The Economic Interrelationships of Tourism: A Computable General Equilibrium Analysis

Part I

by

Jonathan Gillham

A Thesis submitted to the University of Nottingham for the degree of Doctor of Philosophy

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Jonathan Gillham

Submitted to the Department of Economics
on 16th November 2005, in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

Abstract

This thesis investigates the economic interrelationships that tourism has in the wider economy in the context of a country that is heavily reliant on tourism revenues. More specifically, it seeks to examine the welfare, intersectoral, distributional, competitive, investment and dynamic issues relating to the tourism sector that have been under investigated in both the tourism and trade literature. These issues have been investigated empirically using Computable General Equilibrium (CGE) analysis. The thesis is set out as follows:

Chapter 1 sets out the relative position of Spain in terms of its international competitors and defines the tourism sector. It also explains why CGE modelling is felt to be the most suitable approach for modelling the Spanish tourism sector for the purposes of this thesis. It also presents an overview of the planned research.

Chapter 2 gives an overview of the structure and key features of the Spanish economy. It discusses the evolution of the tourism sector and how it varies between the different autonomous communities in Spain. The Spanish Tourism Satellite Account is presented and Spanish tourism policy is examined.

Chapter 3 reviews the theoretical and empirical literature on CGE modelling and tourism analysis relevant to this thesis. Various types of CGE model are scrutinised and their usefulness assessed. The role of tourism in international trade is considered and the characteristics of the tourism sector that need to be embodied into a CGE model are discussed.

Chapter 4 describes the core CGE model used in this thesis and the underlying equations that are associated with it. The central data set used is the Spanish input-output table for 1996. This data set is described and all subsequent input-output tables used in other chapters are amended so as to be consistent with this data set. Closure rules, elasticity parameters, solution methods and calibration methods are also discussed.

Chapter 5 presents the results of the experiments carried out with the dynamic Spanish national CGE model. The core model presented in Chapter 4 has been extended to incorporate foreign direct investment and these changes are disclosed in the opening sections. Counterfactuals are designed so as to estimate the impact of foreign direct investment inflows and tourism

demand shocks on the Spanish economy. Sensitivity analysis of the key exogenous parameters is also undertaken.

Chapter 6 presents the results of the experiments carried out on the static regional CGE model of the regions of Spain. Input-Output tables for four of Spain's autonomous regions were obtained and integrated with the Spanish national table to create a data set which accounts for the four regions analysed and the remainder of the Spanish economy. The model presented in Chapter 4 is adapted to incorporate regional trade flows and structural differences are discussed. Counterfactuals are designed in order to investigate how regional tax policy might affect tourism flows in Spain and how tourism demand impacts on different regions in Spain. Sensitivity analysis of the key exogenous parameters is also undertaken.

Chapter 7 presents the results of the experiments of the dynamic CGE model for the Canary Islands. The core model is identical to that presented in Chapter 4, except that it is applied at a sub-national rather than a national level. Counterfactuals are designed so as to take account of the issues affecting a small island economy that is heavily reliant on tourism. As before, sensitivity analysis of the key exogenous parameters is also undertaken.

Chapter 8 summarises the findings of this study, highlights possibly policy implications and cites limitations of the research. Suggestions for further research are also highlighted.

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Part I

Chapter's 1-4

1.1 Introduction

1.2 Overview

The combined effects of infrastructure development and associated visitor arrivals will mean that tourism can have a significant impact, whether it be positive or negative, on an economy, its culture and environment (Brown, 1998). An important motive for tourism development is the potentially large economic gain that can be realised in relation to employment, income and the balance of payments. However, if it is not managed effectively, tourism can also have damaging effects both at the regional and national level. Therefore it is important for policy makers to have reliable information on the costs and benefits of tourism if they are to make sensible decisions in relation to its future development (Fletcher, 1989). While recognising that tourism can have a wide range of impacts, this thesis will focus specifically on the economic impacts that tourism can have on a recipient economy. Economic benefits are probably the main reason why so many countries are interested in the development of their tourism sectors and its associated impacts (Ennew, 2003). The remainder of this section sets out the motivation for this research and the associated methodological application.

1.3 Defining the Tourism Sector

There has been significant debate in the literature as to how to define the tourism sector. To assist in the understanding of its economic impact it is important to have a clear definition of what is meant by the tourism sector. The purpose of this opening section is to make clear the definition of tourism used in this thesis.

1.3.1 Tourism as an Industry

Whether tourism is a typical industry is open to debate. A typical industry is defined by Ferguson (1988) as "comprising of firms which have the ability to produce, relatively rapidly, the products of any of the other firms in the group". However, it is hard to see many business activities falling into that categorisation in a straightforward fashion. In fact it is also noted by Tucker and Sundberg (1988) that " (tourism) is not an industry in the conventional sense, as there is no single production process, no homogeneous product and no locationally confined market". As Gooroochurn (2002) points out " an airline company cannot produce accommodation and similarly a hotel cannot change its production strucutre and start selling flights instead, at least in the short-run".

1.3.2 A Conceptual Framework

Most studies seek to first define a tourist. A generally accepted definition of tourism as agreed by Eurostat and generally accepted for most EU countries is as follows:

"*Tourism comprises the activities of persons travelling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes*". UK TSA 2004

Some subtle regional differences do occur, but it is generally accepted that the following criteria must be satisfied: visits must be for three hours or more and visits must not be taken on a regular basis. The development of an agreed conceptual mechanism for the defining of the tourism sector has largely be drawn together from the body of work relating to Tourism Satellite Accounts (TSAs). A Satellite Account is an extension to the System of National Accounts (SNA) which enables an understanding of the size and role of economic activity which is usually 'hidden' with such accounts. For example the SNA system does not distinguish between a restaurant meal purchased by a tourist or a local resident. The TSA has developed an international commonality in terms of the definition of tourism. In particular it draws together concepts relating to the definition of the terms visitors, usual environment and visitor consumption. These are presented in Exhibit 1:

Exhibit 1.1: Central Concepts in the Definition of Tourism

Visitor: A person travelling to a place other than that of their usual environment for less than twelve months and whose main purpose of trip is not an activity remunerated within the place visited. **Usual Environment:** The usual environment corresponds to the geographical boundaries within which an individual travels during the regular routine of life, both the direct vicinity of home and place of work or study, and other places frequently visited. The term has two dimensions: frequency - places which are frequently visited by a person (on a routine basis) are considered as part of her/his usual environment even though these places may be located at a considerable distance from her/his place of residence; distance - places located close to the place of residence of a person are also a part of her/his usual environment even if the actual spots are rarely visited. **Visitor Expenditure:** Expenditure that is made by, or on behalf of, the visitor before, during and after a trip, that trip being outside the visitor's usual environment.

Source: As per UK TSA 2004[1]

A key component of the TSA framework is the derivation of tourism ratios. Tourism ratios indicate the extent to which an industry or product is dependent upon the demand of tourists, and can be defined in industry or product terms. A tourism product ratio represents the proportion of supply of that product which is purchased by tourists. A tourism industry ratio represents the proportion of that industry's output consumed by tourists.

[1]These definitions have been agreed by the OECD, Eurostat, the World Tourism Organisation and th United Nations. The same definitions are used in the Spanish TSA.

Table 1.1: Tourism Industry/Product Classifications : New Zealand

Tourism Characteristic Product	A product that would cease to exist in meaningful quantity, or for which the level of consumption would be significantly reduced, in the absence of tourists. In the TSA a tourism characteristic product has a tourism product ratio greater than or equal to 0.25.
Tourism Related Product	A product for which tourists purchase greater than 0 and less than 25 percent of its production (i.e. a tourism-related product has a tourism product ratio that is greater than 0 and less than 0.25).
Tourism Specific Product	Either a tourism characteristic product or a tourism related product.
Tourism Characteristic Industry	An industry that meets the following criteria: • At least 25 percent of the industry's output is purchased by tourists (i.e. the tourism industry ratio is greater than or equal to 0.25); or • The industry's characteristic output includes a tourism characteristic product.
Tourism Related Industry	An industry where: • Between 5 percent and 25 percent of the industry's output is purchased by tourists (i.e. the tourism industry ratio is greater than 0.05 and less than 0.25); and • A direct physical contact occurs between the industry and the tourist buying its products (hence manufacturing and wholesaling industries are not tourism-related industries).

Source: As per UK TSA 2004, as derived from NZ TSA 2004

For the purposes of this thesis we focus explicitly on the definitions used in this section. Tourism ratios are determined and are presented in the relevent sections. In turn where specific sectoral results are presented tourism characteristic sectors are defined accordingly.

1.4 Tourism's Economic Benefit

It can be seen from Table 1.2 that worldwide tourism receipts following the definition given above were estimated to be US$474 billion in 2002, which corresponds to around US$ 675 per tourist arrival. Various calculations have been undertaken to determine tourism's contribution to the world economy, based on World Bank calculations of global GDP, tourism accounted for approximately 1.5% of this figure in 2002. However, measurement methods differ and there are significant variations in this proportion. For example, recent calculations by the World Travel and Tourism Council suggest that this figure is closer to 10%. Nonetheless it is generally accepted that tourism is one of the three largest contributors to global GDP closely rivalling the oil and car manufacturing sectors.

Table 1.2: International Tourism Receipts ($US billion)

	2002*	Change (%) 2002*/2001	Share (%)
World	474.0	3.2	100.0
United States	66.5	-7.4	14.0
Spain	33.6	2.2	7.1
France	32.3	7.8	6.8
Italy	26.9	4.3	5.7
China	20.4	14.6	4.3
Germany	19.2	4.0	4.0
United Kingdom	17.8	9.5	3.8
Austria	11.2	11.1	2.4
Hong Kong (China)	10.1	22.2	2.1
Greece	9.7	3.1	2.1

Source: World Tourism Organisation (2003)

* Denotes Provisional Figures

France and Spain consistently lead the rankings in terms of international tourism arrivals; Table 1.3 shows that together they account for more than 18% of the market. However, Table 1.2 shows that in terms of tourism earnings, the USA earns almost twice as much as its nearest competitor, Spain. This figure is particularly impressive in light of the fact that the USA has experienced a significant drop-off in receipts of almost 20% since 2000. However, in terms of relative importance for the economy, tourism final demand only accounted for 4.1% of USA GDP in 1997[2], while in Spain this figure was 11.1%[3]. Despite France achieving consistently higher visitor numbers than Spain, revenues are lower and its overall contribution to the economy is smaller (7% of GDP[4]). Therefore, in relative terms tourism is a much more important industry for the Spanish economy than for its major competitors.

Table 1.3: International Tourist Arrivals (million)

	2002*	Change (%) 2002*/2001	Share (%)
World	703.0	2.7	100.0
France	77.0	2.4	11.0
Spain	51.7	3.3	7.4
United States	41.9	-6.7	6.0
Italy	39.8	0.6	5.7
China	36.8	110.0	5.2
United Kingdom	24.2	5.9	3.4
Canada	20.1	1.9	2.9
Mexico	19.7	-0.7	2.8
Austria	18.6	2.4	2.6
Germany	18.0	0.6	2.6

Source: World Tourism Organisation (2003)

This preliminary analysis is supported by surveys of international tourism statistics. For example, OECD (2000) reveals that compared with other developed economies, Spain has the largest tourism related economy relative to GDP. Barring the tourism dominated small island economies of the Caribbean and the Pacific Ocean[5] , few countries in the world are as reliant on tourism receipts as Spain. This intensity of tourism related economic activity makes Spain a country well worthy of investigation.

[2]Source: USA Tourism Satellite Account, 1996/1997.
http://www.bea.doc.gov/bea/ARTICLES/NATIONAL/Inputout/2000/0700tta.pdf

[3]Source: Spanish Tourism Satellite Account, 2001. http://www.INE.es

[4]Source: French Tourism Satellite Account, 1999.

[5]For a study of the impact of tourism on a small Island economy see Gooroochurn (2003).

1.5 The Research

1.5.1 Research Overview

The research uses a combination of general equilibrium modelling techniques to develop a Spanish national dynamic computable general equilibrium (CGE) model, a static CGE model incorporating several regions of Spain, and a dynamic CGE model of an individual region of Spain (the Canary Islands). The model will be applied to the service sector, specifically to international tourism. The development of a dynamic CGE model will overcome the deficiencies which are intrinsic to the more commonly estimated static CGE models. The development of a model which incorporates several regions of Spain allows the decentralised decision making processes that are in place in Spain to be taken into account.

The research is innovative in that most theses that undertake CGE modelling develop one model of the country that they are studying. This thesis has involved considerable effort in developing three models; at the national, multi-regional and regional levels. It is also innovative in departing from the common static, perfectly competitive framework, to develop models that incorporate an imperfectly competitive framework that better accord with the behaviour of the firms in the Spanish economy. The development of a dynamic model is also innovative in the context of most past CGE modelling research.

The research attempts to contribute to an understanding of the major forces which influence economic performance and development within an international and comparative context. The application of the model to tourism expenditure will fill a gap in knowledge about the impact of economic activities within the service sector which has been neglected, despite the growing importance of services relative to manufacturing. A further innovative aspect of the research is the application of the model to examine important policy issues at different levels of spatial aggregation, notably foreign direct investment in the Spanish tourism sector and the taxation of tourism at the regional level. This has not been undertaken previously. The model will be applied to the Spanish economy as a whole and, subsequently, to the regional economies within Spain, which are highly dependent upon tourism earnings for their survival. The findings from the research will, therefore, be of general use to policy-makers who are concerned with methods of stimulating and sustaining growth and welfare in non-industrialised regions, as well as at the national level.

1.5.2 Significance of the Research Programme

The evolution of the demand for tourism by different nationalities in the Spanish regions and the economy as a whole has been examined in past research. Other studies have focused on the supply-side, quantifying the concentration of tourism by region, and have also quantified the multiplier effects of tourism. However, knowledge of the impacts of tourism demand are limited and it is this gap the research aims to fill.

Policy makers require a wide range of information in order to formulate policy in an effective manner; for example, the extent to which a rise in the domestic price-level relative to that of competitor countries impacts on the demand for tourism and the income it provides. It is also essential for policy makers to be able to quantify the extent to which variations in tourism demand affect output and employment in areas of tourism concentration, as well as their repercussions on output and employment in other sectors of economic activity. Of further interest are the distributional, and welfare effects of such changes in the regional and national economies. The objective of this research is to provide information about all of the aforementioned effects.

1.5.3 Tourism in Context

Spain provides an interesting case study of an economy where tourism has been at the heart of the development process since it was first liberalised in 1959. The growth of tourism contributed strongly to raising the foreign exchange necessary to finance the purchase of imports which were the foundations for industrialisation, along with remittances from migrant workers. Spain has adjusted from an underdeveloped economy, with high levels of poverty and illiteracy rates, to become one of the industrialised members of the EU. Tourism development has concentrated largely around the Southern Mediterranean coastline, the Balearics and the Canary Islands. As a result, the South coast includes the region in Spain with the highest population density, while the Balearics has become one of the richest and highest growth regions in the country. The position of the Canary Islands is somewhat different. This region has virtually no industrialisation and is highly reliant on tourism. Although all three areas are key tourist destinations, it can be seen that each has points of interest, so that future development opportunities will be regionally sensitive, differing from the national pattern.

Although world tourism revenues are rising, Spain's share of the world market is declining due to competition from other destinations. Most competition occurs in the form of pricing. Therefore, relative prices that are charged for tourism products in different destinations affect both demand and the revenue which is obtained from the tourism sector. At all levels, the economic importance of tourism is increasing, as long-term structural changes in demand are leading to expansion of the service economy, real incomes and leisure time increase and there is a growing demand for recreation and holidays. The importance of this argument is strengthened because of the labour intensity of tourism, which is an important method of job creation. It is also a major contributor to the balance of payments. However, the distribution of tourism is inherently uneven; not only is it polarised, but traditionally, it is concentrated in less urbanised areas indicating the need for measurement at the regional as well as the national level.

1.5.4 Research Methodology

Early research on the economic impacts of tourism focussed specifically on the multiplier effects of tourism (see Sinclair and Sutcliffe, 1988a and 1988b for a review). Keynesian multipliers were calculated in order to try to estimate the relationship between tourism expenditure and output. However, this gives only a limited and partial insight as to the possible economic impacts of toursim. Developments in implementing methodology widely used to analyse other sectors were slow. Input-Output analysis has been used for many years in an attempt to further quantify the economic impact of tourism. However, the complex linkages between tourism and other economic sectors are not well reflected in traditional input-output analysis as the functional forms used in the model are designed specifically to capture direct causal effects. Nonetheless applications of this approach were still being undertaken in the mid 1990s when more complex methodologies were readily available (e.g. Archer and Fletcher, 1996).

The introduction of CGE modelling caused a 'paradigm shift' when it was first applied to the tourism sector in the mid 1990s (Dwyer *et al.*, 2003). In a nutshell, CGE modelling is a simulation based approach to policy analysis, whereby a model is built based on an assumed set of economic inter-relationships and calibrated according to an input-output based dataset. Simulated counterfactual policy changes are then imposed on the model and results are given in terms of changes in quantities of output or demand and relative prices. Dwyer *et al.* (2000) provide a comprehensive review of the tourism CGE modeling applications that were implemented in the late 1990s. However, it can be observed from this review that as compared to the type of CGE models used to analyse issues relating to trade liberalisation, single market harmonisation or economic development, tourism application remain relatively backward. As yet, no research has been undertaken to analyse tourism impacts in a dynamic or imperfectly competitive model framework. A fundamental objective of this thesis is to extend the application of tourism CGE models, so as to incorporate many of the characteristics that have made CGE models of other parts of the economy more advanced. The improvements made are discussed in later Chapters.

The strengths of the CGE approach lie in its solid microfoundations and its ability to incorporate feedback effects into the economy. In terms of tourism policy modelling, feedback effects will occur from a range of factors such as the use of imports as intermediate goods, competition for factors, demand substitution (and complementarity) and government budget effects. Thus the impacts of tourism can be examined within a single analytical framework and additional calculations do not have to be made. CGE models also benefit from an absence of constraints or direct functional relationships between policy instruments and targets (Blake, 1999). They also do not suffer from some of the disadvantages of partial equilibrium or macroeconometric models, in that they can be used to model more than merely marginal changes. Due to the multi-sectoral nature of CGE models, they can be used to evaluate discrete changes on many variables at the same time. A variety of constraints can also be imposed on the form of the models, thus being able to incorporate alternative market structures or behavioural controls with relative ease.

However, CGE models have suffered criticism in the past because of their use of primitive functional forms and the inability of the modeler to econometrically test their suitability. The numerical nature of CGE modeling means that the types of policy changes that can be modelled are limited, and that no general proofs of results can be obtained. Further, data requirements are substantial and may prohibit consistent application across a range of sectors. CGE models are also highly sensitive to the types of macroeconomic closure invoked on the model. All markets are assumed to clear, monetary sectors do not incorporate the complexities of international financial markets, unemployment is constant (as determined by the willingness of household to supply labour) and savings are determined by how much households want to save, rather than by how much investors want to invest. Weaknesses of this nature can be attributed to the naïve treatment of expectations in the model, it is possible to incorporate rational expectations into CGE models, but this can often lead to prohibitively large models which are difficult to solve.

Despite these limitations, alternative modelling approaches (i.e econometric) have not as yet been able to capture the full effect of structural change, which occurs in the productive structures of tourist regions. Macroeconometric models do have a more sophisicated treatment of dynamics, but generally lack detail on the microeconomic structure of the economy. Moreover, macroeconometric models take little account of the structure of the economy, they are also generally unable to provide fine detail about the distributional and efficiency conseqeunces of policy changes. Welfare effects cannot be modelled. Many of the problems with CGE modelling discussed above, although very real, are symptomatic of most types of economic model in some form or another. Econometric models, no matter which level they are implemented at have common problems with assumptions relating to functional forms, the adequacy of available data and its time consistency. Also,the theoretical consistency of these is regularly challenged when issues relating to endogenous varaibles not caputred in the model structure are considered. It is best not to see CGE and econometric models as polar opposites, but as complementary approaches that can have mutual benefits. Strengths and weaknesses are apparent in each approach, yet the strengths in one may be compensated by the weaknesses in other.

For the purposes of analysing the tourism sector in Spain and its inter-relationships with other sectors, it is felt however, that the CGE approach is more suitable. Dynamic CGE analysis will be undertaken to allow the intertemporal effects of both tourist and domestic consumer behaviour to be established, as well as their subsequent effects on savings, investment, the structure of tradable and nontradable production and future tourist activity in the different sectors. The period of estimation for the CGE model will be dependent on the length of time it would take different counterfactual shocks to diffuse through the system. Dynamic models provide the user with an exceptionally rich source of information and although still in their early stages of development, searches have revealed that such an application to tourism has not been undertaken.

Depending on the policy tools used by the government, the general equilibrium model is able to simulate a number of constraints on the tourism sector, and sensitivity analysis can be undertaken to determine the optimum long-term policy mix. One of the most powerful government tools is taxation and a wide range of different taxes can be imposed throughout the industry at many different levels. Taxes can be imposed on airports, hotels, restaurants, associated industries and a wide range of other areas, depending on the level of disaggregation in the model and its overall focus. Where necessary, links can be established which will determine the allocation of tax revenue to different sectors, while the model by definition will reflect the secondary effects of taxation. In the same way other factors which will impact on the tourism sector can also be evaluated e.g. exogenous shocks.

1.5.5 Policy Recommendations

As a result of the various policy counterfactuals simulated by the CGE model, recommendations can be made concerning the current tourism policy of the Spanish and regional governments, in addition to future policy options. The ability of Spain to sustain its tourism sector relates to the interplay of many domestic policy sectors. Moreover, Spanish tourism now evolves within an international policy framework and, in particular, under the guidance of the European Commission. The dynamic CGE model has the flexibility to incorporate exogenous factors, determine endogenous responses, and can be continually redesigned to emphasise different policy frameworks. The results will not only provide vital information to policy makers on a national, regional and household level but will also seek to extend the theoretical boundaries within the general equilibrium framework.

1.6 Thesis Structure

The remainder of this thesis is set out as follows:

- **Chapter 2** gives an overview of the structure and key features of the Spanish economy. It discusses the evolution of the tourism sector and how it varies between the different autonomous communities in Spain. The Spanish Tourism Satellite Account is also presented and Spanish tourism policy is examined.

- **Chapter 3** reviews the theoretical and empirical literature on CGE modeling and tourism analysis relevant to this thesis. Various types of CGE model are scrutinised and their usefulness assessed. The role of tourism in international trade is also considered and the characteristics of the tourism sector that need to be embodied into a CGE model are discussed.

- **Chapter 4** describes the core CGE model used in this thesis and the underlying equations that are associated with it. The central data set used is the Spanish input-output table for 1996. This data set is described. All input-output tables used in subsequent chapters are amended so as to be consistent with this data set. Closure rules, elasticity parameters, solution methods and calibration methods are also discussed.

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- **Chapter 7** presents the results of the experiments of the dynamic CGE model for the Canary Islands. The core model is identical to that presented in Chapter 4, except that it is applied at a sub-national rather than a national level. Counterfactuals are designed so as to take account of the issues affecting a small island economy that is heavily reliant on tourism. As before, sensitivity analysis of the key exogenous parameters is also undertaken.

- **Chapter 8** summarises the findings of this study, highlights possibly policy implications and cites limitations of the research. Suggestions for further research are also highlighted.

Chapter 2

Analysis of the Spanish Economy and the Development of the Tourism Industry

2.1 Overview

The purpose of this chapter is to give an insight into the key features of the Spanish economy and describe some of the factors that have contributed to its current day development. Since the end of the Second World War Spain has transformed itself from an economy reliant on agriculture, to an economy at the heart of the development of the European Union. However, inherent structural problems still exist (ageing population, high unemployment) which are of concern to policy makers and may limit future economic growth.

The second half of the chapter discusses the role of the tourism sector in Spain's economy and its development over the years. Tourism now contributes around 12% of Spain's GDP and is the largest single sector in the economy. The chapter seeks to highlight the main characteristics of the tourism sector and look at the role of tourism at both the national and regional level.

