.2001.
- ³ Dawson, J., & Henley, J., *Internationalisation of Food Retailing in Poland: The Management of Scarcity*, Working Paper Series No.99/1, The University of Edinburgh Management School, December, 1998.
- ⁴ *Polityka, Trzeba wstrząsnąć*, Tygodnik, Nr.14, pages 54-55, 7.4.2001.
- ⁵ Weresa, M., *The Impact of Foreign Direct Investment on Poland's Trade with the European Union*, *Post-Communist Economies*, Vol. 13, No. 1, 2001.
- ⁶ Polish Agency for Foreign Investment, PAIZ, *Special Economic Zones*, 2000.
- ⁷ *Polskie Przedsiębiorstwo Wydawnictw Kartograficznych*, *Geograficzny Atlas Polski*, pages 28-29, 1999.
- ⁸ Polish Agency for Foreign Investment, Legnica, *Special Economic Zone*, 2000.
- ⁹ Deutsche Bundesbank, *Kapitalverflechtung mit dem Ausland*, *Statistische Sonderveröffentlichung* 10, page 34, 2000.
- ¹⁰ Quelch, J & Buzzell, D., *The Marketing Challenge of Eastern Europe*, New York, 1992, page 376.
- ¹¹ Wprost, *Czy grozi nam odwrot inwestorów zagranicznych?* page 37, 20 maja, 2001.
- ¹² Johnson, R., *The New Investment Frontier*, *Business America*, page 2, 7.10.1991.
- ¹³ *Czech Republic, New Life for the New Wave*, *Central European*, 1992, page 41.
- ¹⁴ *Central European Economic Review*, *The Wall Street Journal*, Vol V, No9, November 1997, page 14.
- ¹⁵ Van Hastenberg, *Foreign Direct Investment in Hungary*, *Proefschrift Univeriteit Utrecht*, page 8, 1999.
- ¹⁶ CEER, *Central European Economic Review*, Vol. IV, No.1, page 18, 1996.
- ¹⁷ PAIZ, Polish Agency for Foreign Investment, *The Chemical Industry in Poland*, pages 1-3, 2000.
- ¹⁸ *Gazeta Wyborcza*, *Investycje Zagraniczne*, July 30th, 1998.
- ¹⁹ *The Economist*, *Business Central Europe*, January 1997, page 48.

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- ²⁰ The Manager Magazine, Trends Standort -Serie, Oktober 1995, pages 250-65.
- ²¹ IMF, The Path to a Market Economy, Paper 113, Washington DC, October 1994, pages 75-78.
- ²² The Economist, Business Central Europe, Running out of steam?, pages 1-5, December 2000.
- ²³ Handelsblatt, Polen, Deutsche Unternehmen steigen starker ein, seite B5, Nr. 105, 1.6.1995.
- ²⁴ Central European Economic Review, Vol V, Number 9, November 1997, pages 12-15.
- ²⁵ Deutsche Bundesbank, Kapitalverflechtung mit dem Ausland, Mai 1998, page 71.
- ²⁶ The Economist, Business Central Europe, January 1997, pages 46 and 47.
- ²⁷ Warsaw School of Economics, Poland, International Economic Report, 1995/96, pages 119-131.
- ²⁸ Sompolska, B., The Times, Poland's International Business Monthly, No 12, December 1996, pages 1-2.
- ²⁹ Rocznik Statystyczny, Central Statistics Office, 1999.

Sources for tables and graphs

Table 5a, Foreign capital invested by June 1999, Paiz, 2000.

Table 5b, Mały Rocznik Statystyczny, 1999, Biuletyn Statystyczny, 1/1999 GUS, 1999, OECD, 1999

Table 5c, The Economist, Business Central Europe, December 2000.

Table 5d, Rocznik Statystyczny, Central Statistics Office, Warsaw, 1999.

Graph 5a, Polish Agency for Foreign Investment (PAIZ), 2000.

Graph 5b, The Economist, Business Central Europe, December 2000.

Graph 5c, The Economist, Business Central Europe, December 2000.

Graph 5d, Deutsche Bundesbank, Kapitalverflechtung mit dem Ausland, Mai 2000.

Graph 5e, Paiz, VW, Czechinvest, 1998.

Graph 5f, Deutsche Bundesbank, Kapitalverflechtung mit dem Ausland, Mai 2000.

Graph 5g, Deutsche Bundesbank, Kapitalverflechtung mit dem Ausland, Mai 2000.

Graphs 5h, 5i, 5j & 5k, Polish-German Chamber of Commerce, Warsaw, 1998.

Conclusion

The central objective of this work was to analyse the developments in Polish trade with the EU and Germany during the 1990's with a view to making an evaluation of the extent of the progress made in the growth and development of industry. Before the more contemporary work began, however, we first provided a short background chapter, which enabled us to develop an understanding of the Polish structure of production and trade under central planning. The aim of this was to also provide a basis from which later developments could be measured. Our work in chapter one revealed that Poland, within the system of planning, was a producer and exporter of predominantly labour and resource-intensive goods, such as machinery & transport equipment, industrial products and fuels. This was primarily due to its endowment of chemical and extractive industries and also because production was narrowed down to steel, copper, coal, sulphur and manufactured goods to meet the requirements of the East bloc. In 1970 Poland established greater economic relations with the West in the spheres of trade and credit to facilitate the country's modernisation efforts. The export of Polish products, however, in chiefly coal, copper, iron, steel, machine tools, combustion engines, clothes and textile products could not be maintained owing to the constraints of the planning system, but also because of the negative effects of the world oil shock on western demand. With respect to the former, this was due to the reliance of the planning system on heavy industry, which limited both the volume and quality of certain goods. In terms of the latter, the fall in export demand resulted in lower than expected hard currency earnings, which both limited the country's ability to obtain the necessary inputs for production from the West and to service its debt owed to a consortium of western banks. This resulted in constraints on production and growing shortages, which were more acute towards the end of the 1980's. Individual money holdings relative to the supply of goods increased over time, and this was one of the main reasons behind the rise in retail prices and the resulting wave of strikes. We characterised the Polish economy at the end of the 1980's as one, which was driven by a predominantly labour and resource-intensive

structure of production, but whose industries were over-sized and inefficient. The main macroeconomic symptoms included widespread shortages, spiralling inflation, hidden unemployment and a high foreign debt burden. These were among the main factors, which led to the collapse of the planning system in Poland and the decision to introduce market reform.

Transition to the market needed to be facilitated by the implementation of a stabilisation programme in order to rectify the macroeconomic imbalances of the old system. This was initially successful, although some question marks were placed in respect of the period of time in which the economy spent in recession. Fiscal and monetary action caused a domestic demand shock and, therefore, raised the propensity to save. However, the length of the recession could be more attributed to the effects of high interest rates, which, owing to the high cost of borrowing, restricted industrial potential. Instead, monetary policy attracted speculation capital into the money market, which aggravated inflation further. This, in turn, raised the price of the zloty relative to other currencies and, therefore, negatively affected exports, especially in the later part of the 1990's. For much of the 1990's, however, export growth was a key component of GDP and the balance of payments. This was due to the fact that western demand reinforced the production and sale of goods produced in Poland's traditional industries, and this was further facilitated by the introduction of the Interim Agreement. The agreement was important in enabling greater market access to the EU for Polish industrial goods, although certain sensitive goods such as those from the agricultural sector, steel, iron and coal were initially restricted. The agreement was more liberal in allowing sensitive items such as textiles to be transported across national borders (duty free) in accordance with the arrangements on outward processing trade. The EU agreement, while enabling greater market access and stimulating growth in the Polish economy, did, in effect, raise the attractiveness of the country's traditional industrial sectors. For a number of exporting industries, trade expansion to the West represented more of a continuation of the relations that were developed from the 1970's. Western demand, therefore, played an

influential role in reinforcing the labour- and resource-intensive structure of production in Poland. This is particularly evident on the German side which, given its dominance in Polish trade, will continue to play an influential role in steering the course of the country's future development path. At the same time, however, the liberalisation of trade on most goods (except agriculture) by 1998, together with the improved domestic environment as of the mid-1990's, did reveal a relatively small, but growing share of capital goods in the country's export structure. These were not revealed to be that significant, though, in our empirical and theoretical sections. This suggests that more time should be allowed before these goods contribute more substantially as a share of GDP.

The application of our trade models (intra-industry trade & revealed comparative advantage) yielded a set of results, which were broadly consistent with this line of thought. For example, IIT revealed a structure of trade that was characterised by the exchange of goods from different industries (inter-industry). This, given the difference in the structures of production between Poland and the EU, tallied with the Heckscher-Ohlin proposition, which suggested that trade will occur in those goods that use the abundant factors of a particular country more intensively. We did find that Polish-EU values for IIT did increase over time, signalling a greater exchange of goods from the same industries. However, while this does not exclude that some convergence has occurred in the exchange of capital goods, we found that the higher IIT values obtained were due to the expansion of trade in resource and labour-intensive goods. The dominance of these industries were supported by the results calculated from our RCA model, which indicated that a number the Polish traditional industries have become competitive over time (see appendix 3), but only four of them revealed a comparative advantage: copper, wooden products/furniture, and men's and women's clothes. At the time of writing the latter three of these commodities were the most dominant exports to the EU. This has one or two implications. First of all, the fact that the traditional sectors are revealed to have become relatively more competitive during the 1990's suggests that the main path of development has been built along traditional industry lines. This is supported in chapter five of this

work, which revealed that more than half of the total foreign investment flows had penetrated manufacturing industry. The geographical location of investors in areas of high industrial concentration lent further weight to this. Driving this was the fact that modernisation reform, given the lack of domestic capital, could only be achieved with the help of foreign investment. The privatisation of state enterprises was, therefore, the most realistic option for the Polish government, but also one of the most important incentives to foreign investors. Secondly, although foreign investment was revealed to have a positive effect on industrial output and trade, per-capita income levels remained low compared with those observed in the Czech Republic and Hungary. This was due to the low earnings associated with the export of predominantly labour- and some resource-intensive goods. It is also due to the relatively lower costs of labour in Poland, which continue to be one of the important incentives for foreign investors. This was supported by the results obtained from our Gravity model, where income levels in Poland were revealed to be insignificant, reflecting a demand geared towards “necessity” goods. Per-capita income levels in Poland, therefore, need to rise in order to raise the level of demand for a more diversified range of goods. Part of the explanation behind this has been the simultaneous rise in the number of Polish and foreign firms in manufacturing, which has led to growing competition and a downward pressure on prices. This concurs with the results obtained from our regression analysis, where we ascertained that output positively correlated with the export of labour and resource-intensive exports, especially in the case of adjacent countries. This strongly suggested the influence of neighbouring countries in Poland’s trade and was particularly evident in the case of machinery, raw materials and manufactured goods, which together form the bulk of Polish exports. Polish-German trade has, therefore, influenced these developments. This is consistent with our research in chapter three and also in chapter five where we found that German investors have been particularly active in those branches of industry engaged in trade, especially those that compliment Germany’s own areas of industrial specialisation. Significant in these exchanges was the role of outward processing trade (OPT), which, although dominant in clothes and wooden products, had also began to shift towards the

production of certain capital goods, including mechanical and electrical machinery and transport equipment. This was more significant in the later 1990's following the liberalisation of trade on most sensitive items such as steel & iron and metals. This type of trade necessitates a transfer of technology, which was revealed as evident both on the trade and the investment side. With respect to the former, more disaggregated trade data revealed that high-value added components, parts and machinery were being exported to Poland for the purpose of installation, completion and re-export. This was supported by the comparatively, higher share of human- and capital-intensive products in Polish outflows towards the end of the decade. Our research in the final subsection of chapter five showed that there were a number of German firms engaged, among others, in machinery and metal product's industries, electrical engineering and in the production of transport equipment. Significant also was the fact that these items were beginning to play a greater role in Polish-German trade towards the end of the 1990's. The application of our IIT model in chapter three lent weight to this, revealing that trade between the two countries had become more intra-industry in nature in 1998. German direct investment, which also includes Polish-German joint ventures, has, therefore, been influential in shaping these developments. This is reflective of the behaviour of many international investors in the Polish market who, at the end of the 1990's, contributed almost half of Polish exports. We also found that investment behaviour in Poland mirrors the wave of merger and acquisition activity that was observed in the EU following the formation of the Single European Market. Investment in Poland is, therefore, of a market- and efficiency-seeking nature, implying that access to the market and control of assets have been important in helping investors to realise scale economies through lower overall input costs to production.

Our theoretical and empirical analysis has revealed initial signs of technological change and shifts in production in Poland to include a greater use of skilled-labour and capital-intensive processes. These developments were more visible towards the end of the 1990's and this is consistent with greater trade liberalisation, but also the much-improved

domestic environment. Our theoretical models have, therefore, been applied to a country undergoing institutional and legislative reform, macroeconomic change, restructuring and privatisation. This raises the question of applicability. However, while some question marks may be placed next to the efficiency of certain industries, such as those receiving state subsidies, our models have revealed concrete information concerning the nature and direction of trade, as well as important information concerning the effects of income on the demand for goods. These results were confirmed by our empirical analysis, which found that products embodied with more medium and high technology were beginning to play a greater role in Polish outflows. Our analysis, therefore, finds that Polish trade relations with the EU and Germany have had a positive effect on the growth, modernisation and the development of industry in the 1990's.

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Appendix 1**List of commodity codes for each SITC category from 0-9**

001 LIVE ANIMALS EXCEPT FISH	073 CHOCOLATE/COCOA PREPS
011 BEEF, FRESH/CHILLD/FROZN	074 TEA AND MATE
012 MEAT NES,FRESH/CHLD/FROZ	075 SPICES
016 MEAT/OFFAL PRESERVED	081 ANIMAL FEED EX UNML CER.
017 MEAT/OFFAL PRESVD N.E.S	091 MARGARINE/SHORTENING
022 MILK PR EXC BUTTR/CHEESE	098 EDIBLE PRODUCTS N.E.S.
023 BUTTER AND CHEESE	111 BEVERAGE NON-ALCOHOL NES
024 CHEESE AND CURD	112 ALCOHOLIC BEVERAGES
025 EGGS, ALBUMIN	121 TOBACCO, RAW AND WASTES
034 FISH,LIVE/FRSH/CHLD/FROZ	122 TOBACCO, MANUFACTURED
035 FISH,DRIED/SALTED/SMOKED	211 HIDE/SKIN (EX FUR) RAW
036 CRUSTACEANS MOLLUSCS ETC	212 FURSKINS/PIECES, RAW
037 FISH/SHELLFISH,PREP/PRES	222 OIL SEEDS ETC - SOFT OIL
041 WHEAT/MESLIN	223 OIL SEEDS-NOT SOFT OIL
042 RICE	231 NATURAL RUBBER/LATEX/ETC
043 BARLEY GRAIN	232 RUBBER SYNTH/WASTE/ETC
044 MAIZE EXCEPT SWEET CORN.	244 CORK NATURAL/RAW/WASTE
045 CEREAL GRAINS NES	245 FUEL WOOD/WOOD CHARCOAL
046 FLOUR/MEAL WHEAT/MESLIN	246 WOOD CHIPS/WASTE
047 CEREAL MEAL/FLOUR N.E.S	247 WOOD IN ROUGH/SQUARED
048 CEREAL ETC FLOUR/STARCH	248 WOOD SIMPLY WORKED
054 VEGETABLES,FRSH/CHLD/FRZ	251 PULP AND WASTE PAPER
056 VEG ROOT/TUBER PREP/PRES	261 SILK
057 FRUIT/NUTS, FRESH/DRIED	263 COTTON
058 FRUIT PRESVD/FRUIT PREPS	264 JUTE/BAST FIBRE RAW/RETD
059 FRUIT/VEG JUICES	265 VEG TEXT FIBRE EX COT/JU
061 SUGAR/MOLLASSES/HONEY	266 SYNTHETIC SPINNING FIBRE
062 SUGAR CONFECTIONERY	267 MAN-MADE FIBRES NES/WAST
071 COFFEE/COFFEE SUBSTITUTE	268 WOOL/ANIMAL HAIR
072 COCOA	269 WORN CLOTHING ETC

272 FERTILIZERS CRUDE	512 ALCOHOLS/PHENOLS/DERIVS
273 STONE/SAND/GRAVEL	513 CARBOXYLIC ACID COMPOUND
274 SULPHUR/UNROASTD PYRITES	514 NITROGEN FUNCTION COMPDS
277 NATURAL ABRASIVES N.E.S.	515 ORGANO-INORGANIC COMPNDS
278 OTHER CRUDE MINERALS	516 OTHER ORGANIC COMPOUNDS
281 IRON ORE/CONCENTRATES	522 ELEMENTS/OXIDES/HAL SALT
282 FERROUS WASTE/SCRAP	523 METAL SALTS OF INORG ACD
283 COPPER ORES/CONCENTRATES	524 OTHER INORGANIC CHEMICAL
284 NICKEL ORES/CONCS/ETC	525 RADIO-ACTIVE ETC MATRIAL
285 ALUMINIUM ORES/CONCS/ETC	531 SYNTH ORG COLOUR AGENTS
286 URANIUM/THORIUM ORE/CONC	532 DYEING/TANNING EXTRACTS
287 BASE METAL ORE/CONC NES	533 PIGMENTS/PAINTS/VARNISH
288 NF BASE METAL WASTE NES	541 PHARMACEUT EXC MEDICAMNT
289 PRECIOUS METAL ORE/CONC.	542 MEDICAMENTS INCLUDE VET
291 CRUDE ANIMAL MTERIAL NES	551 ESSENT.OIL/PERFUME/FLAVR
292 CRUDE VEG MATERIALS NES	553 PERFUME/TOILET/COSMETICS
321 COAL NON-AGGLOMERATED	554 SOAPS/CLEANSERS/POLISHES
322 BRIQUETTES/LIGNITE/PEAT	562 MANUFACTURED FERTILIZERS
325 COKE/SEMI-COKE/RETORT C	571 PRIMARY ETHYLENE POLYMER
333 PETROL./BITUM. OIL,CRUDE	572 STYRENE PRIMARY POLYMERS
334 HEAVY PETROL/BITUM OILS	573 VINYL CHLORIDE ETC POLYM
335 RESIDUAL PETROL. PRODS	574 POLYACETALS/POLYESTERS..
342 LIQUID PROPANE/BUTANE	575 PLASTIC NES-PRIMARY FORM
343 NATURAL GAS	579 PLASTIC WASTE/SCRAP
344 PETROL./HYDROCARBON GAS	581 PLASTIC TUBE/PIPE/HOSE
345 COAL GAS/WATER GAS/ETC	582 PLASTIC SHEETS/FILM/ETC
351 ELECTRIC CURRENT	583 MONOFILAMENT RODS/STICKS
411 ANIMAL OIL/FAT	591 HOUSEHOLD/GARDEN CHEMCAL
421 FIXED VEG OIL/FAT, SOFT	592 STARCHES/GLUES/ETC.
422 FIXED VEG OILS NOT SOFT	593 EXPLOSIVES/PYROTECHNICS
431 ANIMAL/VEG OILS PROCES'D	597 OIL ETC ADDITIVES/FLUIDS
511 HYDROCARBONS/DERIVATIVES	598 MISC CHEMICAL PRODS NES

611 LEATHER	676 IRON/STEEL BARS/RODS/ETC
612 LEATHER MANUFACTURES	677 IRON/STEEL RAILWAY MATL
613 FURSKINS TANNED/DRESSED	678 IRON/STEEL WIRE
621 MATERIALS OF RUBBER	679 IRON/STEEL PIPE/TUBE/ETC
625 RUBBER TYRES/TREADS	681 SILVER/PLATINUM ETC
629 ARTICLES OF RUBBER NES	682 COPPER
633 CORK MANUFACTURES	683 NICKEL
634 VENEER/PLYWOOD/ETC	684 ALUMINIUM
635 WOOD MANUFACTURES N.E.S.	685 LEAD
641 PAPER/PAPERBOARD	686 ZINC
642 CUT PAPER/BOARD/ARTICLES	687 TIN
651 TEXTILE YARN	689 MISC NON-FERR BASE METAL
652 COTTON FABRICS, WOVEN	691 IRON/STL/ALUM STRUCTURES
653 MAN-MADE WOVEN FABRICS	692 METAL STORE/TRANSPT CONT
654 WOVEN TEXTILE FABRIC NES	693 WIRE PROD EXC INS ELECTR
655 KNIT/CROCHET FABRICS	694 NAILS/SCREWS/NUTS/BOLTS
656 TULLE/LACE/EMBR/TRIM ETC	695 HAND/MACHINE TOOLS
657 SPECIAL YARNS/FABRICS	696 CUTLERY
658 MADE-UP TEXTILE ARTICLES	697 BASE METAL H'HOLD EQUIPM
659 FLOOR COVERINGS ETC.	699 BASE METAL MANUFAC NES
661 LIME/CEMENT/CONSTR MAT'L	711 STEAM GENERATING BOILERS
662 CLAY/REFRACTORY MATERIAL	712 STEAM/VAPOUR TURBINES
663 MINERAL MANUFACTURES NES	713 INTERNAL COMBUST ENGINES
664 GLASS	714 ENGINES NON-ELECTRIC NES
665 GLASSWARE	716 ROTATING ELECTR PLANT
666 POTTERY	718 POWER GENERATING EQU NES
667 PEARLS/PRECIOUS STONES	721 AGRIC MACHINE EX TRACTR
671 PIG IRON ETC FERRO ALLOY	722 TRACTORS
672 PRIMARY/PRODS IRON/STEEL	723 CIVIL ENGINEERING PLANT
673 FLAT ROLLED IRON/ST PROD	724 TEXTILE/LEATHER MACHINRY
674 ROLLED PLATED M-STEEL	725 PAPER INDUSTRY MACHINERY
675 FLAT ROLLED ALLOY STEEL	726 PRINTING INDUSTRY MACHNY

727 FOOD PROCESSING MACHINES	784 MOTOR VEH PARTS/ACCESS
728 SPECIAL INDUST MACHN NES	785 MOTORCYCLES/CYCLES/ETC
731 MACH-TOOLS REMOVE MTRIAL	786 TRAILERS/CARAVANS/ETC
733 MTL M-TOOLS W/O MTL-RMVL	791 RAILWAY VEHICLES/EQUIPMT
735 METAL MACHINE TOOL PARTS	792 AIRCRAFT/SPACECRAFT/ETC
737 METALWORKING MACHINE NES	793 SHIPS/BOATS/ETC
741 INDUST HEAT/COOL EQUIPMT	811 PREFABRICATED BUILDINGS
742 PUMPS FOR LIQUIDS	812 SANITARY/PLUMB/HEAT FIXT
743 FANS/FILTERS/GAS PUMPS	813 LIGHTING FIXTURES ETC
744 MECHANICAL HANDLING EQUI	821 FURNITURE/STUFF FURNISHG
745 NON-ELECTR MACHINES NES	831 TRUNKS AND CASES
746 BALL/ROLLER BEARINGS	841 MENS/BOYS WEAR, WOVEN
747 TAPS/COCKS/VALVES	842 WOMEN/GIRL CLOTHING WVEN
748 MECH TRANSMISSION EQUMNT	843 MEN/BOY WEAR KNIT/CROCH
749 NON-ELEC PARTS/ACC MACHN	844 WOMEN/GIRL WEAR KNIT/CRO
751 OFFICE MACHINES	845 ARTICLES OF APPAREL NES
752 COMPUTER EQUIPMENT	846 CLOTHING ACCESSORIES
759 OFFICE EQUIP PARTS/ACCS.	848 HEADGEAR/NON-TEXT CLOTHG
761 TELEVISION RECEIVERS	851 FOOTWEAR
762 RADIO BROADCAST RECEIVER	871 OPTICAL INSTRUMENTS NES
763 SOUND/TV RECORDERS ETC	872 MEDICAL/ETC INSTRUMENTS
764 TELECOMMS EQUIPMENT NES	873 METERS AND COUNTERS NES
771 ELECT POWER TRANSM EQUIP	874 MEASURE/CONTROL APP NES
772 ELECTRIC CIRCUIT EQUIPMT	881 PHOTOGRAPHIC EQUIPMENT
773 ELECTRICAL DISTRIB EQUIP	882 PHOTOGRAPHIC SUPPLIES
774 MEDICAL ETC EL DIAG EQUI	883 CINE FILD DEVELOPED
775 DOMESTIC EQUIPMENT	884 OPTICAL FIBRES
776 VALVES/TRANSISTORS/ETC	885 WATCHES AND CLOCKS
778 ELECTRICAL EQUIPMENT NES	891 ARMS AND AMMUNITION
781 PASSENGER CARS ETC	892 PRINTED MATTER
782 GOODS/SERVICE VEHICLES	893 ARTICLES NES OF PLASTICS
783 ROAD MOTOR VEHICLES NES	894 BABY CARR/TOY/GAME/SPORT

895 OFFICE/STATIONERY SUPPLY	911 POSTAL PACKETS NOT CLASS
896 ART/COLLECTIONS/ANTIQUES	931 SPECIAL TRANSACTIONS NES
897 JEWELLERY	961 COIN NONGOLD NON CURRENT
898 MUSICAL INSTRUMS/RECORDS	971 GOLD NON-MONETARY EX ORE
899 MISC MANUF ARTICLES NES	

Appendix 2 – Calculations for Polish-EU Intra-Industry Trade in 1990

$$IIT = \left\{ 1 - \left[\frac{\sum |x_i - m_i|}{\sum (x_i + m_i)} \right] \right\} 100$$

$$IIT^* = \left\{ 1 - 0.5 \left[\sum \left| \left(\frac{x_i}{x} \right) - \left(\frac{m_i}{m} \right) \right| \right] \right\} 100$$

Columns numbered 1-6 represent a breakdown of the above Grubel-Lloyd formula and the steps followed in calculating IIT at the three-digit level. The value in column 6 (far-right) at the foot of the table (highlighted) is that, which is plugged into the equation to calculate the level of IIT for the year being measured.