2.2 The Spanish Economy

2.2.1 Historical Outline

Until the late 1940's Spain was an agrarian nation whose socioeconomic characteristics were not dissimilar to that of an underdeveloped country. Such a slow pace of development stems from a decision in 1874 by the ruling monarch to adopt an inward looking development strategy. The agricultural sector did not emerge as the driving force of development due to lack of entrepreneurial spirit and institutional constraints. The Industrial Revolution bypassed the majority of Spain, although small pockets of industrial activity could be found in Cataluna and the Basque country.

Industrialisation progressed more rapidly in the early 20th century following the repatriation of capital from Cuba and the Philippines after the colonies were lost and the situation was further aided by Spain's neutrality during the First World War. However, the Civil War of 1936-1939 left the country in ruins and marked the return to autarky following the victory of Franco and the Falange (the Spanish Fascist party).

In the 20 years following the end of the civil war the economy was characterised by extensive restrictions on imports and external payments, over-reliance on bilateral clearing agreements and a complex exchange rate structure. Although autarky was the ideological choice it was largely enforced by international resentment towards Franco. Economic success was seen as a secondary objective as the country was saturated with the conservative dogma of the Church and the Army.

The pursuit of protectionism and the associated retreat from the rest of the continent brought Spain to an economic dead-end in 1959. The deterioration of the economy over recent years had been marked by an over-valued exchange rate, persistent balance of payments deficit, low foreign currency reserves, rising inflation and a small inefficient industrial sector. An announcement by the Minister of Commerce stating that the country was virtually bankrupt (Spain did not have enough foreign currency to pay for the most basic of imported goods) prompted Franco to realise the necessity of changing Spain's economic policies.

Two key liberalisation episodes between 1959 and 1975 produced the most important wave of economic prosperity in the recent history of Spain. Liberalisation was largely focused on the reduction of tariffs and the control of imports. The multiple exchange rate system was also abolished, and currency was devalued to a rate of 60 pesetas per $US. During this period the real growth of GDP averaged 5.8% annually, a figure substantially above the 2.8% average registered throughout the previous years of Franco's reign. This impressive growth rate allowed Spain to close the gap between itself and the other European nations. The consensus is that three factors contributed to this outcome (Gonzalez, 1979):

1. Spain successfully utilised the available opportunities resulting from the economic transformation of the 1950s. The agricultural sector had contracted giving way to growing urban and financial centres, endowed more with appropriate and flexible sources of labour and capital.

2. The liberalisation of the Spanish economy allowed it to share in the economic boom enjoyed by most European countries throughout the 1960s. This prosperity had an important impact on the level of foreign investment and tourism receipts. The relative affluence in Europe prompted a large migration of labour, the ensuing migrant remittances were a key source of finance for future expansion.

3. Sustained industrial growth was achieved due to a highly mobile labour force and the emergence of flexible prices (as opposed to prices fixed by the central government).

However, the authoritarian political regime hindered the pace of reform in the tax system, financial system and labour markets, subsequently slowing the transformation of the Spanish economy.

Table 2.1: Principal Economic Indicators, 1960-1975

Year	GDP Growth[a]	Rate of Inflation[b]	Current Account Balance[c]	Fiscal Deficit[c]	Rate of Unemployment
1960-1970	7.1	5.8	-0.2	0.9	1.2
1971-1975	5.3	11.0	-0.5	0.3	2.6
1960-1975	5.8	7.8	-0.3	0.7	1.7

a Real Rate of Growth

b Consumer Price Index

c As a Percentage of GDP

Source: Instituto Nacional de Estadistica, various years

The pattern of Spanish economic growth during this period can be seen in Table 2.1. Rapid economic growth was accompanied by high inflation and balance of payments deficits. However, the current account was nearly balanced, largely due to low unemployment and a corresponding surplus in the social security system.

Franco's death in November 1975 dominated the political and economic scene not only at the time, but for years afterwards. Successive governments became transitory in nature and none had the political support to enforce the severe measures needed to put the economy back on track. For example, lack of control over the labour market in the three years following Franco's death led to wages rising by 30%, which subsequently contributed to a rate of inflation of 26.4% in 1977.

Table 2.2: Principal Economic Indicators, 1976-1986

Year	GDP Growth[a]	Rate of Inflation[b]	Current Account Balance[c]	Fiscal Deficit[c]	Rate of Unemployment
1976-1982	1.5	17.4	-1.6	-2.1	8.4
1983-1986	2.5	10.3	0.7	-5.6	19.9
1976-1986	1.9	14.8	-0.8	-3.4	12.6

a Real Rate of Growth

b Consumer Price Index

c As a Percentage of GDP

Source: Instituto Nacional de Estadistica, various years

Such problems were compounded when the Spanish economy was badly affected by the OPEC oil crisis. At the time Spain, imported around 75% of its energy requirements and was unwilling to adjust to the oil price rise. Due to the fractious political situation, the various governments at this time were not prepared to translate the oil price increase into domestic price rises through fear of a collective backlash. This led to a deterioration in the terms of trade and consequently there was a huge transfer of funds abroad. Coupled with wage inflation at this time, the effects of the shock put the economy on an unsustainable growth path. The policy response was poor and subsequently both inflation and the current account deficit intensified.

Despite this setback, both the rate of inflation and the real rate of growth decelerated between 1977 and 1981 (but excluding 1980). A mix of domestic and external factors contributed significantly towards these developments. The second oil shock in 1979, an escalation in real interest rates and increased variability in exchange rates round the world had an outside influence. Key domestic influences included a decline in inflationary expectations, new wage controls and a new financial policy.

In contrast, the period between 1983-86 was characterised by relative economic prosperity. The current account was permanently in surplus, the national debt was reduced while foreign reserves increased, and by the end of June 1987 reserves were almost equivalent to the entire external debt. Growth in GDP had almost doubled during this time, an increase in consumer expenditure was acknowledged as the driving force. However, high levels of unemployment and public sector deficit were still persistent. Spain had the highest unemployment rate in the OECD at the time, a feature still prevalent in the economy today. Problems with government financing occurred following the economic crisis in the late 1970s. The government tried to cushion the effects of the crisis by making large transfers to households. Consequently the public sector debt increased and subsequent service payments became a burden.

2.2.2 Alignment with Europe and the Current Economic Situation

As the process of Spain's entry into the European Community began, a period of harmonisation and adaptation commenced. Most economic sectors embarked on a seven-year transition period. A restructuring programme was undertaken in uncompetitive sectors, the process of quota and tariff dismantling was completed, wage restraints were imposed and public sector spending was curbed. In 1986 several liberalisation measures were also introduced. These included more flexible labour contracts, price liberalisation and the opening up of the economy to foreign investment.

On December 10th 1991 Spain signed the Maastrict treaty which laid down the criteria for EU convergence. In order for Spain to comply with the Maastrict treaty a four year plan, 1992-1996, was set out with dual emphasis on 'nominal convergence' (inflation, exchange rate stability and public spending) and 'real' convergence (the alignment of Spain's GDP to the rest of the EU). Policies to ensure convergence included strategies to decrease unemployment (real convergence) and measures to reduce inflation and cut public spending (nominal convergence).

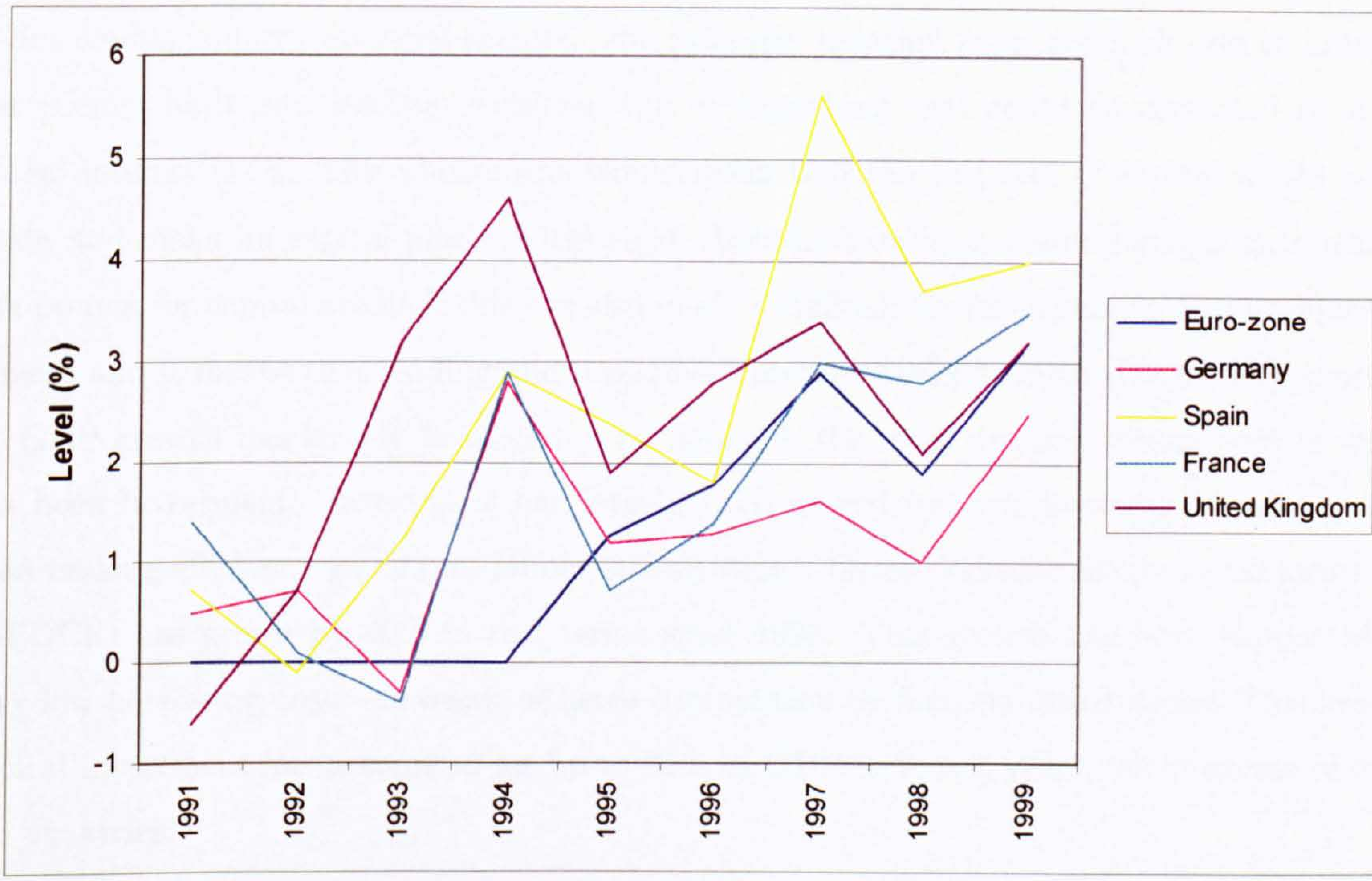
One of the main benefits for Spain from the Maastrict treaty was its receipt of cohesion funds to ensure the success of its adjustment. Spain was allocated more than 50% of the fund which it shared with Greece, Ireland and Portugal. Much of this fund has been channelled into failing sectors such as agriculture and the chemicals industry, the promotion of technology and communications as well as funding for large-scale infrastructure projects. In 1999 Spain received the equivalent of 3% of its GDP from the cohesion fund.

As this opening period of adjustment came to a close in the early 1990's Spain's economy slowed down and had entered a recession by 1992. The recession was largely a delayed reaction to the Gulf War, which had triggered a world-wide slowdown. However, the impact was delayed by the massive public investment associated with Spain hosting the 1992 Olympic Games and the Expo Trade fair in Seville. Once this investment was withdrawn, the economy slumped and problems were further intensified by the re-unification of Germany and the opening up of new investment opportunities in Eastern Europe which, it is thought, took money away from Spain.

Spain's recovery has fluctuated somewhat and it still has some way to go before it catches up with its European partners. For the last ten years Spain's GDP per capita has remained between 10-15 percentage points lower than the European Union average. However, as shown in Figure 2.1, GDP growth has remained at similar levels to the leading countries in the European Union throughout the last decade, and since 1993 has exceeded the EU average, although this has not been enough to ensure convergence with the rest of Europe and establish Spain as a force to be reckoned with within the EU.

Spain has regularly outperformed the EU average growth rate since it signed the Maastrict treaty in 1992. Spain needs to sustain higher growth rates in order to 'catch-up' with the leading countries in the EU. The economy has been able to accommodate such high rates of growth without fuelling inflation because of excess capacity in the economy. However, according to external reports, growth is above "potential" levels, which is putting pressures on costs and prices (Economist, June 1997). A rise in domestic cost components could put future growth at risk. High cost levels weaken competitiveness, are likely to widen the current account deficit and make the new growth in employment difficult to sustain.

Figure 2.1: Euro Area GDP Growth Rates



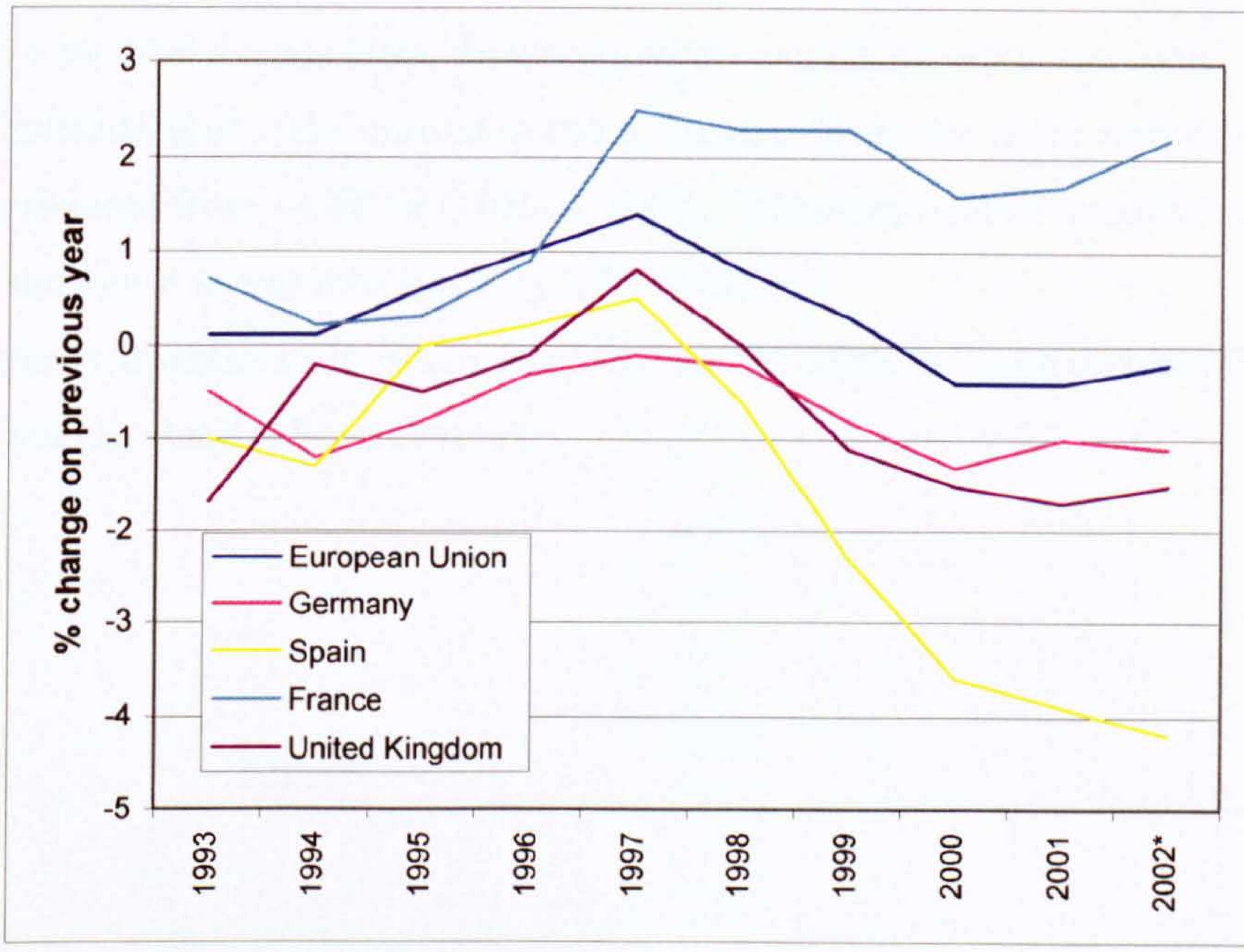
Source: Eurostat Cronos Database

The Spanish economy has grown on average at 1.94% between 1980 and 1999 according to figures published by the Banco de Espaná. Due to the large adjustment process undertaken in the Spanish economy it has been felt that the Spanish economy should have grown more rapidly. However, it has been severely hampered by its lack of export competitiveness and its high import content (OECD, 2003). There have of course been recent advances as can be seen in Figure 2.1, The government's track record in implementing wide ranging reforms has been good in recent years, including the liberalisation of network industries, the "Toledo Pact" on pensions, the devolution of power to lower levels of government and the Public Enterprise Modernisation Programme, which is aimed at the restructuring and privatisation of public enterprises. Further structural reforms are still needed in the labour, product and financial markets if the current pace of non-inflationary growth is to continue. For example labour productivity is amongst the lowest in Europe and addition to this there has been a lack of relative wage adjustment in Spain due to high levels of unionisation (see,for example, Soltwedel *et al.*, 1999).[1] While capital markets are often localised and do not reflect many of the nuances of developing country financial sectors. For example, inflation rates are high due to inflation risk premia built into lending decisions, this is something that could be corrected by a fall in real interest rates. This phenomena would mean that the real cost of capital would fall in Spain and make its capital markets less rigid. Localised decision making means that market risk premia for capital are high this has also made it difficult for businesses to obtain capital to expand and it means that lending and investment are not easily diversified between sectors.

GDP growth has largely been driven by demand, the most dynamic component of which has been investment. Investment has largely been geared towards boosting capacity rather than making efficiency gains (i.e. labour substitution). Gross domestic fixed capital formation (GFDCF) has grown by 40% in real terms since 1993. This growth has been supported by very low borrowing costs – a result of fierce competition by financial institutions. This level of capital investment has accounted for up to 25% of GDP in recent years, far in excess of most EU countries.

[1] If wages are relatively flexible across regions then wage growth should be lower in high unemployment regions than in low unemployment regions such that firms are able to sustain competitiveness, thereby encouraging investment and the creation of more jobs across regions.

Figure 2.2: European Current Account Balances as a Percentage of GDP



Source: Eurostat Cronos Database

Despite the reforms related to many aspects of economic policy in recent years, the government has largely overlooked the current account, which has spent much of the last two decades either verging on, or in deficit. Some policies have been directed at curtailing the deficit, for example, the government launched a National Plan of Export Promotion in the early 1990s. However, the impact was limited because of restrictive EU legislation. Recently this deficit has surged below the EU average, however, it has not been considered a priority, a decision which is likely to be a product of the internationalisation of production, a process characterised by the liberalisation of goods and capital movements. Additionally, high levels of inward investment associated with Spain's membership of the EU have also been responsible for the deficit. Macroeconomic policy has become less orientated towards protecting domestic markets and exploring external markets. Policies concerning exchange rates, trade barriers and export subsidies have lost ground to restrictive monetary and fiscal policies; the optimisation of investment conditions and the accomplishment of economies of scale through the internationalisation of production have become the principal means of attracting capital and increasing market shares. Less concern is directed at maintaining structural trade surpluses due to the growing importance of internationally mobile capital. Table 2.4 reveals a large deficit in the trade balance, particularly for the 8 months during 1999. However, when tourism receipts are added in, which are counted as invisible trade, the current account balance looks far more respectable, with the deficit being reduced from –4.3% of GDP to –0.9%. When the capital transfers are added into the balance the figure moves into surplus (1.0% of GDP).

Foreign direct investment in Spain is central to the analysis contained in this thesis, and will be discussed in chapter 5, section 5.2.

Table 2.3 Summary of the Spanish Balance of Payments, Constant Prices (Millions of Dollars)

	1999	2000	2001
Trade balance	-28585	-37778	-35265
(As a % of GDP)	-5.1	-6.2	-5.4
Non-factor Services (excluding tourism)	-3726	-3539	-2833
Tourism	25250	27782	29971
Net investment income	-8904	-8985	-10655
Net currrent transfers	2853	1528	1836
Current balance	-13112	-20992	-16947
(As a % of GDP)	-2.3	-3.4	-2.6
Capital Balance	6552	5181	5556
Financial Balance (net change)[1]	15800	21300	18827
Assets (net change)	84367	139732	66740
- Spanish Investment Abroad			
- Direct	39501	59344	31072
- Portfolio	43816	63025	49185
- Other Investment[2] and reserve assets	1051	17363	-13517
Liabilities (net change)	100167	161032	85567
- Foreign Direct Investment in Spain			
- Direct[3]	14791	40728	24340
- Portfolio[4]	42688	63644	30838
- Other Investment[2]	42688	56659	30389
Errors and ommissions (net)	-4682	-5488	-7436
Memorandum items:			
Terms of Trade, goods and services (% change)	-0.3	-2.2	2.1

1. Changes in financial assets and liabilities are both net payments. Financial derivatives have been included in the change in financial assets altough they are obtained as the balance of assets less liabilities.

2. Mainly loans, deposits and repo operations

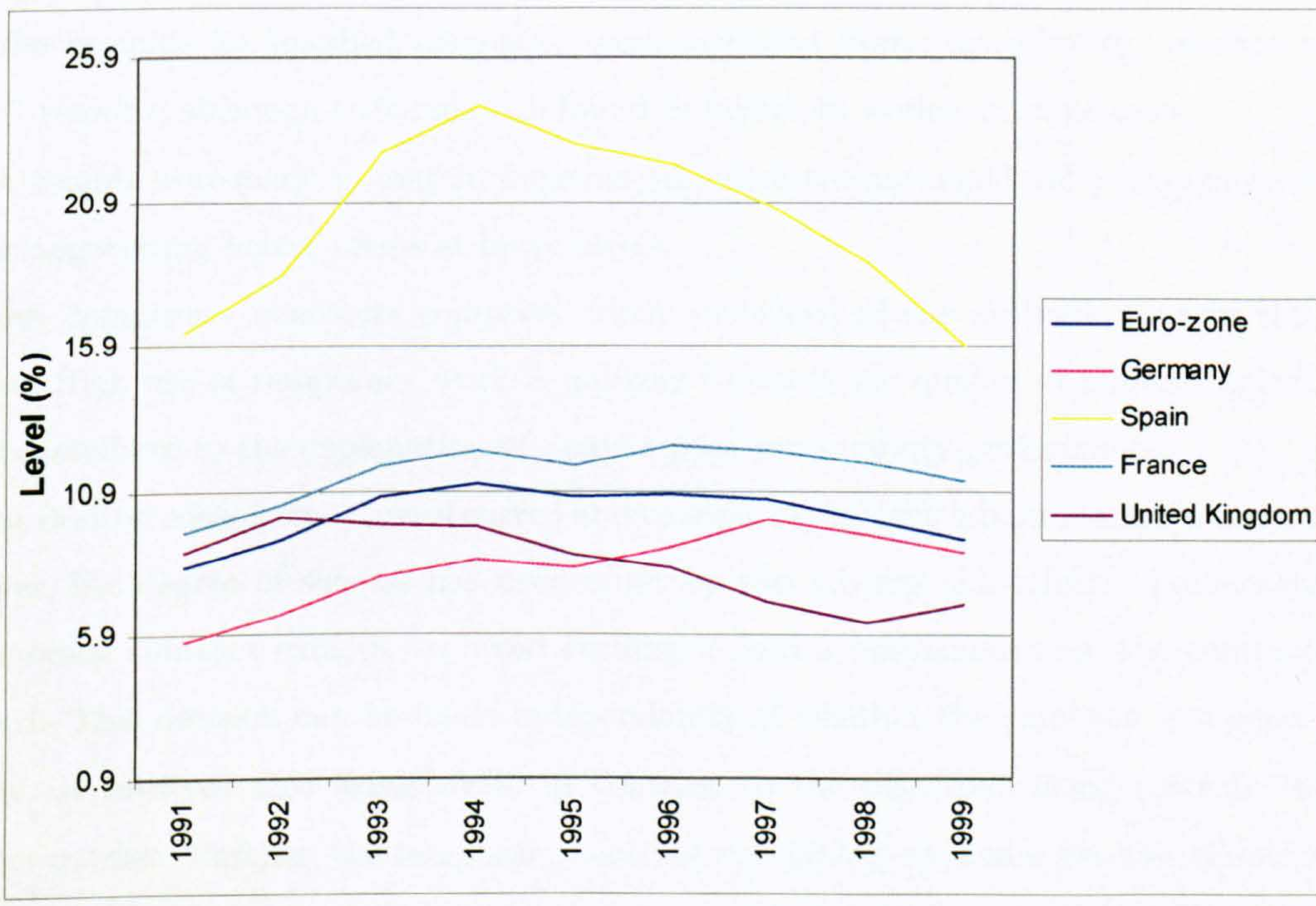
3. Does not include direct investment in listed shares but inlcudes portfolio investment in non-listed shares

4. Includes direcr investment in listed shares but does not include portfolio investmnet in non-listed shares

Source: Adapted from Bank of Spain and OECD

Many of Spain's problems have been caused by the need to conform with EU policy restrictions. Consequently the costs of production rose rapidly throughout the late 1980s and early 1990s as they were brought into line with the rest of Europe. EU regulations forced the modification of many production, manufacture and handling systems, as well as an improvement in the quality of raw materials and services rendered. Higher product prices had a negative influence on Spanish market competitiveness, which contributed to a worsening trade balance during this period. EU policy also entailed a gradual process of customs tariff reduction. However, without sufficiently competitive industry, the commercial balance of trade suffered.

Figure 2.3: Seasonally Adjusted Unemployment Rates



Source: Eurostat Cronos Database

Most of these problems are caused by the complex set of rules that makes Spain's labour market one of the most rigid in the world. Strict Employment Protection Legislation (EPL) covers one-third of the labour market. Firing people who are protected by the EPL is enormously difficult. Firms often have to seek permission from the government in order to make large-scale redundancies. Severance pay costs around three years salary. In practice this figure is often higher, as employers pay more than the minimum to avoid going to court where they have lost three-quarters of all cases. Consequently, these restrictions deter employers from recruiting. They also allow workers to hold on to jobs they are not necessarily good at performing, which impedes both productivity and efficiency

In an attempt to increase flexibility in the labour market the government introduced a system of temporary contracts. Reforms were proposed in 1994, 1997 and again in 2000. They included:

- a new type of low cost permanent contract aimed at those most exposed to unemployment, (young people, over 45s and long-term unemployed). The contract reduced severance payments and social security contributions.

- the grounds for justified dismissals were extended from "disciplinary" reasons to "economic" reasons, although tribunals still found in favour of worker in most cases.

- Attempts were made to contain wage bargaining at the national level to stop more powerful groups negotiating better terms at lower levels.

Now, temporary contracts comprise nearly one-third of the available jobs in the labour market. High use of temporary work is unlikely to boost the quality of human capital, which might contribute to the explanation of Spain's poor productivity performance.

The desired consequence has occurred and to some extent, the labour market is more flexible. However, the degree of success has been offset by two adverse side-effects. Frequently, when a temporary contract expires, to avoid turning it into a permanent one, the contract is not renewed. This decision can be made independently of whether the employer is a good worker or not. It involves zero firing costs, in contrast to the expensive firing costs in the fixed contract market. Further, the temporary contract system has created a two tier labour market: permanent workers have become insiders, while temporary workers have become outsiders. The jobs of the insiders are protected by the rigidities of the labour market, so even in periods of high unemployment their wage demands are unaffected. This has pushed Spain's NAIRU as high as 17%. Temporary contracts have detrimental effects on training and human capital formation, especially for younger workers. The problem is compounded by a statutory minimum wage and generous unemployment benefits. Studies have reported that 40% of unemployed people who did not receive benefits found a job within three months, while for those receiving benefits this figure is much lower at 18%. This system is paid for by a large taxation wedge, as much as 33%

on top of wages, which is twice as that of Britain or Portugal.

The way in which Spanish society has coped with such high unemployment can be attributed to its reliance on the family. Households have traditionally been large and usually contain at least one person in work. Few people live alone, and only 6% of families with children under 15 are headed by single parents. However, the family unit is coming under pressure and is just as susceptible to the symptoms of divorce, family break-up and single parenthood as the rest of Europe.

More recent figures suggest an expansion in employment, and in 1998 440,000 new jobs were created. Labour intensive sectors have been the main area of economic growth. 92% of net jobs created from the beginning of 1998 to the first-quarter of 1999 were in the service sector (in particular, tourism-related activities). The construction sector has also expanded rapidly, while overall more new jobs went to women rather than men and to more people over the age of 50 and to young age groups.

Further labour market reforms are still needed to reduce the structural rate of unemployment and consolidate employment growth without creating bottlenecks. By their very nature, labour market institutions interact with policies in other areas. Therefore, reform should be comprehensive, mutually reinforcing and widespread. An area where the need for centralised policy reform is particularly urgent concerns the low geographical mobility of labour. Labour mobility between the Spanish regions is now at a tenth of its level in the 1960s, fostering structural unemployment and perpetuating regional disparities. Greater mobility would be facilitated by the development of the market for rental housing. This would require the easing of restrictive market regulations on the length of rental contracts, liberalising urban land supply – to slow the surge in home and rental prices – and lowering the generous tax preferences given to owner occupied housing. However, this policy is unlikely to work if employment contracts are only temporary, as is the case now with most new contracts. Further reforms could be made by adjusting the lenient criteria for obtaining income support for seasonally unemployed farm workers. By imposing tighter restrictions these labourers could be encouraged to become more pro-active in job search.

The high level of unemployment compounds the biggest predicament facing the Spanish economy. In the coming years, the problems associated with ageing population are expected to hit Spain more severely than most other EU countries. Public finances are expected to become increasingly strained, as both the size of the average pension grows and the number of claimants increases. Data projections by Eurostat estimate that the total population will remain at its present level for the next 25 years, while the rise in the old-age dependency ratio is expected to be less steep than the OECD average until 2025. However, it is predicted that the total population will decrease by 10% between 2025 and 2050, whilst working age population will decrease by some 25%. During this period forecasts suggest that the dependency ratio will rise from about 27% of 65%, a steeper rise than in any EU country. A solution to this problem might be found if Spain was to increase its participation rate and lower unemployment, there is clearly the capacity to do this in the Spanish economy, with its unemployment burden. Future labour market reform could be orientated towards providing incentives for people to work to later ages and providing more opportunities for females and younger age groups.

It has been observed that there is a degree of rigidity in both labour and capital markets in this section. The rigidity of the labour market is noted by authors such as Fernández-Val (2003) and Saint-Paul (2000) while the Spanish Ministry of Economy and Finance in Spain have introduced a number of reforms to reduce risk premia and increase flexibility (MoFE, 2004). These include measures to reduce the interest rate in the mortgage market by allowing lenders to hedge risk premia and increased corporate governance measures to provide increased transparency for investors. The issue of factor market rigidity is addresses specifically in this thesis and details of amendments made to the CGE model to account for rigidity are given in chapter 4.

2.3 The Contribution of Tourism to the Economy on a National Level

2.3.1 The Development of Tourism in the Spanish Economy

Prior to the civil war of 1936-39, foreign tourism in Spain was relatively small scale, involving only around 200,000 visitors. It was not until the beginning of the first liberalisation episode in 1959 that the major expansion in visitor numbers came about. Franco took the development of tourism extremely seriously, not only because of the potential foreign exchange revenue, but also because he saw an influx of visitors as a tacit acceptance of his dictatorial regime (Acosta Espana, 1981).

The development of the Spanish tourism industry can be separated into five key phases which span the last forty years (EIU, 1990).

i) The first tourism boom of the 1960s

The first real growth in the tourism sector was based on the typical mass tourism package of sun, sea and sand at cheap prices. The expansion occurred at a time when living standards were increasing rapidly, air travel became available to the masses and most jobs in developed countries came with paid holidays. For the first time, the government had an official policy of promoting tourism through publicity campaigns and offering credit to tour operators. This phase was important to the economy as a whole; the income generated from tourist receipts stimulated development in other sectors of the economy at a time when the country was still in a phase of isolationism.

ii) Economic slowdown in the 1970s

The increase in tourist arrivals continued until 1973 but went into virtual stagnation between 1973 and 1976, reflecting the economic crisis in a sector which was particularly affected by rising oil prices. Not only did the oil crisis lead to rising costs across the Spanish economy, it also triggered recession in many of the visitor source countries. This resulted in an imbalance whereby the Spanish economy was still in a growth period even though its most important source of foreign earnings had gone into recession.

iii) Recovery at the end of the 1970s

As the other European economies began to recover from the oil shocks, the tourism sector began to revive. However, because of Spain's isolationist actions, it had gone out of sync with the rest of Europe and was deep in its own delayed crisis. The economy did eventually recover although its progress was disrupted by the second oil crisis of 1979.

iii) Rapid growth in the 1980s

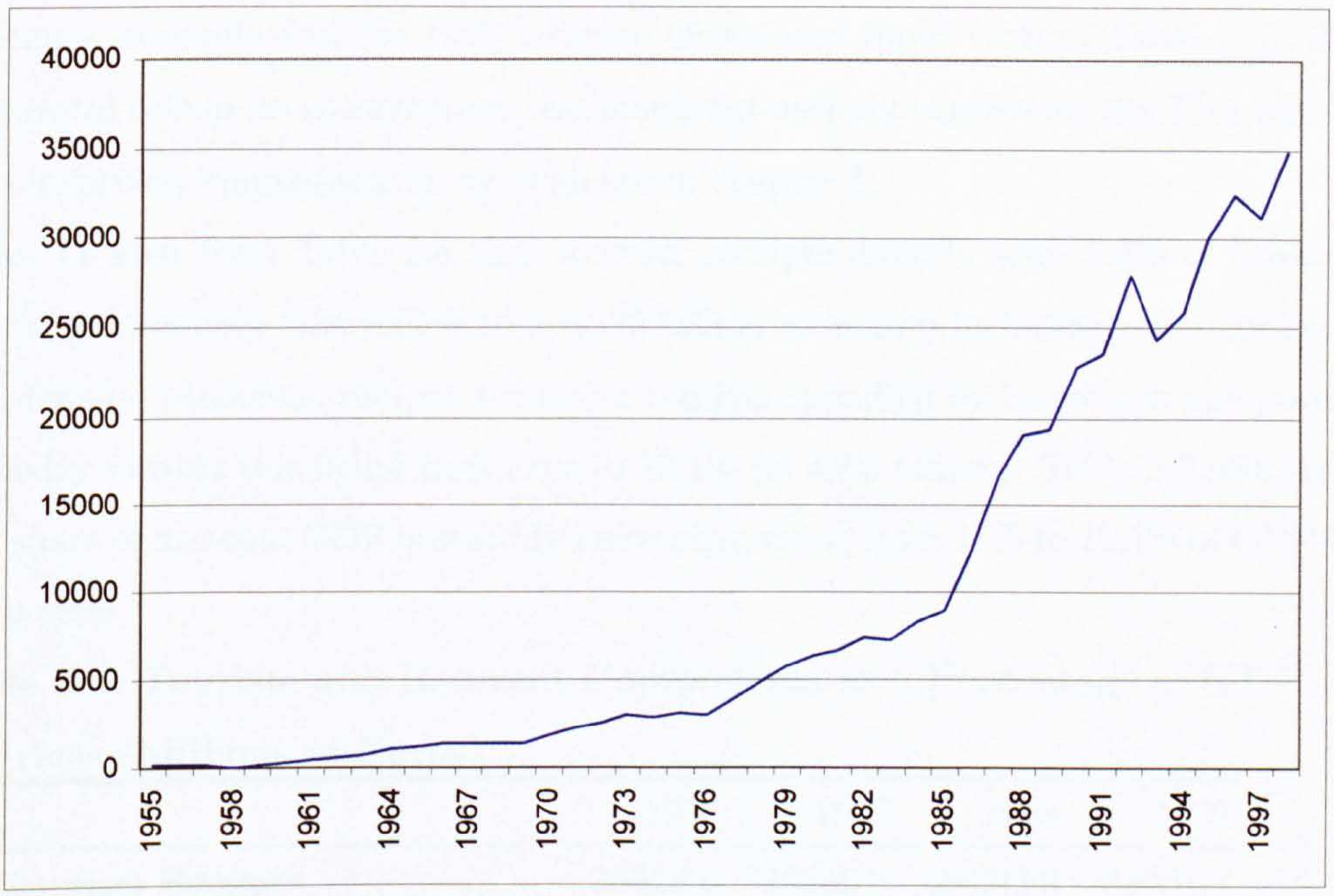
After 1983 there was a further increase in tourism which, at the time, made Spain the second most important country in world tourism (with 8.8% of all tourists and 10.5% of all foreign exchange earnings). In 1986 only France surpassed Spain in terms of visitor volumes, and nearly 50% of tour operators offered Spain as a destination. Although Spain was less isolated economically than under the Franco regime, it still took longer to recover from the economic crisis of the 1970s than the rest of Europe. At this time tourism was growing much faster than the economy as a whole, and the increased confidence in this sector gave rise to a large-scale hotel construction plan. Growth was driven by Spain's price advantage over its key competitors (for example, France, Italy and Yugoslavia).

iv) Changing structure of the tourism sector and further growth

In the late 1980s the virtually uninterrupted growth in tourism arrivals that had been seen throughout the decade started to slow down. Key markets hit saturation point and Spain began to lose its competitive edge in terms of prices as the policies associated with EU integration took effect. There was also a significant negative knock-on effect from the Gulf War. However, things took a turn for the better and 1996 saw a record year for tourism. The German economy slowed and many visitors returned to visit Spain as they could no longer afford long-haul destinations, while the strength of the British pound made Spain an affordable destination once more. Growth continued throughout the 1990s, while the tourism sector evolved to keep up with the times. The Spaniards placed more emphasis on a "quality" holiday experience and sought to develop the attraction of Spain beyond the three S's. More attention was directed towards quality nightlife, while efforts were made to develop other forms of tourism, based on golf, skiing, cities and wildlife.

The growth of travel receipts reflects the phases in tourism expansion described above and can be seen in Figure 2.4 travel receipts exhibit a slow but steady expansion throughout the 1960s, a plateau throughout the 1970s, a colossal boom in the 1980s and large-scale fluctuation in the 1990s. The opening up of the economy in 1959 can barely be seen in the graph because of the scale of the expansion of the tourism industry. This development in net receipts reflects to some extent, the expansion in the tourism sector the world over. However, we can also observe that the development of the tourism industry was not necessarily an instant success, despite the associated government promotion policies.

Figure 2.4: IMF Net Travel Receipts 1955 - 1997, Constant Prices (Millions of Dollars)



Source: IMF Balance of Payments Data Various Years

2.3.2 The Spanish Tourism Satellite Account

It is virtually impossible to obtain accurate estimates of the exact impact of tourism on an economy because of its multi-sectoral effects and associated difficulties in measurements. It is well known that tourism has had a major impact on the Spanish economy but statistics are not always disaggregated enough, or collected in a suitable way to ensure reliable estimates. This is particularly the case when we wish to view time series data, which do not exist for many indicators relating to the tourism sector. More recently, Tourism Satellite Account's (TSA's) have attempted to quantify the size of the tourism sector. Unfortunately, the TSA accounting process has only recently been implemented so it is not possible to perform any detailed time series analysis.

The Spanish TSA was published in 2002 and adheres to the WTO Tourism Satellite Account Recommended Methodological Framework (TSA:RMF). The TSA consists of 8 Tables, Tables 1.1, 2.1, 2.3 and 5 are presented in full in this chapter, while tables 3.0 and 4.0 are presented in Appendix A to this chapter because of their size, the remainder are not displayed as they repeat large segements of data displayed in the other tables. The Spanish TSA is based on the 1995 national accounts and the 1995 Tourism Orientated Input Output Table (TIOT) played a fundamental role in its construction. Although not entirely consistent, the TSA and 1996 IO table are relatively compatable as we shall see in chapter 5.

It can be seen from Table 2.4 that tourism receipts directly were 5.9% of Spanish GDP in 1999 (approximately €34 billion to a €570 billion economy) including other components of tourism demand (domestic tourism including tourism spending by businesses and government; and sameday visitors this figure then rises to 12.1% (or €68 billion). Table 2.3 also shows that tourism share of national GDP is steadily increasing, rising from 11% to 12.1% of GDP between 1996 and 1999.

Table 2.4: Tourism and Relevent Components as a Percentage of GDP at Constant Prices (Millions of Euros)

	1996	1997	1998	1999
Tourism Receipts	23318.0	26356.8	29692.9	33601.8
Other Components of Tourism	27951.8	29792.4	32055.7	34850.7
Total	51269.8	56149.2	61748.6	68452.5
Percentage of GDP				
Tourism Receipts	5.0	5.3	5.6	5.9
Other Components of Tourism	6.0	6.0	6.0	6.2
Total	11.0	11.3	11.6	12.1

Source: Spanish TSA Table 1.1 (INE, 2002)

Table 2.5 details the demand structure of tourism consumers. It can be seen that foreign tourists are responsible for 43% of total tourism consumption, while domestic tourists account for 41%. The government contributes around 1.8% to total tourism receipts, mostly in the non-marketed tourism services sector i.e tourism promotion. Further, a significant proportion (13.6%) of tourism consumption stems from companies using tourism commodities as intermediate inputs in the production process. Much of this usage consists of the activity of travel agents (i.e. companies booking business trips), hotels and air transportation also play an important role in this area.

Table 2.5: **Components of Tourism Demand (1996), Constant Prices (Millions of Euros)**

	Tourists	Same-day Tourists	Intermediate Consumption	Government Consumption	Total
Hotels and Other Lodging Services	3936	1779.4	1917.4	24.6	7657.4
Second Homes	518.7	4056.5	0	0	4575.2
Restaurants	8813.8	7700.2	324.4	36.7	16875
Interurban Railway	151.9	665.8	559.3	151	1528
Road	82.3	952.8	355	13.2	1403.3
Sea	40.8	131.6	43.6	11.4	227.4
Air	2078.7	961.7	1823.1	75.1	4938.6
Travel Agents	89.6	905	1698.2	21	2713.8
Services Annexed to	1012.3	128.2	271.5	0	1412
Car Hire and Other	223	139.2	112.3	0	474.5
Cultural Services of the Market	509.1	627.8	0		1136.9
Non-market Cultural Services	13.2	9.7	0	330	352.9
Non-marketed Tourism Services				328.7	328.7
Total Characteristic Products	17469.4	18057.9	7104.8	991.7	43624
Non Characteristic Goods Consumption	2766.8	1759.4	0	0	4526.2
Distribution Margins	1394.5	807.8	0	0	2202.3
Other Products	1107.2	1136.1	61.3	0	2304.6
Total Non-Characteristic Products	5268.5	3703.3	61.3	0	9033.1
Total Consumption	22737.9	21761.2	7166.1	991.7	52657

Source: Spanish TSA Table 2.1 (INE, 2002)

TSA Table 5 shows that the majority of gross fixed capital formation in the tourism sector originates from construction related activity, either accomodation or non-residential tourism realted construction, and the accumulation of capital equipment (e.g. hotel refurbishment, car fleets). It can also be seen that relatively large amounts of investment are occurring in market based cultural services (i.e. leisure based services ranging from theatres to themeparks) and the infastructure that supports the passenger transport sector (e.g. airports).

Table 2.6a: Gross Fixed Capital Formation of Tourism industries and Related Industries (1996) Millions of Euros

	Hotels and Accomdation	Restaurants and Similar	Road Passenger Transport	Railway Passenger Transport	Water Passenger Transport	Air Passenger Transport	Travel Agencies and Similar
Motor Vehicles	23.2	7.4	214.6	2.4	0.6	15	10.2
Rail Transport	0		27.6	274.2			
Sea Transport	0				37.9		
Air Transport	0					333.4	
Other Machinery and Equipment	504.9	17	21	66.1	9	23.4	61.3
Tourism Accomodation	105.3	298.1	3.6			0.6	
Non-residential Construction	849.2	153.9	11.8	62.5	7.6	9.6	27
Other Construction	272.9	97.4	20.4	189.9	1.8	6	28.8
Other Products	160.7	148.4	8.4	24	5.4	27.4	
Total	1916.2	722.2	307.4	619.1	62.3	415.4	127.3

Table 2.6b:Gross Fixed Capital Formation of Tourism industries and Related Industries (1996) Millions of Euros - Continued

	Passenger Transport Supporting Services	Passenger Trasnport Equipment Rental	Cultural Services of the Market	Cultural Services Non-Market	Total Activities of Tourism Characteristic Industries	Activities of Non-Tourism Characteristic Industries	Total
Motor Vehicles	204.4	411.1	132.2	0.6	1021.7	4781.1	5802.8
Rail Transport					301.8	64.2	366
Sea Transport			67.9		105.8	477.8	583.6
Air Transport		7.8	6		347.2	69.3	416.5
Other Machinery and Equipment	162.8		394.3	0.6	1260.4	21161.5	22421.9
Tourism Accomodation			93.2		500.8	21605	22105.8
Non-residential Construction	289.8	27	304.7	1.2	1744.3	19101.8	20846.1
Other Construction	681.8		229.8	1.8	1530.6	10855.6	12386.2
Other Products	105	2	286.8	0.4	768.5	14689.6	15458.1
Total	1443.8	447.9	1514.9	4.6	7581.1	92805.9	100387

TSA Table 6 is shown in Table 2.7. It gives details of the number of establishments by tourism characteristic industries. It can be seen that the majority of tourism activity, whether it be characteristic or not, takes places in the unsalaried sector. This illustrates the importance of micro-businesses not only to the tourism sector but to the service sector as a whole.

Table 2.7: Number of Establishments in Tourism Characteristic and Tourism Connected Activities - Classified According to Number of Employed Persons (2001)

	Without Salaried Workers	1-2	3-19	20-99	100+	Total
Hotels and Similar	5549	4295	5164	1278	396	16682
Restaurants and Similar	120026	80850	44215	1741	226	247058
Road Transport	138498	41673	17731	1757	182	199841
Rail Transport	164	38	125	66	19	412
Sea Transport	38	34	48	42	20	182
Air Transport	2613	1943	1544	176	37	6313
Travel Agents	4001	3570	4380	644	158	12753
Services Annexed to Transport	985	923	572	72	14	2566
Cultural Services, Recreation and	26629	14021	9147	1299	275	51371
Number of Tourism Related Establishments	298503	147347	82926	7075	1327	537178
Percentage of Total	55.6%	27.4%	15.4%	1.3%	0.2%	100.0%
Number of Non-Tourism Related Establishments	1110188	545614	389194	54080	8948	2108024
Percentage of Total	52.7%	25.9%	18.5%	2.6%	0.4%	100.0%
Total Number of Establishments	1408691	692961	472120	61155	10275	2645202
Percentage of Total	53.3%	26.2%	17.8%	2.3%	0.4%	100.0%

Of particular interest in Table 2.7 is the large number of unsalaried workers in the tourism characterstic sectors, particualrly working in the road transport and restaurant sectors. While these workers may not be officially salaried, they will take payments in kind for the service they provide. In a restaurant for example, if it is a family business this is likely to be lodging, food and indirect cash handouts. A major advantage of using Input-Output or Supply Use Tables in the analytical process as opposed to employment surveys is that they attempt to estimate the returns to these non-salaried workers.[2] This is because these workers are such an important part of the economy, and payments in kind are often a major part of tourism businesses. To truly measure economic activity and output in the tourism sector this type of worker must be accounted for.

2.3.3 The Contribution of Tourism to the Economy on a Regional Level

Tourism and the Autonomous Communities The distribution of both domestic and overseas visitors varies greatly by region, with the highest concentration being along the southern coastline. In this area Andalucia is the first choice destination for domestic tourists, while Catalonia remains more popular with foreign tourists. The island regions of the Canaries and the Balearics are very popular with foreign tourists, while they are less popular with domestic tourists.

[2]This is common practice is Input-Output methodology and is practised widely, see for example ONS (1997) and INE (1996).