IIT 90	(1) xi	(2) mi	(3) x+m	(3) xi - mi	(3) xi - mi	(4) xi / X	(5) m i / M	(6) (4) - (5)	(6) (4) - (5)
001	233086	3901	236987	229185	229185	0.046113584	0.000923649	0.045189936	0.045189936
011	3651	1725	5376	1926	1926	0.000722311	0.000408432	0.000313879	0.000313879
012	103373	8779	112152	94594	94594	0.020451248	0.002078624	0.018372624	0.018372624
016	2528	6786	9314	-4258	4258	0.000500138	0.001606737	-0.001106599	0.001106599
017	32965	25215	58180	7750	7750	0.006521774	0.005970214	0.000551561	0.000551561
022	9724	4135	13859	5589	5589	0.00192379	0.000979053	0.000944736	0.000944736
023	4705	1465	6170	3240	3240	0.000930834	0.000346871	0.000583963	0.000583963
024	4760	2879	7639	1881	1881	0.000941715	0.000681667	0.000260048	0.000260048
025	1092	4383	5475	-3291	3291	0.000216041	0.001037773	-0.000821732	0.000821732
034	129764	11199	140963	118565	118565	0.025672426	0.002651613	0.023020813	0.023020813
035	746	2831	3577	-2085	2085	0.000147588	0.000670302	-0.000522714	0.000522714
036	14677	18101	32778	-3424	3424	0.002903688	0.004285815	-0.001382127	0.001382127
037	27528	5336	32864	22192	22192	0.005446122	0.001263417	0.004182705	0.004182705
041	3	129759	129762	-129756	129756	5.93518E-07	0.030723337	-0.030722743	0.030722743
042	0	12558	12558	-12558	12558	0	0.002973387	-0.002973387	0.002973387
043	45	11667	11712	-11622	11622	8.90277E-06	0.002762422	-0.00275352	0.00275352
044	6	20473	20479	-20467	20467	1.18704E-06	0.004847439	-0.004846252	0.004846252
045	661	1	662	660	660	0.000130772	2.36772E-07	0.000130535	0.000130535
046	4	48	52	-44	44	7.91357E-07	1.13651E-05	-1.05737E-05	1.06E-05
047	0	58	58	-58	58	0	1.37328E-05	-1.37328E-05	1.37E-05
048	505	16093	16598	-15588	15588	9.99089E-05	0.003810377	-0.003710468	0.003710468
054	166601	3184	169785	163417	163417	0.032960235	0.000753883	0.032206352	0.032206352
056	10075	5871	15946	4204	4204	0.001993232	0.00139009	0.000603141	0.000603141

057	14865	51212	66077	-36347	36347	0.002940882	0.012125583	-0.009184701	0.009184701
058	80377	5729	86106	74648	74648	0.015901734	0.001356469	0.014545265	0.014545265
059	50309	8033	58342	42276	42276	0.0099531	0.001901992	0.008051108	0.008051108
061	30855	624	31479	30231	30231	0.006104333	0.000147746	0.005956587	0.005956587
062	3272	12049	15321	-8777	8777	0.00064733	0.002852869	-0.002205539	0.002205539
071	460	12740	13200	-12280	12280	9.10061E-05	0.003016479	-0.002925473	0.002925473
072	7593	2098	9691	5495	5495	0.001502194	0.000496748	0.001005446	0.001005446
073	1014	22486	23500	-21472	21472	0.000200609	0.005324062	-0.005123453	0.005123453
074	0	12387	12387	-12387	12387	0	0.002932898	-0.002932898	0.002932898
075	1009	2895	3904	-1886	1886	0.00019962	0.000685456	-0.000485836	0.000485836
081	22734	11937	34671	10797	10797	0.00449768	0.002826351	0.001671329	0.001671329
091	0	2223	2223	-2223	2223	0	0.000526345	-0.000526345	0.000526345
098	508	23449	23957	-22941	22941	0.000100502	0.005552074	-0.005451571	0.005451571
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
111	6	14959	14965	-14953	14953	1.18704E-06	0.003541877	-0.00354069	0.00354069
112	4937	55411	60348	-50474	50474	0.000976733	0.01311979	-0.012143057	0.012143057
121	779	1672	2451	-893	893	0.000154117	0.000395883	-0.000241766	0.000241766
122	11	15695	15706	-15684	15684	2.17623E-06	0.003716141	-0.003713965	0.003713965
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
211	19529	3296	22825	16233	16233	0.003863605	0.000780402	0.003083203	0.003083203
212	2309	338	2647	1971	1971	0.000456811	8.0029E-05	0.000376782	0.000376782
222	76297	3220	79517	73077	73077	0.015094549	0.000762407	0.014332143	0.014332143
223	676	16	692	660	660	0.000133739	3.78836E-06	0.000129951	0.000129951
231	508	197	705	311	311	0.000100502	4.66441E-05	5.38582E-05	5.39E-05
232	19397	3644	23041	15753	15753	0.00383749	0.000862798	0.002974692	0.002974692
244	0	75	75	-75	75	0	1.77579E-05	-1.77579E-05	1.78E-05
245	2345	1	2346	2344	2344	0.000463933	2.36772E-07	0.000463697	0.000463697
246	753	58	811	695	695	0.000148973	1.37328E-05	0.00013524	0.00013524
247	6779	90	6869	6689	6689	0.001341153	2.13095E-05	0.001319843	0.001319843
248	106427	1987	108414	104440	104440	0.021055449	0.000470467	0.020584983	0.020584983
251	3586	2835	6421	751	751	0.000709452	0.000671249	3.82025E-05	3.82E-05
261	2	32	34	-30	30	3.95679E-07	7.57671E-06	-7.18103E-06	7.18E-06
263	1459	11314	12773	-9855	9855	0.000288648	0.002678842	-0.002390194	0.002390194
264	12	3	15	9	9	2.37407E-06	7.10317E-07	1.66376E-06	1.66E-06
265	469	341	810	128	128	9.27867E-05	8.07394E-05	1.20473E-05	1.20E-05
266	5722	2398	8120	3324	3324	0.001132037	0.00056778	0.000564257	0.000564257

267	7012	1268	8280	5744	5744	0.00138725	0.000300227	0.001087022	0.001087022
268	578	5878	6456	-5300	5300	0.000114351	0.001391748	-0.001277396	0.001277396
269	1074	6497	7571	-5423	5423	0.000212479	0.00153831	-0.00132583	0.00132583
272	738	30	768	708	708	0.000146005	7.10317E-06	0.000138902	0.000138902
273	2865	435	3300	2430	2430	0.00056681	0.000102996	0.000463814	0.000463814
274	57810	245	58055	57565	57565	0.011437093	5.80092E-05	0.011379084	0.011379084
277	0	864	864	-864	864	0	0.000204571	-0.000204571	0.000204571
278	4304	5409	9713	-1105	1105	0.000851501	0.001280701	-0.000429201	0.000429201
281	0	0	0	0	0	0	0	0	0
282	48765	145	48910	48620	48620	0.009647636	3.4332E-05	0.009613304	0.009613304
283	0	0	0	0	0	0	0	0	0
284	0	0	0	0	0	0	0	0	0
285	11	19250	19261	-19239	19239	2.17623E-06	0.004557867	-0.004555691	0.004555691
286	0	0	0	0	0	0	0	0	0
287	20162	2964	23126	17198	17198	0.003988837	0.000701793	0.003287044	0.003287044
288	41624	3087	44711	38537	38537	0.008234865	0.000730916	0.007503949	0.007503949
289	477	0	477	477	477	9.43694E-05	0	9.43694E-05	9.44E-05
291	19256	7996	27252	11260	11260	0.003809595	0.001893231	0.001916363	0.001916363
292	26428	12229	38657	14199	14199	0.005228499	0.002895488	0.00233301	0.00233301
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
321	350450	167	350617	350283	350283	0.069332803	3.9541E-05	0.069293262	0.069293262
322	531	3	534	528	528	0.000105053	7.10317E-07	0.000104342	0.000104342
325	39387	179	39566	39208	39208	0.007792299	4.23822E-05	0.007749917	0.007749917
333	353	0	353	353	353	6.98373E-05	0	6.98373E-05	6.98E-05
334	83355	124793	208148	-41438	41438	0.0164909	0.029547526	-0.013056626	0.013056626
335	30446	2645	33091	27801	27801	0.006023417	0.000626263	0.005397154	0.005397154
342	0	2549	2549	-2549	2549	0	0.000603533	-0.000603533	0.000603533
343	0	9	9	-9	9	0	2.13095E-06	-2.13095E-06	2.13E-06
344	2895	220	3115	2675	2675	0.000572745	5.20899E-05	0.000520655	0.000520655
345	0	0	0	0	0	0	0	0	0
351	0	0	0	0	0	0	0	0	0
39999	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
411	1469	1329	2798	140	140	0.000290626	0.00031467	-2.40444E-05	2.40E-05
421	5311	23982	29293	-18671	18671	0.001050725	0.005678273	-0.004627548	0.004627548
422	4	306	310	-302	302	7.91357E-07	7.24523E-05	-7.1661E-05	7.17E-05

431	3003	4217	7220	-1214	1214	0.000594112	0.000998469	-0.000404357	0.000404357
				0	0	0	0	0	0
				0	0	0	0	0	0
511	18599	14380	32979	4219	4219	0.003679614	0.003404786	0.000274829	0.000274829
512	21604	12234	33838	9370	9370	0.004274121	0.002896672	0.001377449	0.001377449
513	8862	9859	18721	-997	997	0.001753252	0.002334338	-0.000581086	0.000581086
514	14854	17164	32018	-2310	2310	0.002938706	0.00406396	-0.001125254	0.001125254
515	40796	13490	54286	27306	27306	0.008071054	0.003194058	0.004876996	0.004876996
516	9225	9954	19179	-729	729	0.001825068	0.002356831	-0.000531763	0.000531763
522	30426	6520	36946	23906	23906	0.00601946	0.001543755	0.004475705	0.004475705
523	18023	4041	22064	13982	13982	0.003565659	0.000956797	0.002608862	0.002608862
524	3289	645	3934	2644	2644	0.000650694	0.000152718	0.000497976	0.000497976
525	48	797	845	-749	749	9.49629E-06	0.000188708	-0.000179211	0.000179211
531	4281	8386	12667	-4105	4105	0.00084695	0.001985573	-0.001138622	0.001138622
532	3	1300	1303	-1297	1297	5.93518E-07	0.000307804	-0.00030721	0.00030721
533	1378	37822	39200	-36444	36444	0.000272623	0.008955202	-0.008682579	0.008682579
541	3275	32458	35733	-29183	29183	0.000647924	0.007685155	-0.007037231	0.007037231
542	209	77779	77988	-77570	77570	4.13484E-05	0.018415913	-0.018374564	0.018374564
551	1687	6481	8168	-4794	4794	0.000333755	0.001534521	-0.001200766	0.001200766
553	482	40745	41227	-40263	40263	9.53586E-05	0.009647287	-0.009551929	0.009551929
554	964	21446	22410	-20482	20482	0.000190717	0.005077819	-0.004887102	0.004887102
562	96190	221	96411	95969	95969	0.019030168	5.23267E-05	0.018977841	0.018977841
571	23340	2663	26003	20677	20677	0.004617571	0.000630525	0.003987046	0.003987046
572	1143	8663	9806	-7520	7520	0.00022613	0.002051158	-0.001825028	0.001825028
573	36587	17593	54180	18994	18994	0.007238349	0.004165535	0.003072813	0.003072813
574	9804	7423	17227	2381	2381	0.001939617	0.001757561	0.000182056	0.000182056
575	10419	24071	34490	-13652	13652	0.002061288	0.005699346	-0.003638058	0.003638058
579	1510	382	1892	1128	1128	0.000298737	9.0447E-05	0.00020829	0.00020829
581	471	5845	6316	-5374	5374	9.31823E-05	0.001383934	-0.001290752	0.001290752
582	7298	22996	30294	-15698	15698	0.001443832	0.005444816	-0.004000984	0.004000984
583	2	2906	2908	-2904	2904	3.95679E-07	0.00068806	-0.000687665	0.000687665
591	824	33886	34710	-33062	33062	0.00016302	0.008023266	-0.007860247	0.007860247
592	65725	4541	70266	61184	61184	0.013002992	0.001075183	0.011927809	0.011927809
593	968	474	1442	494	494	0.000191508	0.00011223	7.92784E-05	7.93E-05
597	939	11930	12869	-10991	10991	0.000185771	0.002824694	-0.002638922	0.002638922
598	4144	32304	36448	-28160	28160	0.000819846	0.007648692	-0.006828846	0.006828846
				0	0	0	0	0	0
				0	0	0	0	0	0

600	0	582	582	-582	582	0	0.000137801	-0.000137801	0.000137801
611	11766	32515	44281	-20749	20749	0.002327778	0.007698651	-0.005370873	0.005370873
612	476	549	1025	-73	73	9.41715E-05	0.000129988	-3.58165E-05	3.58E-05
613	733	1631	2364	-898	898	0.000145016	0.000386176	-0.000241159	0.000241159
621	3968	8384	12352	-4416	4416	0.000785027	0.001985099	-0.001200072	0.001200072
625	21603	7971	29574	13632	13632	0.004273924	0.001887312	0.002386612	0.002386612
629	1525	7421	8946	-5896	5896	0.000301705	0.001757087	-0.001455382	0.001455382
633	2	86	88	-84	84	3.95679E-07	2.03624E-05	-1.99667E-05	2.00E-05
634	45149	878	46027	44271	44271	0.008932249	0.000207886	0.008724363	0.008724363
635	68887	2246	71133	66641	66641	0.01362856	0.000531791	0.013096769	0.013096769
641	37028	27645	64673	9383	9383	0.007325596	0.00654557	0.000780025	0.000780025
642	2178	18954	21132	-16776	16776	0.000430894	0.004487782	-0.004056888	0.004056888
651	8718	21338	30056	-12620	12620	0.001724764	0.005052247	-0.003327484	0.003327484
652	8372	77338	85710	-68966	68966	0.001656311	0.018311496	-0.016655185	0.016655185
653	14459	142852	157311	-128393	128393	0.002860559	0.033823397	-0.030962837	0.030962837
654	6952	48063	55015	-41111	41111	0.001375379	0.011379987	-0.010004608	0.010004608
655	8277	28716	36993	-20439	20439	0.001637516	0.006799153	-0.005161637	0.005161637
656	2030	7482	9512	-5452	5452	0.000401614	0.00177153	-0.001369916	0.001369916
657	3247	47648	50895	-44401	44401	0.000642384	0.011281727	-0.010639342	0.010639342
658	27713	7218	34931	20495	20495	0.005482722	0.001709022	0.0037737	0.0037737
659	5584	22324	27908	-16740	16740	0.001104735	0.005285705	-0.00418097	0.00418097
660	0	0	0	0	0	0	0	0	0
661	34577	1558	36135	33019	33019	0.006840691	0.000368891	0.0064718	0.0064718
662	3180	15827	19007	-12647	12647	0.000629129	0.003747395	-0.003118266	0.003118266
663	3625	11867	15492	-8242	8242	0.000717168	0.002809777	-0.002092609	0.002092609
664	19517	5482	24999	14035	14035	0.003861231	0.001297986	0.002563245	0.002563245
665	38194	14134	52328	24060	24060	0.007556276	0.00334654	0.004209737	0.004209737
666	12353	865	13218	11488	11488	0.00244391	0.000204808	0.002239102	0.002239102
667	33	447	480	-414	414	6.5287E-06	0.000105837	-9.93085E-05	9.93E-05
671	20191	1720	21911	18471	18471	0.003994574	0.000407248	0.003587326	0.003587326
672	28652	467	29119	28185	28185	0.005668493	0.000110573	0.005557921	0.005557921
673	42981	33323	76304	9658	9658	0.008503333	0.007889963	0.00061337	0.00061337
674	12985	15512	28497	-2527	2527	0.002568944	0.003672812	-0.001103868	0.001103868
675	1953	17632	19585	-15679	15679	0.00038638	0.004174769	-0.003788389	0.003788389
676	112992	29396	142388	83596	83596	0.022354265	0.006960159	0.015394106	0.015394106
677	5915	22	5937	5893	5893	0.00117022	5.20899E-06	0.001165011	0.001165011
678	7904	11623	19527	-3719	3719	0.001563722	0.002752004	-0.001188282	0.001188282
679	38024	30098	68122	7926	7926	0.007522644	0.007126373	0.000396271	0.000396271

681	23889	662	24551	23227	23227	0.004726184	0.000156743	0.004569441	0.004569441
682	308957	6138	315095	302819	302819	0.061123854	0.001453308	0.059670546	0.059670546
683	3197	816	4013	2381	2381	0.000632492	0.000193206	0.000439286	0.000439286
684	3190	5375	8565	-2185	2185	0.000631108	0.001272651	-0.000641544	0.000641544
685	5279	255	5534	5024	5024	0.001044394	6.03769E-05	0.000984017	0.000984017
686	3295	172	3467	3123	3123	0.000651881	4.07248E-05	0.000611156	0.000611156
687	1	286	287	-285	285	1.97839E-07	6.77169E-05	-6.7519E-05	6.75E-05
689	787	241	1028	546	546	0.0001557	5.70621E-05	9.86374E-05	9.86E-05
691	45293	13377	58670	31916	31916	0.008960738	0.003167303	0.005793435	0.005793435
692	7246	4043	11289	3203	3203	0.001433544	0.00095727	0.000476274	0.000476274
693	9170	11095	20265	-1925	1925	0.001814187	0.002626989	-0.000812802	0.000812802
694	27701	5719	33420	21982	21982	0.005480348	0.001354101	0.004126247	0.004126247
695	14544	36443	50987	-21899	21899	0.002877376	0.008628693	-0.005751317	0.005751317
696	392	1822	2214	-1430	1430	7.7553E-05	0.000431399	-0.000353846	0.000353846
697	6564	5456	12020	1108	1108	0.001298618	0.00129183	6.78786E-06	6.79E-06
699	59686	28900	88586	30786	30786	0.01180824	0.00684272	0.00496552	0.00496552
				0	0	0	0	0	0
				0	0	0	0	0	0
700	0	9786	9786	-9786	9786	0	0.002317054	-0.002317054	0.002317054
711	1961	3311	5272	-1350	1350	0.000387963	0.000783953	-0.00039599	0.00039599
712	913	4405	5318	-3492	3492	0.000180627	0.001042982	-0.000862355	0.000862355
713	42759	16810	59569	25949	25949	0.008459413	0.003980142	0.004479271	0.004479271
714	3698	1014	4712	2684	2684	0.00073161	0.000240087	0.000491523	0.000491523
716	20385	13990	34375	6395	6395	0.004032955	0.003312444	0.000720511	0.000720511
718	359	3597	3956	-3238	3238	7.10243E-05	0.00085167	-0.000780646	0.000780646
721	7232	20898	28130	-13666	13666	0.001430774	0.004948068	-0.003517293	0.003517293
722	7744	2484	10228	5260	5260	0.001532068	0.000588142	0.000943926	0.000943926
723	8054	14434	22488	-6380	6380	0.001593398	0.003417571	-0.001824173	0.001824173
724	9719	81215	90934	-71496	71496	0.001922801	0.019229462	-0.017306662	0.017306662
725	427	12819	13246	-12392	12392	8.44774E-05	0.003035184	-0.002950707	0.002950707
726	868	15070	15938	-14202	14202	0.000171725	0.003568159	-0.003396434	0.003396434
727	2691	40906	43597	-38215	38215	0.000532386	0.009685408	-0.009153022	0.009153022
728	16860	183710	200570	-166850	166850	0.003335572	0.043497439	-0.040161868	0.040161868
731	15886	96317	112203	-80431	80431	0.003142876	0.022805198	-0.019662322	0.019662322
733	1117	50213	51330	-49096	49096	0.000220987	0.011889048	-0.011668061	0.011668061
735	7992	26193	34185	-18201	18201	0.001581132	0.006201777	-0.004620645	0.004620645
737	3080	45153	48233	-42073	42073	0.000609345	0.01069098	-0.010081634	0.010081634
741	3459	99394	102853	-95935	95935	0.000684326	0.023533746	-0.02284942	0.02284942

742	1805	26028	27833	-24223	24223	0.0003571	0.006162709	-0.005805609	0.005805609
743	8866	49667	58533	-40801	40801	0.001754044	0.01175977	-0.010005726	0.010005726
744	10108	46167	56275	-36059	36059	0.00199976	0.010931067	-0.008931307	0.008931307
745	2974	70119	73093	-67145	67145	0.000588374	0.016602237	-0.016013863	0.016013863
746	28431	18822	47253	9609	9609	0.005624771	0.004456528	0.001168243	0.001168243
747	11287	22995	34282	-11708	11708	0.002233013	0.005444579	-0.003211566	0.003211566
748	8815	13283	22098	-4468	4468	0.001743954	0.003145046	-0.001401093	0.001401093
749	3303	22930	26233	-19627	19627	0.000653463	0.005429189	-0.004775725	0.004775725
751	413	12440	12853	-12027	12027	8.17077E-05	0.002945447	-0.00286374	0.00286374
752	869	58502	59371	-57633	57633	0.000171922	0.013851653	-0.013679731	0.013679731
761	4650	50747	55397	-46097	46097	0.000919953	0.012015484	-0.011095531	0.011095531
762	5870	3856	9726	2014	2014	0.001161317	0.000912994	0.000248323	0.000248323
763	2434	4755	7189	-2321	2321	0.000481541	0.001125852	-0.000644311	0.000644311
764	11804	55535	67339	-43731	43731	0.002335296	0.01314915	-0.010813854	0.010813854
771	4285	3617	7902	668	668	0.000847742	0.000856405	-8.66377E-06	8.66E-06
772	14644	27038	41682	-12394	12394	0.00289716	0.006401849	-0.00350469	0.00350469
773	91485	14403	105888	77082	77082	0.018099334	0.003410231	0.014689102	0.014689102
774	966	15319	16285	-14353	14353	0.000191113	0.003627115	-0.003436002	0.003436002
775	29088	35316	64404	-6228	6228	0.005754751	0.008361851	-0.002607099	-0.002607099
776	3664	10263	13927	-6599	6599	0.000724883	0.002429994	-0.001705111	0.001705111
778	25344	56812	82156	-31468	31468	0.005014041	0.013451508	-0.008437467	0.008437467
781	66808	103867	170675	-37059	37059	0.013217252	0.024592829	-0.011375577	0.011375577
782	4170	32321	36491	-28151	28151	0.00082499	0.007652718	-0.006827727	0.006827727
783	172	26073	26245	-25901	25901	3.40284E-05	0.006173364	-0.006139336	0.006139336
784	13916	53240	67156	-39324	39324	0.002753132	0.012605757	-0.009852625	0.009852625
785	7788	1828	9616	5960	5960	0.001540773	0.00043282	0.001107953	0.001107953
786	21992	25357	47349	-3365	3365	0.004350883	0.006003835	-0.001652952	0.001652952
791	13570	7986	21556	5584	5584	0.00268468	0.001890864	0.000793816	0.000793816
792	3187	292	3479	2895	2895	0.000630514	6.91375E-05	0.000561377	0.000561377
793	20196	4627	24823	15569	15569	0.003995564	0.001095545	0.002900018	0.002900018
				0	0	0	0	0	0
				0	0	0	0	0	0
800	0	1	1	-1	1	0	2.36772E-07	-2.36772E-07	2.37E-07
811	4524	1738	6262	2786	2786	0.000895025	0.00041151	0.000483515	0.000483515
813	10174	3046	13220	7128	7128	0.002012818	0.000721208	0.001291609	0.001291609
821	172382	20267	192649	152115	152115	0.034103944	0.004798664	0.02930528	0.02930528
831	18080	3653	21733	14427	14427	0.003576936	0.000864929	0.002712006	0.002712006
841	199497	15062	214559	184435	184435	0.039468358	0.003566264	0.035902094	0.035902094

842	215439	15854	231293	199585	199585	0.042622313	0.003753788	0.038868525	0.038868525
843	7295	2359	9654	4936	4936	0.001443238	0.000558546	0.000884692	0.000884692
844	22356	5576	27932	16780	16780	0.004422897	0.001320242	0.003102654	0.003102654
845	42056	21963	64019	20093	20093	0.008320332	0.00520023	0.003120102	0.003120102
846	5667	16003	21670	-10336	10336	0.001121156	0.003789067	-0.002667911	0.002667911
848	15072	6643	21715	8429	8429	0.002981835	0.001572878	0.001408956	0.001408956
851	83001	43415	126416	39586	39586	0.016420864	0.010279469	0.006141395	0.006141395
871	1044	2568	3612	-1524	1524	0.000206544	0.000608031	-0.000401487	0.000401487
872	2659	29521	32180	-26862	26862	0.000526055	0.006989755	-0.0064637	0.0064637
873	542	3624	4166	-3082	3082	0.000107229	0.000858063	-0.000750834	0.000750834
874	12322	69760	82082	-57438	57438	0.002437777	0.016517236	-0.014079459	0.014079459
881	283	4111	4394	-3828	3828	5.59885E-05	0.000973371	-0.000917382	0.000917382
882	131	12212	12343	-12081	12081	2.5917E-05	0.002891463	-0.002865546	0.002865546
883	247	299	546	-52	52	4.88663E-05	7.07949E-05	-2.19286E-05	2.19E-05
884	351	2190	2541	-1839	1839	6.94416E-05	0.000518531	-0.00044909	0.00044909
885	434	1954	2388	-1520	1520	8.58623E-05	0.000462653	-0.000376791	0.000376791
891	540	3910	4450	-3370	3370	0.000106833	0.00092578	-0.000818946	0.000818946
892	2120	20766	22886	-18646	18646	0.000419419	0.004916814	-0.004497394	0.004497394
893	9623	42161	51784	-32538	32538	0.001903808	0.009982557	-0.008078749	0.008078749
894	13154	29367	42521	-16213	16213	0.002602379	0.006953292	-0.004350913	0.004350913
895	1637	7573	9210	-5936	5936	0.000323863	0.001793077	-0.001469214	0.001469214
896	2878	7826	10704	-4948	4948	0.000569382	0.00185298	-0.001283598	0.001283598
897	2196	3821	6017	-1625	1625	0.000434455	0.000904707	-0.000470252	0.000470252
898	3663	25521	29184	-21858	21858	0.000724686	0.006042666	-0.00531798	0.00531798
899	10497	26975	37472	-16478	16478	0.00207672	0.006386933	-0.004310213	0.004310213
				0	0	0	0	0	0
				0	0	0	0	0	0
911	410	3781	4191	-3371	3371	8.11141E-05	0.000895236	-0.000814122	0.000814122
931	27909	17443	45352	10466	10466	0.005521499	0.004130019	0.001391479	0.001391479
941	0	661	661	-661	661	0	0.000156506	-0.000156506	0.000156506
961	2124	0	2124	2124	2124	0.000420211	0	0.000420211	0.000420211
971	7983	217	8200	7766	7766	0.001579352	5.13796E-05	0.001527972	0.001527972
972	99	1	100	98	98	1.95861E-05	2.36772E-07	1.93493E-05	1.93E-05
999	0	13101	13101	-13101	13101	0	0.003101954	-0.003101954	0.003101954
			9278073		6349473				1.359874149

ИТ*=32,006

ИТ=31,565

Calculations for 1996

ИТ 96	(1) xi	(2) mi	x+m	(3) xi - mi	(3) xi - mi	(4) xi / X	(5) m i / M	(6) (4) - (5)	(6) (4) - (5)
001	139920	24478	164398	115442	115442	0.011521749	0.00117283	0.010348917	0.010348917
011	8618	8915	17533	-297	297	0.000709651	0.00042715	0.000282501	0.000282501
012	103469	55489	158958	47980	47980	0.008520182	0.00265868	0.005861498	0.005861498
016	55	173	228	-118	118	4.52899E-06	8.2891E-06	-3.7601E-06	3.76E-06
017	15571	2838	18409	12733	12733	0.001282198	0.00013598	0.001146219	0.001146219
022	27091	8933	36024	18158	18158	0.002230815	0.00042801	0.001802802	0.001802802
023	3335	810	4145	2525	2525	0.000274621	3.881E-05	0.000235811	0.000235811
024	7249	15829	23078	-8580	8580	0.000596921	0.00075843	-0.00016151	0.00016151
025	69	2295	2364	-2226	2226	5.68182E-06	0.00010996	-0.00010428	0.00010428
034	63180	29988	93168	33192	33192	0.005202573	0.00143684	0.003765737	0.003765737
035	8611	2773	11384	5838	5838	0.000709075	0.00013286	0.00057621	0.00057621
036	390	11671	12061	-11281	11281	3.21147E-05	0.0005592	-0.00052709	0.00052709
037	33928	12500	46428	21428	21428	0.00279381	0.00059892	0.002194889	0.002194889
041	0	189866	189866	-189866	189866	0	0.00909718	-0.00909718	0.00909718
042	0	9662	9662	-9662	9662	0	0.00046294	-0.00046294	0.00046294
043	61	51958	52019	-51897	51897	5.02306E-06	0.0024895	-0.00248448	0.00248448
044	17	1907	1924	-1890	1890	1.39987E-06	9.1371E-05	-8.9972E-05	9.00E-05
045	161	14387	14548	-14226	14226	1.32576E-05	0.00068933	-0.00067608	0.00067608
046	4	1459	1463	-1455	1455	3.29381E-07	6.9906E-05	-6.9577E-05	6.96E-05
047	17	4728	4745	-4711	4711	1.39987E-06	0.00022654	-0.00022514	0.00022514
048	4902	39208	44110	-34306	34306	0.000403656	0.0018786	-0.00147494	0.00147494
054	85415	59452	144867	25963	25963	0.00703352	0.00284857	0.004184954	0.004184954
056	36891	10482	47373	26409	26409	0.003037799	0.00050223	0.002535567	0.002535567
057	32980	141138	174118	-108158	108158	0.002715747	0.00676245	-0.0040467	0.0040467
058	125770	20081	145851	105689	105689	0.010356563	0.00096216	0.009394408	0.009394408
059	82813	4582	87395	78231	78231	0.006819258	0.00021954	0.006599717	0.006599717
061	43452	17606	61058	25846	25846	0.003578066	0.00084357	0.002734497	0.002734497
062	6171	33391	39562	-27220	27220	0.000508153	0.00159989	-0.00109173	0.00109173
071	1268	24599	25867	-23331	23331	0.000104414	0.00117863	-0.00107422	0.00107422
072	28	11886	11914	-11858	11858	2.30567E-06	0.0005695	-0.0005672	0.0005672
073	11414	54667	66081	-43253	43253	0.000939889	0.0026193	-0.00167941	0.00167941
074	177	2309	2486	-2132	2132	1.45751E-05	0.00011063	-9.6058E-05	9.61E-05
075	2434	6002	8436	-3568	3568	0.000200428	0.00028758	-8.715E-05	8.72E-05

081	37613	141871	179484	-104258	104258	0.003097252	0.00679757	-0.00370031	0.00370031
091	56	17881	17937	-17825	17825	4.61133E-06	0.00085675	-0.00085213	0.00085213
098	1644	125521	127165	-123877	123877	0.000135376	0.00601418	-0.0058788	0.0058788
				0	0	0	0	0	0
				0	0	0	0	0	0
111	1540	43212	44752	-41672	41672	0.000126812	0.00207045	-0.00194364	0.00194364
112	5598	34736	40334	-29138	29138	0.000460969	0.00166433	-0.00120336	0.00120336
121	499	0	499	499	499	4.10903E-05	0	4.10903E-05	4.11E-05
122	650	0	650	650	650	5.35244E-05	0	5.35244E-05	5.35E-05
				0	0	0	0	0	0
				0	0	0	0	0	0
211	6563	37594	44157	-31031	31031	0.000540432	0.00180127	-0.00126084	0.00126084
212	6435	18857	25292	-12422	12422	0.000529892	0.00090351	-0.00037362	0.00037362
222	12577	61619	74196	-49042	49042	0.001035656	0.0029524	-0.00191674	0.00191674
223	254	2004	2258	-1750	1750	2.09157E-05	9.6019E-05	-7.5103E-05	7.51E-05
231	162	2644	2806	-2482	2482	1.33399E-05	0.00012668	-0.00011334	0.00011334
232	38716	30858	69574	7858	7858	0.003188079	0.00147852	0.001709558	0.001709558
244	0	116	116	-116	116	0	5.558E-06	-5.558E-06	5.56E-06
245	12624	17	12641	12607	12607	0.001039527	8.1453E-07	0.001038712	0.001038712
246	2170	1280	3450	890	890	0.000178689	6.133E-05	0.00011736	0.00011736
247	14915	2122	17037	12793	12793	0.00122818	0.00010167	0.001126507	0.001126507
248	143223	15658	158881	127565	127565	0.011793735	0.00075023	0.011043502	0.011043502
251	21700	41912	63612	-20212	20212	0.001786892	0.00200816	-0.00022127	0.00022127
261	0	7	7	-7	7	0	3.354E-07	-3.354E-07	3.35E-07
263	686	4572	5258	-3886	3886	5.64888E-05	0.00021906	-0.00016257	0.00016257
264	42	1	43	41	41	3.4585E-06	4.7914E-08	3.41059E-06	3.41E-06
265	470	1506	1976	-1036	1036	3.87023E-05	7.2158E-05	-3.3456E-05	3.35E-05
266	8248	4202	12450	4046	4046	0.000679184	0.00020133	0.00047785	0.00047785
267	6783	18723	25506	-11940	11940	0.000558548	0.00089709	-0.00033854	0.00033854
268	4433	37176	41609	-32743	32743	0.000365037	0.00178124	-0.0014162	0.0014162
269	2642	20264	22906	-17622	17622	0.000217556	0.00097092	-0.00075337	0.00075337
272	814	73	887	741	741	6.7029E-05	3.4977E-06	6.35313E-05	6.35E-05
273	55794	19169	74963	36625	36625	0.004594371	0.00091846	0.003675913	0.003675913
274	14688	44	14732	14644	14644	0.001209487	2.1082E-06	0.001207379	0.001207379
277	56	956	1012	-900	900	4.61133E-06	4.5806E-05	-4.1194E-05	4.12E-05
278	11271	24426	35697	-13155	13155	0.000928113	0.00117034	-0.00024223	0.00024223
281	1628	5334	6962	-3706	3706	0.000134058	0.00025557	-0.00012151	0.00012151
282	26015	209	26224	25806	25806	0.002142212	1.0014E-05	0.002132198	0.002132198

283	337	52	389	285	285	2.77504E-05	2.4915E-06	2.52588E-05	2.53E-05
284	0	13	13	-13	13	0	6.2288E-07	-6.2288E-07	6.23E-07
285	20	16805	16825	-16785	16785	1.64691E-06	0.00080519	-0.00080354	0.00080354
286	0	0	0	0	0	0	0	0	0
287	6757	5971	12728	786	786	0.000556407	0.00028609	0.000270314	0.000270314
288	12557	304	12861	12253	12253	0.001034009	1.4566E-05	0.001019444	0.001019444
289	4779	31	4810	4748	4748	0.000393528	1.4853E-06	0.000392043	0.000392043
291	26937	43546	70483	-16609	16609	0.002218134	0.00208645	0.000131684	0.000131684
292	37097	62847	99944	-25750	25750	0.003054762	0.00301123	4.3529E-05	4.35E-05
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321	595720	253	595973	595467	595467	0.049054718	1.2122E-05	0.049042595	0.049042595
322	6780	308	7088	6472	6472	0.000558301	1.4757E-05	0.000543543	0.000543543
325	136066	0	136066	136066	136066	0.01120439	0	0.01120439	0.01120439
333	0	252178	252178	-252178	252178	0	0.01208278	-0.01208278	0.01208278
334	56509	264770	321279	-208261	208261	0.004653248	0.01268611	-0.00803287	0.00803287
3341	0	162834	162834	-162834	162834	0	0.00780198	-0.00780198	0.00780198
3342	0	1401	1401	-1401	1401	0	6.7127E-05	-6.7127E-05	6.71E-05
3343	0	50089	50089	-50089	50089	0	0.00239995	-0.00239995	0.00239995
3344	0	9701	9701	-9701	9701	0	0.00046481	-0.00046481	0.00046481
3345	0	40745	40745	-40745	40745	0	0.00195224	-0.00195224	0.00195224
335	12776	10121	22897	2655	2655	0.001052043	0.00048493	0.000567108	0.000567108
342	38	12145	12183	-12107	12107	3.12912E-06	0.00058191	-0.00057878	0.00057878
343	22	0	22	22	22	1.8116E-06	0	1.8116E-06	1.81E-06
344	3	4284	4287	-4281	4281	2.47036E-07	0.00020526	-0.00020502	0.00020502
345	0	0	0	0	0	0	0	0	0
351	52652	0	52652	52652	52652	0.004335643	0	0.004335643	0.004335643
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411	254	1982	2236	-1728	1728	2.09157E-05	9.4965E-05	-7.4049E-05	7.40E-05
421	441	36069	36510	-35628	35628	3.63143E-05	0.0017282	-0.00169189	0.00169189
422	531	15060	15591	-14529	14529	4.37253E-05	0.00072158	-0.00067786	0.00067786
431	10492	35533	46025	-25041	25041	0.000863966	0.00170252	-0.00083855	0.00083855
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511	11113	47779	58892	-36666	36666	0.000915103	0.00228927	-0.00137417	0.00137417
512	41512	35438	76950	6074	6074	0.003418316	0.00169797	0.00172035	0.00172035

513	15063	25198	40261	-10135	10135	0.001240367	0.00120733	3.30369E-05	3.30E-05
514	33668	50007	83675	-16339	16339	0.0027724	0.00239602	0.000376379	0.000376379
515	51572	31864	83436	19708	19708	0.00424671	0.00152672	0.002719987	0.002719987
516	21624	42857	64481	-21233	21233	0.001780634	0.00205344	-0.0002728	0.0002728
522	61512	25174	86686	36338	36338	0.005065222	0.00120618	0.003859042	0.003859042
523	47006	28440	75446	18566	18566	0.003870721	0.00136267	0.002508055	0.002508055
524	8819	4062	12881	4757	4757	0.000726203	0.00019463	0.000531577	0.000531577
525	296	1455	1751	-1159	1159	2.43742E-05	6.9714E-05	-4.534E-05	4.53E-05
531	5281	27284	32565	-22003	22003	0.000434865	0.00130728	-0.00087241	0.00087241
532	58	7464	7522	-7406	7406	4.77603E-06	0.00035763	-0.00035285	0.00035285
533	11895	262880	274775	-250985	250985	0.000979497	0.01259556	-0.01161606	0.01161606
541	14383	110598	124981	-96215	96215	0.001184372	0.00529916	-0.00411479	0.00411479
542	3707	411727	415434	-408020	408020	0.000305254	0.01972737	-0.01942212	0.01942212
551	3822	50984	54806	-47162	47162	0.000314724	0.00244283	-0.00212811	0.00212811
553	11216	187155	198371	-175939	175939	0.000923584	0.00896729	-0.00804371	0.00804371
554	9174	81586	90760	-72412	72412	0.000755435	0.00390909	-0.00315365	0.00315365
562	168582	25653	194235	142929	142929	0.013881928	0.00122913	0.012652798	0.012652798
571	11817	51771	63588	-39954	39954	0.000973074	0.00248054	-0.00150747	0.00150747
572	1598	44860	46458	-43262	43262	0.000131588	0.00214941	-0.00201782	0.00201782
573	33998	48512	82510	-14514	14514	0.002799574	0.00232439	0.000475184	0.000475184
574	12446	76216	88662	-63770	63770	0.001024869	0.00365179	-0.00262692	0.00262692
575	21712	177879	199591	-156167	156167	0.00178788	0.00852284	-0.00673496	0.00673496
579	1246	1379	2625	-133	133	0.000102602	6.6073E-05	3.65292E-05	3.65E-05
581	4197	76285	80482	-72088	72088	0.000345603	0.0036551	-0.00330949	0.00330949
582	12280	277200	289480	-264920	264920	0.0010112	0.01328168	-0.01227048	0.01227048
583	2250	56601	58851	-54351	54351	0.000185277	0.00271196	-0.00252669	0.00252669
591	2216	110478	112694	-108262	108262	0.000182477	0.00529341	-0.00511093	0.00511093
592	17389	52185	69574	-34796	34796	0.001431902	0.00250038	-0.00106848	0.00106848
593	3208	1054	4262	2154	2154	0.000264164	5.0501E-05	0.000213663	0.000213663
597	345	52686	53031	-52341	52341	2.84091E-05	0.00252438	-0.00249597	0.00249597
598	9135	170796	179931	-161661	161661	0.000752224	0.00818347	-0.00743125	0.00743125
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600	0	10906	10906	-10906	10906	0	0.00052255	-0.00052255	0.00052255
611	37220	119918	157138	-82698	82698	0.003064891	0.00574572	-0.00268083	0.00268083
612	8837	1606	10443	7231	7231	0.000727685	7.6949E-05	0.000650736	0.000650736
613	23492	9359	32851	14133	14133	0.001934455	0.00044842	0.00148603	0.00148603
621	16154	40014	56168	-23860	23860	0.001330205	0.00191722	-0.00058701	0.00058701

625	99883	47535	147418	52348	52348	0.008224891	0.00227758	0.005947313	0.005947313
629	13326	50041	63367	-36715	36715	0.001097333	0.00239765	-0.00130032	0.00130032
633	2	4321	4323	-4319	4319	1.64691E-07	0.00020704	-0.00020687	0.00020687
634	92607	44145	136752	48462	48462	0.007625747	0.00211515	0.005510597	0.005510597
635	359650	29003	388653	330647	330647	0.029615472	0.00138964	0.028225831	0.028225831
641	108837	502215	611052	-393378	393378	0.008962211	0.02406299	-0.01510077	0.01510077
642	84857	195792	280649	-110935	110935	0.006987572	0.00938112	-0.00239355	0.00239355
651	41599	98675	140274	-57076	57076	0.00342548	0.00472789	-0.00130241	0.00130241
652	10286	284367	294653	-274081	274081	0.000847003	0.01362508	-0.01277808	0.01277808
653	16480	453106	469586	-436626	436626	0.00135705	0.02170999	-0.02035294	0.02035294
654	17250	171704	188954	-154454	154454	0.001420456	0.00822698	-0.00680652	0.00680652
655	6720	148262	154982	-141542	141542	0.00055336	0.00710378	-0.00655042	0.00655042
656	4577	34607	39184	-30030	30030	0.000376894	0.00165815	-0.00128126	0.00128126
657	12754	227025	239779	-214271	214271	0.001050231	0.01087761	-0.00982738	0.00982738
658	150922	29345	180267	121577	121577	0.012427711	0.00140603	0.011021683	0.011021683
659	7643	81881	89524	-74238	74238	0.000629365	0.00392322	-0.00329386	0.00329386
660	0	0	0	0	0	0	0	0	0
661	157369	46616	203985	110753	110753	0.012958591	0.00223355	0.010725045	0.010725045
662	16140	167208	183348	-151068	151068	0.001329052	0.00801156	-0.0066825	0.0066825
663	47836	80799	128635	-32963	32963	0.003939068	0.00387138	6.76878E-05	6.77E-05
664	31379	70799	102178	-39420	39420	0.002583912	0.00339224	-0.00080833	0.00080833
665	72503	55820	128323	16683	16683	0.005970278	0.00267454	0.003295735	0.003295735
666	62059	5191	67250	56868	56868	0.005110264	0.00024872	0.004861544	0.004861544
667	171	1928	2099	-1757	1757	1.4081E-05	9.2378E-05	-7.8297E-05	7.83E-05
671	28298	5921	34219	22377	22377	0.002330206	0.0002837	0.002046509	0.002046509
672	17812	4386	22198	13426	13426	0.001466734	0.00021015	0.001256584	0.001256584
673	78743	57908	136651	20835	20835	0.006484113	0.00277459	0.003709525	0.003709525
674	5838	91213	97051	-85375	85375	0.000480732	0.00437035	-0.00388962	0.00388962
675	11729	83994	95723	-72265	72265	0.000965828	0.00402446	-0.00305864	0.00305864
676	177571	67320	244891	110251	110251	0.01462213	0.00322555	0.011396579	0.011396579
677	28070	8766	36836	19304	19304	0.002311431	0.00042001	0.00189142	0.00189142
678	9709	19555	29264	-9846	9846	0.00079949	0.00093695	-0.00013746	0.00013746
679	78650	123623	202273	-44973	44973	0.006476455	0.00592324	0.000553218	0.000553218
681	76900	1285	78185	75615	75615	0.00633235	6.1569E-05	0.006270781	0.006270781
682	443497	34373	477870	409124	409124	0.036519875	0.00164694	0.034872937	0.034872937
683	49	5046	5095	-4997	4997	4.03492E-06	0.00024177	-0.00023774	0.00023774
684	50237	141995	192232	-91758	91758	0.004136779	0.00680351	-0.00266673	0.00266673
685	12911	4109	17020	8802	8802	0.00106316	0.00019688	0.000866282	0.000866282

686	41137	2764	43901	38373	38373	0.003387437	0.00013243	0.003255003	0.003255003
687	100	284	384	-184	184	8.23453E-06	1.3607E-05	-5.373E-06	5.37E-06
689	1019	1220	2239	-201	201	8.39098E-05	5.8455E-05	2.54551E-05	2.55E-05
691	240439	118991	359430	121448	121448	0.019799012	0.0057013	0.014097711	0.014097711
692	39358	58527	97885	-19169	19169	0.003240945	0.00280425	0.000436699	0.000436699
693	26174	23821	49995	2353	2353	0.002155305	0.00114135	0.001013952	0.001013952
694	42197	33173	75370	9024	9024	0.003474723	0.00158944	0.001885281	0.001885281
695	24569	70171	94740	-45602	45602	0.002023141	0.00336215	-0.00133901	0.00133901
696	1699	12191	13890	-10492	10492	0.000139905	0.00058412	-0.00044421	0.00044421
69680	0	1495	1495	-1495	1495	0	7.1631E-05	-7.1631E-05	7.16E-05
697	29997	87380	117377	-57383	57383	0.002470111	0.0041867	-0.00171659	0.00171659
699	262421	268246	530667	-5825	5825	0.021609125	0.01285266	0.008756463	0.008756463
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700	0	56584	56584	-56584	56584	0	0.00271115	-0.00271115	0.00271115
711	15468	38700	54168	-23232	23232	0.001273716	0.00185426	-0.00058054	0.00058054
712	11791	15935	27726	-4144	4144	0.000970933	0.00076351	0.000207428	0.000207428
713	69898	206281	276179	-136383	136383	0.005755769	0.00988369	-0.00412792	0.00412792
714	34335	7318	41653	27017	27017	0.002827324	0.00035063	0.002476692	0.002476692
716	41111	49451	90562	-8340	8340	0.003385296	0.00236938	0.001015915	0.001015915
718	2558	13389	15947	-10831	10831	0.000210639	0.00064152	-0.00043088	0.00043088
721	31850	161651	193501	-129801	129801	0.002622696	0.0077453	-0.0051226	0.0051226
72199	0	3007	3007	-3007	3007	0	0.00014408	-0.00014408	0.00014408
722	32893	19730	52623	13163	13163	0.002708583	0.00094534	0.001763245	0.001763245
723	39536	89606	129142	-50070	50070	0.003255602	0.00429336	-0.00103775	0.00103775
724	12104	130652	142756	-118548	118548	0.000996707	0.00626002	-0.00526332	0.00526332
725	5800	70139	75939	-64339	64339	0.000477603	0.00336062	-0.00288302	0.00288302
726	3386	88666	92052	-85280	85280	0.000278821	0.00424832	-0.0039695	0.0039695
727	9298	128959	138257	-119661	119661	0.000765646	0.0061789	-0.00541326	0.00541326
728	62563	474345	536908	-411782	411782	0.005151766	0.02272763	-0.01757586	0.01757586
731	12413	52133	64546	-39720	39720	0.001022152	0.00249789	-0.00147573	0.00147573
733	3361	53749	57110	-50388	50388	0.000276762	0.00257531	-0.00229855	0.00229855
735	18612	26450	45062	-7838	7838	0.00153261	0.00126732	0.000265292	0.000265292
737	10020	66343	76363	-56323	56323	0.000825099	0.00317874	-0.00235364	0.00235364
741	26752	362502	389254	-335750	335750	0.0022029	0.01736882	-0.01516592	0.01516592
742	12809	82300	95109	-69491	69491	0.00105476	0.0039433	-0.00288854	0.00288854
743	24903	231089	255992	-206186	206186	0.002050644	0.01107233	-0.00902169	0.00902169
744	42601	162581	205182	-119980	119980	0.00350799	0.00778986	-0.00428187	0.00428187