Table 2.8 Visitors by Autonomous Community 2000

Region	Domestic	Foreign	Domestic (%)	Foreign (%)	Total (%)	Rank
Andalucia	5,943,519	5,224,602	18.5%	19.2%	18.8%	1
Aragon	1,501,469	262,082	4.7%	1.0%	3.0%	10
Asturias	944,164	106,615	2.9%	0.4%	1.8%	13
Balearics	1,108,492	5,579,078	3.5%	20.6%	11.3%	3
Canary's	1,412,131	3,488,603	4.4%	12.9%	8.3%	5
Cantabria	744,495	15,184	2.3%	0.1%	1.3%	15
Castilla y Léon	2,885,024	694,034	9.0%	2.6%	6.0%	7
Castilla - La Mancha	1,518,491	328,467	4.7%	1.2%	3.1%	9
Catalonia	4,536,132	5,627,187	14.1%	20.7%	17.1%	2
Valencia	2,969,353	1,529,271	9.2%	5.6%	7.6%	6
Extremadura	952,196	147,593	3.0%	0.5%	1.9%	12
Galicia	2,078,835	449,602	6.5%	1.7%	4.3%	8
Madrid	3,020,648	2,760,522	9.4%	10.2%	9.8%	4
Murcia	647,825	119,568	2.0%	0.4%	1.3%	14
Navarra	449,276	116,593	1.4%	0.4%	1.0%	16
Pais Vasco	1,017,812	461,793	3.2%	1.7%	2.5%	11
Rioja	335,481	70,984	1.0%	0.3%	0.7%	17
Ceuta y Melilla	67,651	31,097	0.2%	0.1%	0.2%	18
Total	32,132,993	27,149,530	100%	100%	100%	18

Source INE 2001

More recently there has been a growth in visitor numbers along the northern coastline region of Asturias and Cantabria, which can be attributed to the development of rural tourism. Madrid has also experienced significant visitor increases over recent years driven largely by the business tourism and city break markets.

Table 2.8 also reveals that there are some areas which are virtually overlooked by both domestic and foreign visitors. For example, Cantabria picks up only 0.06% of the foreign tourist market. Here there is significant scope for improving the range of services offered to tourists. Most of these regions are based in the interior (i.e. non-coastline) region of Spain, away from the coastal regions where tour operators traditionally channel visitors. A key problem for these areas is the lack of high quality accommodation and related tourist services (Bote Gomez 1988). These regions have many attractive features including wildlife, mountains and plains, historical culture and fine architecture, but such resources remain untapped as many tourists do not have significant awareness of their existence. Most visitors to these areas are of domestic origin.

There are considerable differences in terms of the preferences that different nationalities have for different regions. Although domestic tourism is much more widely spread across the regions most still favour the South coast, and the regions of Valencia, Catalunia and Andalucia account for more than 40% of visitor numbers, while foreign tourists are more partial to the Canary and Balearic Islands. The UK and Germany have long been the main source markets for Spanish visitors. Both groups traditionally have resorts that they favour. The island of Majorca has long been a favourite of German tourists and many own second homes on the island, which has consequentially driven up house prices and made the cost of living more expensive with local people on the island. Although the Balearics and the Canaries are both highly popular for British tourists they also spend a significant amount of time visiting the Mediterranean coast.

There are also substantial variations in the preferences of different nationalities as to the type of accommodation they favour. From Table 2.9 we can deduce that most tourists, whether they be domestic or foreign, prefer to stay in hotel accommodation. However, there are significant regional variations which appear more prominently in the foreign tourist sector. Such differences can be explained to a certain degree by making cultural distinctions in the foreign tourist market. For example, in the Balearics, a resort favoured by German tourists, significantly more people stay in hotel accommodation (77.4%) than in apartments (22.4%).While in regions favoured more by British tourists, such as the Canaries, apartment style accommodation is more popular (61.38% compared to 38.58% for hotels).

Many Spanish families own a second home which they will move into during the summer. The apartments of families who live in touristic areas anyway might only be a few miles from their main home, often at a local resort. However, some people will often use their second homes as a way of securing year round work. Many families who work in the agricultural sector will uproot from their homes close to the farms where they work, and find employment in hotels or bars during the peak tourism season. This type of migration accounts for much of the use of apartment style accommodation by domestic visitors. Also, when holidaying, most Spanish prefer to stay in hotels as it is seen as a respite from either living in the normal or summer home. Hence in the majority of regions a higher proportion of domestic visitors stay in hotels.

Most overnight stays in campsights are by Spanish people. This high proportion exists because of the relative cheapness of hotel-based package deals for overseas visitors. However, there is a high level of camping activity in Catalonia (19.42%) and Aragon (32.68%) by overseas visitors. This can be attributed to the fact that Catalonia is close to the French border, a country where camping volumes are very high, and it is quite simple for tourists to step over the border and experience a different culture without having to travel far into Spain.

Table 2.9 Overnight Stays by Region and Type of Accommodation

		Total	Hotels(%)	Apartments(%)	Camping(%)
Andalucía	Domestic	18,532,368	81.62%	8.35%	10.03%
	Foreign	24,815,926	78.19%	16.56%	5.25%
Aragón	Domestic	3,795,416	84.53%	2.91%	12.56%
	Foreign	722,664	66.68%	0.64%	32.68%
Balears	Domestic	6,299,093	92.07%	6.97%	0.96%
	Foreign	61,503,053	77.44%	22.40%	0.16%
Canarias	Domestic	8,980,356	67.25%	32.02%	0.73%
	Foreign	82,197,039	38.58%	61.38%	0.04%
Castilla y Leon	Domestic	5,611,102	88.24%	0.09%	11.68%
	Foreign	1,144,146	86.63%	0.04%	13.33%
Catalonia	Domestic	21,038,078	59.44%	7.78%	32.78%
	Foreign	35,493,399	68.46%	12.12%	19.42%
Valenciana	Domestic	16,401,423	66.51%	20.13%	13.36%
	Foreign	16,166,149	56.75%	29.42%	13.84%
Madrid	Domestic	7,341,800	86.76%	5.33%	7.91%
	Foreign	6,616,704	95.00%	3.88%	1.12%

Source: INE 2000

The average length of stay of tourists has declined significantly over the past 20 years. In 1984 tourists spent an average of 8.6 nights on their vacation but by 1999 this average had fallen to 4.6 (Anuario Estadisticas de Turismo, various years). This decline can be partly explained by the reduced costs of air travel which now makes it financially viable for tourists to stay for one week rather than two. These cheaper air costs also make it possible for tourists to visit two different destinations in a year as opposed to one (Key Note Report, 1998).

Table 2.10 reveals that average stay varies according to region and by type of accommodation. The Canary Islands are able to achieve slightly longer average stays. than other regions because of their relative remoteness. Apartment stays seem to last longer than both hotel and campsite stays. This can largely be explained by their relatively low prices compared to hotels and the added degree of comfort and facilities relative to camp sites. These figures might also be driven upwards by domestic tourists making extended stays in their holiday homes. In the Balearics, the average stay in hotels exceeds the average stay in apartments, which again reflects German tourists' preference for hotel accommodation.

Table 2.10 Average Stay and Occupancy Rates by Type of Accommodation and Region.

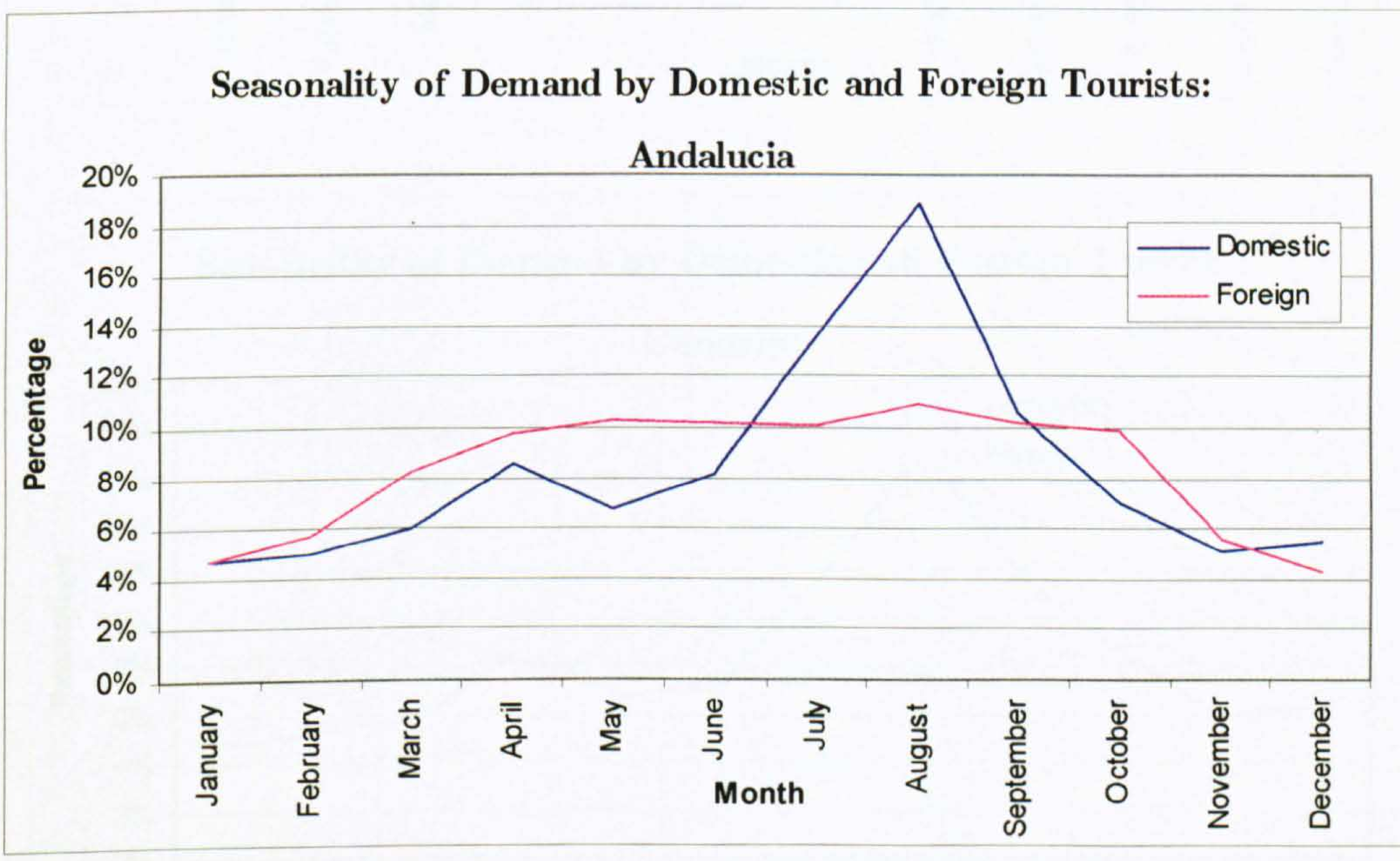
Region	Tourists	Average Stay	Occupation Rate
Andalucía	Hotels	3.09	56.5
	Apartments	7.71	45.72
	Camp Sites	3.67	17.38
Aragón	Hotels	2.09	37.26
	Apartments	4.59	27.9
	Camp Sites	3.12	13.25
Balearics	Hotels	7.99	74.88
	Apartments	7.83	72.74
	Camp Sites	5.71	39.53
Canary's	Hotels	7.7	71.26
	Apartments	9.71	59.87
	Camp Sites	7.8	27.35
Castilla y Leon	Hotels	1.66	37.19
	Apartments	4.52	9.28
	Camp Sites	2.39	20.44
Catalonia	Hotels	3.62	59.93
	Apartments	9.93	45.38
	Camp Sites	6.24	33.69
Valencia	Hotels	4.46	64.57
	Apartments	10.81	31.9
	Camp Sites	7.5	46.69
Madrid	Hotels	2.19	54.78
	Apartments	3.77	41.47
	Camp Sites	3.29	30.54

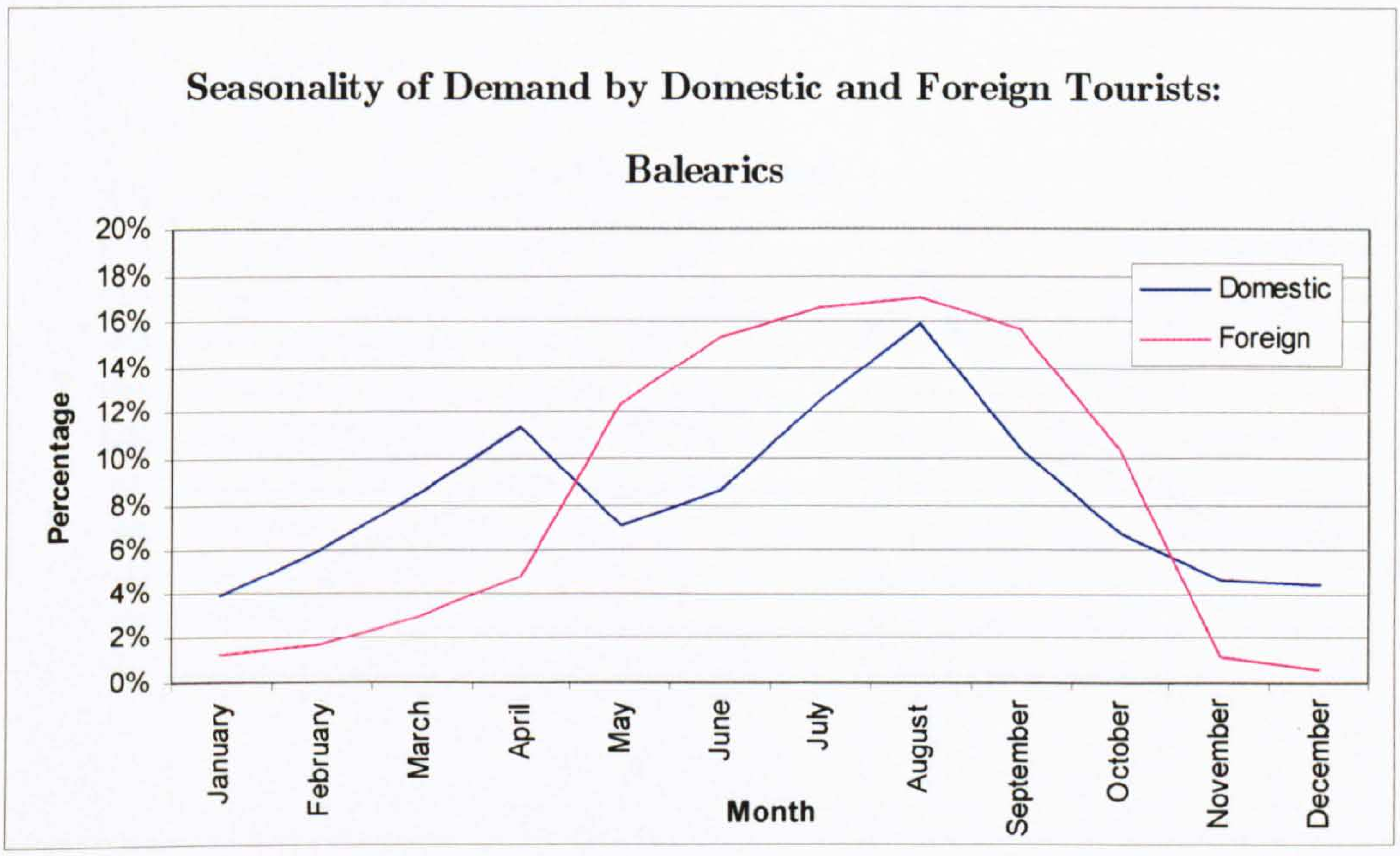
Source: INE (2000)

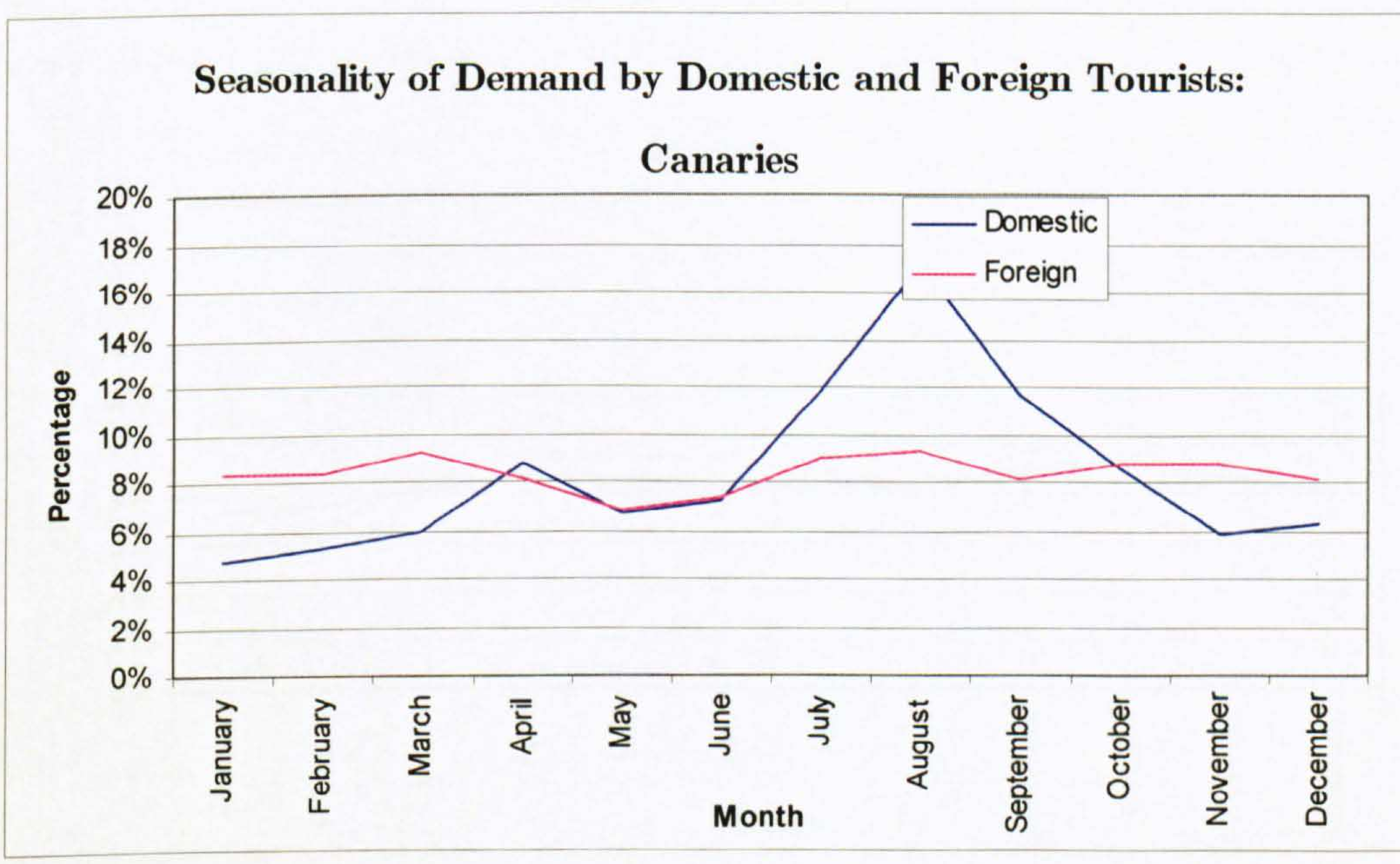
Hotels have considerably higher occupancy rates than either campsites or apartments. To some extent this phenomenon might be explained by the rationale that hotels receive higher proportions of domestic tourists who are in a better position to make off-season visits. Campsites only tend to attract visitors when there is some guarantee that the weather is nice, hence they are more exposed to lower occupation rates. Lower occupancy rates in apartments might be related to their extensive ownership by Spanish residents who may only visit them at certain times of the year.

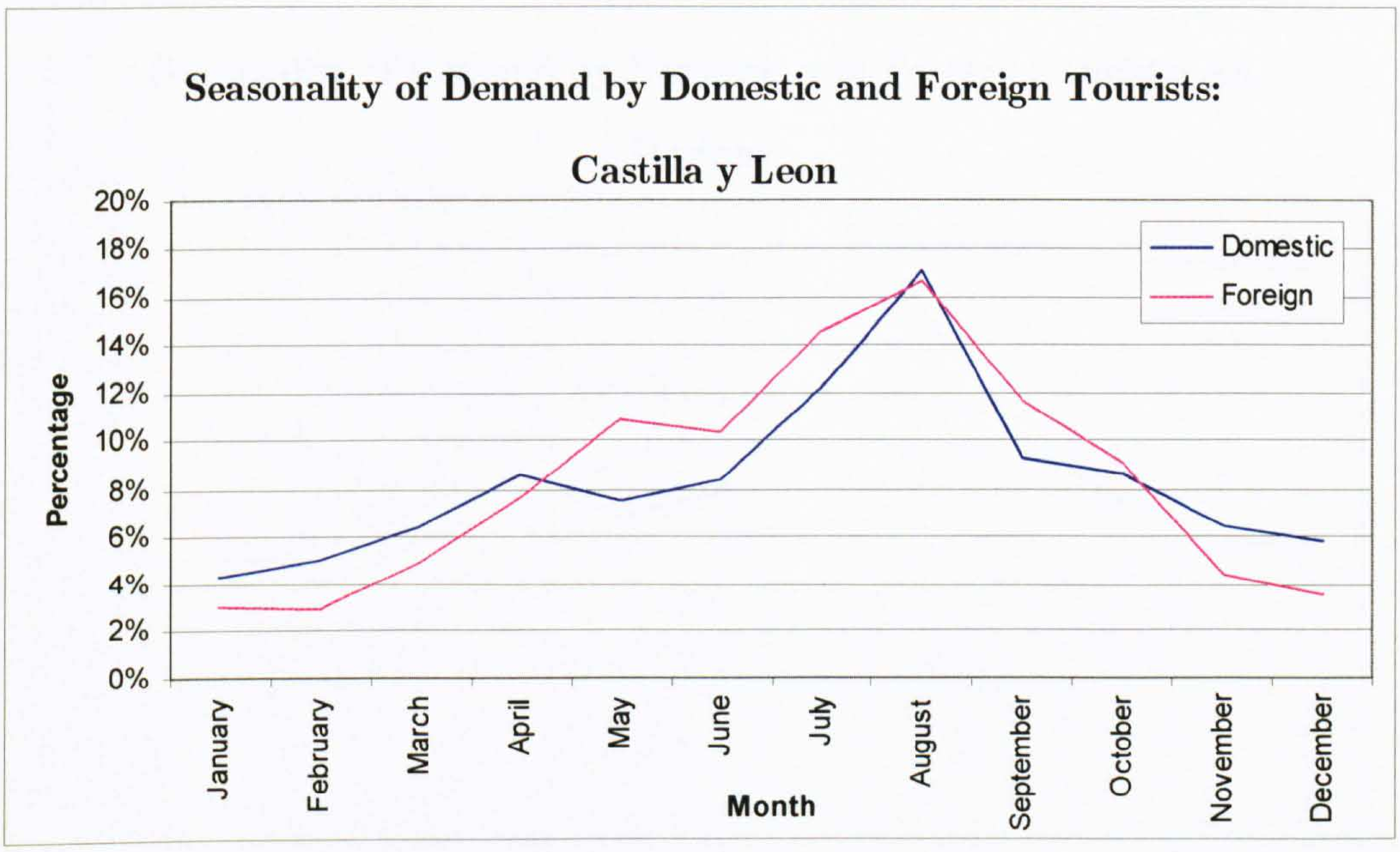
Large volumes of visitors can be attributed, in part, to low seasonalitly. The Canaries are now seen as an all year round destination by many due to the consistently high temperatures.