745	17218	254787	272005	-237569	237569	0.001417821	0.01220779	-0.01078997	0.01078997
746	50653	28540	79193	22113	22113	0.004171034	0.00136746	0.002803577	0.002803577
747	34941	207909	242850	-172968	172968	0.002877226	0.00996169	-0.00708447	0.00708447
748	32152	48891	81043	-16739	16739	0.002647565	0.00234255	0.000305015	0.000305015
749	24467	84157	108624	-59690	59690	0.002014741	0.00403227	-0.00201753	0.00201753
751	673	39801	40474	-39128	39128	5.54184E-05	0.00190701	-0.0018516	0.0018516
752	26499	211163	237662	-184664	184664	0.002182067	0.0101176	-0.00793554	0.00793554
759	7676	107384	115060	-99708	99708	0.000632082	0.00514517	-0.00451308	0.00451308
761	75297	45787	121084	29510	29510	0.006200351	0.00219383	0.004006526	0.004006526
762	2141	12426	14567	-10285	10285	0.000176301	0.00059538	-0.00041907	0.00041907
763	10142	15539	25681	-5397	5397	0.000835146	0.00074453	9.06144E-05	9.06E-05
764	79644	509141	588785	-429497	429497	0.006558306	0.02439484	-0.01783653	0.01783653
771	52085	111543	163628	-59458	59458	0.004288953	0.00534444	-0.00105549	0.00105549
772	91589	315918	407507	-224329	224329	0.00754192	0.0151368	-0.00759488	0.00759488
773	218229	126829	345058	91400	91400	0.017970123	0.00607685	0.011893275	0.011893275
774	1337	49979	51316	-48642	48642	0.000110096	0.00239468	-0.00228458	0.00228458
775	69655	268268	337923	-198613	198613	0.005735759	0.01285372	-0.00711796	0.00711796
776	125836	142177	268013	-16341	16341	0.010361998	0.00681223	0.00354977	0.00354977
778	154501	222486	376987	-67985	67985	0.012722425	0.01066013	0.002062295	0.002062295
781	606751	1128863	1735614	-522112	522112	0.049963068	0.05408802	-0.00412495	0.00412495
7812	0	1128572	1128572	-1128572	1128572	0	0.05407407	-0.05407407	0.05407407
782	150521	223992	374513	-73471	73471	0.012394691	0.01073229	0.001662402	0.001662402
783	3790	81492	85282	-77702	77702	0.000312089	0.00390458	-0.0035925	0.0035925
784	128581	888687	1017268	-760106	760106	0.010588036	0.04258029	-0.03199226	0.03199226
785	29980	46762	76742	-16782	16782	0.002468711	0.00224054	0.00022817	0.00022817
786	93146	89601	182747	3545	3545	0.007670131	0.00429312	0.003377015	0.003377015
790	0	84392	84392	-84392	84392	0	0.00404353	-0.00404353	0.00404353
791	10926	65557	76483	-54631	54631	0.000899704	0.00314108	-0.00224137	0.00224137
792	3487	15768	19255	-12281	12281	0.000287138	0.0007555	-0.00046837	0.00046837
793	143929	3067	146996	140862	140862	0.011851871	0.00014695	0.011704919	0.011704919
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800	0	10097	10097	-10097	10097	0	0.00048378	-0.00048378	0.00048378
811	35640	12537	48177	23103	23103	0.002934785	0.00060069	0.002334091	0.002334091
812	6698	98314	105012	-91616	91616	0.000551549	0.00471059	-0.00415904	0.00415904
813	51814	63697	115511	-11883	11883	0.004266637	0.00305196	0.001214678	0.001214678
821	965986	144545	1110531	821441	821441	0.079544367	0.00692569	0.07261868	0.07261868

831	18394	14363	32757	4031	4031	0.001514659	0.00068818	0.000826474	0.000826474
841	455998	70297	526295	385701	385701	0.037549273	0.00336819	0.034181083	0.034181083
842	749680	51472	801152	698208	698208	0.061732594	0.00246621	0.059266379	0.059266379
843	18049	4703	22752	13346	13346	0.00148625	0.00022534	0.001260911	0.001260911
844	111565	36800	148365	74765	74765	0.009186849	0.00176322	0.007423624	0.007423624
845	258007	74638	332645	183369	183369	0.021245653	0.00357618	0.01766947	0.01766947
846	17263	78877	96140	-61614	61614	0.001421526	0.00377929	-0.00235776	0.00235776
848	22878	20418	43296	2460	2460	0.001883895	0.0009783	0.000905593	0.000905593
851	141212	110676	251888	30536	30536	0.011628139	0.0053029	0.006325241	0.006325241
871	724	7139	7863	-6415	6415	5.9618E-05	0.00034206	-0.00028244	0.00028244
872	12189	86392	98581	-74203	74203	0.001003706	0.00413936	-0.00313566	0.00313566
873	5495	16353	21848	-10858	10858	0.000452487	0.00078353	-0.00033105	0.00033105
874	31538	220342	251880	-188804	188804	0.002597005	0.0105574	-0.0079604	0.0079604
881	529	17581	18110	-17052	17052	4.35606E-05	0.00084237	-0.00079881	0.00079881
882	1351	55232	56583	-53881	53881	0.000111248	0.00264637	-0.00253512	0.00253512
883	368	420	788	-52	52	3.03031E-05	2.0124E-05	1.01793E-05	1.02E-05
884	1543	19912	21455	-18369	18369	0.000127059	0.00095406	-0.000827	0.000827
885	4946	13302	18248	-8356	8356	0.00040728	0.00063735	-0.00023007	0.00023007
891	1047	1897	2944	-850	850	8.62155E-05	9.0892E-05	-4.6768E-06	4.68E-06
892	18651	183304	201955	-164653	164653	0.001535821	0.00878278	-0.00724695	0.00724695
893	99058	334164	433222	-235106	235106	0.008156957	0.01601104	-0.00785408	0.00785408
894	52012	56908	108920	-4896	4896	0.004282942	0.00272667	0.001556268	0.001556268
895	7257	37076	44333	-29819	29819	0.00059758	0.00177645	-0.00117887	0.00117887
896	5236	3461	8697	1775	1775	0.00043116	0.00016583	0.00026533	0.00026533
897	9615	18372	27987	-8757	8757	0.00079175	0.00088027	-8.8521E-05	8.85E-05
898	12312	80547	92859	-68235	68235	0.001013835	0.00385931	-0.00284547	0.00284547
899	44502	99463	143965	-54961	54961	0.003664529	0.00476564	-0.00110111	0.00110111
				0	0	0	0	0	0
				0	0	0	0	0	0
911	1059	5716	6775	-4657	4657	8.72036E-05	0.00027387	-0.00018667	0.00018667
931	74640	41297	115937	33343	33343	0.00614625	0.00197869	0.004167558	0.004167558
941	0	14782	14782	-14782	14782	0	0.00070826	-0.00070826	0.00070826
961	83	0	83	83	83	6.83466E-06	0	6.83466E-06	6.83E-06
971	6120	821	6941	5299	5299	0.000503953	3.9337E-05	0.000464616	0.000464616
972	68	62	130	6	6	5.59948E-06	2.9707E-06	2.62883E-06	2.63E-06
998	0	0	0	0	0	0	0	0	0
999	0	717	717	-717	717	0	3.4354E-05	-3.4354E-05	3.44E-05
	12143990	20870852	33014842		20768544				1.178193252

ИТ*=41,09

ИТ=37,093

Calculations for 1998

IIT 98	(1) xi	(2) mi	x+m	(3) xi - mi	(3) xi - mi	(4) xi / X	(5) m i / M	(6) (4) - (5)	(6) (4) - (5)
001	142588	29697	172285	112891	112891	0.008880366	0.001077624	0.007802742	0.007802742
011	14134	112	14246	14022	14022	0.000880264	4.06418E-06	0.0008762	0.0008762
012	105828	73607	179435	32221	32221	0.006590957	0.002670999	0.003919958	0.003919958
016	55	263	318	-208	208	3.42539E-06	9.54356E-06	-6.11817E-06	6.12E-06
017	22633	2988	25621	19645	19645	0.001409581	0.000108426	0.001301155	0.001301155
022	27501	40413	67914	-12912	12912	0.00171276	0.001466479	0.000246281	0.000246281
023	1771	1924	3695	-153	153	0.000110298	6.98168E-05	4.04809E-05	4.05E-05
024	181	16596	16777	-16415	16415	1.12727E-05	0.000602224	-0.000590951	0.000590951
025	52	4722	4774	-4670	4670	3.23855E-06	0.000171349	-0.00016811	0.00016811
034	81138	41058	122196	40080	40080	0.005053266	0.001489884	0.003563382	0.003563382
035	17455	8178	25633	9277	9277	0.001087096	0.000296758	0.000790338	0.000790338
036	140	10493	10633	-10353	10353	8.71919E-06	0.000380763	-0.000372043	0.000372043
037	40233	14226	54459	26007	26007	0.002505707	0.000516223	0.001989484	0.001989484
041	7	5678	5685	-5671	5671	4.35959E-07	0.000206039	-0.000205603	0.000205603
042	0	2992	2992	-2992	2992	0	0.000108572	-0.000108572	0.000108572
043	7	19808	19815	-19801	19801	4.35959E-07	0.000718779	-0.000718343	0.000718343
044	39	2117	2156	-2078	2078	2.42892E-06	7.68202E-05	-7.43913E-05	7.44E-05
045	814	2554	3368	-1740	1740	5.06958E-05	9.26778E-05	-4.19819E-05	4.20E-05
046	0	1514	1514	-1514	1514	0	5.4939E-05	-5.4939E-05	5.49E-05
047	4	3553	3557	-3549	3549	2.4912E-07	0.000128929	-0.00012868	0.00012868
048	4078	57664	61742	-53586	53586	0.000253977	0.002092471	-0.001838493	0.001838493
054	100006	84801	184807	15205	15205	0.006228364	0.003077199	0.003151164	0.003151164
056	29067	23336	52403	5731	5731	0.00181029	0.0008468	0.000963489	0.000963489
057	53061	184050	237111	-130989	130989	0.003304634	0.006678678	-0.003374044	0.003374044
058	198140	30810	228950	167330	167330	0.012340139	0.001118012	0.011222127	0.011222127
059	91300	8177	99477	83123	83123	0.005686155	0.000296721	0.005389434	0.005389434
061	30645	6967	37612	23678	23678	0.001908568	0.000252814	0.001655754	0.001655754
062	8555	32290	40845	-23735	23735	0.000532805	0.001171717	-0.000638912	0.000638912
071	1799	41754	43553	-39955	39955	0.000112042	0.00151514	-0.001403098	0.001403098
072	620	26133	26753	-25513	25513	3.86135E-05	0.000948296	-0.000909682	0.000909682
073	15028	38194	53222	-23166	23166	0.000935942	0.001385957	-0.000450015	0.000450015
074	130	2848	2978	-2718	2718	8.09639E-06	0.000103346	-9.52498E-05	9.52E-05
075	1878	9730	11608	-7852	7852	0.000116962	0.000353075	-0.000236114	0.000236114
081	40705	284179	324884	-243474	243474	0.002535103	0.010312089	-0.007776985	0.007776985

091	21	13081	13102	-13060	13060	1.30788E-06	0.000474674	-0.000473366	0.000473366
098	1596	149304	150900	-147708	147708	9.93987E-05	0.005417839	-0.00531844	0.00531844
				0	0	0	0	0	0
				0	0	0	0	0	0
111	4749	9769	14518	-5020	5020	0.000295767	0.000354491	-5.87234E-05	5.87E-05
112	7418	50369	57787	-42951	42951	0.000461992	0.001827755	-0.001365763	0.001365763
121	787	32782	33569	-31995	31995	4.90143E-05	0.00118957	-0.001140556	0.001140556
122	224	6675	6899	-6451	6451	1.39507E-05	0.000242218	-0.000228267	0.000228267
				0	0	0	0	0	0
				0	0	0	0	0	0
211	14182	23909	38091	-9727	9727	0.000883254	0.000867593	1.56605E-05	1.57E-05
212	8009	17123	25132	-9114	9114	0.0004988	0.000621347	-0.000122548	0.000122548
222	12365	15627	27992	-3262	3262	0.000770091	0.000567062	0.000203029	0.000203029
223	1234	5155	6389	-3921	3921	7.68534E-05	0.000187061	-0.000110208	0.000110208
231	3225	2417	5642	808	808	0.000200853	8.77064E-05	0.000113146	0.000113146
232	29526	29168	58694	358	358	0.001838876	0.001058428	0.000780448	0.000780448
244	0	158	158	-158	158	0	5.73339E-06	-5.73339E-06	5.73E-06
245	14008	119	14127	13889	13889	0.000872417	4.31819E-06	0.000868099	0.000868099
246	3442	359	3801	3083	3083	0.000214367	1.30271E-05	0.00020134	0.00020134
247	13924	1751	15675	12173	12173	0.000867185	6.35391E-05	0.000803646	0.000803646
248	179720	23740	203460	155980	155980	0.011192943	0.00086146	0.010331483	0.010331483
251	17151	26179	43330	-9028	9028	0.001068163	0.000949965	0.000118197	0.000118197
261	0	0	0	0	0	0	0	0	0
263	244	5409	5653	-5165	5165	1.51963E-05	0.000196278	-0.000181082	0.000181082
264	0	0	0	0	0	0	0	0	0
265	537	4970	5507	-4433	4433	3.34443E-05	0.000180348	-0.000146904	0.000146904
266	18515	4921	23436	13594	13594	0.001153112	0.00017857	0.000974543	0.000974543
267	1220	3433	4653	-2213	2213	7.59815E-05	0.000124574	-4.85928E-05	4.86E-05
268	1846	52235	54081	-50389	50389	0.000114969	0.001895467	-0.001780498	0.001780498
269	5945	28002	33947	-22057	22057	0.000370254	0.001016117	-0.000645863	0.000645863
272	492	194	686	298	298	3.06417E-05	7.03974E-06	2.3602E-05	2.36E-05
273	28695	32622	61317	-3927	3927	0.001787122	0.001183764	0.000603357	0.000603357
274	11415	240	11655	11175	11175	0.000710925	8.70895E-06	0.000702216	0.000702216
277	25	996	1021	-971	971	1.557E-06	3.61422E-05	-3.45852E-05	3.46E-05
278	8845	31254	40099	-22409	22409	0.000550866	0.001134123	-0.000583258	0.000583258
281	0	7431	7431	-7431	7431	0	0.000269651	-0.000269651	0.000269651
282	49083	194	49277	48889	48889	0.003056884	7.03974E-06	0.003049845	0.003049845
283	3	703	706	-700	700	1.8684E-07	2.551E-05	-2.53231E-05	2.53E-05

284	0	74	74	-74	74	0	2.68526E-06	-2.68526E-06	2.69E-06
285	94	21477	21571	-21383	21383	5.85431E-06	0.000779342	-0.000773488	0.000773488
286	0	1	1	-1	1	0	3.62873E-08	-3.62873E-08	3.63E-08
287	6945	4839	11784	2106	2106	0.000432534	0.000175594	0.00025694	0.00025694
288	30843	2605	33448	28238	28238	0.001920899	9.45284E-05	0.001826371	0.001826371
289	6395	11	6406	6384	6384	0.00039828	3.9916E-07	0.000397881	0.000397881
291	32448	30753	63201	1695	1695	0.002020858	0.001115943	0.000904915	0.000904915
292	48919	96494	145413	-47575	47575	0.00304667	0.003501507	-0.000454836	0.000454836
				0	0	0	0	0	0
				0	0	0	0	0	0
321	570809	2433	573242	568376	568376	0.035549927	8.8287E-05	0.03546164	0.03546164
322	4188	912	5100	3276	3276	0.000260828	3.3094E-05	0.000227734	0.000227734
325	219538	169	219707	219369	219369	0.013672804	6.13255E-06	0.013666672	0.013666672
333	3136	119147	122283	-116011	116011	0.00019531	0.004323523	-0.004128213	0.004128213
334	55206	358516	413722	-303310	303310	0.003438224	0.013009578	-0.009571353	0.009571353
335	10912	15252	26164	-4340	4340	0.000679598	0.000553454	0.000126144	0.000126144
342	0	16959	16959	-16959	16959	0	0.000615396	-0.000615396	0.000615396
343	0	10	10	-10	10	0	3.62873E-07	-3.62873E-07	3.63E-07
344	21	6992	7013	-6971	6971	1.30788E-06	0.000253721	-0.000252413	0.000252413
345	0	0	0	0	0	0	0	0	0
351	67759	0	67759	67759	67759	0.004220024	0	0.004220024	0.004220024
				0	0	0	0	0	0
				0	0	0	0	0	0
411	404	3384	3788	-2980	2980	2.51611E-05	0.000122796	-9.76351E-05	9.76E-05
421	77	65205	65282	-65128	65128	4.79555E-06	0.002366113	-0.002361318	0.002361318
422	686	21168	21854	-20482	20482	4.2724E-05	0.00076813	-0.000725406	0.000725406
431	12263	50387	62650	-38124	38124	0.000763738	0.001828408	-0.00106467	0.00106467
				0	0	0	0	0	0
				0	0	0	0	0	0
511	10642	29616	40258	-18974	18974	0.000662783	0.001074685	-0.000411902	0.000411902
512	35789	45449	81238	-9660	9660	0.002228935	0.001649221	0.000579714	0.000579714
513	10923	27521	38444	-16598	16598	0.000680283	0.000998663	-0.000318379	0.000318379
514	41838	61748	103586	-19910	19910	0.002605666	0.002240668	0.000364998	0.000364998
515	54467	40708	95175	13759	13759	0.003392199	0.001477183	0.001915016	0.001915016
516	21998	54652	76650	-32654	32654	0.001370033	0.001983174	-0.00061314	0.00061314
522	84228	29896	114124	54332	54332	0.005245711	0.001084845	0.004160866	0.004160866
523	58528	39083	97611	19445	19445	0.003645118	0.001418217	0.002226901	0.002226901
524	8055	3158	11213	4897	4897	0.000501665	0.000114595	0.000387069	0.000387069

525	324	2659	2983	-2335	2335	2.01787E-05	9.64879E-05	-7.63092E-05	7.63E-05
531	4150	39071	43221	-34921	34921	0.000258462	0.001417781	-0.00115932	0.00115932
532	518	9808	10326	-9290	9290	3.2261E-05	0.000355906	-0.000323645	0.000323645
533	20987	395571	416558	-374584	374584	0.001307068	0.014354203	-0.013047135	0.013047135
541	18298	142208	160506	-123910	123910	0.001139598	0.005160344	-0.004020747	0.004020747
542	3749	687804	691553	-684055	684055	0.000233487	0.02495855	-0.024725063	0.024725063
551	2942	92173	95115	-89231	89231	0.000183227	0.003344709	-0.003161482	0.003161482
553	14307	222478	236785	-208171	208171	0.000891039	0.008073126	-0.007182087	0.007182087
554	18885	103443	122328	-84558	84558	0.001176156	0.003753667	-0.002577511	0.002577511
562	184009	22149	206158	161860	161860	0.011460062	0.000803727	0.010656335	0.010656335
571	18758	80305	99063	-61547	61547	0.001168246	0.002914052	-0.001745805	0.001745805
572	2402	65657	68059	-63255	63255	0.000149596	0.002382515	-0.002232919	0.002232919
573	44364	53912	98276	-9548	9548	0.002762985	0.001956321	0.000806665	0.000806665
574	14039	98367	112406	-84328	84328	0.000874348	0.003569473	-0.002695125	0.002695125
575	37464	258938	296402	-221474	221474	0.002333254	0.009396161	-0.007062907	0.007062907
579	1253	1624	2877	-371	371	7.80367E-05	5.89306E-05	1.91061E-05	1.91E-05
581	10764	115254	126018	-104490	104490	0.000670381	0.004182256	-0.003511876	0.003511876
582	15190	390568	405758	-375378	375378	0.000946032	0.014172658	-0.013226626	0.013226626
583	2649	101413	104062	-98764	98764	0.000164979	0.003680004	-0.003515024	0.003515024
591	3031	146827	149858	-143796	143796	0.00018877	0.005327955	-0.005139185	0.005139185
592	10675	83384	94059	-72709	72709	0.000664838	0.00302578	-0.002360942	0.002360942
593	4486	1109	5595	3377	3377	0.000279388	4.02426E-05	0.000239145	0.000239145
597	423	69569	69992	-69146	69146	2.63444E-05	0.002524471	-0.002498127	0.002498127
598	15689	258414	274103	-242725	242725	0.000977109	0.009377146	-0.008400037	0.008400037
			0		0	0	0	0	0
			0		0	0	0	0	0
600	0	2147	2147	-2147	2147	0	7.79088E-05	-7.79088E-05	7.79E-05
611	46643	180119	226762	-133476	133476	0.002904921	0.006536032	-0.003631111	0.003631111
612	8514	5704	14218	2810	2810	0.000530251	0.000206983	0.000323268	0.000323268
613	23310	9241	32551	14069	14069	0.001451744	0.000335331	0.001116414	0.001116414
621	28842	58905	87747	-30063	30063	0.001796277	0.002137503	-0.000341227	0.000341227
625	146763	73204	219967	73559	73559	0.009140385	0.002656375	0.006484009	0.006484009
629	25258	76562	101820	-51304	51304	0.001573066	0.002778228	-0.001205163	0.001205163
633	6	3886	3892	-3880	3880	3.73679E-07	0.000141012	-0.000140639	0.000140639
634	159194	117676	276870	41518	41518	0.009914586	0.004270144	0.005644442	0.005644442
635	469257	53656	522913	415601	415601	0.029225279	0.001947031	0.027278247	0.027278247
641	176214	695561	871775	-519347	519347	0.01097459	0.025240031	-0.01426544	0.01426544
642	104708	271608	376316	-166900	166900	0.006521204	0.009855921	-0.003334717	0.003334717

651	118112	125572	243684	-7460	7460	0.007356003	0.004556669	0.002799335	0.002799335
652	9229	316133	325362	-306904	306904	0.000574781	0.011471613	-0.010896832	0.010896832
653	23149	544098	567247	-520949	520949	0.001441717	0.019743847	-0.01830213	0.01830213
654	20429	196203	216632	-175774	175774	0.001272316	0.007119677	-0.005847361	0.005847361
655	9872	189963	199835	-180091	180091	0.000614827	0.006893244	-0.006278417	0.006278417
656	5801	49479	55280	-43678	43678	0.000361286	0.001795459	-0.001434174	0.001434174
657	27845	302131	329976	-274286	274286	0.001734184	0.010963518	-0.009229334	0.009229334
658	210347	48930	259277	161417	161417	0.01310039	0.001775538	0.011324852	0.011324852
659	14185	98585	112770	-84400	84400	0.00088344	0.003577383	-0.002693943	0.002693943
660	0	0	0	0	0	0	0	0	0
661	119842	82064	201906	37778	37778	0.007463748	0.002977881	0.004485867	0.004485867
662	24461	230222	254683	-205761	205761	0.001523429	0.008354135	-0.006830706	0.006830706
663	49166	129456	178622	-80290	80290	0.003062054	0.004697609	-0.001635555	0.001635555
664	64837	116927	181764	-52090	52090	0.004038042	0.004242965	-0.000204923	0.000204923
665	94354	79450	173804	14904	14904	0.005876358	0.002883026	0.002993332	0.002993332
666	73373	8849	82222	64524	64524	0.004569663	0.000321106	0.004248557	0.004248557
667	527	3433	3960	-2906	2906	3.28215E-05	0.000124574	-9.17528E-05	9.18E-05
671	39453	12581	52034	26872	26872	0.002457129	0.000456531	0.002000598	0.002000598
672	72026	5719	77745	66307	66307	0.004485772	0.000207527	0.004278245	0.004278245
673	97536	89215	186751	8321	8321	0.006074532	0.003237371	0.002837161	0.002837161
674	6603	173495	180098	-166892	166892	0.000411234	0.006295665	-0.005884431	0.005884431
675	14789	116829	131618	-102040	102040	0.000921057	0.004239409	-0.003318352	0.003318352
676	258913	99704	358617	159209	159209	0.016125075	0.003617989	0.012507087	0.012507087
677	30198	3785	33983	26413	26413	0.001880728	0.000137347	0.001743381	0.001743381
678	17636	27411	45047	-9775	9775	0.001098368	0.000994671	0.000103697	0.000103697
679	93615	323167	416782	-229552	229552	0.005830333	0.011726858	-0.005896525	0.005896525
681	162004	2197	164201	159807	159807	0.010089593	7.97232E-05	0.01000987	0.01000987
682	431935	61417	493352	370518	370518	0.026900868	0.002228657	0.024672211	0.024672211
683	34	5928	5962	-5894	5894	2.11752E-06	0.000215111	-0.000212994	0.000212994
684	111173	221503	332676	-110330	110330	0.006923843	0.008037746	-0.001113903	0.001113903
685	12300	3189	15489	9111	9111	0.000766043	0.00011572	0.000650323	0.000650323
686	32636	5463	38099	27173	27173	0.002032567	0.000198238	0.001834329	0.001834329
687	283	1829	2112	-1546	1546	1.76252E-05	6.63695E-05	-4.87443E-05	4.87E-05
689	632	1492	2124	-860	860	3.93609E-05	5.41407E-05	-1.47798E-05	1.48E-05
691	249336	211389	460725	37947	37947	0.015528621	0.007670736	0.007857885	0.007857885
692	52543	64675	117218	-12132	12132	0.003272373	0.002346881	0.000925492	0.000925492
693	37016	30168	67184	6848	6848	0.002305353	0.001094715	0.001210637	0.001210637
694	62213	56874	119087	5339	5339	0.003874619	0.002063804	0.001810815	0.001810815