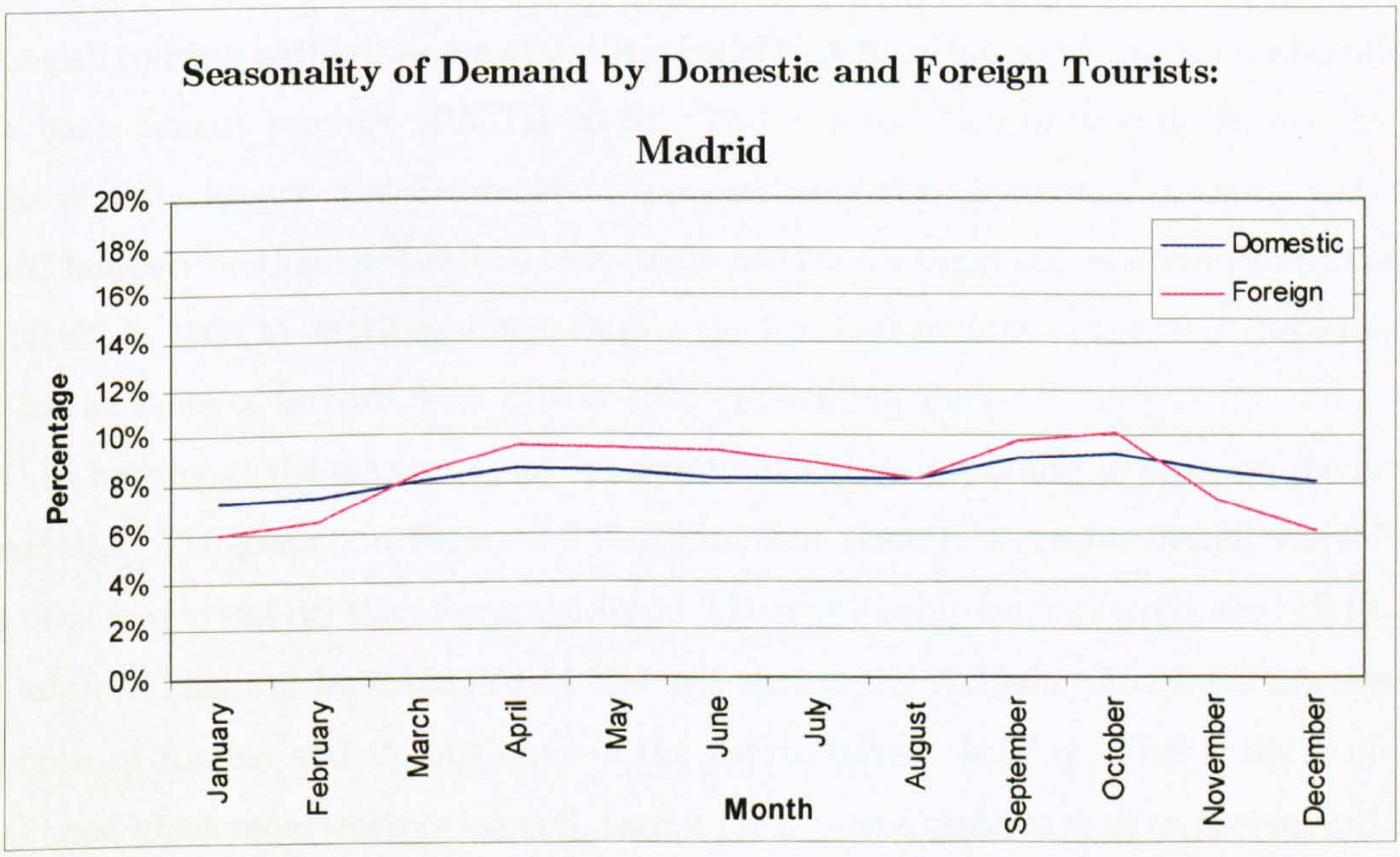
Figure: 2.5 Seasonality of Demand by Domestic and Foreign Tourists by Region




Seasonality of Demand by Domestic and Foreign Tourists:
Balearics
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Percentage
Domestic
Foreign
January
February
March
April
May
June
July
August
September
October
November
December
Month


Seasonality of Demand by Domestic and Foreign Tourists:
Canaries
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Percentage
Domestic
Foreign
January
February
March
April
May
June
July
August
September
October
November
December
Month


Seasonality of Demand by Domestic and Foreign Tourists:
Castilla y Leon
Percentage
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Domestic
Foreign
January
February
March
April
May
June
July
August
September
October
November
December
Month


Seasonality of Demand by Domestic and Foreign Tourists:
Madrid
Percentage
20%
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
Domestic
Foreign
January
February
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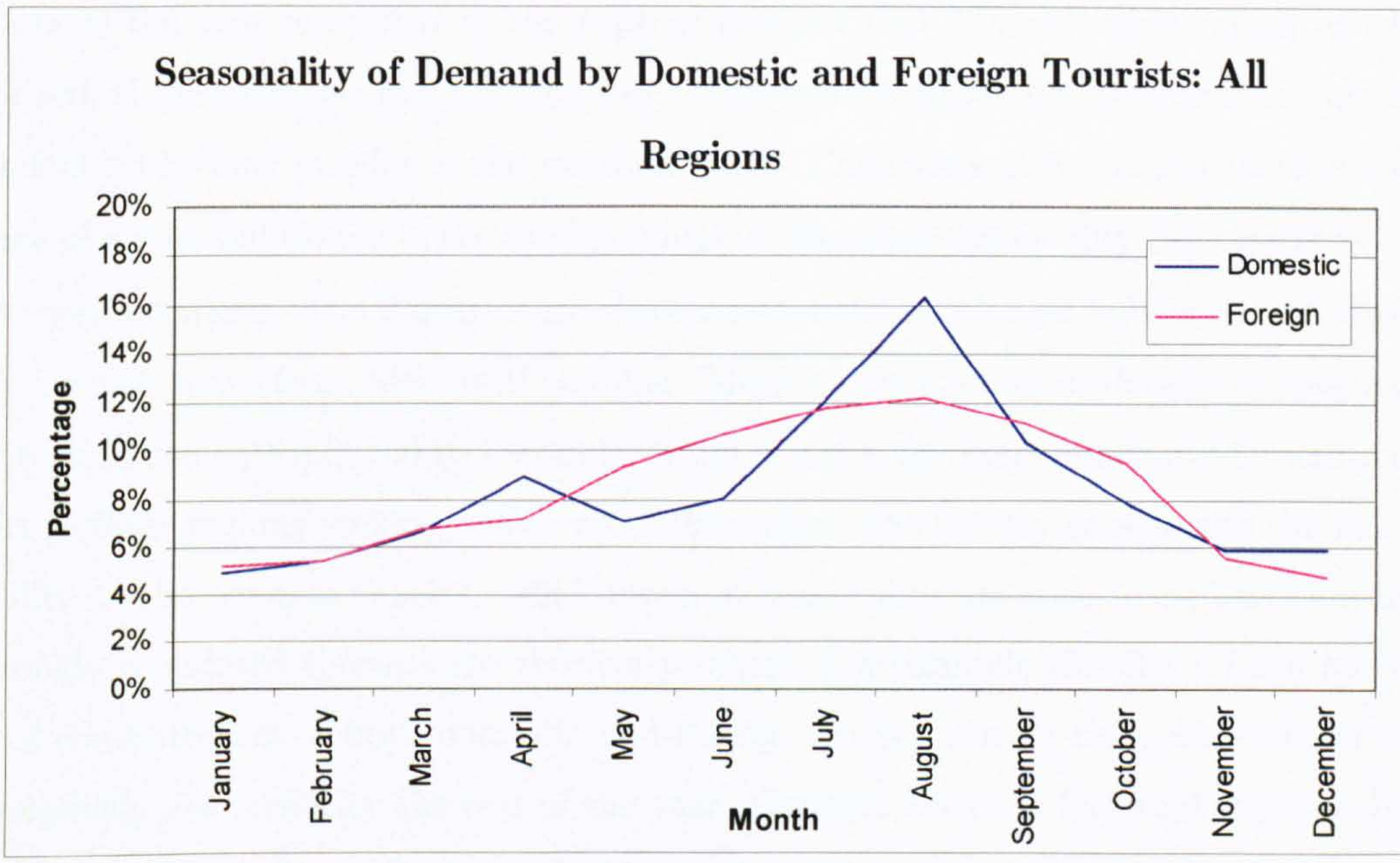
Month



Source: INE (2000)

Spanish tourism authorities are of the firm belief that there is a progressive deseasonalisation of the basic tourist product (PICTE 2000). The concentration of arrivals during the peak months of July, August and September, represent more than a third of the total number of arrivals; however, within the last two years there has been a slight reduction in this percentage, from 39.6% in 1995 to 38.9% in 1998. During the last four months of the year there has been a rise in the share of arrivals from 19% in 1995 to 20.3% in 1998.

When looking at the seasonality of Spanish tourism it is important to examine the regional implications. The graphs in Figure 2.5 illustrate that there is a greater overall variability in terms of domestic visitors than foreign visitors. The relationship can be seen in the 'All Regions' graph above. This can be explained by the fact that much of Spain virtually closes down for the month of August and the majority of the nation takes a holiday. This is the traditional time of year which most workers take off, except for maybe a skeleton staff to prevent industrial shutdown and to ensure the provision of key services. Hence it is very difficult to discount the seasonal element from domestic tourism.

Some communities are in greater control of the issue of seasonality than others. The region which has the lowest overall seasonal profile is that of Madrid. The steady flow of tourists throughout the year is related to the type of product that Madrid offers, much of which is comprised of business tourism and the city break market which are products not necessarily dependent on holiday profiles or the weather. In the Canaries and Andalucia there is a virtual absence of a seasonal profile in the foreign markets. However, seasonality can clearly be seen in the domestic markets. The Balearics are also characterised by a longer holiday season than most regions, which spans from May until October. Much of the absence or decline in seasonality in these regions can be explained by continual warm climate, the large number of foreign property owners in these regions making repeat visits throughout the holiday season, and the increasing flexibility of the overseas market. High levels of seasonality are seen in regions that are not so strongly orientated towards the tourism product. For example Castilla y Leon has a high level of concentration of both domestic and foreign tourism during the peak summer season, and relatively low levels for the rest of the year. Coupled with the fact that the area benefits from only 6.04% of the total share of visitors, the region experiences the problems typically associated with seasonality, see Sutcliffe and Sinclair (1980).

By establishing profiles of active markets it has been established that the more mature European markets are exhibiting a tendency to reduce the length of stay but increase the frequency of trips particularly during the spring and autumn periods. The majority of visitors that travel to Spain come from European countries; during 1999 tourists resident in some European country adds up to 76.3%, in 1998 this figure was recorded at 91.3% (PICTE 2000). Table 2.11 shows that in 1999 the country with the highest proportion of visitors was the United Kingdom, with 22.9% of the total figure. Both the United Kingdom and Germany make up 44.6% of the tourist arrivals to Spain. The high concentration of visitors from these two source markets has caused a degree of concern over previous years. When there is a recession, exchange rate depreciation or other associated economic problem, tourist flows from these countries tend to go into decline, which has caused problems for Spain's tourism revenue and its current account. Spain is working to broaden the range of countries from which visitors arrive. It has marketed itself heavily in both the USA and Japanese markets where the average spend per day is higher than European countries and the length of stay is longer also (PICTE 2000).

Table 2.11 Percentage of Arrivals by Nationality and by Region

Region	Germany	U.K	France	U.S.A	Japan	Other Europe	Rest of World
Andalucia	25.7	26.9	9.3	5.7	2	13.7	16.7
Aragón	15	13.7	29.7	4.5	-	21	21.1
Balearics	46.7	27.5	3.3	-	-	13.2	9.3
Canaries	43.2	23	-	-	-	24.8	9
Castilla y Leon	10.7	11.4	26	9.3	2	19.4	21.2
Catalonia	18.9	16.7	15.8	4.3	-	20.5	23.8
Valencia	-	61.5	5.2	0.9	-	27.2	11.2
Madrid	7.5	12.9	9.6	16.5	5.6	15	42.9
All Regions	21.7	22.9	12.3	5.1	1.2	19.3	19.4

Source: INE (2000)

Spain has seen a rapid growth in arrivals in terms of some nationalities, while it has witnessed a decline in others. Using time-series data Bote Gómez and Sinclair 1996 show that the number of arrivals from France diminished significantly over the past 25 years, when they made up 31% of total visitors in 1975 while according to table 3.4 they now only make up 12.3%. The growth of German tourists has also been noticeable over the past 20 years, in 1980 only 12% of visitors came from Germany, but now it accounts for approximately 25% of the market. Much of this growth can be attributed to the rising affluence of the German nation, which has experienced the highest GDP growth in Europe, greater integration of the EU and the broadening of the market base after the re-unification in 1992.

2.3.4 The Development of Tourism Policy in the Regions

As we shall see in Chapter 3 the analysis of the tourism sector is made difficult because of the extent of its conceptual boundaries. However, it is quite clear to establish that tourism is usually delivered via considerable co-operation between the private and public sector. Although much of the development of the tourism sector should be attributed to entrepreneurship in the private sector, the structure of public administration has had a strong influence on the development of the tourism sector

Since Franco's death and the establishment of democracy Spain has undergone a significant political transformation. Spain now defines itself as "a unitary regional state" which is comprised of 17 autonomous communities. Most communities have similar amounts of power, although Catalonia, the Basque region and Galacia all have distinct national identities and have stronger bargaining powers when it comes to centralised decisions and the option not to adopt some areas of national policy in their region.

Under Franco, tourism policy consisted of the promotion of tourism in coastal areas with little thought about the regional consequences. The development of tourism was demand driven, such a pronounced economic perspective led to unplanned and indiscriminate development with little respect for environmental or cultural consequences. Despite the economic importance of tourism, there was comparatively little government intervention due to the fact that tourism was not seen as a political issue because its development required little public funding. Most governmental tourism policy related to the fostering of large resorts and the promotion of Spain abroad. Planning was supposed to take place at the regional level. However, the devolution of power meant that there were 17 autonomous communities with 17 different tourism policies. This resulted in a weakening of control as local authorities pursued short-term advancement polices with scant regard for the future implications.

The 1980s were seen as a transitional period for tourism policy. Most regions made it a rather low priority, and there were few significant developments in the sector until the early 1990s. The most notable evolution occurred when the plan FUTURES emerged in 1994, which followed a government white paper on tourism in 1992. The principal aim of the plan was to improve the competitiveness and profitability of the tourism industry. However, it also sought to encompass social, environmental and technical perspectives. FUTURES was agreed to by all the autonomous communities and the central Ministry of Industry, Commerce and Tourism. This was seen as a major progression of the relationship between the state and the communities, who declared that they sought to carry the plan out jointly.

FUTURES was allocated nearly 50,000 million pesetas between 1992 and 1995 (Pearce 1996). Most of this money was directed at improving the quality of the industry and modernising it across the board. Several coastal resorts were regenerated and much effort was directed at providing a more diversified end product, and improving the associated infrastructure. However, significant criticism was directed at the central government relating to the way it handed out money in association with the plan. It was argued that those regions who received the most funding from the project were those whose electorate had voted for the ruling party. Such political considerations exacerbated state-community relations and cynics claimed the entire plan was a façade, merely a means of channelling funds into favoured communities.

The FUTURES plan came to an end in 1995 and although other less major 'Competitive Framework' plans were implemented, no other major plan was revealed until the year 2000. The plan, known as PICTE 2000, which roughly translates as: The Comprehensive Plan for the Quality of Spanish Tourism, sought to define the strategies and objectives to secure Spain's leadership as a provider of quality tourism. The ideas behind the PICTE plan emerge from the difficult situation that Spanish tourism went through at the end of the 1980s and the beginning of the 1990s, with a decline in the quality of the products and a deterioration of the image of Spanish destinations and main active markets, together with loss of competitiveness against other destinations. Under PICTE 2000 the objective of quality replaces competitiveness as the differential feature of Spanish tourism.

PICTE took a step forward from previous plans as it was formulated by members of all the autonomous communities and groups from the private and public sector. Co-operation is seen as a basic instrument of the plan, both on a national (institutional) and local level. Policy is determined in the national interest but local authorities are able to carry out its implementation. Such discussion and execution is co-ordinated by the "Promotory Council of Tourism", who aim to ensure the enforcement of policy and removed red tape, especially in terms of inter ministerial bureaucracy.

The notion of quality seeks to make radical changes in the way that the tourism sector is managed, the professionalism of its workers and the diversification of its product. Quality is measured in terms of customer satisfaction and is dependent on their perception bearing in mind the price they have paid. Hence, the notion of quality implies that "cost should be as the client expects it to be". If quality is thought to have fallen below minimum levels, the government may remove the destination from the market. Quality is linked to sustainable development, and seeks to guarantee increases in wealth and social well-being, without jeopardising the future. Under the PICTE plan the measurement of development implies both traditional concepts of growth and improvements in quality.

PICTE also involves several "energisation" plans where the government and private sector seek to exploit emerging destinations and regenerate mature resorts. The government also seeks to continue and develop its promotion and funding of alternative tourism options such as cultural and rural tourism. Its policy of setting up localised projects based in the interior communities, has been rewarded with increases in the visitor share in recent years. Credit is provided to restore or develop facilities that can be used for tourism purposes, ideally in accordance with the traditional characteristics of the area.

The supply and demand for tourism in the regions has developed with a relatively low level of regulation. The government only tends to intervene at a national level to promote foreign tourism or initiate policy discussion. Market forces have dictated supply and market structure, resulting in the acute concentration of the industry in the sun, sea and sand market (the key growth stimulus for the Spanish market), while other types of tourism have been overlooked. The density of supply and demand along southern coastal areas and Spain's dependence on the German and UK markets will only compound problems in both mature and emerging resorts. Further exploitation of the interior and northern coastline could go some way to relieving such tensions. Investment in infrastructure and regeneration projects should also assist in securing the current stream of tourists, although uncontrolled construction projects have compounded problems in many areas.

2.4 Conclusion

It can be seen that the tourism sector makes a positive contribution to Spain's economy and has played a substantial role in its developmental process. Several important issues have merged from this analysis. Firstly, it is clear that the characteristics of the tourism sector differ significantly between the autonomous communities in Spain. Some regions are heavily relient on tourism (Canaries), while others are not (industrialised areas such as Castilla y Léon). Secondly, it can be seen that the autonomous communities have varying degrees of powers of self-government, particularly with regard to taxation. Thirdly, the orientation of tourism differs significantly between regions e.g. the Canaries have a much larger hotel sector, while Andalucia is more focussed on self-catering accommodation. Fourthly, the chapter also highlights the degree of factor market rigidity in the Spanish economy. This is dealt with explicitly in Chapter 4. Finally it is shown that Spain has a persistent balance of payments deficit, some of which tourism helps to divert to some extent. Growth in tourism receipts is obviously a potential solution to problems of this nature. This feature of the economy will pay a key role in the outcomes of the CGE model later in this thesis.

It is very important to note that although this chapter provides a very comprehensive overview of the Spanish economy some of the characteristics that have been discussed will not be modelled explicitly in the subsequent chapters. For example, although seasonality is a characteristic of tourism in Spain, it will not be taken into account in the CGE models of the economy that are subsequently developed. This is partly to do with the fact that the CGE model is developed using annual data, quarterly input-output information is not available, nor monthly for that matter, and neither is much of the tourism data needed for disaggregation purposes. It is possible to analyse the seasons in aggregate by scaling post simulation results by weighted averages of tourism receipts. However, this procedure is not undertaken, as this is not the focus of this thesis. The degree of seasonality also makes little difference to the aggregate results as occupancy rates are generally below 90% even in peak months, so there is scope to accommodate the additional tourists associated with the scale of demand shocks undertaken in this thesis. Further, any model based on annual data, whether it be tourism related or not, suffers from seasonality issues on both the production and consumption side. This is normal, as any model is a simplification of a complex reality and, therefore, concentrates on explaining a limited number of characteristics and their effects. In the case of this thesis, the emphasis lies in explaining economic relationships at the national and regional levels, using models that are specifically developed for the purpose. Nonetheless, it is felt that the provision of a comprehensive overview of the economy provides a useful context for the models and analysis in the following chapters.

Chapter 3

Survey of the Literature

3.1 Overview

The purpose of this chapter is to give an overview of the theoretical literature on tourism and international trade in services and its application within the field of computable general equilibrium modelling[1]. The chapter seeks to identify key issues of relevance to the modelling applications used later in this thesis and possible gaps that exist in the current literature. The chapter is ordered as follows. Firstly, the chapter explores issues relating to the modelling of services in analytical models. These differences are well documented in the international trade literature and also have implications for the modelling of goods. Secondly, the chapter describes the way in which trade in tourism differs from trade in goods and services and investigates the possible impacts of tourism demand on the recipient economy. It is shown that tourism demand has played a significant role in the growth of the Spanish economy, however, possible Dutch Disease effects are identified as an unwanted by product. A possible solution to this problem is to increase the supply of tourist goods and services. The chapter then seeks to evaluate the role of Multinational Enterprise (MNE) activity in the tourism sector and how it can be used to facilitate trade, it shows that international capital mobility is an important concept when considering tourism trade. The effects of MNE activity can both positively or negatively impact on the tourism sector and the economy in general and it is the effects of these characteristics

[1]An abridged version of this chapter appears in Blake *et al.* (2005).

which are evaluated in later chapters.

The chapter then goes on to consider the usefulness of CGE modelling in considering the role of tourism. However, to incorporate the nuances of the service sector and the key characteristics associated with foreign direct investment a departure is required from the standard "neoclassical" CGE models. The chapter provides a discussion of the relevant CGE papers and evaluates the usefulness and characteristics of previous attempts in the relevant literature, particularly in the context, of imperfect competition, dynamics, FDI and tourism. The issue of CGE model closure is also discussed, both in terms of the general macro closures and labour market closures. Finally the model considers issues relating to the modelling of ownership and location

3.2 Services and Services Trade

The nature of services and their relationship with trade theory literature has already been discussed extensively by Sapir and Winter (1994) and Stibora and de Vaal (1997). For the purposes of this thesis it is not necessary to add to this literature. However, it is necessary to explain the main concepts of how services are defined and interpreted within this thesis.

3.2.1 The Definition of a Service

The definition of what constitutes a service has attracted a considerable amount of attention in the trade literature. The extensive review by Stibora and de Vaal (1997) cites the definition offered by Hill (1977) as the most comprehensive discussion of what distinguishes a service from a good. Hill states:

> "A service may be defined as a change in the condition of a person, or of a good belonging to the same economic unit, which is brought about as the result of the activity of some other economic unit, with the prior agreement of the former person or economic unit" (p. 318).

Stibora and de Vaal propose two facets of the definition for consideration so that it might be fully appreciated. Firstly, a service is considered to be the end-product of a production process. It is a "change in the condition of a person or a good belonging to the same economic unit"; prior economic activity is not included. Secondly, a service is "brought about as the result of the activity of some other economic unit". It is argued that service flows might be obtained from the consumption of goods and this is implicit in the definition. However, what the definition does not encompass is the change in utility associated with the consumption of the service.

Following Hill's definition, service output is measured as the change in condition of the consumer, rather than the activity of the producer. Initially it is not difficult to quantify the service (for example, hotel occupancy or the distance a good is transported), which can then be measured in terms of price. However, this can only be used as an estimate of the change in condition unless we include a proxy for quality. Stibora and de Vaal cite transport as an example; while an objective measure of a service rendered is the number of miles travelled, other factors play a role, for example, the amount of time taken to transport the goods and the amount of care needed to ensure their safe arrival. As quality plays an important role in the provision of services, Stibora and de Vaal recommend that price be treated as a strategic variable; hence a perfectly competitive model no longer remains appropriate.

A further concern for the economic modelling of services cited by Hill relates to the characteristic of services being a flow rather than a store.

> "Services are consumed as they are produced in the sense that the change in the condition of the consumer unit must occur simultaneously with the production of that change by the producer: they are one, and the same change... the fact that services must be acquired by consumers as they are produced means that they cannot be put into stock by producers" (p. 377).

Static models do not reflect the fact that goods need not necessarily be consumed immediately; they can be stored and used later, while as soon as the majority of services are produced they are consumed[2]. Due to the existence of these nonstorable characteristics, the choice of capacity becomes crucial for service providers; hence, it is not just a dynamic framework that is needed, but one that can incorporate capacity choice.

[2]Exceptions to this rule include services such as warranties or insurance which are effectively stored until they are needed (i.e. in the event of an accident).

Another characteristic associated with services provision is the high level of consumer-producer interaction associated with their production. Bhagwati (1984) distinguishes two types of interaction:

> "Basically one has to draw a distinction between services as embodied in the supplier of the services and requiring their physical presence where the user happens to be, and services which can be disembodied from the supplier and provided without a physical presence being necessary" (p. 101)

How this interaction impacts on the modelling of services trade is discussed in detail in section 3.3.1. It is possible that the combination of non-storability and producer-consumer interaction allows a significant degree of production flexibility and even leads to tailor-made service provision. Hence, services will be considered as heterogenous goods.. Services production tends to be more flexible than goods production; costs relating to the adjustment of goods tend to be higher because of their more tangible physical content.

3.2.2 Services and Market Structure

The industrial organisation literature implies that market structure is determined by the interaction of the firm(s) and the size of the market. The size of the market is dependent on the position of the demand curve, while the size of each firm is dependent on the position and shape of its cost function. Both parameters then simultaneously determine the number and size of the firm(s) and thereby establish the actual market structure (Panzar, 1989). The cost function is directly effected by economies of scale (the reduction of average costs as output increases) and scope (cost savings realised from producing a range of goods in a single plant rather than producing them separately in specialised firms). Market structure is determined by the interaction of the cost function and the demand function (which reflects whether products are homogenous or differentiated). It has already been determined that services are heterogenous products, and from the high mark-ups on services products, it can be inferred that services are best modelled when using either a monopolistic or oligopolistic market structure.

In addition to the interaction of the demand curve and the cost function, barriers to entry also influence the structure of the market. A wide range of entry barriers exist, but increasing returns to scale due to fixed costs are generally considered to be the main barrier in a monopolistic market. However, according to Baumol, Panzar and Willig (1982), fixed costs are not sufficient as a barrier to entry. They argue that a perfectly competitive outcome can be achieved for a monopolist when the threat of entry of new firms is a distinct possibility.

It has been shown that economies of scale and scope and sunk costs may have impacts on market structure. However, it is necessary to consider the size of and the potential for these impacts to occur. Economies of scale and scope are believed to vary broadly between industries, although few detailed analyses have been undertaken. In sectors such as telecommunications, energy supply or any sector requiring a large supporting infrastructure, both are generally considered important (Panzar, 1989). Baumol and Willig (1986) find that such factors do not play such a significant role in sectors such as banking and transportation, while Caves *et al.* (1984) show that the same is the case for airlines. Stibora and De Vaal (1997) argue that, following the industries considered above, "all remaining service industries are considered to exhibit a relatively low degree of scale and scope economies".

It is argued by Sapir (1991) that scale economies are quite small for most service providers. This proposition is based on a now relatively commonplace characteristic of services trade, which was first identified by Ethier and Horn (1991), that many services are customised to the individual needs of consumers. This property does, however, seem to support the notion of economies of scope in service firms. For example, brands, advertising campaigns or management strategies can quite easily be conceived at a central office and applied across all regional branches of the firm at little extra cost. Despite the appealing nature of such a property, it is generally one level of product differentiation below that included in the nesting structure of most trade models. Dee (2001) and Brown *et al.* (1996) are pessimistic about the possibility of its inclusion in formal economic analysis. With respect to the issue of sunk costs, it is argued by Sapir (1991) that they are not important in business, financial and professional services and that in industries such as airlines, shipping and other forms of transportation they are quite low. On this basis Sapir argues that the service sector is generally contestable. Such a proposition conflicts with the notion that services are highly differentiated products. However, a wide range of services rely heavily on factors such as reputation, experience and learning-by-doing. These factors can significantly lower the costs of trading (Tirole, 1990) and as they are investments that cannot be recovered, they should be categorised as sunk costs, which are clearly an important barrier to entry.

3.3 Tourism and International Trade

3.3.1 The Mechanism of Tourism Trade

If the definition of Hill (1977) is accepted, then in order for there to be international trade in services, it is necessary that the economic agents engaged in the services transaction be located in different countries. A categorisation of services trade is given in the General Agreement on Trade in Services (GATS); for a more detailed explanation see Hoekman (1996). The GATS categorisations are based on earlier work by Bhagwati (1984a) and Sampson and Snape (1985), whose four part typology is as follows:

- Mode 1: through cross-border communications in which neither the producer nor the consumer moves physically, interacting instead through a postal or communications network, so called separated services;
- Mode 2: through the movement of the consumer to the supplier's country of residence,
- Mode 3: through the movement of the supplier, to the consumer's country of residence, i.e. the movement of the factors of production;
- Mode 4: transactions involving the movement of both the supplier and the consumer of the service.

It can be seen from the above definitions that the current concepts of international trade in services encopasses foreign investment, in that the definitions allow for the movement of the factors of production. Only Mode 1 can be regarded as trade the traditional goods sense, while the other types require the movement of consumers, producers or both. From this it is clear that the analysis of international trade in services requires an approach beyond the scope of the traditional trade models, i.e. one that is capable of including the movement of the factors of production as part of a transaction and which no longer defines all services as "non-tradables".

Further, models also need to distinguish between the *ownership* of a services activity and the *location* of a services activity (Dee, 2001).

Since we observe international trade in tourism, the previous categorisation must be modified. Three possibilities occur. Firstly, in order for individuals to consume a foreign holiday they must of course travel to the supplier's country of residence (Mode 2). However, it is possible for an international supplier to establish a physical presence in the consumer's country of residence (Mode 3), for example, if Spanish people stayed in an international hotel chain in Spain. If an overseas visitor stayed in a international hotel chain in Spain, for example, a traveller from the UK staying in a Marriot hotel, then both the consumer and supplier will have crossed international borders (Mode 4). Thus it can be seen that for international trade to take place in the tourism sector in any form, it is necessary for either the producer, consumer or both to cross an international border.

So although foreign tourism is not a traditional export good, it earns foreign currency in a conventional sense; however, international visitors cross boundaries to consume it. In the same way domestic outbound tourism is equivalent to an import good in that it represents a foreign currency outflow; however, Spanish residents travel abroad to consume it. Tourism characteristic sectors can of course still export in the conventional sense; for example, capital goods may be sent abroad for use by industry service providers for example, cruise ships or aeroplanes. In terms of the dataset used in this thesis, the recording of exports in the input-output tables is discussed in chapter 4, section 2.

An important part of this thesis is to establish the economic impact of both consumers and producers of tourism products on the Spanish economy. Considering that, according to the Spanish TSA, 43% of tourism demand in Spain was generated by foreign tourists in 1996, ignoring the effects of their consumption patterns would imply a naive analytical framework. Further, a great deal of international trade in the tourism sector takes place via Modes 3 and 4, the extent of which will be analysed in later chapters (chapter 5). Therefore it is important to consider the mechanisms by which Modes 3 and 4 can be achieved. The preceding definitions imply that a physical presence needs to be established via the movement of the factors of production. The factors of production that can be considered internationally mobile which relate to the production of a tourism good are labour and capital.

At this point it should be noted that the potential for analysis is broad. There is a significant literature on both international movements of labour (Feenstra, 2000) and capital (Dunning, 1993) and how they combine. What is important to establish is a context for and analysis of how factor movements occur within the tourism sector. Firstly, it is important to examine the possibilities for the movement of labour. Labour may cross international borders to supply a tourism product, possibly with any subsequent earnings being repatriated to the home country. Highly skilled labour may cross-international borders and provide "expertise" in international markets, for example, management consultancy: for a more detailed discussion see Markusen, Rutherford and Tarr (1999). The extent to which international movements of skilled labour impact on the displacement of local labour markets in Spain is debatable. Rather than replacing local skilled labour it is more likely that foreign labour either monitors the interests of a "third" party, or acts as an "expert" body. Thus, although overseas workers do contribute to the Spanish tourism sector, they are not the key factor of production by which international trade is facilitated.

The main apparatus though which international trade in tourism is generated is via capital investment. When capital investment crosses international borders it is termed foreign direct investment (FDI). Coupled with FDI, it is possible that labour (probably highly skilled) will accompany any investment to administer its transition and to assist the maximisation of returns. The sizes of such flows can be considerable. For example, it is estimated that FDI, in its various forms, flowing into the Hotels and Restaurants sector in Spain amounted to €630.5 million (Banco de Espanã) in 1999, which is approximately 5% of final output. The geographical pattern of FDI has been discussed at length by many authors (Dunning, 1992, 1996; Caves, 1999, Krugman 1991). Again, it is not the purpose of this thesis to contribute anything new to this literature per se, but rather to extract relevant components and examine them in the context of Spanish tourism.

Therefore, an important feature relating to FDI and the tourism sector is its relationship with the factors of production and hence consumer demand. FDI is able to augment the use of factor resources so that they are more efficient than domestic resources. Evidence for this is widespread (Görg and Stobl, 2001), this can either occur through the augmentation of capital, labour or both. The basic premise is that factors are employed more productively in MNEs than domestic firms, this concept is explored in more detail in the next section. As well as increased productivity associated with factor inputs MNEs also provide additional capital which can allow the tourism sector to increase capacity. So international trade in tourism can be a vehicle to limit the bottleneck effects caused by the Dutch Disease, Mavrotas (2003). These are discussed in more detail in sub-section 3.4.2.

The purpose of the next subsection is to propose some simple definitions, relating to FDI, which will hold to and be referred to throughout the rest of this thesis.

3.3.2 Multinational Activity

We must initially make the important distinction between foreign direct investment and portfolio investment. To do this we turn to the definition made by Dunning (1992).

Exhibit 3.1: Foreign Direct Investment and Foreign Indirect Investment

Foreign Direct Investment

(1) The investment is made *outside* the home country of the investing company, but *inside* the investing company. Control over the use of the resources transferred remains with the *investor.*

(2) It consists of a "package" of assets and intermediate products, such as capital, technology, management skills, access to markets and entrepreneurship.

Foreign Indirect Investment (i.e. portfolio or contractual transfer of resources)

(1) Specific assets and intermediate products (e.g. capital, debt or equity, technology) are separately transferred between two independent economic agents through the modality of the market. Control over the resources is relinquished by the seller to the buyer.

(2) Only these resources are transferred.

Source: Dunning (1992)

The central issue here is one of control. The distinguishing feature of foreign direct investment (FDI), as opposed to portfolio investment, is that FDI is concerned with control over foreign assets. FDI might involve the direct purchase of one or any combination of the following: physical capital, rival technologies, brand names, management and workforce skills.[3] It is generally argued that to achieve control, the MNE needs to purchase a significant equity stake, or have authority in terms of the company's management. It is not strictly necessary to acquire a stake of more than 51% of equity to exert control. An MNE may acquire a minority

[3]It is, of course, possible that both management and workforce may subsequently leave. However, such prospective risk is likely to be built into the MNE investment decision.

stake and still exert a significant degree of influence over the decision-making processes within the recipient firm. There is no international consensus on the requisite size of the equity state deemed necessary for "control", but in the compilation of national data on FDI it tends to vary between 10% and 25% (Dunning, 1992)[4]. FDI is not the only way in which MNEs might seek to profit from transnational investment. International investment transfers frequently occur in such a situation whereby the MNE relinquishes control over the assets it has transferred. Dunning calls this Foreign Indirect Investment (FII). In such a case we would usually expect that the MNE is exploiting some advantage that it has over existing (domestic and foreign) firms in the recipient sector, or is obtaining a strategic holding.

3.3.3 Explaining Foreign Direct Investment

The literature explaining the causes of foreign direct investment is very large, and for the purposes of this thesis it is not necessary to cover it all. However, there are two competing classes of explanations for foreign direct investment (Graham and Krugman, 1994) and these are reviewed below.

Suppose that a Spanish hotel chain could easily be acquired by an existing Spanish hotel company or a UK-based hotel company and that both firms believe that they can obtain a profitable cash flow by investing in the chain. Why might the UK-based firm be willing to pay more for the hotel chain? There are two reasons for this: either it believes that the hotel chain will be more profitable under its control, or that it has a lower cost of capital than the Spanish firms.

To counter the supposed cost advantage that domestic firms have in their own country, Glass and Saggi (2002), Graham and Krugman (1994), Markusen *et al.* (1999) argue that a foreign firm must have some asset to enable it to outperform the domestic firm. Alternatively the UK company may believe that the Spanish hotel chain has the potential to play a key role in its global strategy and to assist it in appropriating gains from elsewhere. In general the reasons why the hotel chain might be worth more to a foreign company than a domestic company can be explained via the industrial organisation literature which is surveyed in more detail in the next subsection. However, if it is the case that foreign firms are no better in running hotel chains

[4]The figure for Spain is 10%.

than domestic firms yet they are willing to pay more for the chain, then the "cost-of-capital" argument must be considered the most suitable explanation.

It is noted by Graham and Krugman (1994) that since the early work of Hymer (1959), the industrial organisation approach better explains the determinants of FDI than do cost-of-capital considerations. If this consensus is correct, FDI is best viewed as a strategy for obtaining control over a firm, rather than as a "channel for shifting resources from one country to another" (Graham and Krugman, 1994). If this is the case, then investment is not seen as the most important part of the story, and several reasons can be put forward to support this view. Firstly, if the UK company was simply seeking a higher return on its investments, it would make more sense to engage in portfolio investment in the European stockmarkets, rather than becoming entangled in the complexities of the management of an international hotel chain. Secondly, firms engaging in FDI often raise a significant portion of funds on the recipient countries' financial markets; it would not be logical to do this if they had a lower cost of capital in their own country. Thirdly, FDI amongst developed countries typically moves in both directions; although Spain receives a sizeable portion of its inward FDI from the UK, it also invests significantly in British interests and frequently this investment occurs in the same industry.

3.3.4 The OLI Paradigm

The basis for the industrial organisation approach was developed by Dunning (1973). He describes three alternative motives for engaging in FDI - Ownership, Location and Internalisation (OLI) - which are assumed to encapsulate "the activities of enterprises engaging in cross-border value-adding activities" (Dunning, 1996). Each of these concepts is explored in terms of the Spanish tourism case.

Ownership

Ownership advantages exist when an MNE has the capability to supply certain assets, which are either unavailable, or not available on such favourable terms, to domestic and foreign competitors. These so-called "O" advantages are specific to the firm. When describing the nature of "O" advantages we also seek to explain "why" firms might consider engaging in MNE activity.

MNEs investing in the Spanish tourism sector often have superior technological, organisational and management skills. Other "O" specific advantages that particularly relate to the tourism industry, and which can be deduced from Dunning's previous work, are the opportunities to exploit product innovations, and the ability to reduce the costs of intra/inter-firm transactions. Many of these firms are large hotel chains or firms with interests in the tourism sector. Due to the heterogenous nature of the service sector (Stibora and de Vaal, 1997) and hence of the tourism product we assume that MNEs tend to focus their activities in directly related sectors as this is where they are better able to exploit their "O" specific advantages. Additionally there is very little evidence of non-tourism related industries investing in the Spanish tourism sector and vice-versa, (Ramon, 2001).

Complementary "O" assets that a MNE might acquire from investing in the Spanish tourism sector include more favoured and better access to international markets. This is particularly notable in the Spanish case as many MNEs use Spain as a springboard into Latin America due to its strong economic and cultural links (Ramon 2001). MNEs will be able to gain information relating to societal differences in managerial and organisational systems, while at the same time being able to diversify away some of the risk associated with direct entry into the comparatively unstable Latin American economy. Södersten and Reed (1994) remind us of possible feedback effects, since when firms engage in international activities they may increase their ownership advantages, which in turn may allow them to explore further international activities.

Location

Locational, or "L" specific assets effectively determine where an MNE chooses to produce. If "L" advantages are present it is more profitable to produce in a country than to export to it. The "L" decision is dependent on a wide range of factors, for example, cost conditions, tax policies, political stability, the extent to which investment gives preferential access to the local market, and trade restrictions and other policies in the host country.

The MNE will be attracted to operate in Spain's tourism sector due to several beneficial "L" type advantages. MNEs are highly motivated by Spain's extremely attractive tourism-related natural resources and may seek to exploit them on entry. Spain already has a large-scale tourism infrastructure in place and is an established destination, so serves as an obvious choice for an MNE. Such an advantage, coupled with increasing globalisation of the market place, could also reinforce an MNE's motivation to pursue an international network of resorts. Further, locational diversification allows firms to keep track of the emergence of new holiday destinations and business tourism centers and may also assist in the reduction of seasonality. Firms may also be influenced by fiscal advantages offered by the government of the recipient country, the need for overseas expansion due to falling profit margins in domestic markets or the search of production inputs at lower prices. Firms may also be tempted to invest in Spain to meet growing demand in the continually expanding tourism sector.

Geographical decisions relating to trade restrictions might well include locating in an area where access can be gained to a preferential trading agreement for example, the EU (of which Spain is a member). Governmental trade policy will also have a significant influence on the location decision i.e. whether the MNE is able to exploit trade barriers or if it is offered a fiscal incentive. Qualitative barriers, such as quality restrictions, may also have a positive or negative influence on the entry decision.

Internalisation

As firms seek to add-value to their "O" advantages rather than sell them, or their right of use, they realign their ownership and organisation of their activities so that transactions are carried out within the firm rather than in external markets. Hence, firms impose hierarchical control and internalise their operations. Internalisation, "I" specific, advantages make it more profitable for the firm to produce the good itself, rather than contract out production to a local producer. Firms will internalise if they feel that they can better exploit these advantages if they are kept within the firm. The theory implies that the firm fears losing the "I" advantage if production is contracted out to an external firm. The external firm may use the technology to establish itself independently, or managers/workers could pass on information and skills to competitors.

"I" specific advantages will arise when firms are able to realise gains from the diversification of production; the reduction of risk, particularly, economic, political and financial; and scale economies. Some firms may wish to strengthen their bargaining position with tour operators, while tour operators may enter the market to ensure the stability of supply.

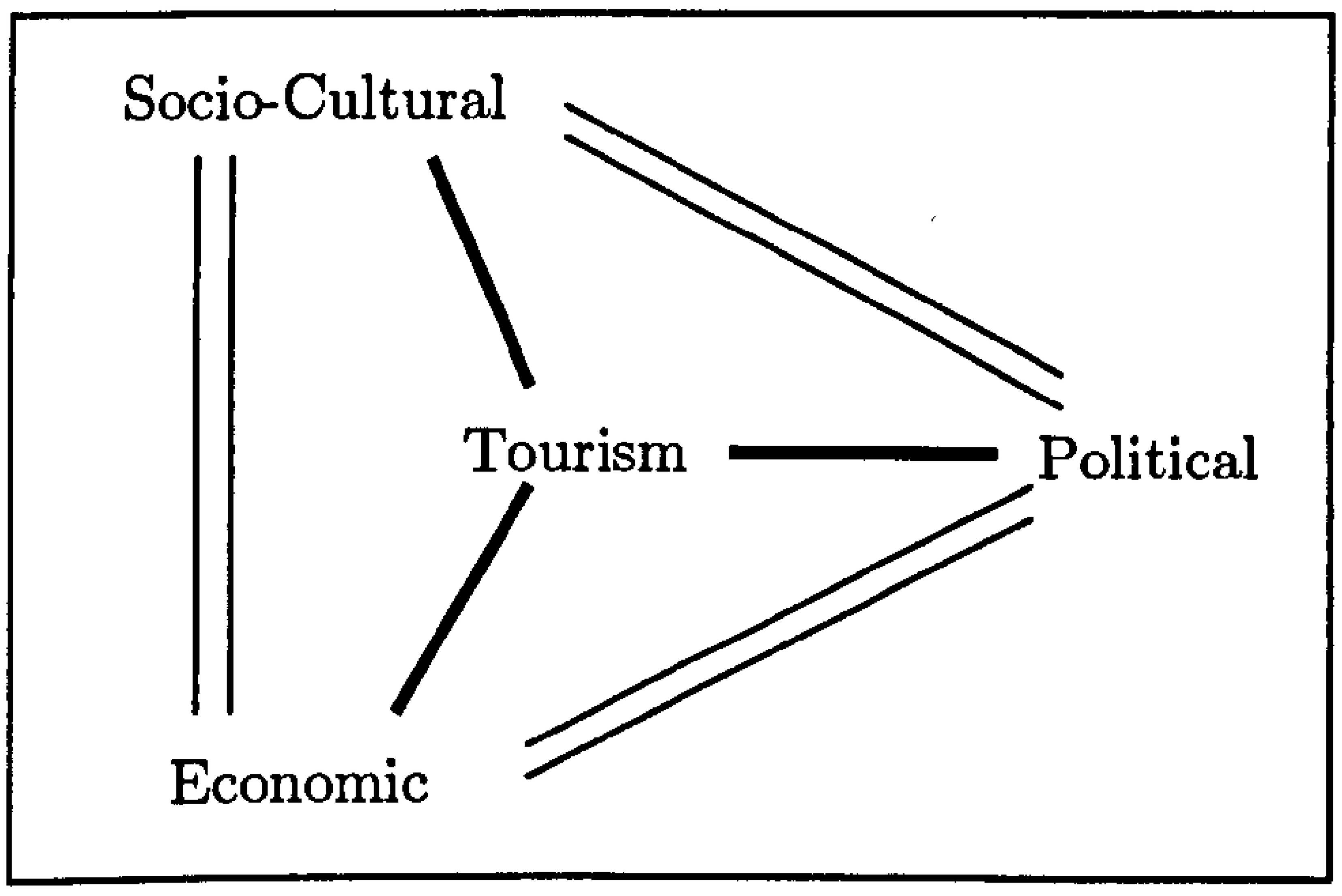
3.4 Modelling Tourism and its Tradable Components

This next section is devoted to developing a suitable modelling framework that is capable of capturing the key features of the tourism sector, the different characteristics of international trade flows and the demand and supply phenomena associated with tourism.

3.4.1 The Role of Tourism in the Economy

Tourism is by no means an independent sector. The theory of systems states that it is a subsystem within a wider system (Sessa, 1983, 1985) and its economic, political and social aspects are conditioned by the structure of society. Changes in the structure of society will influence the tourism sub-system and in turn, tourism will have its own influence on the structure of society (the general system). Such feedback effects can be illustrated in Figure 3.1.

Figure 3.1 The Feedback System Between Tourism and the Structure of Society



Source: Sessa (1983)

Figure 3.1 summarises the mutual effects of the different systems which condition tourism. Such effects might be of an economic, political, social or cultural order, and many will be difficult to quantify. Tourism is a phenomenon that goes beyond the earning of foreign currency. For example, tourism can alter the political and cultural standing of a destination and even its entire environment. This can have both positive and negative effects. For example, as noted in chapter 2, tourism led to the tacit acceptance of Franco's dictatorship. Yet tourism can have negative effects on local communities; problems in large resorts are well documented in the media, notably the incidence of noise and environmental pollution, anti-social behavior and lack of respect for the feelings of permanent residents. In the Balearics, an influx of foreigners buying residences on the Islands has driven up house prices beyond the reach of many local people.[5] These problems are not specific to mainland Europe. In remote Asian and African communities, for example, tourism can have damaging effects on remote communities and their indigenous traditions. In some African regions tribes often make an entire living from putting on 'cultural' displays for tourists, reflecting their past way of life. This often means that these communities remain in low paid jobs often relying on handouts from visitors to survive. The extent of these sociocultural effects and the wider impacts of tourism in general are far reaching (Perrin, 2001). This thesis is concerned with the economic effects, but, it should be noted that the relationship between tourism and the economy is influenced by a wide range of factors that extend beyond boundaries of economic analysis.

Economists and statisticians often confine tourism within the conceptual boundary of the service sector, whereas it is clear that there are considerable spillover effects (Barke *et al.*, 1996). The net economy-wide effect of tourism is much more complex than simply the earning of foreign currency. Copeland (1991) observed that tourism activity can lead to either beneficial effects for sectors that supply goods and services used by tourism, or detrimental effects for sectors that do not, but rather compete with tourist sectors for factors and intermediate inputs. This can be seen in areas such as agriculture (food production, rural tourism), manufacturing (souvenirs, packaging and a wide range of general consumption goods) and construction (hotels, restaurants and bars). Due to these wide-ranging intra-sectoral linkages, which occur on both the demand side (tourism consumption) and supply-side (intermediate goods usage), it is no surprise that tourism is often described as a demand phenomenon rather than an industry. In order to facilitate tourism activity a multi-staged, multi-sectoral and multi-layered production process occurs. In an effort to formalise the diverse mechanism of tourism facilitation Smith (1994) posits that there is a "generic" production function associated with the production of a generic tourism product.