695	28663	103641	132304	-74978	74978	0.001785129	0.003760852	-0.001975723	0.001975723
696	1944	13011	14955	-11067	11067	0.000121072	0.000472134	-0.000351062	0.000351062
697	34527	98544	133071	-64017	64017	0.002150338	0.003575896	-0.001425558	0.001425558
699	379920	446649	826569	-66729	66729	0.023661379	0.016207686	0.007453693	0.007453693
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
700	0	22362	22362	-22362	22362	0	0.000811457	-0.000811457	0.000811457
711	20067	75284	95351	-55217	55217	0.001249771	0.002731853	-0.001482082	0.001482082
712	14051	25045	39096	-10994	10994	0.000875095	0.000908815	-3.37206E-05	3.37E-05
713	95585	298897	394482	-203312	203312	0.005953024	0.010846165	-0.004893141	0.004893141
714	25077	18276	43353	6801	6801	0.001561793	0.000663187	0.000898606	0.000898606
716	68643	93491	162134	-24848	24848	0.004275079	0.003392536	0.000882543	0.000882543
718	2355	15305	17660	-12950	12950	0.000146669	0.000555377	-0.000408708	0.000408708
721	46106	171132	217238	-125026	125026	0.002871477	0.006209918	-0.003338441	0.003338441
722	30609	15175	45784	15434	15434	0.001906325	0.000550666	0.001355666	0.001355666
723	54498	163968	218466	-109470	109470	0.00339413	0.005949956	-0.002555826	0.002555826
724	16290	180851	197141	-164561	164561	0.00101454	0.006562594	-0.005548055	0.005548055
725	13318	103098	116416	-89780	89780	0.000829444	0.003741148	-0.002911704	0.002911704
726	5013	198505	203518	-193492	193492	0.000312209	0.00720321	-0.006891001	0.006891001
727	10935	158274	169209	-147339	147339	0.000681031	0.005743336	-0.005062305	0.005062305
728	83040	846712	929752	-763672	763672	0.005171723	0.030724892	-0.025553169	0.025553169
731	16532	102506	119038	-85974	85974	0.001029611	0.003719666	-0.002690055	0.002690055
733	4548	72276	76824	-67728	67728	0.000283249	0.002622701	-0.002339452	0.002339452
735	27406	29426	56832	-2020	2020	0.001706843	0.00106779	0.000639053	0.000639053
737	21477	103624	125101	-82147	82147	0.001337585	0.003760235	-0.00242265	0.00242265
741	50826	509715	560541	-458889	458889	0.003165438	0.018496181	-0.015330743	0.015330743
742	22079	140031	162110	-117952	117952	0.001375078	0.005081347	-0.003706269	0.003706269
743	30760	346588	377348	-315828	315828	0.00191573	0.012576743	-0.010661013	0.010661013
744	67981	278461	346442	-210480	210480	0.00423385	0.010104598	-0.005870748	0.005870748
745	26068	366500	392568	-340432	340432	0.001623512	0.013299295	-0.011675783	0.011675783
746	63275	41254	104529	22021	22021	0.003940761	0.001496996	0.002443764	0.002443764
747	61310	290861	352171	-229551	229551	0.003818381	0.01055456	-0.00673618	0.00673618
748	36645	60363	97008	-23718	23718	0.002282247	0.00219041	9.18366E-05	9.18E-05
749	35283	145659	180942	-110376	110376	0.002197422	0.005285572	-0.00308815	0.00308815
751	998	68541	69539	-67543	67543	6.21553E-05	0.002487168	-0.002425012	0.002425012
752	14970	468868	483838	-453898	453898	0.00093233	0.017013954	-0.016081624	0.016081624
759	16668	170843	187511	-154175	154175	0.001038081	0.006199431	-0.00516135	0.00516135
761	444341	117562	561903	326779	326779	0.027673513	0.004266008	0.023407505	0.023407505

762	2851	18503	21354	-15652	15652	0.00017756	0.000671424	-0.000493864	0.000493864
763	1060	18212	19272	-17152	17152	6.60167E-05	0.000660864	-0.000594848	0.000594848
764	103796	882357	986153	-778561	778561	0.006464404	0.032018353	-0.025553949	0.025553949
771	125063	154587	279650	-29524	29524	0.007788911	0.005609545	0.002179366	0.002179366
772	157004	479324	636328	-322320	322320	0.009778193	0.017393374	-0.00761518	0.00761518
773	328443	202285	530728	126158	126158	0.020455397	0.007340376	0.01311502	0.01311502
774	1128	65683	66811	-64555	64555	7.02517E-05	0.002383459	-0.002313207	0.002313207
775	111537	390405	501942	-278868	278868	0.006946513	0.014166743	-0.00722023	0.00722023
776	172316	288769	461085	-116453	116453	0.010731823	0.010478647	0.000253176	0.000253176
778	278158	340888	619046	-62730	62730	0.017323652	0.012369905	0.004953747	0.004953747
781	764358	923912	1688270	-159554	159554	0.047604139	0.033526272	0.014077867	0.014077867
782	271655	290057	561712	-18402	18402	0.016918646	0.010525385	0.006393261	0.006393261
783	13290	161058	174348	-147768	147768	0.0008277	0.00584436	-0.00501666	0.00501666
784	321801	1635871	1957672	-1314070	1314070	0.020041734	0.059361341	-0.039319608	0.039319608
785	42076	51059	93135	-8983	8983	0.002620489	0.001852793	0.000767696	0.000767696
786	122787	158243	281030	-35456	35456	0.007647162	0.005742211	0.001904951	0.001904951
791	16811	56945	73756	-40134	40134	0.001046987	0.00206638	-0.001019393	0.001019393
792	9818	14228	24046	-4410	4410	0.000611464	0.000516296	9.51683E-05	9.52E-05
793	40428	10189	50617	30239	30239	0.002517852	0.000369731	0.00214812	0.00214812
			0	0	0	0	0	0	0
			0	0	0	0	0	0	0
800	0	242	242	-242	242	0	8.78153E-06	-8.78153E-06	8.78E-06
811	42042	63659	105701	-21617	21617	0.002618372	0.002310013	0.000308358	0.000308358
812	19438	171468	190906	-152030	152030	0.001210597	0.006222111	-0.005011514	0.005011514
813	86051	112944	198995	-26893	26893	0.005359248	0.004098433	0.001260815	0.001260815
821	1322017	266767	1588784	1055250	1055250	0.082335085	0.009680254	0.072654831	0.072654831
831	14909	16340	31249	-1431	1431	0.000928531	0.000592934	0.000335597	0.000335597
841	507375	85309	592684	422066	422066	0.031599264	0.003095633	0.02850363	0.02850363
842	859888	85058	944946	774830	774830	0.053553738	0.003086525	0.050467213	0.050467213
843	18461	7179	25640	11282	11282	0.001149749	0.000260507	0.000889243	0.000889243
844	127173	49230	176403	77943	77943	0.007920322	0.001786424	0.006133898	0.006133898
845	304877	110129	415006	194748	194748	0.018987709	0.003996284	0.014991425	0.014991425
846	25346	79266	104612	-53920	53920	0.001578546	0.002876349	-0.001297803	0.001297803
848	25609	23348	48957	2261	2261	0.001594926	0.000847236	0.00074769	0.00074769
851	137915	161400	299315	-23485	23485	0.008589332	0.00585677	0.002732562	0.002732562
871	1425	8588	10013	-7163	7163	8.87489E-05	0.000311635	-0.000222886	0.000222886
872	25587	114426	140013	-88839	88839	0.001593556	0.004152211	-0.002558655	0.002558655
873	10317	25587	35904	-15270	15270	0.000642542	0.000928483	-0.000285941	0.000285941

874	38635	280634	319269	-241999	241999	0.002406184	0.01018345	-0.007777266	0.007777266
881	1083	17968	19051	-16885	16885	6.74491E-05	0.00065201	-0.000584561	0.000584561
882	300	71791	72091	-71491	71491	1.8684E-05	0.002605102	-0.002586418	0.002586418
883	23	602	625	-579	579	1.43244E-06	2.1845E-05	-2.04125E-05	2.04E-05
884	1663	23603	25266	-21940	21940	0.000103571	0.000856489	-0.000752918	0.000752918
885	12017	19134	31151	-7117	7117	0.000748418	0.000694321	5.40964E-05	5.41E-05
891	974	2981	3955	-2007	2007	6.06606E-05	0.000108172	-4.75118E-05	4.75E-05
892	30992	214890	245882	-183898	183898	0.001930179	0.007797778	-0.005867599	0.005867599
893	146726	453009	599735	-306283	306283	0.00913808	0.016438473	-0.007300393	0.007300393
894	71379	76701	148080	-5322	5322	0.004445477	0.002783272	0.001662205	0.001662205
895	9127	53883	63010	-44756	44756	0.000568429	0.001955269	-0.00138684	0.00138684
896	5824	3699	9523	2125	2125	0.000362718	0.000134227	0.000228491	0.000228491
897	13858	25271	39129	-11413	11413	0.000863075	0.000917016	-5.39415E-05	5.39E-05
898	15261	112597	127858	-97336	97336	0.000950454	0.004085841	-0.003135388	0.003135388
899	71155	114617	185772	-43462	43462	0.004431526	0.004159141	0.000272385	0.000272385
				0	0	0	0	0	0
				0	0	0	0	0	0
911	1745	3531	5276	-1786	1786	0.000108678	0.00012813	-1.9452E-05	1.95E-05
931	103733	44334	148067	59399	59399	0.006460481	0.001608761	0.00485172	0.00485172
941	0	1720	1720	-1720	1720	0	6.24142E-05	-6.24142E-05	6.24E-05
961	21	25	46	-4	4	1.30788E-06	9.07182E-07	4.00695E-07	4.01E-07
971	4344	1636	5980	2708	2708	0.000270544	5.9366E-05	0.000211178	0.000211178
972	922	16	938	906	906	5.74221E-05	5.80597E-07	5.68415E-05	5.68E-05
998	0	0	0	0	0	0	0	0	0
999	90528	277563	368091	-187035	187035	0.005638075	0.010072012	-0.004433937	0.004433937
	16056545	27557851	43614396		25151956				1.097416818

ИТ*=45,129

ИТ=32,331

Appendix 3 – Revealed Comparative Advantage (RCA)

$$RCA_{it} = \frac{(x_{it}^e - m_{it}^e)}{(x_{it}^e + m_{it}^e)} \times 100$$

Where: x_{it}^e = exports of industry i and

m_{it}^e = imports of industry i over time t .

This formula was applied to measure whether any of Poland's industries have become more competitive over time and reveal a comparative advantage in production. A value closer to 100 reveals a higher degree of competitiveness. These results should be compared with those from other models.

RCA in 1990

289	PRECIOUS METAL ORE/CONC.	100	841	MENS/BOYS WEAR, WOVEN	85.96004
333	PETROL./BITUM. OIL,CRUDE	100	344	PETROL./HYDROCARBON GAS	85.8748
961	COIN NONGOLD NON CURRENT	100	246	WOOD CHIPS/WASTE	85.69667
245	FUEL WOOD/WOOD CHARCOAL	99.91474851	012	MEAT NES,FRESH/CHLD/FROZ	84.34446
321	COAL NON-AGGLOMERATED	99.90473936	671	PIG IRON ETC FERRO ALLOY	84.30012
045	CEREAL GRAINS NES	99.6978852	034	FISH,LIVE/FRSH/CHLD/FROZ	84.11072
562	MANUFACTURED FERTILIZERS	99.54154609	335	RESIDUAL PETROL. PRODS	84.01378
282	FERROUS WASTE/SCRAP	99.40707422	792	AIRCRAFT/SPACECRAFT/ETC	83.21357
677	IRON/STEEL RAILWAY MATL	99.25888496	571	PRIMARY ETHYLENE POLYMER	79.51775
274	SULPHUR/UNROASTD PYRITES	99.15597278	821	FURNITURE/STUFF FURNISHG	78.95966
325	COKE/SEMI-COKE/RETORT C	99.09518273	212	FURSKINS/PIECES, RAW	74.46165
322	BRIQUETTES/LIGNITE/PEAT	98.87640449	287	BASE METAL ORE/CONC NES	74.36651
972	NON CLASSIFIED SITC 9	98	273	STONE/SAND/GRAVEL	73.63636
247	WOOD IN ROUGH/SQUARED	97.37953123	773	ELECTRICAL DISTRIB EQUIP	72.79578
672	PRIMARY/PRODS IRON/STEEL	96.79247227	059	FRUIT/VEG JUICES	72.46238
001	LIVE ANIMALS EXCEPT FISH	96.70783629	211	HIDE/SKIN (EX FUR) RAW	71.11939
248	WOOD SIMPLY WORKED	96.33442175	267	MAN-MADE FIBRES NES/WAST	69.37198
054	VEGETABLES,FRSH/CHLD/FRZ	96.24937421	232	RUBBER SYNTH/WASTE/ETC	68.36943
634	VENEER/PLYWOOD/ETC	96.18484802	037	FISH/SHELLFISH,PREP/PRES	67.52678
682	COPPER	96.10403212	524	OTHER INORGANIC CHEMICAL	67.20895
061	SUGAR/MOLLASSES/HONEY	96.03545221	831	TRUNKS AND CASES	66.38292
223	OIL SEEDS-NOT SOFT OIL	95.37572254	694	NAILS/SCREWS/NUTS/BOLTS	65.77499
971	GOLD NON-MONETARY EX ORE	94.70731707	522	ELEMENTS/OXIDES/HAL SALT	64.70525
681	SILVER/PLATINUM ETC	94.60714431	523	METAL SALTS OF INORG ACD	63.3702
635	WOOD MANUFACTURES N.E.S.	93.68506881	793	SHIPS/BOATS/ETC	62.72006
272	FERTILIZERS CRUDE	92.1875	785	MOTORCYCLES/CYCLES/ETC	61.98003
222	OIL SEEDS ETC - SOFT OIL	91.90110291	844	WOMEN/GIRL WEAR KNIT/CRO	60.07447
661	LIME/CEMENT/CONSTR MATL	91.37678151	264	JUTE/BAST FIBRE RAW/RETD	60
685	LEAD	90.78424286	579	PLASTIC WASTE/SCRAP	59.61945

686 ZINC	90.07787713	683 NICKEL	59.33217
592 STARCHES/GLUES/ETC.	87.07482993	676 IRON/STEEL BARS/RODS/ETC	58.71
666 POTTERY	86.91178696	658 MADE-UP TEXTILE ARTICLES	58.67281
058 FRUIT PRESVD/FRUIT PREPS	86.69314566	714 ENGINES NON-ELECTRIC NES	56.96095
842 WOMEN/GIRL CLOTHING WVEN	86.29098157	072 COCOA	56.70209
288 NF BASE METAL WASTE NES	86.19131757	664 GLASS	56.14225
691 IRON/STL/ALUM STRUCTURES	54.39918186	574 POLYACETALS/POLYESTERS..	13.82133
813 LIGHTING FIXTURES ETC	53.9183056	017 MEAT/OFFAL PRESVD N.E.S	13.32073
689 MISC NON-FERR BASE METAL	53.11284047	511 HYDROCARBONS/DERIVATIVES	12.79299
023 BUTTER AND CHEESE	52.51215559	673 FLAT ROLLED IRON/ST PROD	12.65727
722 TRACTORS	51.42745405	251 PULP AND WASTE PAPER	11.696
843 MEN/BOY WEAR KNIT/CROCH	51.12906567	679 IRON/STEEL PIPE/TUBE/ETC	11.63501
515 ORGANO-INORGANIC COMPNDS	50.30026158	697 BASE METAL H'HOLD EQUIPM	9.21797
625 RUBBER TYRES/TREADS	46.0945425	771 ELECT POWER TRANSM EQUIP	8.453556
665 GLASSWARE	45.97920807	411 ANIMAL OIL/FAT	5.003574
811 PREFABRICATED BUILDINGS	44.49057809	516 OTHER ORGANIC COMPOUNDS	-3.80103
231 NATURAL RUBBER/LATEX/ETC	44.11347518	513 CARBOXYLIC ACID COMPOUND	-5.32557
713 INTERNAL COMBUST ENGINES	43.5612483	786 TRAILERS/CARAVANS/ETC	-7.1068
291 CRUDE ANIMAL MTERIAL NES	41.3180684	612 LEATHER MANUFACTURES	-7.12195
266 SYNTHETIC SPINNING FIBRE	40.93596059	514 NITROGEN FUNCTION COMPDS	-7.21469
022 MILK PR EXC BUTTR/CHEESE	40.32758496	674 ROLLED PLATED M-STEEL	-8.8676
848 HEADGEAR/NON-TEXT CLOTHG	38.8164863	693 WIRE PROD EXC INS ELECTR	-9.49914
292 CRUDE VEG MATERIALS NES	36.73073441	883 CINE FILD DEVELOPED	-9.52381
011 BEEF, FRESH/CHILLD/FROZN	35.82589286	775 DOMESTIC EQUIPMENT	-9.67021
573 VINYL CHLORIDE ETC POLYM	35.05721669	036 CRUSTACEANS MOLLUSCS ETC	-10.446
699 BASE METAL MANUFAC NES	34.75266972	278 OTHER CRUDE MINERALS	-11.3765
593 EXPLOSIVES/PYROTECHNICS	34.25797503	431 ANIMAL/VEG OILS PROCES'D	-16.8144
845 ARTICLES OF APPAREL NES	31.38599478	678 IRON/STEEL WIRE	-19.0454
851 FOOTWEAR	31.31407417	334 HEAVY PETROL/BITUM OILS	-19.908
081 ANIMAL FEED EX UNML CER.	31.14129965	748 MECH TRANSMISSION EQUMNT	-20.219
692 METAL STORE/TRANSPT CONT	28.37275224	781 PASSENGER CARS ETC	-21.7132
512 ALCOHOLS/PHENOLS/DERIVS	27.69076187	684 ALUMINIUM	-25.5108
056 VEG ROOT/TUBER PREP/PRES	26.36397843	711 STEAM GENERATING BOILERS	-25.607
791 RAILWAY VEHICLES/EQUIPMT	25.90462052	897 JEWELLERY	-27.0068
024 CHEESE AND CURD	24.62364184	723 CIVIL ENGINEERING PLANT	-28.3707
931 SPECIAL TRANSACTIONS NES	23.0772623	772 ELECTRIC CIRCUIT EQUIPMT	-29.7347
762 RADIO BROADCAST RECEIVER	20.70738227	763 SOUND/TV RECORDERS ETC	-32.2854
746 BALL/ROLLER BEARINGS	20.33521681	531 SYNTH ORG COLOUR AGENTS	-32.407
716 ROTATING ELECTR PLANT	18.60363636	747 TAPS/COCKS/VALVES	-34.152
265 VEG TEXT FIBRE EX COT/JU	15.80246914	621 MATERIALS OF RUBBER	-35.7513
641 PAPER/PAPERBOARD	14.50837289	121 TOBACCO, RAW AND WASTES	-36.4341
613 FURSKINS TANNED/DRESSED	-37.98646362	662 CLAY/REFRACTORY MATERIAL	-66.5386
894 BABY CARR/TOY/GAME/SPORT	-38.12939489	743 FANS/FILTERS/GAS PUMPS	-69.706
778 ELECTRICAL EQUIPMENT NES	-38.30274113	874 MEASURE/CONTROL APP NES	-69.9764

575 PLASTIC NES-PRIMARY FORM	-39.58248768	269 WORN CLOTHING ETC	-71.6286
651 TEXTILE YARN	-41.98828853	731 MACH-TOOLS REMOVE MTRIAL	-71.6835
871 OPTICAL INSTRUMENTS NES	-42.19269103	884 OPTICAL FIBRES	-72.3731
695 HAND/MACHINE TOOLS	-42.95016377	873 METERS AND COUNTERS NES	-73.9798
899 MISC MANUF ARTICLES NES	-43.97416738	654 WOVEN TEXTILE FABRIC NES	-74.7269
016 MEAT/OFFAL PRESERVED	-45.71612626	749 NON-ELEC PARTS/ACC MACHN	-74.818
896 ART/COLLECTIONS/ANTIQUES	-46.22571001	898 MUSICAL INSTRUMS/RECORDS	-74.8972
611 LEATHER	-46.85756871	891 ARMS AND AMMUNITION	-75.7303
776 VALVES/TRANSISTORS/ETC	-47.38278165	572 STYRENE PRIMARY POLYMERS	-76.6877
846 CLOTHING ACCESSORIES	-47.69727734	782 GOODS/SERVICE VEHICLES	-77.145
075 SPICES	-48.30942623	263 COTTON	-77.1549
721 AGRIC MACHINE EX TRACTR	-48.5815855	598 MISC CHEMICAL PRODS NES	-77.2608
582 PLASTIC SHEETS/FILM/ETC	-51.81884201	724 TEXTILE/LEATHER MACHINRY	-78.6241
663 MINERAL MANUFACTURES NES	-53.20165247	642 CUT PAPER/BOARD/ARTICLES	-79.3867
735 METAL MACHINE TOOL PARTS	-53.24265029	675 FLAT ROLLED ALLOY STEEL	-80.0562
057 FRUIT/NUTS, FRESH/DRIED	-55.00703724	911 POSTAL PACKETS NOT CLASS	-80.4343
655 KNIT/CROCHET FABRICS	-55.25099343	652 COTTON FABRICS, WOVEN	-80.4644
062 SUGAR CONFECTIONERY	-57.28738333	892 PRINTED MATTER	-81.4734
656 TULLE/LACE/EMBR/TRIM ETC	-57.31707317	653 MAN-MADE WOVEN FABRICS	-81.6173
035 FISH,DRIED/SALTED/SMOKED	-58.28906905	541 PHARMACEUT EXC MEDICAMNT	-81.6696
784 MOTOR VEH PARTS/ACCESS	-58.55619751	718 POWER GENERATING EQU NES	-81.8504
551 ESSENT.OIL/PERFUME/FLAVR	-58.69245837	268 WOOL/ANIMAL HAIR	-82.0942
659 FLOOR COVERINGS ETC.	-59.98280063	728 SPECIAL INDUST MACHN NES	-83.1879
025 EGGS, ALBUMIN	-60.10958904	761 TELEVISION RECEIVERS	-83.2121
893 ARTICLES NES OF PLASTICS	-62.83408002	872 MEDICAL/ETC INSTRUMENTS	-83.4742
885 WATCHES AND CLOCKS	-63.65159129	112 ALCOHOLIC BEVERAGES	-83.6382
421 FIXED VEG OIL/FAT, SOFT	-63.73877718	046 FLOUR/MEAL WHEAT/MESLIN	-84.6154
744 MECHANICAL HANDLING EQUI	-64.07641048	581 PLASTIC TUBE/PIPE/HOSE	-85.0855
895 OFFICE/STATIONERY SUPPLY	-64.45168295	597 OIL ETC ADDITIVES/FLUIDS	-85.4068
696 CUTLERY	-64.58897922	667 PEARLS/PRECIOUS STONES	-86.25
764 TELECOMMS EQUIPMENT NES	-64.94156432	742 PUMPS FOR LIQUIDS	-87.0298
712 STEAM/VAPOUR TURBINES	-65.66378338	881 PHOTOGRAPHIC EQUIPMENT	-87.1188
629 ARTICLES OF RUBBER NES	-65.90655041	737 METALWORKING MACHINE NES	-87.2287
657 SPECIAL YARNS/FABRICS	-87.2403969	553 PERFUME/TOILET/COSMETICS	-97.6617
727 FOOD PROCESSING MACHINES	-87.65511388	882 PHOTOGRAPHIC SUPPLIES	-97.8773
774 MEDICAL ETC EL DIAG EQUI	-88.13632177	783 ROAD MOTOR VEHICLES NES	-98.6893
261 SILK	-88.23529412	043 BARLEY GRAIN	-99.2316
525 RADIO-ACTIVE ETC MATRIAL	-88.63905325	687 TIN	-99.3031
726 PRINTING INDUSTRY MACHNY	-89.1077927	542 MEDICAMENTS INCLUDE VET	-99.464
073 CHOCOLATE/COCOA PREPS	-91.37021277	532 DYEING/TANNING EXTRACTS	-99.5395
554 SOAPS/CLEANSERS/POLISHES	-91.3966979	122 TOBACCO, MANUFACTURED	-99.8599
745 NON-ELECTR MACHINES NES	-91.86242185	583 MONOFILAMENT RODS/STICKS	-99.8624
533 PIGMENTS/PAINTS/VARNISH	-92.96938776	285 ALUMINIUM ORES/CONCS/ETC	-99.8858
071 COFFEE/COFFEE SUBSTITUTE	-93.03030303	111 BEVERAGE NON-ALCOHOL NES	-99.9198
741 INDUST HEAT/COOL EQUIPMT	-93.27389575	044 MAIZE EXCEPT SWEET CORN.	-99.9414