[5] The population of German people has reached such an extent on the Islands, that the German government offered to buy the Islands from the Spanish government in order to compensate for lost tax revenues.

Table 3.1: The Generic Tourism Production Function

Primary Inputs →	Intermediate Inputs →	Intermediate Outputs →	"Generic" Final Outputs
Resources	*Facilties*	*Services*	*Experiences*
Land	Parks	Park Interpretations	Recreation
Labour	Resorts	Guide Services	Social Contracts
Water	Transportation	Cultural Shows	Education
Fuel	Museums	Souvenirs	Relaxations
Building	Craft Shops	Conventions	Memories
Capital	Hotels	Accomodations	Business Contacts
	Restaurants	Meals and Drinks	
	Car Rental	Festivals and Events	

Source: Smith 1994

Although by no means comprehensive, Table 3.1 indicates the need for modelers to take an approach that is capable of linking raw materials to welfare via intermediate production and visitor consumption. Another aspect of tourist consumption is that tourists will assess the quality and price of a complete package of goods and services (a good, well priced hotel will not attract tourists without other services nearby, such as transport, restaurants, bars, shops and amusement attractions) and their decisions will also extend to the consideration of non-product features such as culture, history, climate and environment. As well as the characteristics described above, tourism, and the Spanish case in particular, has other features that need to be accounted for, which are described below.

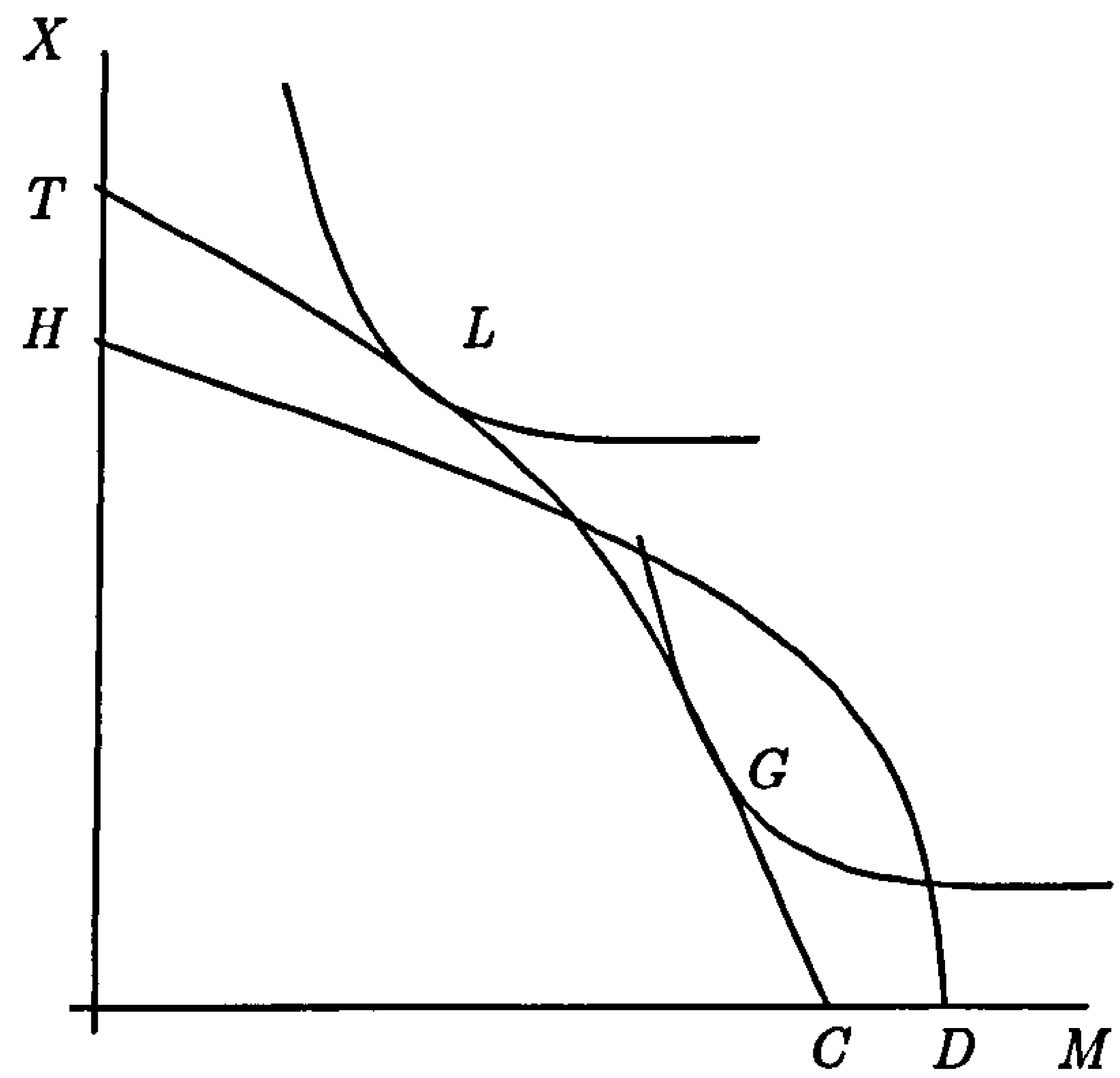
3.4.2 Tourism and Trade

The tourism industry has grown very quickly over the last 30 years. In the case of Spain for example, national accounts figures indicate that long-run average growth rates for tourism sector output are estimated to be around 6% since its liberalisation in 1959. Hence it is no real surprise that Balaguer and Cantavella-Jorda (2002) have shown, using co-integration analysis, that tourism has made a significant contribution to economic growth in Spain. Their argument is based on the export-led-growth hypothesis whereby it is possible to infer that tourism is capable of generating foreign currency which can, in turn, be used to finance the purchase of capital goods from overseas. An increase in capital goods in the economy can be used to produce additional goods and services and in turn can lead to economic growth (McKinnon 1964). Bhagwati and Srinivasan (1979) and Krueger (1980) also highlight opportunities for further enhancements in income via increased competition among firms as a result of export growth. Helpman and Krugman (1985) suggest that such an expansion might render the exploitation of economies of scale.

As previously stated, tourists consume goods which are generally considered non-tradable. Consequently, tourist consumption brings in foreign currency , so we should be able to view the proportion of non-traded goods consumed by tourists as exports. However, if we pursue this conception, then our understanding of the tourism market is misconstrued, largely because of two key characteristics of the tourism product that differentiate it from the traditional export good. Firstly, the price of these so-called exports is determined on the domestic market as opposed to world markets. In addition, tourists must cross international borders to consume tourism goods as opposed to normal export goods, which cross international borders to reach consumers.

It is possible to illustrate conditions under which an increase in tourism demand can be either welfare improving or immiserising. Results are based on the following intuition. If we consider the effects that the consumption of tourists have on non-tradables we must redraw the consumption possibility frontier as follows:

Figure 3.2: The Tourism Consumption Possibilities Frontier



In Figure 3.2 the locus TC represents the consumption possibilities frontier for domestic consumers, without tourist consumption, of the domestic non-traded good X and the imported good M. The introduction of tourism then leads to consumption of the good X equal to $T - H$ by the tourists, so that the maximum amount of X available to domestic consumers falls to H. However, the foreign exchange generated by the tourist expenditure on X allows an increase in imports of amount $D - C$ of good M, so that the maximum consumption of the M good by domestic consumers is now D. Hence the post tourism consumption possibilities frontier is shown by curve HD.

If the preferences of domestic consumers are shown by the indifference curve tangential to the pre-tourism consumption possibilities frontier a G, then the effect of tourism is to increase the welfare of domestic consumers. If however, domestic preferences are as shown by the indifference curve tangental to the pre-tourism consumption possibilities frontier at L then the effect of tourism is to decrease the welfare of domestic consumers. So whether domestic consumers gain from the introduction of tourism consumption is dependent on their preference for non-traded goods and services[6].

We have determined that the majority of tourism expenditure is spent on non-traded goods,

[6]A similar result is found by Hazari and Ng (1993).

and that tourism consumption might have an adverse effect. However, some attention needs to be paid to the possible effects that an influx of foreign currency associated with overseas tourism activity might have. Corden and Neary (1982) distinguish between two possible effects of a boom in overseas demand[7]. A demand expansion in the tourism sector will raise the marginal product of mobile factors associated with tourism. Consequently these resources will be "drawn out" of other unrelated sectors and concurrent economic adjustments will occur. This is known as the *resource movement effect.* If it is the case that the tourism sector draws relatively few intermediate inputs from other sectors, it is likely that the major impact of the tourism boom will come instead via what Corden and Neary describe as a *spending effect*[8]. The increase in real income generated by the boom will lead to an increase in consumption which will raise prices across all sectors. A rapid increase in tourism expenditure above is akin to the resource boom in the Dutch Disease literature. The ability to attract foreign tourists is largely driven by natural resources, in Spain's case this is largely the climate and the coastline. Corden and Neary (1982) show that higher income from these natural resources will bring about deindustrialisation via the resource movement and the spending effect. Such an explanation is certainly consistent with the pattern of Spain's economic development which has seen a significant shift away from manufacturing towards services sectors. While the drivers of this shift a numerous and this is a characteristic of the majority of developed economies, there is no doubt that in Spain's case the tourism sector has contributed significantly to structural economic change.

Copeland (1991) concurs with this explanation, he notes that in the case of a tourism boom the *spending effect* is caused both by the consumption of domestic residents (as suggested in the standard literature) and by the influx of tourists. According to Copeland (1991), in the absence of taxes and distortions an increase in tourism is welfare improving if and only if it induces an increase in the price of non-tradable goods (due to the corresponding income effect). The increase in consumption of non-tradables has a direct effect on the country's real exchange rate (i.e. the price of non-tradables relative to tradables) and hence welfare. Hence, in order for a tourist boom to yield significant benefits, domestic residents must reap some benefit from the

[7] Although they do not base their analysis on the tourism sector, there is certainly scope for application.
[8] *Other authors term this effect as an income effect, the two are used interchangeably throughout this thesis.*

exchange rate improvement or extract some additional rent from the natural amenities enjoyed by tourists. In such a case, mechanisms could be imposed to prevent the appreciation of the real exchange rate or to capture some of the additional rents from tourism. However, theoretically at least, a commodity boom which leads to an exchange rate appreciation will have an adverse effect on non-tourism related tradable sectors as the price of tradables declines relative to non-tradables and wages. Consequently these sectors may find it difficult to remain profitable. It is possible that these sectors may even be "dismantled" as resources flow in to the more profitable productive sectors, that is the booming sector and the non-tradable sectors. Further, demand for tradable goods then shifts to less expensive imports. Bruno and Sachs (1982) note that this increase in demand for imports is driven by the exchange rate appreciation and the resource movement effect. The reaction of the economy in this way to a commodity boom is what is known as the "Dutch Disease", in reference to the appreciation of the real exchange rate in the Netherlands when it started to export large quantities of North Sea natural gas.

Bruno and Sachs (1982) argue that static analysis of this problem is inappropriate; the shift in production caused by the resource movement effect will cause returns to capital to diverge between the two sectors, thus differing from potential returns on world markets. Such a divergence cannot be sustained in the long-run and the rates of return will equalise. So in the long-run the Rybczynski theorem does not hold. The returns to capital in the tourism sector are not sustainable due to capital mobility. Capital will flow into the tourism sector and compete away any excess returns.

3.4.3 Direct, Indirect and Induced Effects of Tourism Expenditure

The inflows of tourism expenditure into a region are generally thought of as injections of "new money" (Frechtling, 1987; Fletcher, 1994a; Archer and Cooper, 1995; Dwyer *et al.*, 2000). The expenditure injection is regarded as having three types of impacts - direct, indirect and induced (Dwyer *et al.*, 2000). Direct effects are realised in the increased sales revenues of firms supplying tourism specific goods, whether they be inside or outside the "traditionally" defined tourism sector. These firms, will, in turn, purchase goods and services which are used as inputs in their production process, these are termed indirect effects. Induced effects arise when the recipients of the direct and in-direct expenditure spend their increased incomes. This, in turn, stimulates sets of successive spending rounds of consumption which contribute to GDP and employment (Archer, 1979; Jackson, 1986; Holloway, 1989; Eadington and Redman, 1991; Fletcher, 1994a and Dwyer *et al.,* 2000).

According to this "standard view", the direct, indirect and induced effects of tourism expenditure combine so that the ultimate increase in income within the destination exceeds the initial increase. The extent to which this expenditure impacts on the recipient economy depends on the strength of linkages with regional businesses and the level of "import leakages" from outside sources and is termed the tourism multiplier effect (Mathieseon and Wall, 1982; Archer and Fletcher, 1996; Bull, 1995; Sinclair, 1998; Tribe, 1999; Dwyer *et al.*, 2000).

The discussion in this section highlights various key issues emerging from the tourism and trade literature. It can be seen that theoretically, at least, that the tourism sector has wide-ranging sectoral and potential multiplier effects. Further, the effects of a commodity boom and its relationship with tourism expansion are also shown. In order to capture these effects requires a requires "a framework that, as well as containing information on the links between tourism and other industries, can also account for resulting cost pressures that act as a brake to future economic expansion" Dwyer *et al.* (2000 p. 335). In the past, the technique most commonly used to capture these effects was input-output analysis (Fletcher, 1989; Bull, 1995; Archer and Cooper, 1995). However, these models are subject to well known limitations such as no capacity constraints, constant technical coefficients, linear and additive relationships; for a useful summary see Dwyer *et al.,* (2000).

3.5 Computable General Equilibrium Modelling

A significant advance in the modelling of multi-sectoral relationships and multiplier effects comes in the form of Computable General Equilibrium (CGE) models. CGE models have grown steadily in their importance since Johansen's (1960) model of Norway as a tool of both research and policy analysis. CGE models are routinely used by governments in policy formulation and debate and modelling capacity can be seen in at least 20 countries around the world (Devarajan and Robinson, 2002). However, tourism modelers have been slow to recognise their existence with many authors still preferring the input-output approach even well into the mid 1990s (for example, Archer and Fletcher, 1996; West 1993) when the CGE approach had been well established. The next section provides a brief overview of the sources of the CGE approach and its application across a range of issues including tourism.

3.5.1 The Structure of Computable General Equilibrium Models

Partial equilibrium analysis only permits us to look at one market at a time. However, it is suggested by Nicholson (1995), that pricing outcomes in one market usually have effects in other markets. These interactions cause feedback effects throughout the economy which might even affect the price quantity equilibrium in the original market. de Melo and Tarr (1992) argue that such inter-industry linkages are best captured in a general as opposed to a partial equilibrium framework. The body of research discussed in this section is a subset of a wider literature which has become known as "computable general equilibrium analysis".

The precise use of the term general equilibrium is not explicitly defined, although there is a general consensus that a general equilibrium model is one in which all markets clear in equilibrium. This agreement has been extended in recent literature and now forms the essential characteristic of a general equilibrium system, so that market demand equals supply for a set of relative prices that can be identified. However, there is less consensus as to the general structure which underlies the equilibrium formulation, (Shoven and Whalley, 1984). The literature seeks to develop the Walrasian general-equilibrium framework formalised and refined by *inter alia*, Arrow and Debreu (1954), Debreu (1959) and Arrow and Hahn (1971). They showed that two of the oldest and most important questions of neoclassical economics, the viability and efficiency of the market system, were susceptible to analysis. The Arrow-Debreu framework identifies a number of consumers, who possess an individual endowment of factors and commodities. Market demands are the sum of each individuals' consumer demand. Consumers have their own individual preferences and are assumed to maximise utility over each commodity. Commodity market demands depend on all prices, they are: continuous, non-negative, homogenous of degree zero (i.e. no money illusion) and must satisfy Walras' Law: that at any set of prices, the total value of consumer expenditure equals consumer income. As producers are assumed to maximise profits, this implies that in the constant returns to scale case no production activity can do better than break even at equilibrium prices, so long as there are no barriers to entry or exit.

Many other aspects can be built into this framework which will be elaborated in later sections of this chapter. This Walrasian structure provides an ideal framework for appraising the effects of policy changes on resource allocation and assessing who gains and who loses. A detailed structural account of the core CGE model used in this is presented in chapter 4, but alternative versions are presented in chapters 5 and 6.

Until only recently, the capacity of general equilibrium analysis was greatly limited by computational resources. The rapid expansion of computer power has broadened the possibilities of application so that more realistic market scenarios can be examined. Hence, the adoption of the general equilibrium framework to analyse the impact of policy issues and shocks is expanding across the range of issues to which it is applied and is intensifying in its incidence of application (Greenaway *et al.*, 1993). Although general equilibrium analysis is recommended for the purpose of this study, this does not mean that econometric estimates for individual sectors have little relevance. Rather, the two approaches should be viewed as complementary because it is neither feasible nor desirable to estimate, as a system of simultaneous equations, the full set of conditions describing a multi-sector economy model (de Melo and Tarr, 1992). In fact, the quality of results from the general equilibrium model can be improved by using the estimates from partial equilibrium econometric studies as parameter estimates or for calibration purposes (Bourguignon *et al.*, 2002).

3.5.2 Computable General Equilibrium Models for Scenario Analysis

This next Sub-section aims to give an overview of the literature relevant to the application of CGE modeling in this thesis. More detailed discussions of some of the alternative model structures are presented in later chapters of this thesis where relevant.

Tourism and CGE Models

A substantial body of literature has examined the phenomenon of tourism economics, whether it be from a theoretical perspective or applied quantitative analysis (Sinclair and Stabler, 1997). Despite this expanding literature, few studies exist which apply the general equilibrium framework to tourism. As we have seen, the nature of tourism lends itself to CGE analysis because of its multi-sectoral activity, as emphasised by Blake (2000). In section 3.4 we have seen that for many sectors the effects of tourism are unclear from economic theory alone, so that in these cases and more generally for the economy as a whole, numerical general equilibrium simulation is required to quantify the effects of tourism.

The first attempts to apply the CGE modelling framework to the tourism sector were presented by Adams and Parmenter (1991, 1993 and 1995), who base their models on the ORANI-F[9] database of Australia. In their 1995, paper Adams and Parmenter construct a 19 sector general equilibrium model with a simplified dynamic structure in that the growth path is determined exogenously rather than endogenously. The effects of tourism are projected for key macroeconomic variables, sectoral and regional growth rates. The model simulates an additional 10% expansion in tourist arrivals on the base case of 7%, thus assuming tourism to grow at an average annual rate of 17% to predict the effects of a tourism boom. The appreciation of the exchange rate leads to import substitution and the contraction of the traditional export sectors of mining and agriculture which, coupled with the high import content of the tourism sector, causes the balance of trade to worsen. As implied by Copeland (1991), some sectors will benefit and some lose out as a result of tourist expansion. Some sectors experience direct stimulation (air transport, restaurants and hotels), others experience indirect stimulation due to the rising price of intermediates supplied to the tourism sector (clothing and food) and others contract as a result of adverse exchange rate effects (traditional exports). On a regional level, Queensland, the state with the most tourist specific orientation, experiences an overall negative effect due to the crowding out of traditional exports, which are highly concentrated in the state. Victoria, which has little reliance on traditional exports and also houses one of the country's principal airports, experiences the largest expansion.

Zhou *et al.* (1997) analyse the economic impact of the recent decline of tourism demand in Hawaii, and in doing so they draw comparisons as to the effectiveness of input-output and CGE analysis. Constraints were imposed on the CGE model to make its results more comparable with the input-output specification, thus making it operate in somewhat rigid conditions. A 10% decline in visitor expenditure was simulated, and output reduced in all sectors. Results were ambiguous in that the results for the manufacturing and transport sector not only represented larger negative impacts than the corresponding effects on the tourism sector but they were also

[9]For more information aout the ORANI database see Dixon *et al.* (1982)

larger that the counterfactual itself.

CGE Models of Spain

The Spanish economy has been analysed previously in a CGE framework (Polo and Sancho, 1993a; Polo and Sancho, 1993b; Kehoe *et al.*, 1995; Corboda and Kehoe, 1999) to assess the impact of the 1986 fiscal reform programme, which accompanied Spain's entry to the EEC. While Polo and Sancho (1993a) sought to assess the policy impact, subsequent papers (Polo *et al.*, 1993b; Kehoe *et al.*, 1995) sought to evaluate the performance of CGE models in this area.

In accordance with the EEC's goal of becoming a single market by the end of 1992, Spain was forced to implement the EEC requirements of the elimination of all barriers to the movement of goods, services, labour and capital within the community boundaries. Polo *et al.* (1993a) examine the effects of the elimination of barriers to trade, financial liberalisation and tax harmonisation. Quantitative results from the simulations suggest Spain would receive an overall benefit from the reform policies and estimates reveal substantial gains in production, employment and welfare. However, some of these positive effects might be cancelled out by the likely increase in indirect taxation as Spain aligns with the EEC. Polo *et al.* (1993b) and Kehoe *et al.* (1995) update the previous model and then test how robust the model is to alternative parameters and closure rules. Polo *et al.* (1993b) confront the outcome of their updated CGE model with preliminary data for 1988. They conclude that by simply updating the exogenous variables in a standard CGE model, the evolution of some major indicators can be adequately captured.

Blake (2000) uses a 49-sector tourism orientated input-output table as a basis of a CGE model to assess the impact of a 10% increase in foreign tourism demand for the Spanish economy. The resulting increase in tourism leads to a half a percent growth in GDP, which is measured at approximately 27.7 bn psetas. As a result of the simulation, foreign tourism increases by 8.65% as the effects of the 10% increase are partially offset by a rise in the real exchange rate which makes the tourist good more expensive. Further analysis is directed towards the taxation of the tourism sector. It appears that there is scope for further taxation of foreign tourists but it is a question of finding the correct tax handles, to avoid taxing domestic consumption. It is recognised by the author that an element of caution is needed when interpreting such results because there will be transition costs associated with the new tax policy (temporary unemployment, capacity underutilisation) as the economy moves towards long-run equilibrium.

Modelling Imperfect Competition and Increasing Returns to Scale in CGE Models

Any observer of the modern market economy can be left in no doubt as to the myriad of choices facing the modern consumer. With multiple products and billions of consumers it is only natural to expect preferences to be rather diverse. The way in which firms respond to this is to produce highly differentiated goods in an attempt to match these preferences. It has already been noted in sub-section 3.2.1; that a perfectly competitive market structure is not suitable when attempting to model service provision. However, it is clear that while the extent of product differentiation will vary between sectors, given the aggregation of the data used in this thesis and the nature of the Spanish economy, it would be difficult to find a sector that can accurately be characterised by product homogeneity. On this basis, assuming that firms produce at constant returns to scale (CRTS), they then experience increasing returns to scale (IRTS).

As firms seek to differentiate their products they will incur fixed costs relating to R&D, marketing and, as is often found in the case of the tourism sector, quality infrastructure. As noted by Swaminathan and Hertel (1996), the existence of these fixed costs makes the market for differentiated products imperfectly competitive on two counts: firstly, firms cannot adopt marginal cost pricing, and secondly they do not produce a homogenous good. In addition to this, when attempting to model multinational firms CRTS is inappropriate, as MNEs are associated with increasing returns to scale generated via the OLI paradigm (as discussed in section 3.3.4).

Concepts associated with imperfect competition originated in the industrial organisation literature and were first incorporated into trade theory in the late 1970s/early 1980s. They are often referred to as the "new trade theory". It was argued that as well as comparative advantage, gains from trade can be realised via enlarging markets, increased competition and greater exploitation of economies of scale (Krugman, 1979, 1981; Lancaster, 1980; Dixit and Norman, 1980; Helpman, 1981; Ethier, 1982). These models are characterised by imperfect competition and unrealised scale economies in production - Increasing Returns To Scale (IRTS) at firm level. They generally apply the Lerner Index of market power $((P - MC)/P)$ to set endogenously the price mark-up over marginal cost. Under IRTS, average costs fall as output rises. This usually takes the form of a monotonically decreasing average cost function (Francois and Roland-Holst, 1997).