725 PAPER INDUSTRY MACHINERY	-93.55277065	041 WHEAT/MESLIN	-99.9954
751 OFFICE MACHINES	-93.57348479	042 RICE	-100
048 CEREAL ETC FLOUR/STARCH	-93.91492951	047 CEREAL MEAL/FLOUR N.E.S	-100
591 HOUSEHOLD/GARDEN CHEMICAL	-95.25208874	074 TEA AND MATE	-100
633 CORK MANUFACTURES	-95.45454545	091 MARGARINE/SHORTENING	-100
733 MTL M-TOOLS W/O MTL-RMVL	-95.64776934	244 CORK NATURAL/RAW/WASTE	-100
098 EDIBLE PRODUCTS N.E.S.	-95.75906833	277 NATURAL ABRASIVES N.E.S.	-100
752 COMPUTER EQUIPMENT	-97.07264489	342 LIQUID PROPANE/BUTANE	-100
422 FIXED VEG OILS NOT SOFT	-97.41935484	343 NATURAL GAS	-100

Calculations for 1996

RCA in 1996

121 TOBACCO, RAW AND WASTES	100	671 PIG IRON ETC FERRO ALLOY	65.39349484
122 TOBACCO, MANUFACTURED	100	714 ENGINES NON-ELECTRIC NES	64.86207476
325 COKE/SEMI-COKE/RETORT C	100	023 BUTTER AND CHEESE	60.91676719
343 NATURAL GAS	100	672 PRIMARY/PRODS IRON/STEEL	60.48292639
351 ELECTRIC CURRENT	100	843 MEN/BOY WEAR KNIT/CROCH	58.65857947
961 COIN NONGOLD NON CURRENT	100	056 VEG ROOT/TUBER PREP/PRES	55.74694446
321 COAL NON-AGGLOMERATED	99.91509682	845 ARTICLES OF APPAREL NES	55.12453216
245 FUEL WOOD/WOOD CHARCOAL	99.73103394	661 LIME/CEMENT/CONSTR MATL	54.29467853
274 SULPHUR/UNROASTD PYRITES	99.40266087	677 IRON/STEEL RAILWAY MATL	52.40525573
289 PRECIOUS METAL ORE/CONC.	98.71101871	685 LEAD	51.71562867
282 FERROUS WASTE/SCRAP	98.40604027	035 FISH,DRIED/SALTED/SMOKED	51.28250176
681 SILVER/PLATINUM ETC	96.71292447	593 EXPLOSIVES/PYROTECHNICS	50.53965275
793 SHIPS/BOATS/ETC	95.82709734	022 MILK PR EXC BUTTR/CHEESE	50.40528537
264 JUTE/BAST FIBRE RAW/RETD	95.34883721	844 WOMEN/GIRL WEAR KNIT/CRO	50.39261281
288 NF BASE METAL WASTE NES	95.27252935	273 STONE/SAND/GRAVEL	48.85743634
322 BRIQUETTES/LIGNITE/PEAT	91.30925508	811 PREFABRICATED BUILDINGS	47.95441808
059 FRUIT/VEG JUICES	89.51427427	037 FISH/SHELLFISH,PREP/PRES	46.15318342
686 ZINC	87.40803171	676 IRON/STEEL BARS/RODS/ETC	45.02043766
842 WOMEN/GIRL CLOTHING WVEN	87.15050328	613 FURSKINS TANNED/DRESSED	43.02152141
682 COPPER	85.61407914	061 SUGAR/MOLLASSES/HONEY	42.33024338
635 WOOD MANUFACTURES N.E.S.	85.07511842	522 ELEMENTS/OXIDES/HAL SALT	41.91911035
666 POTTERY	84.56208178	524 OTHER INORGANIC CHEMICAL	36.93036255
272 FERTILIZERS CRUDE	83.54002255	034 FISH,LIVE/FRSH/CHLD/FROZ	35.625966
248 WOOD SIMPLY WORKED	80.28965074	625 RUBBER TYRES/TREADS	35.50991059
971 GOLD NON-MONETARY EX ORE	76.34346636	634 VENEER/PLYWOOD/ETC	35.43787294
247 WOOD IN ROUGH/SQUARED	75.08951106	691 IRON/STL/ALUM STRUCTURES	33.78905489
821 FURNITURE/STUFF FURNISHG	73.96830885	266 SYNTHETIC SPINNING FIBRE	32.49799197
562 MANUFACTURED FERTILIZERS	73.58560507	012 MEAT NES,FRESH/CHLD/FROZ	30.18407378
841 MENS/BOYS WEAR, WOVEN	73.2860848	931 SPECIAL TRANSACTIONS NES	28.75958495
283 COPPER ORES/CONCENTRATES	73.26478149	746 BALL/ROLLER BEARINGS	27.92292248
058 FRUIT PRESVD/FRUIT PREPS	72.46367869	773 ELECTRICAL DISTRIB EQUIP	26.48830052
001 LIVE ANIMALS EXCEPT FISH	70.22104892	246 WOOD CHIPS/WASTE	25.79710145
612 LEATHER MANUFACTURES	69.24255482	722 TRACTORS	25.01377725
017 MEAT/OFFAL PRESVD N.E.S	69.16725515	523 METAL SALTS OF INORG ACD	24.60832914
658 MADE-UP TEXTILE ARTICLES	67.44273772	761 TELEVISION RECEIVERS	24.37151069
515 ORGANO-INORGANIC COMPNDS	23.62049954	679 IRON/STEEL PIPE/TUBE/ETC	-22.23381272
896 ART/COLLECTIONS/ANTIQUES	20.40933655	291 CRUDE ANIMAL MTERIAL NES	-23.56454748
054 VEGETABLES,FRSH/CHLD/FRZ	17.921956	513 CARBOXYLIC ACID COMPOUND	-25.17324458
673 FLAT ROLLED IRON/ST PROD	15.24686976	663 MINERAL MANUFACTURES NES	-25.62521864
665 GLASSWARE	13.00078708	292 CRUDE VEG MATERIALS NES	-25.76442808
831 TRUNKS AND CASES	12.30576671	891 ARMS AND AMMUNITION	-28.87228261

851 FOOTWEAR	12.12284825	781 PASSENGER CARS ETC	-30.08226484
694 NAILS/SCREWS/NUTS/BOLTS	11.97293353	897 JEWELLERY	-31.28952728
335 RESIDUAL PETROL. PRODS	11.59540551	251 PULP AND WASTE PAPER	-31.77387914
232 RUBBER SYNTH/WASTE/ETC	11.29444908	516 OTHER ORGANIC COMPOUNDS	-32.92907988
512 ALCOHOLS/PHENOLS/DERIVS	7.893437297	678 IRON/STEEL WIRE	-33.64543466
287 BASE METAL ORE/CONC NES	6.175361408	771 ELECT POWER TRANSM EQUIP	-36.33730168
848 HEADGEAR/NON-TEXT CLOTHG	5.681818182	278 OTHER CRUDE MINERALS	-36.85183629
693 WIRE PROD EXC INS ELECTR	4.706470647	024 CHEESE AND CURD	-37.17826501
972 NON CLASSIFIED SITC 9	4.615384615	899 MISC MANUF ARTICLES NES	-38.17664016
786 TRAILERS/CARAVANS/ETC	1.939840326	664 GLASS	-38.57973341
699 BASE METAL MANUFAC NES	-1.09767519	723 CIVIL ENGINEERING PLANT	-38.77127503
011 BEEF, FRESH/CHILLD/FROZN	-1.693948554	642 CUT PAPER/BOARD/ARTICLES	-39.52802255
894 BABY CARR/TOY/GAME/SPORT	-4.495042233	651 TEXTILE YARN	-40.68893737
579 PLASTIC WASTE/SCRAP	-5.066666667	075 SPICES	-42.29492651
776 VALVES/TRANSISTORS/ETC	-6.097092305	621 MATERIALS OF RUBBER	-42.47970375
883 CINE FILD DEVELOPED	-6.598984772	711 STEAM GENERATING BOILERS	-42.88879043
689 MISC NON-FERR BASE METAL	-8.977221974	885 WATCHES AND CLOCKS	-45.7913196
716 ROTATING ELECTR PLANT	-9.209160575	267 MAN-MADE FIBRES NES/WAST	-46.8125147
813 LIGHTING FIXTURES ETC	-10.28733194	684 ALUMINIUM	-47.73294769
712 STEAM/VAPOUR TURBINES	-14.94625983	687 TIN	-47.91666667
735 METAL MACHINE TOOL PARTS	-17.39381297	695 HAND/MACHINE TOOLS	-48.13383998
573 VINYL CHLORIDE ETC POLYM	-17.59059508	697 BASE METAL HTHOLD EQUIPM	-48.88777188
778 ELECTRICAL EQUIPMENT NES	-18.03377835	212 FURSKINS/PIECES, RAW	-49.11434446
514 NITROGEN FUNCTION COMPDS	-19.52674036	713 INTERNAL COMBUST ENGINES	-49.38210364
692 METAL STORE/TRANSP T CONT	-19.58318435	873 METERS AND COUNTERS NES	-49.69791285
782 GOODS/SERVICE VEHICLES	-19.61774358	592 STARCHES/GLUES/ETC.	-50.01293587
748 MECH TRANSMISSION EQUmnt	-20.65446738	016 MEAT/OFFAL PRESERVED	-51.75438596
763 SOUND/TV RECORDERS ETC	-21.01553678	265 VEG TEXT FIBRE EX COT/JU	-52.4291498
785 MOTORCYCLES/CYCLES/ETC	-21.86807745	611 LEATHER	-52.62762667
281 IRON ORE/CONCENTRATES	-53.23182993	263 COTTON	-73.9064283
893 ARTICLES NES OF PLASTICS	-54.26917377	784 MOTOR VEH PARTS/ACCESS	-74.72032935
431 ANIMAL/VEG OILS PROCES'D	-54.40738729	874 MEASURE/CONTROL APP NES	-74.95791647
749 NON-ELEC PARTS/ACC MACHN	-54.95102371	872 MEDICAL/ETC INSTRUMENTS	-75.27109686
772 ELECTRIC CIRCUIT EQUIPMT	-55.04911572	675 FLAT ROLLED ALLOY STEEL	-75.49387295
629 ARTICLES OF RUBBER NES	-57.94025281	696 CUTLERY	-75.53635709
081 ANIMAL FEED EX UNML CER.	-58.08762898	656 TULLE/LACE/EMBR/TRIM ETC	-76.63842385
744 MECHANICAL HANDLING EQUI	-58.47491495	728 SPECIAL INDUST MACHN NES	-76.69507625
775 DOMESTIC EQUIPMENT	-58.77463209	269 WORN CLOTHING ETC	-76.93180826
731 MACH-TOOLS REMOVE MTRIAL	-61.53750813	541 PHARMACEUT EXC MEDICAMNT	-76.98370152
057 FRUIT/NUTS, FRESH/DRIED	-62.11764436	411 ANIMAL OIL/FAT	-77.28085868
511 HYDROCARBONS/DERIVATIVES	-62.25972967	223 OIL SEEDS-NOT SOFT OIL	-77.50221435
571 PRIMARY ETHYLENE POLYMER	-62.83260993	752 COMPUTER EQUIPMENT	-77.7002634
792 AIRCRAFT/SPACECRAFT/ETC	-63.78083615	048 CEREAL ETC FLOUR/STARCH	-77.77374745
846 CLOTHING ACCESSORIES	-64.08778864	575 PLASTIC NES-PRIMARY FORM	-78.24350797
641 PAPER/PAPERBOARD	-64.37717248	268 WOOL/ANIMAL HAIR	-78.69210988

334	HEAVY PETROL/BITUM OILS	-64.82247517	554	SOAPS/CLEANSERS/POLISHES	-79.78404584
073	CHOCOLATE/COCOA PREPS	-65.45451794	743	FANS/FILTERS/GAS PUMPS	-80.54392325
222	OIL SEEDS ETC - SOFT OIL	-66.09790285	892	PRINTED MATTER	-81.52954866
525	RADIO-ACTIVE ETC MATRIAL	-66.19074814	871	OPTICAL INSTRUMENTS NES	-81.58463691
721	AGRIC MACHINE EX TRACTR	-67.08027349	654	WOVEN TEXTILE FABRIC NES	-81.7415879
895	OFFICE/STATIONERY SUPPLY	-67.26140798	662	CLAY/REFRACTORY MATERIAL	-82.39413574
531	SYNTH ORG COLOUR AGENTS	-67.56640565	659	FLOOR COVERINGS ETC.	-82.9252491
718	POWER GENERATING EQU NES	-67.9187308	724	TEXTILE/LEATHER MACHINRY	-83.04239401
911	POSTAL PACKETS NOT CLASS	-68.73800738	667	PEARLS/PRECIOUS STONES	-83.70652692
062	SUGAR CONFECTIONERY	-68.8033972	725	PAPER INDUSTRY MACHINERY	-84.72458157
211	HIDE/SKIN (EX FUR) RAW	-70.2742487	884	OPTICAL FIBRES	-85.61640643
762	RADIO BROADCAST RECEIVER	-70.60479165	074	TEA AND MATE	-85.76025744
747	TAPS/COCKS/VALVES	-71.22421248	551	ESSENT.OIL/PERFUME/FLAVR	-86.05262198
791	RAILWAY VEHICLES/EQUIPMT	-71.42894499	741	INDUST HEAT/COOL EQUIPMT	-86.25473341
574	POLYACETALS/POLYESTERS..	-71.92483815	727	FOOD PROCESSING MACHINES	-86.54968645
112	ALCOHOLIC BEVERAGES	-72.24178113	759	OFFICE EQUIPMENT/PARTS/	-86.65739614
764	TELECOMMS EQUIPMENT NES	-72.94632166	812	SANITARY/PLUMBING/HEATING	-87.24336266
742	PUMPS FOR LIQUIDS	-73.06458905	745	NON-ELECTR MACHINES NES	-87.3399386
898	MUSICAL INSTRUMS/RECORDS	-73.48237651	674	ROLLED PLATED M-STEEL	-87.96921206
737	METALWORKING MACHINE NES	-73.75692416	733	MTL M-TOOLS W/O MTL-RMVL	-88.2297321
231	NATURAL RUBBER/LATEX/ETC	-88.45331433	751	OFFICE MACHINES	-96.67440826
553	PERFUME/TOILET/COSMETICS	-88.69189549	098	EDIBLE PRODUCTS N.E.S.	-97.41438289
277	NATURAL ABRASIVES N.E.S.	-88.93280632	421	FIXED VEG OIL/FAT, SOFT	-97.5842235
657	SPECIAL YARNS/FABRICS	-89.36187072	045	CEREAL GRAINS NES	-97.78663734
581	PLASTIC TUBE/PIPE/HOSE	-89.57033871	683	NICKEL	-98.07654563
598	MISC CHEMICAL PRODS NES	-89.84610767	542	MEDICAMENTS INCLUDE VET	-98.21536032
071	COFFEE/COFFEE SUBSTITUTE	-90.19600263	044	MAIZE EXCEPT SWEET CORN.	-98.23284823
783	ROAD MOTOR VEHICLES NES	-91.11184072	532	DYEING/TANNING EXTRACTS	-98.45785695
655	KNIT/CROCHET FABRICS	-91.32802519	597	OIL ETC ADDITIVES/FLUIDS	-98.69887424
533	PIGMENTS/PAINTS/VARNISH	-91.3420071	047	CEREAL MEAL/FLOUR N.E.S	-99.28345627
582	PLASTIC SHEETS/FILM/ETC	-91.51582147	091	MARGARINE/SHORTENING	-99.37559235
583	MONOFILAMENT RODS/STICKS	-92.35357088	342	LIQUID PROPANE/BUTANE	-99.37617992
726	PRINTING INDUSTRY MACHNY	-92.64328858	046	FLOUR/MEAL WHEAT/MESLIN	-99.4531784
653	MAN-MADE WOVEN FABRICS	-92.98105139	072	COCOA	-99.52996475
652	COTTON FABRICS, WOVEN	-93.01822822	285	ALUMINIUM ORES/CONCS/ETC	-99.76225854
111	BEVERAGE NON-ALCOHOL NES	-93.11762603	043	BARLEY GRAIN	-99.76547031
572	STYRENE PRIMARY POLYMERS	-93.12066813	344	PETROL./HYDROCARBON GAS	-99.86004199
422	FIXED VEG OILS NOT SOFT	-93.18837791	633	CORK MANUFACTURES	-99.90747166
036	CRUSTACEANS MOLLUSCS ETC	-93.53287455	041	WHEAT/MESLIN	-100
881	PHOTOGRAPHIC EQUIPMENT	-94.1579238	042	RICE	-100
025	EGGS, ALBUMIN	-94.16243655	244	CORK NATURAL/RAW/WASTE	-100
774	MEDICAL ETC EL DIAG EQUI	-94.78914958	261	SILK	-100
882	PHOTOGRAPHIC SUPPLIES	-95.22471414	284	NICKEL ORES/CONCS/ETC	-100
591	HOUSEHOLD/GARDEN CHEMICAL	-96.06722629	333	PETROL./BITUM. OIL,CRUDE	-100

Calculations for 1998

RCA in 1998

351 ELECTRIC CURRENT	100	266 SYNTHETIC SPINNING FIBRE	58.00478
325 COKE/SEMI-COKE/RETORT C	99.84616	671 PIG IRON ETC FERRO ALLOY	51.64316
289 PRECIOUS METAL ORE/CONC.	99.65657	037 FISH/SHELLFISH,PREP/PRES	47.75519
282 FERROUS WASTE/SCRAP	99.21261	522 ELEMENTS/OXIDES/HAL SALT	47.60787
321 COAL NON-AGGLOMERATED	99.15114	845 ARTICLES OF APPAREL NES	46.92655
011 BEEF, FRESH/CHILLD/FROZN	98.42763	971 GOLD NON-MONETARY EX ORE	45.28428
245 FUEL WOOD/WOOD CHARCOAL	98.31528	676 IRON/STEEL BARS/RODS/ETC	44.39527
681 SILVER/PLATINUM ETC	97.32401	844 WOMEN/GIRL WEAR KNIT/CRO	44.18462
972 NON CLASSIFIED SITC 9	96.58849	843 MEN/BOY WEAR KNIT/CROCH	44.00156
274 SULPHUR/UNROASTD PYRITES	95.8816	524 OTHER INORGANIC CHEMICAL	43.67252
672 PRIMARY/PRODS IRON/STEEL	85.2878	272 FERTILIZERS CRUDE	43.44023
288 NF BASE METAL WASTE NES	84.42358	613 FURSKINS TANNED/DRESSED	43.22141
059 FRUIT/VEG JUICES	83.56002	931 SPECIAL TRANSACTIONS NES	40.1163
842 WOMEN/GIRL CLOTHING WVEN	81.99728	035 FISH,DRIED/SALTED/SMOKED	36.19163
246 WOOD CHIPS/WASTE	81.11023	722 TRACTORS	33.71047
635 WOOD MANUFACTURES N.E.S.	79.47804	625 RUBBER TYRES/TREADS	33.44093
562 MANUFACTURED FERTILIZERS	78.5126	034 FISH,LIVE/FRSH/CHLD/FROZ	32.79976
666 POTTERY	78.47535	773 ELECTRICAL DISTRIB EQUIP	23.77075
677 IRON/STEEL RAILWAY MATL	77.72416	896 ART/COLLECTIONS/ANTIQUES	22.3144
247 WOOD IN ROUGH/SQUARED	77.65869	746 BALL/ROLLER BEARINGS	21.06688
017 MEAT/OFFAL PRESVD N.E.S	76.67538	523 METAL SALTS OF INORG ACD	19.92091
248 WOOD SIMPLY WORKED	76.66372	612 LEATHER MANUFACTURES	19.76368
682 COPPER	75.10216	661 LIME/CEMENT/CONSTR MATL	18.71069
058 FRUIT PRESVD/FRUIT PREPS	73.08583	012 MEAT NES,FRESH/CHLD/FROZ	17.95692
686 ZINC	71.32208	287 BASE METAL ORE/CONC NES	17.87169
841 MENS/BOYS WEAR, WOVEN	71.21265	714 ENGINES NON-ELECTRIC NES	15.6875
821 FURNITURE/STUFF FURNISHG	66.41872	634 VENEER/PLYWOOD/ETC	14.99549
001 LIVE ANIMALS EXCEPT FISH	65.52573	515 ORGANO-INORGANIC COMPNDS	14.45653
322 BRIQUETTES/LIGNITE/PEAT	64.23529	231 NATURAL RUBBER/LATEX/ETC	14.32116
061 SUGAR/MOLLASSES/HONEY	62.95331	056 VEG ROOT/TUBER PREP/PRES	10.9364
658 MADE-UP TEXTILE ARTICLES	62.25658	693 WIRE PROD EXC INS ELECTR	10.1929
593 EXPLOSIVES/PYROTECHNICS	60.35746	665 GLASSWARE	8.575177
793 SHIPS/BOATS/ETC	59.7408	691 IRON/STL/ALUM STRUCTURES	8.236367
685 LEAD	58.82239	054 VEGETABLES,FRSH/CHLD/FRZ	8.227502
761 TELEVISION RECEIVERS	58.15577	848 HEADGEAR/NON-TEXT CLOTHG	4.618339
694 NAILS/SCREWS/NUTS/BOLTS	4.483277	899 MISC MANUF ARTICLES NES	-23.3953
673 FLAT ROLLED IRON/ST PROD	4.455666	748 MECH TRANSMISSION EQUMNT	-24.4495
291 CRUDE ANIMAL MTERIAL NES	2.68192	776 VALVES/TRANSISTORS/ETC	-25.2563
232 RUBBER SYNTH/WASTE/ETC	0.609943	211 HIDE/SKIN (EX FUR) RAW	-25.5362
345 COAL GAS/WATER GAS/ETC	0	712 STEAM/VAPOUR TURBINES	-28.1205
651 TEXTILE YARN	-3.06134	664 GLASS	-28.658

782	GOODS/SERVICE VEHICLES	-3.27606	897	JEWELLERY	-29.1676
735	METAL MACHINE TOOL PARTS	-3.55434	292	CRUDE VEG MATERIALS NES	-32.7172
894	BABY CARR/TOY/GAME/SPORT	-3.594	684	ALUMINIUM	-33.1644
023	BUTTER AND CHEESE	-4.14073	911	POSTAL PACKETS NOT CLASS	-33.8514
831	TRUNKS AND CASES	-4.57935	621	MATERIALS OF RUBBER	-34.261
273	STONE/SAND/GRAVEL	-6.40442	111	BEVERAGE NON-ALCOHOL NES	-34.5778
851	FOOTWEAR	-7.84625	212	FURSKINS/PIECES, RAW	-36.2645
699	BASE METAL MANUFAC NES	-8.07301	689	MISC NON-FERR BASE METAL	-40.4896
961	COIN NONGOLD NON CURRENT	-8.69565	873	METERS AND COUNTERS NES	-42.5301
781	PASSENGER CARS ETC	-9.45074	516	OTHER ORGANIC COMPOUNDS	-42.6014
785	MOTORCYCLES/CYCLES/ETC	-9.64514	513	CARBOXYLIC ACID COMPOUND	-43.1745
573	VINYL CHLORIDE ETC POLYM	-9.7155	073	CHOCOLATE/COCOA PREPS	-43.5271
778	ELECTRICAL EQUIPMENT NES	-10.1333	642	CUT PAPER/BOARD/ARTICLES	-44.351
692	METAL STORE/TRANSP T CONT	-10.3499	663	MINERAL MANUFACTURES NES	-44.9497
771	ELECT POWER TRANSM EQUIP	-10.5575	511	HYDROCARBONS/DERIVATIVES	-47.131
222	OIL SEEDS ETC - SOFT OIL	-11.6533	267	MAN-MADE FIBRES NES/WAST	-47.5607
512	ALCOHOLS/PHENOLS/DERIVS	-11.891	697	BASE METAL H'HOLD EQUIPM	-48.1074
786	TRAILERS/CARAVANS/ETC	-12.6164	723	CIVIL ENGINEERING PLANT	-50.1085
579	PLASTIC WASTE/SCRAP	-12.8954	629	ARTICLES OF RUBBER NES	-50.387
813	LIGHTING FIXTURES ETC	-13.5144	772	ELECTRIC CIRCUIT EQUIPMT	-50.6531
716	ROTATING ELECTR PLANT	-15.3256	891	ARMS AND AMMUNITION	-50.7459
335	RESIDUAL PETROL. PRODS	-16.5877			-50.8122
792	AIRCRAFT/SPACECRAFT/ETC	-18.3398	893	ARTICLES NES OF PLASTICS	-51.0697
022	MILK PR EXC BUTTR/CHEESE	-19.0123	713	INTERNAL COMBUST ENGINES	-51.539
514	NITROGEN FUNCTION COMPDS	-19.2207	846	CLOTHING ACCESSORIES	-51.5428
811	PREFABRICATED BUILDINGS	-20.4511	045	CEREAL GRAINS NES	-51.6627
251	PULP AND WASTE PAPER	-20.8354	791	RAILWAY VEHICLES/EQUIPMT	-54.4146
678	IRON/STEEL WIRE	-21.6996	679	IRON/STEEL PIPE/TUBE/ETC	-55.0772
885	WATCHES AND CLOCKS	-22.8468	057	FRUIT/NUTS, FRESH/DRIED	-55.2437
775	DOMESTIC EQUIPMENT	-55.5578	574	POLYACETALS/POLYESTERS..	-75.0209
278	OTHER CRUDE MINERALS	-55.8842	874	MEASURE/CONTROL APP NES	-75.7978
695	HAND/MACHINE TOOLS	-56.671	898	MUSICAL INSTRUMS/RECORDS	-76.1282
721	AGRIC MACHINE EX TRACTR	-57.5525	725	PAPER INDUSTRY MACHINERY	-77.12
711	STEAM GENERATING BOILERS	-57.9092	541	PHARMACEUT EXC MEDICAMNT	-77.1996
062	SUGAR CONFECTIONERY	-58.1099	592	STARCHES/GLUES/ETC.	-77.3015
611	LEATHER	-58.8617	675	FLAT ROLLED ALLOY STEEL	-77.5274
641	PAPER/PAPERBOARD	-59.5735	525	RADIO-ACTIVE ETC MTRIAL	-78.2769
744	MECHANICAL HANDLING EQUI	-60.7548	411	ANIMAL OIL/FAT	-78.6695
431	ANIMAL/VEG OILS PROCES'D	-60.8524	764	TELECOMMS EQUIPMENT NES	-78.9493
749	NON-ELEC PARTS/ACC MACHN	-61.0008	656	TULLE/LACE/EMBR/TRIM ETC	-79.0123
223	OIL SEEDS-NOT SOFT OIL	-61.3711	812	SANITARY/PLUMBING/HEATING	-79.6361
571	PRIMARY ETHYLENE POLYMER	-62.1292	265	VEG TEXT FIBRE EX COT/JU	-80.4975
872	MEDICAL/ETC INSTRUMENTS	-63.4505	662	CLAY/REFRACTORY MATERIAL	-80.791
269	WORN CLOTHING ETC	-64.9748	531	SYNTH ORG COLOUR AGENTS	-80.7964
747	TAPS/COCKS/VALVES	-65.1817	654	WOVEN TEXTILE FABRIC NES	-81.1394

016 MEAT/OFFAL PRESERVED	-65.4088	741 INDUST HEAT/COOL EQUIPMT	-81.8654
737 METALWORKING MACHINE NES	-65.6645	728 SPECIAL INDUST MACHN NES	-82.1372
784 MOTOR VEH PARTS/ACCESS	-67.1241	759 OFFICE EQUIPMENT PARTS	-82.2218
075 SPICES	-67.643	581 PLASTIC TUBE/PIPE/HOSE	-82.9167
554 SOAPS/CLEANSERS/POLISHES	-69.124	657 SPECIAL YARNS/FABRICS	-83.123
895 OFFICE/STATIONERY SUPPLY	-71.03	724 TEXTILE/LEATHER MACHINRY	-83.4738
871 OPTICAL INSTRUMENTS NES	-71.537	743 FANS/FILTERS/GAS PUMPS	-83.6967
731 MACH-TOOLS REMOVE MTRIAL	-72.224	783 ROAD MOTOR VEHICLES NES	-84.7546
742 PUMPS FOR LIQUIDS	-72.7605	745 NON-ELECTR MACHINES NES	-86.7192
687 TIN	-73.2008	048 CEREAL ETC FLOUR/STARCH	-86.7902
762 RADIO BROADCAST RECEIVER	-73.2977	884 OPTICAL FIBRES	-86.8361
334 HEAVY PETROL/BITUM OILS	-73.3125	727 FOOD PROCESSING MACHINES	-87.0752
718 POWER GENERATING EQU NES	-73.3296	553 PERFUME/TOILET/COSMETICS	-87.9156
667 PEARLS/PRECIOUS STONES	-73.3838	733 MTL M-TOOLS W/O MTL-RMVL	-88.16
696 CUTLERY	-74.002	598 MISC CHEMICAL PRODS NES	-88.5525
112 ALCOHOLIC BEVERAGES	-74.3264	881 PHOTOGRAPHIC EQUIPMENT	-88.6305
575 PLASTIC NES-PRIMARY FORM	-74.7208	763 SOUND/TV RECORDERS ETC	-88.9996
892 PRINTED MATTER	-74.7912	533 PIGMENTS/PAINTS/VARNISH	-89.9236
659 FLOOR COVERINGS ETC.	-74.8426	532 DYEING/TANNING EXTRACTS	-89.9671
081 ANIMAL FEED EX UNML CER.	-74.9418	655 KNIT/CROCHET FABRICS	-90.1198
074 TEA AND MATE	-91.2693	025 EGGS, ALBUMIN	-97.8215
263 COTTON	-91.3674	024 CHEESE AND CURD	-97.8423
071 COFFEE/COFFEE SUBSTITUTE	-91.7388	098 EDIBLE PRODUCTS N.E.S.	-97.8847
653 MAN-MADE WOVEN FABRICS	-91.8381	597 OIL ETC ADDITIVES/FLUIDS	-98.7913
582 PLASTIC SHEETS/FILM/ETC	-92.5128	683 NICKEL	-98.8594
883 CINE FILD DEVELOPED	-92.64	542 MEDICAMENTS INCLUDE VET	-98.9158
674 ROLLED PLATED M-STEEL	-92.6673	285 ALUMINIUM ORES/CONCS/ETC	-99.1285
572 STYRENE PRIMARY POLYMERS	-92.9414	283 COPPER ORES/CONCENTRATES	-99.1501
268 WOOL/ANIMAL HAIR	-93.1732	882 PHOTOGRAPHIC SUPPLIES	-99.1677
122 TOBACCO, MANUFACTURED	-93.5063	344 PETROL./HYDROCARBON GAS	-99.4011
422 FIXED VEG OILS NOT SOFT	-93.722	091 MARGARINE/SHORTENING	-99.6794
752 COMPUTER EQUIPMENT	-93.812	633 CORK MANUFACTURES	-99.6917
551 ESSENT.OIL/PERFUME/FLAVR	-93.8138	041 WHEAT/MESLIN	-99.7537
652 COTTON FABRICS, WOVEN	-94.3269	421 FIXED VEG OIL/FAT, SOFT	-99.7641
333 PETROL./BITUM. OIL,CRUDE	-94.8709	047 CEREAL MEAL/FLOUR N.E.S	-99.7751
583 MONOFILAMENT RODS/STICKS	-94.9088	043 BARLEY GRAIN	-99.9293
726 PRINTING INDUSTRY MACHNY	-95.0737	042 RICE	-100
277 NATURAL ABRASIVES N.E.S.	-95.1028	046 FLOUR/MEAL WHEAT/MESLIN	-100
121 TOBACCO, RAW AND WASTES	-95.3112	244 CORK NATURAL/RAW/WASTE	-100
072 COCOA	-95.365	281 IRON ORE/CONCENTRATES	-100
591 HOUSEHOLD/GARDEN CHEMICAL	-95.9548	284 NICKEL ORES/CONCS/ETC	-100
044 MAIZE EXCEPT SWEET CORN.	-96.3822	286 URANIUM/THORIUM ORE/CONC	-100
774 MEDICAL ETC EL DIAG EQUI	-96.6233	342 LIQUID PROPANE/BUTANE	-100
751 OFFICE MACHINES	-97.1297	343 NATURAL GAS	-100
036 CRUSTACEANS MOLLUSCS ETC	-97.3667		

Appendix 4 – Gravity Results (Ordinary Least Squares Estimation)

This appendix contains all the results and tests obtained from the regression of Poland's trade with 17 European countries in 1998, and also some brief notes on their interpretation.

(1)

$$\ln E_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies$$

(2)

$$\ln M_{ij} = \alpha + \beta_1 \ln GDP_j + \beta_2 \ln \frac{gdp_j}{pop_j} + \ln \beta_3 GDP_i + \ln \beta_4 \frac{gdp_i}{pop_i} + \beta_5 Dist + Dummies$$

E_{ij} = value of Polish exports to countries j; j = 17 selected European countries.

M_{ij} = value of Polish imports from countries j;

GDP_j = Gross Domestic Product (at market exchange rates) of European countries;

GDP_i = Gross Domestic Product (at market exchange rates) of Poland;

GDP/POP_j = GDP capita of European countries;

GDP/POP_i = GDP capita of Poland;

$Dist_{ij}$ = distance in km between the capital cities of countries i and j;

Dummies = dummy variables representing the adjacency (ADJ) between countries i and j (sharing a national border) and preferential relationships (EU membership).

Notes on the interpretation of the main coefficients and diagnostic tests

R-squared (R^2): This tells us whether the regression has successfully provided an accurate fit of all variables. A value closer to 1 indicates that the regression was successful, and closer to 0 suggests a weak fit.

R-bar-squared ($\overline{R^2}$): Some regressions over estimate the R^2 value, providing a slightly higher coefficient than is really the case. The $\overline{R^2}$ value is the corrected coefficient of R^2 .

DW-Statistic (Durbin-Watson Test) The d-Stat is calculated from the residuals of the regression and is used to test for autocorrelation. Of significance, the further away the d-stat is from 2, the less confident one can be that there is no autocorrelation.

S.E. (Standard Error) of regression & **MDE** (Mean of Dependent Variable). Both S.E. and MDE values are taken for the calculation of the following:

$$\frac{SE}{MDV} * 100 = \text{level of deviation (\%)}$$

This test determines the scale of deviation between the actual fitted values and the empirical values. For example, the application of this test to the SE & MDV values for total imports (see following page), reveals:

$$\frac{SE}{MDV} * 100 = \text{level of deviation (\%)} \Rightarrow \frac{.35213}{25.0349} * 100 = 1.4\%$$

Heteroscedasticity

One of the main diagnostic tests carried out is to determine whether heteroscedasticity is present. Specifically, the purpose of this test is to determine the degree of error associated with estimation. For example, if we wish to run a regression to show how consumption (K) behaves given a higher level of income (I), measurement becomes problematic at higher levels of I , since consumption behaviour becomes more diversified. Therefore, if our dependent variable is I and our independent variable is K , then heteroscedasticity refers to the problems of measuring K at higher levels of I .

For further elaboration on linear regressions and the tests contained in the tables, please consult:

Kennedy, P., *A Guide to Econometrics*, 1979 and/or;

Stewart, J., *Understanding Econometrics*, 1976.

Dependent variable is IMPORTS

17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	3.8219	2.8574	1.3375 [.214]
GDP _i	0.83460	0.10113	8.2531 [.000]
GDP/POP _i	0.067023	0.15779	0.42476 [.681]
GDP _i	-0.071494	0.11306	-0.63234 [.543]
GDP/POP _i	0.070313	0.14208	0.49489 [.633]
DISTANCE	-0.18654	0.27212	-0.68550 [.510]
EU	-0.074406	0.36172	-0.20570 [.842]
ADJ	0.077697	0.33384	0.23274 [.821]

R-Squared	.94402	R-Bar-Squared	.90047
S.E. of Regression	.35213	F-stat. F(7, 9)	21.6796[.000]
Mean of Dependent Variable	25.0349	S.D. of Dependent Variable	1.1162
Residual Sum of Squares	1.1160	Equation Log-likelihood	-.97236
Akaike Info. Criterion	-8.9724	Schwarz Bayesian Criterion	-12.3052
DW-statistic	1.4211		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .16256[.687]	F(1, 8)= .077235[.788]
B:Functional Form	CHSQ(1)= 1.8506[.174]	F(1, 8)= .97725[.352]
C:Normality	CHSQ(2)= 6.1332[.047]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .0016555[.968]	F(1, 15)= .0014609[.970]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Imports of Raw Materials
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	3.5369	3.1017	1.1403 [.284]
GDP _i	0.68603	0.10977	6.2497 [.000]
GDP/POP _i	-0.091393	0.17128	-0.53360 [.607]
GDP _i	-0.088652	0.12273	-0.72236 [.488]
GDP/POP _i	0.038105	0.15422	0.24708 [.810]
DISTANCE	0.090147	0.29538	0.30519 [.767]
EU	0.78671	0.39264	2.0036 [.076]
ADJ	0.39856	0.36237	1.0999 [.300]

R-Squared	.93670	R-Bar-Squared	.88746
S.E. of Regression	.38223	F-stat. F(7, 9)	19.0248[.000]
Mean of Dependent Variable	21.8942	S.D. of Dependent Variable	1.1394
Residual Sum of Squares	1.3149	Equation Log-likelihood	-2.3668
Akaike Info. Criterion	-10.3668	Schwarz Bayesian Criterion	-13.6996
DW-statistic	1.4014		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .52510[.469]	F(1, 8)= .25498[.627]
B:Functional Form	CHSQ(1)= 1.7019[.192]	F(1, 8)= .88998[.373]
C:Normality	CHSQ(2)= 4.4851[.106]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .50477[.477]	F(1, 15)= .45901[.508]

- A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Imports of Fuels
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	6.3968	3.6071	1.7734 [.110]
GDP _i	0.73912	0.12766	5.7898 [.000]
GDP/POP _i	-0.28826	0.19918	-1.4472 [.182]
GDP _i	0.085962	0.14272	0.60230 [.562]
GDP/POP _i	0.14049	0.17935	0.78330 [.454]
DISTANCE	-0.15854	0.34351	-0.46154 [.655]
EU	0.043177	0.45662	0.094557 [.927]
ADJ	0.18658	0.42142	0.44275 [.668]

R-Squared	.88668	R-Bar-Squared	.79854
S.E. of Regression	.44452	F-stat. F(7, 9)	10.0600[.001]
Mean of Dependent Variable	22.1364	S.D. of Dependent Variable	.99036
Residual Sum of Squares	1.7784	Equation Log-likelihood	-4.9330
Akaike Info. Criterion	-12.9330	Schwarz Bayesian Criterion	-16.2659
DW-statistic	1.5661		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .13760[.711]	F(1, 8)= .065279[.805]
B:Functional Form	CHSQ(1)= .82231[.365]	F(1, 8)= .40664[.541]
C:Normality	CHSQ(2)= 1.5155[.469]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .26483[.607]	F(1, 15)= .23737[.633]

- A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Imports of Agricultural Goods (including food)
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	-1.8308	3.6780	-0.49777 [.631]
GDP _i	0.90130	0.13017	6.9243 [.000]
GDP/POP _i	0.0050662	0.20310	0.024944 [.981]
GDP _i	-0.13974	0.14553	-0.96026 [.362]
GDP/POP _i	0.23759	0.18288	1.2992 [.226]
DISTANCE	0.016054	0.35026	0.045836 [.964]
EU	0.27222	0.46559	0.58467 [.573]
ADJ	0.23885	0.42970	0.55586 [.592]

R-Squared	.93185	R-Bar-Squared	.87885
S.E. of Regression	.45325	F-stat. F(7, 9)	17.5807[.000]
Mean of Dependent Variable	22.4415	S.D. of Dependent Variable	1.3022
Residual Sum of Squares	1.8489	Equation Log-likelihood	-5.2637
Akaike Info. Criterion	-13.2637	Schwarz Bayesian Criterion	-16.5966
DW-statistic	1.6796		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .091974[.762]	F(1, 8)= .043517[.840]
B:Functional Form	CHSQ(1)= 2.6442[.104]	F(1, 8)= 1.4735[.259]
C:Normality	CHSQ(2)= 5.7860[.055]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .11664[.733]	F(1, 15)= .10363[.752]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Imports of Manufactured Goods
 17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	2.1198	2.9401	0.72102 [.489]
GDP _i	0.87629	0.10405	8.4218 [.000]
GDP/POP _i	0.12518	0.16235	0.77107 [.460]
GDP _i	-0.096290	0.11633	-0.82773 [.429]
GDP/POP _i	0.12541	0.14619	0.85785 [.413]
DISTANCE	-0.28693	0.27998	-1.0248 [.332]
EU	-0.26526	0.37218	-0.71271 [.494]
ADJ	-0.021659	0.34349	-.063055 [.951]

R-Squared	.94234	R-Bar-Squared	.89750
S.E. of Regression	.36231	F-stat. F(7, 9)	21.0137[.000]
Mean of Dependent Variable	24.1917	S.D. of Dependent Variable	1.1317
Residual Sum of Squares	1.1814	Equation Log-likelihood	-1.4569
Akaike Info. Criterion	-9.4569	Schwarz Bayesian Criterion	-12.7897
DW-statistic	1.3864		

Diagnostic Tests

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(1)= .0084019[.927]	F(1, 8)= .0039558[.951]
B: Functional Form	CHSQ(1)= 2.3636[.124]	F(1, 8)= 1.2919[.289]
C: Normality	CHSQ(2)= 15.8147[.000]	Not applicable
D: Heteroscedasticity	CHSQ(1)= .020382[.886]	F(1, 15)= .018005[.895]

- A: Lagrange multiplier test of residual serial correlation
- B: Ramsey's RESET test using the square of the fitted values
- C: Based on a test of skewness and kurtosis of residuals
- D: Based on the regression of squared residuals on squared fitted values

Dependent variable is Imports of Machinery
 17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	3.2510	3.1066	1.0465 [.323]
GDP _j	0.80820	0.10994	7.3511 [.000]
GDP/POP _j	0.089703	0.17154	0.52292 [.614]
GDP _i	-0.047909	0.12292	-0.38976 [.706]
GDP/POP _i	-0.032015	0.15447	-0.20727 [.840]
DISTANCE	-0.16456	0.29584	-0.55623 [.592]
EU	-0.0093863	0.39326	-.023868 [.981]
ADJ	0.13640	0.36294	0.37581 [.716]

R-Squared	.93529	R-Bar-Squared	.88496
S.E. of Regression	.38283	F-stat. F(7, 9)	18.5825[.000]
Mean of Dependent Variable	24.0706	S.D. of Dependent Variable	1.1287
Residual Sum of Squares	1.3190	Equation Log-likelihood	-2.3934
Akaike Info. Criterion	-10.3934	Schwarz Bayesian Criterion	-13.7262
DW-statistic	1.5702		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .48177[.488]	F(1, 8)= .23333[.642]
B:Functional Form	CHSQ(1)= 1.1835[.277]	F(1, 8)= .59863[.461]
C:Normality	CHSQ(2)= .56721[.753]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .54058[.462]	F(1, 15)= .49265[.493]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Dependent variable is EXPORTS

17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	3.1722	3.8522	0.82349 [.432]
GDP _j	0.86411	0.13633	6.3384 [.000]
GDP/POP _j	0.15947	0.21272	0.74967 [.473]
GDP _i	0.22665	0.15242	1.4870 [.171]
GDP/POP _i	-0.28588	0.19154	-1.4925 [.170]
DISTANCE	-0.24236	0.36685	-0.66066 [.525]
EU	-0.61779	0.48764	-1.2669 [.237]
ADJ	0.018192	0.45005	0.040422 [.969]

R-Squared	.91495	R-Bar-Squared	.84880
S.E. of Regression	.47472	F-stat. F(7, 9)	13.8316[.000]
Mean of Dependent Variable	24.8970	S.D. of Dependent Variable	1.2208
Residual Sum of Squares	2.0282	Equation Log-likelihood	-6.0504
Akaike Info. Criterion	-14.0504	Schwarz Bayesian Criterion	-17.3833
DW-statistic	.93637		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 1.5854[.208]	F(1, 8)= .82278[.391]
B:Functional Form	CHSQ(1)= .25204[.616]	F(1, 8)= .12039[.738]
C:Normality	CHSQ(2)= 13.7380[.001]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .064815[.799]	F(1, 15)= .057408[.814]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Exports of Raw Materials
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	14.9479	5.3404	2.7990 [.021]
GDP _i	0.40360	0.18900	2.1354 [.061]
GDP/POP _i	-0.13155	0.29490	-0.44607 [.666]
GDP _i	0.50903	0.21131	2.4090 [.039]
GDP/POP _i	-0.45668	0.26554	-1.7198 [.120]
DISTANCE	-0.37284	0.50857	-0.73310 [.482]
EU	0.39577	0.67604	0.58542 [.573]
ADJ	-0.21333	0.62392	-0.34192 [.740]

R-Squared	.78969	R-Bar-Squared	.62611
S.E. of Regression	.65812	F-stat. F(7, 9)	4.8276[.016]
Mean of Dependent Variable	21.4296	S.D. of Dependent Variable	1.0763
Residual Sum of Squares	3.8981	Equation Log-likelihood	-11.6038
Akaike Info. Criterion	-19.6038	Schwarz Bayesian Criterion	-22.9366
DW-statistic	.88422		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 3.8276[.050]	F(1, 8)= 2.3246[.166]
B:Functional Form	CHSQ(1)= 1.3481[.246]	F(1, 8)= .68903[.431]
C:Normality	CHSQ(2)= 2.3596[.307]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .20712[.649]	F(1, 15)= .18501[.673]

- A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Exports of Fuels
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	8.4005	6.5911	1.2745 [.234]
GDP _i	0.43656	0.23326	1.8715 [.094]
GDP/POP _i	0.0021839	0.36396	.0060005 [.995]
GDP _i	0.24221	0.26079	0.92876 [.377]
GDP/POP _i	-0.93569	0.32773	-2.8551 [.019]
DISTANCE	0.31123	0.62768	0.49584 [.632]
EU	0.52666	0.83436	0.63121 [.544]
ADJ	0.30842	0.77004	0.40053 [.698]

R-Squared	.77714	R-Bar-Squared	.60381
S.E. of Regression	.81225	F-stat. F(7, 9)	4.4835 [.020]
Mean of Dependent Variable	21.2725	S.D. of Dependent Variable	1.2904
Residual Sum of Squares	5.9377	Equation Log-likelihood	-15.1809
Akaike Info. Criterion	-23.1809	Schwarz Bayesian Criterion	-26.5137
DW-statistic	2.2371		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 1.1734 [.279]	F(1, 8)= .59311 [.463]
B:Functional Form	CHSQ(1)= 6.9039 [.009]	F(1, 8)= 5.4706 [.047]
C:Normality	CHSQ(2)= .21255 [.899]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .11356 [.736]	F(1, 15)= .10087 [.755]

- A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Exports of Agricultural Goods (including food)
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio	[Prob]
INTERCEPT	1.2046	7.4098	.16257	[.874]
GDP _i	0.98035	0.26224	3.7384	[.005]
GDP/POP _i	-0.051719	0.40917	-0.12640	[.902]
GDP _i	0.021698	0.29319	0.074006	[.943]
GDP/POP _i	-0.29120	0.36843	-0.79036	[.450]
DISTANCE	-0.55062	0.70565	-0.78031	[.455]
EU	0.22765	0.93800	0.24269	[.814]
ADJ	-0.52275	0.86569	-0.60386	[.561]

R-Squared	0.79425	R-Bar-Squared	0.63422
S.E. of Regression	.91314	F-stat. F(7, 9)	4.9631 [.015]
Mean of Dependent Variable	22.1443	S.D. of Dependent Variable	1.5098
Residual Sum of Squares	7.5044	Equation Log-likelihood	-17.1713
Akaike Info. Criterion	-25.1713	Schwarz Bayesian Criterion	-28.5042
DW-statistic	1.8969		

Diagnostic Tests

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ(1)= .012743 [.910]	F(1, 8)= .0060014 [.940]
B: Functional Form	CHSQ(1)= .050199 [.823]	F(1, 8)= .023693 [.881]
C: Normality	CHSQ(2)= 1.5893 [.452]	Not applicable
D: Heteroscedasticity	CHSQ(1)= .12153 [.727]	F(1, 15)= .10800 [.747]

A: Lagrange multiplier test of residual serial correlation

B: Ramsey's RESET test using the square of the fitted values

C: Based on a test of skewness and kurtosis of residuals

D: Based on the regression of squared residuals on squared fitted values

Dependent variable is Exports of Manufactured Goods
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	1.2574	3.4184	0.36782 [.722]
GDP _i	0.88157	0.12098	7.2870 [.000]
GDP/POP _i	0.17884	0.18876	0.94742 [.368]
GDP _i	0.18906	0.13526	1.3978 [.196]
GDP/POP _i	-0.078223	0.16997	-0.46022 [.656]
DISTANCE	-0.18972	0.32554	-0.58278 [.574]
EU	-0.88442	0.43273	-2.0438 [.071]
ADJ	0.038516	0.39937	0.096442 [.925]

R-Squared	.92662	R-Bar-Squared	.86955
S.E. of Regression	.42126	F-stat. F(7, 9)	16.2360[.000]
Mean of Dependent Variable	24.0913	S.D. of Dependent Variable	1.1663
Residual Sum of Squares	1.5971	Equation Log-likelihood	-4.0194
Akaike Info. Criterion	-12.0194	Schwarz Bayesian Criterion	-15.3523
DW-statistic	.88569		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 2.5537[.110]	F(1, 8)= 1.4142[.268]
B:Functional Form	CHSQ(1)= 1.3935[.238]	F(1, 8)= .71431[.423]
C:Normality	CHSQ(2)= 8.0187[.018]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .054430[.816]	F(1, 15)= .048181[.829]

A:Lagrange multiplier test of residual serial correlation

B:Ramsey's RESET test using the square of the fitted values

C:Based on a test of skewness and kurtosis of residuals

D:Based on the regression of squared residuals on squared fitted values

Dependent variable is Exports of Machinery
17 observations used for estimation from 1 to 17

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
INTERCEPT	-0.78484	6.0862	-0.12895 [.900]
GDP _i	1.0048	0.21539	4.6651 [.001]
GDP/POP _i	0.18252	0.33608	0.54308 [.600]
GDP _i	0.23942	0.24082	0.99421 [.346]
GDP/POP _i	-0.24897	0.30262	-0.82273 [.432]
DISTANCE	-0.38304	0.57959	-0.66088 [.525]
EU	-0.72787	0.77045	-0.94473 [.369]
ADJ	0.19672	0.71105	0.27665 [.788]

R-Squared	.84731	R-Bar-Squared	.72854
S.E. of Regression	.75002	F-stat. F(7, 9)	7.1345[.004]
Mean of Dependent Variable	23.8641	S.D. of Dependent Variable	1.4395
Residual Sum of Squares	5.0628	Equation Log-likelihood	-13.8260
Akaike Info. Criterion	-21.8260	Schwarz Bayesian Criterion	-25.1588
DW-statistic	1.5153		

Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= .29448[.587]	F(1, 8)= .14102[.717]
B:Functional Form	CHSQ(1)= 2.2740[.132]	F(1, 8)= 1.2354[.299]
C:Normality	CHSQ(2)= 2.0133[.365]	Not applicable
D:Heteroscedasticity	CHSQ(1)= 2.0463[.153]	F(1, 15)= 2.0527[.172]

- A:Lagrange multiplier test of residual serial correlation
 B:Ramsey's RESET test using the square of the fitted values
 C:Based on a test of skewness and kurtosis of residuals
 D:Based on the regression of squared residuals on squared fitted values

Appendix 5 – Polish-German traded goods and the level of Intra-industry trade

$$IIT = \left\{ 1 - \left[\frac{\sum |x_i - m_i|}{\sum (x_i + m_i)} \right] \right\} 100$$

$$IIT^* = \left\{ 1 - 0.5 \left[\sum \left(\left| \frac{x_i}{x} \right| - \left| \frac{m_i}{m} \right| \right) \right] \right\} 100$$

The same procedure was followed for the calculation of Polish-German IIT values. The given columns represent a breakdown of the above Grubel-Lloyd formula. Calculations were performed using two-digit data. See foot of table for results.

Calculations for 1990

Industry	xi - mi	xi	mi	xi-mi	xi+mi	xi/X	mi/M	xi/X - mi/M
Agricultural, Forestry & fisheries	72,787.0	441,568.0	368,781.0	72,787.00	810,349.0	0.08	0.07	0.01
Food industry & tobacco	242,379.0	519,411.0	277,032.0	242379	796,443.0	0.1	0.05	0.05
Electricity, Gas, district heat & water	0.0	0.0	0.0	0	0.0	0	0	0
Mining products								
Coal, briquettes, coke, tar & benzene	303,909.0	304,246.0	337.0	303909	304,583.0	0.05	0.00007	0.05
Crude oil & Natural gas	0.0	0.0	0.0	0	0.0	0	0	0
Iron ore	0.0	0.0	0.0	0	0.0	0	0	0
Non-ferrous metals & pyrite	9,667.0	10,056.0	389.0	9667	10,445.0	0.0019	0.00008	0.0019
Unwrought phosphate	-63.0	0.0	63.0	63	63.0	0	0	0
Stone	159.0	278.0	119.0	159	397.0	0.00005	0.00002	0.00005
Heavy spar, graphite & petroleum ore	-235.0	0.0	235.0	235	235.0	0	0.00005	0.00005
Turf	650.0	656.0	6.0	650	662.0	0.0001	0	0.0001
Primary goods								
Fissure & spawn materials	-402.0	0.0	402.0	402	402.0	0	0.00008	0.0008
Stone, earth & asbestos goods	30,517.0	52,726.0	22,209.0	30517	74,935.0	0.01	0.004	0.006
Iron & steel	120,520.0	255,658.0	135,138.0	120520	390,796.0	0.049	0.002	0.047
Iron, steel & cast iron	13,185.0	19,505.0	6,320.0	13185	25,825.0	0.0037	0.001	0.0027
Products from foundaries & steel mills	-10,036.0	28,254.0	38,290.0	10036	66,544.0	0.005	0.008	0.003
Non-ferrous & semi-finished metal prcts	629,552.0	650,093.0	20,541.0	629552	670,634.0	0.125	0.004	0.121
Non-ferrous metal casts	723.0	920.0	197.0	723	1,117.0	0.0001	0.00004	0.00006
Mineral products	8,379.0	128,139.0	119,760.0	8379	247,899.0	0.024	0.025	0.226
Chemical products	-183,039.	355,035.0	538,074.0	183039	893,109.0	0.068	0.1147	0.0467
Cut, waste & other processed wood	137,676.0	140,168.0	2,492.0	137676	142,660.0	0.027	0.00053	0.026
Grinded wood, cellulose & paper board	18,022.0	41,466.0	23,444.0	18022	64,910.0	0.008	0.004	0.004
Rubber goods	-6,450.0	18,984.0	25,434.0	6450	44,418.0	0.0036	0.0054	0.0018
Capital goods								
Steel products & trams	48,446.0	66,081.0	17,635.0	48446	83,716.0	0.012	0.003	0.009
Machine products	-732,652.	217,099.0	949,751.0	732652	1,166,850	0.042	0.202	0.16
Motor vehicles (excl. agricultural)	-254,122.	45,815.0	299,937.0	254122	345,752.0	0.008	0.063	0.055

Motor craft & ships	1,436.0	6,271.0	4,835.0	1436	11,106.0	0.001	0.001	0
Aircraft and spaceships	159.0	661.0	502.0	159	1,163.0	0.0001	0.0001	0
Electronic products	-207,360.0	232,078.0	439,438.0	207360	671,516.0	0.044	0.093	0.049
Fine mechanical & optical instruments:	-71,248.0	9,849.0	81,097.0	71248	90,946.0	0.0019	0.017	0.0151
Formed steel products	63,731.0	79,543.0	15,812.0	63731	95,355.0	0.015	0.0033	0.0117
Iron, steel & sheet metal products	14,714.0	109,363.0	94,649.0	14714	204,012.0	0.0211	0.0201	0.001
Office machines, computers	-82,844.0	537.0	83,381.0	82844	83,918.0	0.0001	0.0177	0.0176
Prefabricated buildings	3,327.0	3,835.0	508.0	3327	4,343.0	0.0007	0.0001	0.0006
Consumption goods								
Fine ceramic goods	-4,704.0	5,442.0	10,146.0	4704	15,588.0	0.001	0.0021	0.0011
Glass & glass products	49,586.0	69,750.0	20,164.0	49586	89,914.0	0.013	0.004	0.017
Wooden products	326,372.0	345,278.0	18,906.0	326372	364,184.0	0.066	0.004	0.062
Musical instruments, & sports equipment	-31,023.0	20,073.0	51,096.0	31023	71,169.0	0.003	0.01	0.007
paper & paper goods	-38,519.0	2,710.0	41,229.0	38519	43,939.0	0.0005	0.008	0.0075
Printed products	-22,554.0	2,584.0	25,138.0	22554	27,722.0	0.0005	0.005	0.0045
Works of art	-103,858.0	24,264.0	128,122.0	103858	152,386.0	0.004	0.027	0.023
Leather	-28,688.0	10,120.0	38,808.0	28688	48,928.0	0.0019	0.008	0.0061
Leather goods	19,266.0	25,245.0	5,979.0	19266	31,224.0	0.004	0.001	0.003
Shoes	57,015.0	78,747.0	21,732.0	57015	100,479.0	0.015	0.004	0.011
Textiles	-496,596.0	101,449.0	598,045.0	496596	699,494.0	0.019	0.127	0.108
Clothing	624,893.0	683,997.0	59,104.0	624893	743,101.0	0.132	0.012	0.12
Other	-50,090.0	55,316.0	105,406.0	50090	160,722.0	0.01	0.02	0.01
								1.29636

ITT = 48.03

ITT* = 35.18

Calculations for 1994

Industry	xi - mi	xi	mi	xi - mi	xi+mi	xi/X	mi/M	xi/X - mi/M
Agricultural, Forestry & fisheries	151387	305,756.0	154369	151,387	460,125	0.03	0.01	0.02
Food industry & tobacco	116922	565,317.0	682239	116,922	1,247,556	0.05	0.06	0.01
Electricity, Gas, district heat & water	26	26.0	0	26	26	0.000002	0	0.000002
Mining products				0	0			
Coal, briquettes, coke, tar & benzene	433343	434,135.0	792	433,343	434,927	0.04	0.00007	0.039
Crude oil & Natural gas	5721	2,999.0	8720	5,721	11,719	0.0002	0.0008	0.0006
Iron ore	7	0.0	7	7	7	0	6E-07	6E-07
Non-ferrous metals & pyrite	2474	4,442.0	1968	2,474	6,410	0.0004	0.00019	0.00021
Unwrought phosphate	22830	75.0	22905	22,830	22,980	0.000007	0.0022	0.002
Stone	3170	3,387.0	217	3,170	3,604	0.00033	0.00002	0.00013
Heavy spar, graphite & petroleum ore	685	31.0	716	685	747	0.000003	0.00006	0.00005
Turf	1801	1,958.0	157	1,801	2,115	0.0001	0.00001	0.00009
Primary goods				0	0			
Fissure & spawn materials	824	83.0	907	824	990	0.000008	0.00008	0.0007
Stone, earth & asbestos goods	397485	489,052.0	91567	397,485	580,619	0.048	0.008	0.04
Iron & steel	317928	501,127.0	183199	317,928	684,326	0.049	0.017	0.032
Iron, steel & cast iron	40520	54,636.0	14115	40,521	68,751	0.005	0.001	0.004
Products from foundaries & steel mills	13627	52,518.0	38891	13,627	91,409	0.005	0.003	0.002
Non-ferrous & semi-finished metal products	544995	623,552.0	78557	544,995	702,109	0.06	0.007	0.053
Non-ferrous metal casts	1809	7,518.0	5709	1,809	13,227	0.0007	0.0005	0.0002
Mineral products	50308	52,362.0	102670	50,308	155,032	0.0051	0.0099	0.0048
Chemical products	1021711	435,886.0	1457597	1,021,711	1,893,483	0.043	0.14	0.097
Cut, waste & other processed wood	233121	268,188.0	35067	233,121	303,255	0.026	0.003	0.023
Grinded wood, cellulose, paper & paper board	38764	76,115.0	114879	38,764	190,994	0.007	0.011	0.004
Rubber goods	26402	58,684.0	85086	26,402	143,770	0.005	0.008	0.003
Capital goods				0	0			
Steel products & trams	115952	258,332.0	142380	115,952	400,712	0.02	0.01	0.01
Machine products	1195312	349,421.0	1544733	1,195,312	1,894,154	0.034	0.14	0.106
Motor vehicles (excl. agricultural)	452586	365,811.0	818397	452,586	1,184,208	0.036	0.07	0.034
Motor craft & ships	55629	57,169.0	1540	55,629	58,709	0.005	0.0001	0.0049
Aircraft and spaceships	107	2,716.0	2609	107	5,325	0.0002	0.0002	0
Electronic products	547183	541,634.0	1088817	547,183	1,630,451	0.053	0.1	0.047
Fine mechanical & optical instruments: watches/clocks	117854	20,437.0	138291	117,854	158,728	0.002	0.013	0.011
Formed steel products	47069	134,077.0	87008	47,069	221,085	0.013	0.008	0.005
Iron, steel & sheet metal products	33233	310,805.0	344038	33,233	654,843	0.03	0.033	0.003
Office machines, computers	183920	6,373.0	190293	183,920	196,666	0.0006	0.01	0.0094
Prefabricated buildings	27364	27,508.0	144	27,364	27,652	0.002	0.00001	0.0019
Consumption goods								
Fine ceramic goods	4900	18,445.0	23345	4,900	41,790	0.001	0.002	0.001

Glass & glass products	29534	82,875.0	53341	29,534	136,216	0.008	0.005	0.003
Wooden products	1206466	1,285,633.0	79167	1,206,466	1,364,800	0.126	0.007	0.119
Musical instruments, toys & sports equip.	20402	48,410.0	68812	20,402	117,222	0.004	0.006	0.002
paper & paper goods	119911	43,298.0	163209	119,911	206,507	0.004	0.015	0.011
Printed products	117702	8,551.0	126263	117,712	134,814	0.0008	0.012	0.0112
Works of art	384841	108,871.0	493712	384,841	602,583	0.01	0.047	0.037
Leather	20535	51,432.0	71967	20,535	123,399	0.005	0.006	0.001
Leather goods	10191	25,974.0	15783	10,191	41,757	0.002	0.001	0.001
Shoes	96545	115,454.0	18909	96,545	134,363	0.011	0.001	0.01
Textiles	1285062	329,480.0	1614542	1,285,062	1,944,022	0.032	0.155	0.123
Clothing	1757604	1,864,929.0	107325	1,757,604	1,972,254	0.184	0.01	0.174
Other	52922	130,512.0	77590	52,922	208,102	0.012	0.007	0.005
				11,308,695	20,478,54			1.066183

ITT = 44.77

ITT* = 46.69

Calculations for 1998

Industry	xi - mi	xi	mi	xi - mi	xi+mi	xi/X	mi/M	xi/X - mi/M
Agricultural products & livestock animals	13215	215201	201986	13,215	417187	0.013	0.008	0.005
Forestry products	10284	17272	6988	10,284	24260	0.001	0.0002	0.0008
Fish & fish products	-15165	6277	21442	15,165	27719	0.0003	0.0008	0.0005
Coal & turf	316131	317323	1192	316,131	318515	0.019	0.00004	0.0189
Crude oil & natural gas	1193	4975	3782	1,193	8757	0.0003	0.0001	0.0002
Ore	4383	7831	3448	4,383	11279	0.0004	0.0001	0.0003
Stone, earth & other mining products	32909	68102	35193	32,909	103295	0.004	0.001	0.003
Food products	-111442	991296	1102738	111,442	2094034	0.06	0.045	0.015
Tobacco products	-5767	430	6197	5,767	6627	0.00002	0.0002	0.00018
Textiles	-1435002	576146	2011148	1,435,002	2587294	0.035	0.083	0.048
Clothes	1867878	2263482	395604	1,867,878	2659086	0.137	0.016	0.121
Leather & leather goods	-52488	221081	273569	52,488	494650	0.013	0.011	0.002
Wood, wooden products, cork & cork products, woven and basket goods	818828	1059580	240752	818,828	1300332	0.064	0.009	0.055
Paper	-566945	225487	792432	566,945	1017919	0.013	0.032	0.019
Published & printed products	-149239	43580	192819	149,239	236399	0.002	0.007	0.005
Coke & mineral products, fissure- & spawn materials	92146	407985	315839	92,146	723824	0.02	0.013	0.007
Chemical products	-2222317	661099	2883416	2,222,317	3544515	0.04	0.119	0.079
Rubber & art goods	-925506	381200	1306706	925,506	1687906	0.023	0.054	0.031
Glass, ceramic, worked/processed stone & earth	-26901	563379	590280	26,901	1153659	0.034	0.024	0.01
Iron & steel products, non-ferrous metals & products	276587	1499110	1222523	276,587	2721633	0.091	0.05	0.041
Metal products	-147481	1091135	1238616	147,481	2329751	0.066	0.051	0.015
Machines	-3660118	895859	4555977	3,660,118	5451836	0.054	0.188	0.134
Office machines, data processing equipment	-510268	26641	536909	510,268	563550	0.001	0.022	0.021
Electrical products & distribution	-153595	1026096	1179691	153,595	2205787	0.062	0.048	0.014
News-, Radio- & television-equipment as well as electronic components	-600667	172852	773519	600,667	946371	0.01	0.032	0.022
Medicine, measurement, steering, regulation & optical products	-490695	98430	589125	490,695	687555	0.005	0.024	0.019
Motor vehicles and parts	-835845	1192652	2028497	835,845	3221149	0.072	0.084	0.012
Other vehicles	-9811	109886	119697	9,811	229583	0.006	0.004	0.002
Furniture, Jewellery, Musical instruments, sports equipment, toys & other products	1696518	2078179	381661	1,696,518	2459840	0.126	0.015	0.111
Energy	40110	40110	0	40,110	40110	0.002	0	0.002
Other goods	-920925	179790	1100715	920,925	1280505	0.01	0.045	0.035
				18,010,359	40554927			0.84888

IT = 55.59

IT* = 57.55

Appendix 6 Polish export specialisation with Germany

$$SI = \frac{(x_i^p / x)}{(x_i^g / x)} \times 100$$

x_i^p = total exports of industry i from Poland to Germany

x = total exports from Poland to Germany

x_i^g = total exports of industry i from Germany to Poland

x = total exports from Germany to Poland

The above formula was applied to measure in which industries export specialisation has occurred. A value > 100 indicates that the industry is relatively specialised and < 100 indicates low specialisation.

Column A represents the upper part (denominator) of the above equation (Polish exports from industry i divided by total Polish exports to Germany). x_i^p / X

Column B represents the lower part (numerator) of the above equation (German exports from industry i divided by total exports to Poland). x_i^g / X

Export specialisation in 1990.

Industry	x_i^p / x	x_i^g / x	A / B * 100 = SI
	A	B	SI
Agricultural, Forestry & fisheries	0.08	0.07	114.3
Food industry & tobacco	0.1	0.05	200.0
Electricity, Gas, district heat & water	0	0	0.0
Mining products			
Coal, briquettes, coke, tar & benzene	0.05	0.00007	71,428.6
Crude oil & Natural gas	0	0	0.0
Iron ore	0	0	0.0

Non-ferrous metals & pyrite	0.0019	0.00008	2,375.0
Unwrought phosphate	0	0	0.0
Stone	0.00005	0.00002	250.0
Heavy spar, graphite & petroleum ore	0	0.00005	0.0
Turf	0.0001	0	0.0
Primary goods			
Fissure & spawn materials	0	0.00008	0.0
Stone, earth & asbestos goods	0.01	0.004	250.0
Iron & steel	0.049	0.002	2,450.0
Iron, steel & cast iron	0.0037	0.001	370.0
Products from foundaries & steel mills	0.005	0.008	62.5
Non-ferrous & semi-finished metal products	0.125	0.004	3,125.0
Non-ferrous metal casts	0.0001	0.00004	250.0
Mineral products	0.024	0.025	96.0
Chemical products	0.068	0.1147	59.3
Cut, waste & other processed wood	0.027	0.00053	5,094.3
Grinded wood, cellulose, paper & paper board	0.008	0.004	200.0
Rubber goods	0.0036	0.0054	66.7
Capital goods			
Steel products & trams	0.012	0.003	400.0
Machine products	0.042	0.202	20.8
Motor vehicles (excl. agricultural)	0.008	0.063	12.7
Motor craft & ships	0.001	0.001	100.0
Aircraft and spaceships	0.0001	0.0001	100.0
Electronic products	0.044	0.093	47.3
Fine mechanical & optical instruments: watches/clocks	0.0019	0.017	11.2
Formed steel products	0.015	0.0033	454.5
Iron, steel & sheet metal products	0.0211	0.0201	105.0
Office machines, computers	0.0001	0.0177	0.6
Prefabricated buildings	0.0007	0.0001	700.0
Consumption goods			
Fine ceramic goods	0.001	0.0021	47.6
Glass & glass products	0.013	0.004	325.0
Wooden products	0.066	0.004	1,650.0
Musical instruments, toys & sports equipment	0.003	0.01	30.0
paper & paper goods	0.0005	0.008	6.3
Printed products	0.0005	0.005	10.0
Works of art	0.004	0.027	14.8
Leather	0.0019	0.008	23.8
Leather goods	0.004	0.001	400.0
Shoes	0.015	0.004	375.0
Textiles	0.019	0.127	15.0
Clothing	0.132	0.012	1,100.0
Other	0.01	0.02	50.0

Export specialisation in 1994.

Industry	χ_i^p / χ A	χ_i^g / χ B	A / B * 100 = SI SI
Agricultural, Forestry & fisheries	0.03	0.01	300.0
Food industry & tobacco	0.05	0.06	83.3
Electricity, Gas, district heat & water	0.000002	0	0.0
Mining products			
Coal, briquettes, coke, tar & benzene	0.04	0.00007	57,142.9
Crude oil & Natural gas	0.0002	0.0008	25.0
Iron ore	0	6E-07	0.0
Non-ferrous metals & pyrite	0.0004	0.00019	210.5
Unwrought phosphate	0.000007	0.0022	0.3
Stone	0.00033	0.00002	1,650.0
Heavy spar, graphite & petroleum ore	0.000003	0.00006	5.0
Turf	0.0001	0.00001	1,000.0
Primary goods			
Fissure & spawn materials	0.000008	0.00008	10.0
Stone, earth & asbestos goods	0.048	0.008	600.0
Iron & steel	0.049	0.017	288.2
Iron, steel & cast iron	0.005	0.001	500.0
Products from foundaries & steel mills	0.005	0.003	166.7
Non-ferrous & semi-finished metal products	0.06	0.007	857.1
Non-ferrous metal casts	0.0007	0.0005	140.0
Mineral products	0.0051	0.0099	51.5
Chemical products	0.043	0.14	30.7
Cut, waste & other processed wood	0.026	0.003	866.7
Grinded wood, cellulose, paper & paper board	0.007	0.011	63.6
Rubber goods	0.005	0.008	62.5
Capital goods			
Steel products & trams	0.02	0.01	200.0
Machine products	0.034	0.14	24.3
Motor vehicles (excl. agricultural)	0.036	0.07	51.4
Motor craft & ships	0.005	0.0001	5,000.0
Aircraft and spaceships	0.0002	0.0002	100.0
Electronic products	0.053	0.1	53.0
Fine mechanical & optical instruments: watches/clocks	0.002	0.013	15.4
Formed steel products	0.013	0.008	162.5
Iron, steel & sheet metal products	0.03	0.033	90.9
Office machines, computers	0.0006	0.01	6.0
Prefabricated buildings	0.002	0.00001	20,000.0
Consumption goods			
Fine ceramic goods	0.001	0.002	50.0
Glass & glass products	0.008	0.005	160.0
Wooden products	0.126	0.007	1,800.0
Musical instruments, toys & sports equipment	0.004	0.006	66.7

paper & paper goods	0.004	0.015	26.7
Printed products	0.0008	0.012	6.7
Works of art	0.01	0.047	21.3
Leather	0.005	0.006	83.3
Leather goods	0.002	0.001	200.0
Shoes	0.011	0.001	1,100.0
Textiles	0.032	0.155	20.6
Clothing	0.184	0.01	1,840.0
Other	0.012	0.007	171.4

Export specialisation in 1998.

Industry	χ_i^p / χ	χ_i^s / χ	A / B * 100 = SI
	A	B	SI
Agricultural products & livestock animals	0.013	0.008	162.5
Forestry products	0.001	0.0002	500.0
Fish & fish products	0.0003	0.0008	37.5
Coal & turf	0.019	0.00004	47,500.0
Crude oil & natural gas	0.0003	0.0001	300.0
Ore	0.0004	0.0001	400.0
Stone, earth & other mining products	0.004	0.001	400.0
Food products	0.06	0.045	133.3
Tobacco products	0.00002	0.0002	10.0
Textiles	0.035	0.083	42.2
Clothes	0.137	0.016	856.3
Leather & leather goods	0.013	0.011	118.2
Wood, wooden products, cork & etc	0.064	0.009	711.1
Paper	0.013	0.032	40.6
Published & printed products	0.002	0.007	28.6
Coke & mineral products, fissure- & spawn materials	0.02	0.013	153.8
Chemical products	0.04	0.119	33.6
Rubber & art goods	0.023	0.054	42.6
Glass, ceramic, worked/processed stone & earth	0.034	0.024	141.7
Iron & steel products, non-ferrous metals & products	0.091	0.05	182.0
Metal products	0.066	0.051	129.4
Machines	0.054	0.188	28.7
Office machines, data processing equipment	0.001	0.022	4.5
Electrical products & distribution	0.062	0.048	129.2
News-, Radio- & television-equipment & electronic components	0.01	0.032	31.3
Medicine, measurement, steering, regulation & optical products	0.005	0.024	20.8
Motor vehicles and parts	0.072	0.084	85.7
Other vehicles	0.006	0.004	150.0
Furniture, Jewellery, Musical instruments, sports equipment & toys	0.126	0.015	840.0
Energy	0.002	0	0.0
Other goods	0.01	0.045	22.2