One of the earliest and most influential applied works in this area is the analysis of the interaction of Canadian trade policy and market structure by Harris (1984) and Harris and Cox (1984). As well as imperfect competition, Harris (1984) incorporates collusive behaviour by assuming that protected oligopolistic industries set prices as a weighted average of the monopolistic Lerner price and the tariff inclusive price of the import competing goods. The model shows that the potential gains from multilateral trade liberalisation (i.e. tariff removal simulations) can be as much as 8 - 12% of GDP, gains which are considerably larger than suggested by a constant returns to scale (CRTS) type model (0.5% - 0.2%). Much of this increase can be explained by the reduction in collusive behaviour associated with the liberalisation episode and the reduction in domestic firms and subsequent output increases associated with the remaining firms.

The results generated by Harris have led to a number of different studies. In particular, the completion of the single market in the European Union and estimation of the associated gains from trade generated a significant amount of interest amongst CGE modellers. Official estimates of the welfare gains associated with the single-market are between 4.3% and 6.4% of 1988 European GDP (Cecchini *et al.*, 1988 p. 83 and Emerson *et al.*, 1988 p. 203). These estimates, clearly quite large, are described as "heroic" by Winters (1992), an opinion shared by Harrison *et al.* (1996). A key problem of these official estimates was that they were extrapolated from partial equilibrium analysis for a handful of sectors by Smith and Venables (1988); they were also derived from a model which assumes that price discrimination between European regions is impossible once the EU market has been completed. Several authors have engaged in research in this area. Baldwin (1989) sought to calculate the dynamic gains of EU market integration, in a small IRTS model. Baldwin assumed only that the integration of EU markets lowered non-tariff trade barriers and found that the dynamic welfare gains from trade liberalisation were between 15% and 90% of the Cecchini *et al.* (1988) estimates.

Multicountry models incorporating industrial organisation features have also been used to analyse the impact of EU integration (Gasiorek *et al.*, 1992; Harrison, Rutherford and Tarr, 1994 and 1996). As is the case in many of the studies surveyed in this section, only part of the model is characterised by IRTS. Gaisorek *et al.* (1992) model 14 IRTS and 1 CRTS sectors, assuming that for each industry and country firms are symmetric. The Harrison *et al.* (1994, 1996) model also assumes firm symmetry but uses a 26-sector model, 12 of which are characterised by IRTS. It is generally accepted in the literature that in some instances, that the sectors modeled using CRTS are appropriately chosen (i.e. they are better characterised by a perfectly competitive framework)[10].

Harrison *et al.* (1994, 1996) do not find as large differences as Harris (1984) between the CRTS and IRTS versions of their model, although differences are significant. In their model of EU integration they model two types of trade costs: border costs and standardisation costs. Border costs represent the costs of undertaking trade for example, admin and transport costs. Standardisation costs are caused by technical specification differences between regions. Following previous studies (Gaisorek *et al.*, 1992; Haaland and Norman, 1992; Mercenier, 1992), it is assumed that the sum of these border and standardisation costs is equivalent to 2.5% of value added for each region modelled. Coupled with this 2.5% reduction in trade costs, they also assume that EU integration will bring about increased substitution by consumers between domestic and other EU produced products. In their static model, removal of border costs only improves the welfare of EU countries by 0.5%. Welfare gains increase to about 1.2% of GDP when this simulation is coupled with the effects of increased integration. Increased consumer demand elasticities raise competition and reduce mark-ups, which lead to gains from rationalisation and consumer efficiency gains. Welfare gains in the IRTS case are more than double the equivalent CRTS case (0.5% of GDP). However, even larger welfare gains of 2.6% of GDP are observed when Comparative Steady State (CSS) dynamics are incorporated into the model[11]. The creation of a single market will produce a new equilibrium where the rate of return on capital increases, investment increases until the marginal productivity of capital equates to its long-run rate. This increased capital stock acts like an "endowment effect" which

[10] In the case of Harrison et al. (1994, 1996) the selection of IRTS sectors appears to be driven by external estimates of the cost disadvantage ratio.

[11] A more detailed discussion of Comparative Steady State dynamics is provided in the next section on dynamic CGE models.

generates larger welfare gains since there are more resources available.

Nguyen and Wigle (1992) present results that conflict somewhat with those of Harris.[12] They do show that the welfare gains from trade liberalisation are larger after the introduction of imperfect competition, but not of the scale of Harris. Nguyen and Wigle (1992) construct a global trade model with 8 regions and 6 products, of which only two (derivative manufacturing) sectors are calibrated for imperfect competition. In fact, in some cases (US), the opposite is found. Following the trade liberalisation, a rise in aggregate demand occurs and profits rise. New firms enter the market to contest these profits and competition increases. However, the domestic US market is large in the model and American producers have already achieved minimum efficient scale economies; therefore, the potential to exploit further scale economies from trade liberalisation is limited. The welfare loss is driven by new entrants driving down margins, implying that fixed costs rise as a proportion, of production which is welfare reducing.

A key difference between the Nguyen and Wigle (1992) and the Harris (1984) models is the implementation of a 'mixed pricing rule'. Harris (1984) assumes that the firm sets its price according to the geometric mean of the imported substitute. Nguyen and Wigle (1992) assume that in the case where a major supplier makes up more than 20% of domestic consumption, monopolistically competitive firms set their prices equal to a weighted average of domestic prices and imports from the major competitor.

Devarajan and Rodrik (1991) construct an 11 sector model of Cameroon, in which six sectors are characterized by imperfect competition. They find that trade liberalization has an output-expanding pro-competitive effect. As import competition rises following the removal of tariffs, domestic firms' mark-ups fall; consequently their perceived marginal revenue curve becomes flatter and the incentive to reduce sales to prop up prices is diminished. This effect outweighs the increased volume of imports in the economy and domestic output rises. The effects of trade liberalisation in Cameroon are estimated to be equivalent to a 2% increase in welfare in the IRTS case, whereas in the CRTS case this figure is close to zero.

As pointed out by Francois and Roland-Holst (1997), it is possible to separate monopolistic/oligopolistic type behaviour and IRTS models. However, virtually all specifications of non-CRTS models incorporate both scale economies and imperfect competition, with Francois

[12] Unfortunately they do not present their results as a % of GDP, so they are not directly comparable.

and Roland-Holst (1997) being virtually the only exception found in literature. They find that by combining IRTS with imperfect competition in a stylised model of Korean trade liberalisation, welfare effects are nearly double in a dual rather than separate specification.

What is clear from the various studies is that the dramatic results found by Harris (1984) are not necessarily replicated in other studies and that the use of imperfect competition in CGE models is more of an issue-driven phenomenon. It is dependent on whether the particular policy shock being investigated has a relatively large impact on sectors that are uncompetitive. If this is the case, then large pro/anti-competitive effects will be observed. On this basis the use of IRTS should not be ruled out; in fact it should be incorporated as a subsection of the core model. This would allow comparisons to be made between the CRTS and IRTS case, and with different specifications of IRTS as well. This would give significant insights as to the likely competitive outcomes of the policy being analysed. Results of this nature are too crucial to overlook, and proper discussion of the calibration procedure, the associated data and sensitivity tests should reveal the nature of what drives the difference between the CRTS and IRTS case.

On this basis, the calibration and structure of the IRTS part of the model need to be considered carefully. In almost all models of imperfect competition the following relationship is considered in some form or another (Willenbockel, 2004):

$$m_0 = f(\sigma, n_0)$$

where m_0 is the benchmark equilibrium mark-up, n_0 is the number of firms and σ is the elasticity of substitution between firm specific varieties produced in the same region (it is the elasticity for the domestic/imported goods composite as used in the Dixit-Stiglitz love of variety function). Under the definitions given by Willenbockel of these three variables, in practice given the nature of the calibration strategy, two must be set exogenously and the third is an endogenously determined residual. Examples found in the literature include:

(i) set n_0 and σ and calibrate m_0 residually (for example, Brown and Stern, 1989; Mercenier, 1992; Harrison, *et al.* 1994, 1996, 1997)

(ii) set n_0 and m_0 and calibrate σ residually (for example, Dixit 1987, 1988; Gasiorek *et al.*, 1992; Haaland and Norman 1992; Willenbockel, 1999)

(iii) set m_0 and σ and calibrate n_0 residually (for example, Devarajan and Rodrik, 1991; Cortes and Jean, 1995)

Generally some information is available on at least two of the three sets of parameters. In terms of the most commonly available data, many countries produce data on the number of firms by industry as related to the sectors of their IO tables. Others have suggested that it is possible to assume that the model equivalent number of firms can be based on the inverse of the Herfindahl index (Chatti, 1999; Willenbockel 2004).

Choices for Armington elasticities are usually fairly ad hoc although the intuition is fairly consistent. Three key elasticities of substitution are used in most imperfectly competitive models σ^{DM}, σ^{DD} and σ^{MM}. These reflect this substitutability between domestic (D) and imported goods (M) i.e. the Armington elasticity (σ^{DM}), between alternative domestic varieties (σ^{DD}) and between alternative foreign countries varieties (σ^{MM}).[13] Harrison, Rutherford and Tarr (1994) argue extensively for the hypothesis that elasticity values should be ordered such that $\sigma^{DM} < \sigma^{MM} < \sigma^{DD}$. The motivation for this is based on an extended discussion whereby it is contended that products produced in the same country will be more substitutable among themselves than products from different countries, implying models $(\sigma^{DM}, \sigma^{MM}) < \sigma^{DD}$. Further, it is also assumed that domestic consumers are also less willing to substitute foreign varieties for domestic varieties than they are among different varieties from foreign sources ($\sigma^{DM} < \sigma^{MM} < \sigma^{DD}$). Parameter values for σ^{DM} can be taken from econometric values sourced from the literature by the GTAP project team,[14] or previously econometrically calculated Armington elasticity estimates (such as Gallaway, McDaniel and Rivera, 2000).[15] Usually it is the case that the value of σ^{DD} and σ^{MM} are inferred as some multiple of the Armington elasticity value (for example, Harrison *et al.*, 1996, 1997c; De Santis, 2002; Hanslow *et al.*, 2000; Bchir *et al.*, 2002).

Devarajan and Rodrik (1991) determine the mark-up endogenously via a calibrated marginal cost function and a set of simultaneous equations. An extension to this approach is offered by Bchir *et al.*, (2002). They take GTAP Armington elasticities, mark-ups are sourced from the literature and firms are taken from a study by Davies and Lyons (1996). Information is available

[13] σ^{DD} and σ^{MM} are the Dixit-Stiglitz elasticities for domestic and imported firms respectively.

[14] For more details see http://www.gtap.agecon.purdue.edu/

[15] Although Harrison, *et al.* (1994, 1996 and 1997) choose Armington values arbitrarily.

on all three sets of parameters, as well their variance. For each sector, the values to be used in the model are then chosen so as to minimize the distance from these estimates. Full details of this estimation process are given in Bchir *et al.*, (2002).

From the evidence presented in this section it is clear that calibration is an extremely important part of constructing a CGE model with IRTS. For the purposes of this thesis, calibration approach (i) is used with GTAP elasticities and data on the number of firms. The reasons for choosing this approach are threefold. Firstly, no data exist on mark-ups that are up to date or of relevance to the Spanish economy. Secondly, the use of GTAP elasticities is preferable than using assumed parameters in the rein of Harrison *et al.*, (1996, 1997c) or Hanslow *et al.*, (2000). Finally, data on the sectoral number of firms are published annually by the Spanish national statistical office, the Instituto Nacional Estadistica (INE). However, another important issue in the implementation of a imperfectly competitive CGE model is the choice of model structure. This is explicitly recognised by Willenbockel (2004, p. 1066): "the design of a structural model allowing for industrial organisation effects faces and immediate problem: Once the fairly clear-cut world of perfect competition is abandoned, a wide range of a priori plausible alternative specifications of firm conduct opens up".

Willenbockel (2004) considers a range of theoretical structures underpinning the strategic interaction between firms[16]. The core types relate to the early theories of strategic firm behaviour as developed by Cournot and Bertrand. More recently, CGE modelers have adapted the principles underlying these original theories in a range of different studies. These methods are surveyed by Willenbockel (2004) and are presented in Table 3.2.

[16] A similar but less detailed review is found in Francois and Roland Holst (1997).

Table 3.2a: Different Types of Imperfect Competition, Intra-Industry Product Homogeneity - as per Willenbockel (2004)

A. INTRA-INDUSTRY PRODUCT HOMOGENEITY		
A.1	Domestic Cournot Oligopoly under Global Market Integration	The individual Cournot oligopolist from region r chooses its profit maximising supply quantity xr to the world market under the assumption that domestic rivals' supply quantities do not respond to changes in its own supply. It is assumed that foreign rivals output does change. However, the implicit assumption of Francois and Roland-Host (1997, p346) is imposed whereby the more distant foreign rivals, who produce similar goods in the same commodity group, are not considered as players in the oligopoly game contemplated by the r firm under consideration
A.2	Domestic Cournot Oligopoly under Regional Market Segmentation	This specification is similar to A.1, only markets are geographically segmented. Therefore the Cournot oligopolist chooses its profit maximising supply quantity according to the region it is supplying.
A.3	Domestic Cournot Oligopoly with Conjectural Output Variations	The Cournot model presented above can be seen as a special case of a general conjectural variations model in outputs, in which each oligopolist is assumed to conjecture that changes in its own supply quantity have a non-zero impact on domestic industry supply. The magnitude of the domestic industry supply response is determined by the degree of collusion among firms.
A.4	International Cournot Oligopoly under Market Integration	Under the domestic Cournot oligopoly with global market integration, when markets are globally integrated, the individual Cournot oligopolist from region r chooses its profit maximising supply quantity to the world market under the assumption that domestic rivals' supply quantities do not respond to changes in its own supply. This proposed structure presents an alternative whereby foreign rivals do respond to domestic firms' output changes.
A.5	Bertrand Oligopoly	Under this type of oligopoly game, firms compete on price as opposed to quantity.

Table 3.2b: Different Types of Imperfect Competition, Intra-Industry Product Differentiation - as per Willenbockel (2004)

B. INTRA-INDUSTRY PRODUCT DIFFERENTIATION		
B.1	Bertrand Product Differentiation Oligopoly under Regional Market Segmentation	Each firm forms its conjectures on the assumption that domestic and foreign rivals keep their supply prices in market s fixed when it varies its own price in market s.
B.2	Bertrand Product Differentiation Oligopoly under Global Market Integration	Similar to the Cournot case as discussed in A.1., but firms compete on price instead of quantity. Therefore the individual Bertrand oligopolist from region r chooses its profit maximising price $p^{*}r$ to the world market under the assumption that domestic rivals' prices do not respond to changes in its price. Under this scenario, the perceived demand elasticity is defined as the output-weighted average of the perceived Bertrand elasticities in the various destination markets.
B.3	Bertrand Product Differentiation Oligopoly with Conjectural Price Variations under Market Segmentation	Under this scenario it is assumed that firms conjecture that rivals will respond to changes in its own price with a non-zero price reaction. Non-zero price reactions are assumed in relation to domestic and foreign firms.
B.4	Bertrand Domestic Product Differentiation Oligopoly with Conjectural Price Variations under Market Segmentation	As in B.3 but the firm only holds non-zero price conjectures in relation to domestic rivals. This method was used by Delorme and van der Mensbrugghe (1990) to assess the effects of agricultural trade liberalisation in Canada.
B.5	Bertrand Domestic Product Differentiation Oligopoly with Conjectural Price Variations under Market Segmentation	The perceived elasticities are defined in the same way as in B.2., but conjectural variation parameters are included so that firms consider foreign rivals' price responses
B.6	International Cournot Product Differentation Oligopoly under Market Segmentation	Each firm conjectures that all domestic and foreign rivals keep their supply quantities to market s fixed when it varies its own quantity x^{*} in market s.
B.7	International Cournot Product Differentiation Oligopoly with Conjectural Output Variations under Market Segmentation	A generalisation of B.6. whereby it is assumed that firms conjecture that domestic and foreign rivals' supply quantities to each market segment respond to changes in its own supply quantities. This specification is based on the assumption that the conjectural reaction of rivals' quantities with respect to changes in its own output are identical across all regions in competing destinations.

B.8	**International Cournot Product Differentiation Oligopoly under Market Integration**	This specification sits in contrast to the product homogeneity specification of International Cournot Oligopoly under Market Integration. Products are differentiated by region, but markets are integrated. This approach has been widely used by a number of authors including Smith and Venables (1988) and Willenbockel (1994).
B.9	**Domestic Cournot Product Differentiation Oligopoly under Market Integration**	As in B.8. but the firm holds the quantity conjecture with respect to domestic rivals.
B.10	**Chamberlinian Large Group Monopolistic Competition**	While positive profits can exist, they are not sustainable. Firms have the incentive to lower price and gain market share. This process continues until there are zero profits in the model.

Willenbockel (2004) constructs a small-scale generic CGE model in order to compare the alternative types of imperfectly competitive specification presented in Table 3.2. The model includes three countries (A,B,C), with two industries/commodities per country one perfectly competitive and the other imperfectly competitive (PC,IC). There is also a primary factor of production which is mobile between sectors, but not across countries. The same counterfactual is compared across a range of specifications whereby a 20% ad valorem tariff by country A on IC imports from regions B and C is administered.

Simulation results from the perfectly competitive case are intuitive; the tariff raises the price of imported goods from regions B and C and output in the protected domestic sector A rises. The fall in demand by region A for imports from B and C causes a terms of trade improvement for country A to restore external balance. The terms of trade effect dominates any efficiency losses due to the price distortion, which in turn leads to a welfare improvement. These core results are observed in the imperfectly competitive models as well. However, in addition to this other specific effects are observed. The introduction of the tariff raises mark-ups for firm A's oligopolist, due to the corresponding rise in the perceived elasticity of demand and increased domestic market share. As mark-ups rise, new firms will wish to enter the market and consequently equilibrium output per firm will contract while fixed costs as a proportion of output will rise. Thus, as a result of tariff protection, inefficient entry will occur.[17] This result occurs in specifications considering market integration and market segmentation. In addition to this a conjectural variation approach is considered based on a market integrated Cournot structure (equivalent to specification **A3** in Table 3.2).[18] Under this specification, a conjecture is imposed on the model that is "well above unity" (Willenbockel, 2004 p. 1082) in order to support higher calibrated mark-ups. It is found that if mark-up values in this specification are equivalent to the market integrated pure Cournot structure, then there is little deviation in the results between the two models. In fact the key result that Willenbokel (2004) finds is that the simulation results are far more sensitive to the "choice of values for the elasticities of substitution in demand that to the choice of assumption about firm conduct" (Willenbockel, 2004 p. 1082). However, there is an important exception to this conclusion in that significant differences will occur if additional assumptions are included in the model for example, the Harris 'mixed pricing rule' as discussed above.

Willenbockel (2004) then compares the relative merits of the alternative calibration strategies outlined above. When analysing method (i) it is found that choosing values for m and n that are consistent with other studies, yields unusually large values of σ. However, when values for m and n are chosen so as to give alternative structures the same values of σ, little differences are observed between the different structures. This reinforces the earlier point that the choice of parameter value is more important than the choice of model structure. A key distinction that does arise when comparing the alternative structures relates to models with intra-industry product homogeneity as opposed to product differentiation. Under product differentiation increased varieties following trade liberalisation is found to be welfare improving as opposed to being inefficient due to the use of the Dixit-Stiglitz love of variety function.

Further comparisons are made by Willenbockel (2004) relating to pure Dixit-Stiglitz $(\sigma = \sigma^M = \sigma^A)$[19], pure Armington $(\sigma \rightarrow \infty,\ \sigma^M = \sigma^A)$and Armington-Dixit-Stiglitz

[17] As Willenbockel (2004) points out, the inefficient entry result is consistent with the findings of Horstmann and Markusen (1986).

[18] This is equivalent to specifiying $(P - MC)/P = \Omega/n\sigma$ as opposed to $(P - MC)/P = 1/\sigma$ in the pure Cournot model, where Ω is the conjectural variations parameter, σ is the market elasticity of substitution and n is the number of firms.

[19] where σ^A is the Armington elasticity of substitution between domestic output and the import composite and σ^M is the elasticity of substitution between imports of different origin. When $\sigma^A = \sigma^M$, the demand nest collapses and there is no differentiation between goods from different geographic origins.

$(\sigma \neq \sigma^M = \sigma^A)$ demand systems. It is shown that crucial differences exist when comparing the pure Dixit- Stiglitz and pure Armington scenarios. Taking the domestic Cournot market integration structure under these two specifications **(A1)** and **(B9)** as the example, it is shown that while the model generates similar key results for variables such as imports into the imperfectly competitive sector in region A (-20.2% vs -21.2%), output per firm in region A (-0.47% vs -0.51%) and firm numbers (1.9% vs 2.3%), there is a significant difference in the welfare results. Welfare results are found to be more than double under the pure Dixit-Stiglitz scenario. The reason for this is that even relatively small increases in the number of varieties lead to welfare gains when σ is low and thus agents' love of variety is high. However, under an alternative specification of the model where free entry/exit is barred, this variety effect is eliminated. When entry/exit is barred in the pure Dixit-Stiglitz model the resulting growth in the number of varieties and the subsequent welfare gain does not occur. However, where there is product homogeneity in the model specification and there is barred entry/exit, significant growth in output per firm is observed in the protected industry which is of course found to be welfare improving. Differences in results with such significantly different model structures is only to be expected. Yet similar results do occur between similar model structures. This leads Willenbockel (2004) to conclude that the key drivers of the model results are the sensitivity to the chosen values of n_0, σ and m_0 as opposed to the plethora of available model structures. On this basis, particular care is taken in this thesis to test the sensitivity of the model results to values of n_0 and σ and to see what the implications are for the model results. In terms of the published literature these parameters are rarely subjected to sensitivity tests. Following an extensive search, Willenbockel (2004) appears to be only author who discusses the problem.

As noted in Table 3.2, many different specifications of imperfect competition apply. But how is this motivated from the basic equations in the CGE model and what options exist? Francois and Roland-Holst (1997) present a practical interpretation of this motivation. Under the perfectly competitive representation, firms behave competitively in factor markets and relevant output markets. Prices are given and the typical firm produces at:

$$P = MC \tag{3.1}$$

Perceived or real entry by rival firms forces economic profits to zero so that demand for intermediates and factors depends on:

$$P = AC \tag{3.2}$$

However, if increasing returns to scale hold then the relationship specified in equation (3.2) no longer holds. Under the most basic representation of imperfect competition and increasing returns to scale given by Francois and Roland-Holst (1997) a monopoly scenario is considered. In this specification a fundamental difference exists in that the pricing equation (3.1) is replaced by:

$$\frac{P - MC}{P} = \frac{1}{\varepsilon} \tag{3.3}$$

where ε is the elasticity of demand perceived by the firm. Thus the firm is no longer a price taker, instead it limits supply and chooses price. The relationship (3.2) now depends on the assumed relationships relating to the cost and competitive structure of the industry Francois and Roland-Holst, (1997). This is the monopoly paradigm. Between the monopoly paradigm and the perfectly competitive paradigm, an infinite combination of firm distributions exists. If the number of firms is relatively small, their behaviour can influence each other. The likelihood of this ability to influence increases in markets with heterogenous products as there are likely to be less competitors due to the niche nature of markets. The specifications in Table 3.2 give an overview of some of the representations used in the literature. These interactions can play a decisive role in determining price, quantity, efficiency and welfare (Francois and Roland-Holst, 1997). The factor that determines the extent of how much firms can influence each other is the conjectural variations approach. This is based on Cournot conjectures, where we assume that firms anticipate or conjecture the output responses of their rivals, and the market price is the equilibriating variable. In the Cournot model a firm operates under the assumption that its rivals do not alter their supply quantities as a result to changes in the firm's supply. On the other hand, the firm conjectures that its rivals prices will change. This expected price change, called "conjectural variation" is assumed zero in the Bertrand case. Under the standard Cournot representation of mark-ups equation (3.3) then becomes:

$$\frac{P - MC}{P} = \frac{\mu}{n\varepsilon} \tag{3.4}$$

where μ is the conjectural variation parameter and n is the number of firms. Under the Cournot specification each firm believes that it rival will not change output in response to a change in its own output. It can be seen in equation (3.4) that the price cost margin varies inversely with n and ε. There are a wide range of possible outcomes; when $\mu = 0$ this corresponds to perfectly competitive average cost pricing, when $\mu = n$, this represents perfect collusion or a monopolistic market and $\mu = 1$ corresponds to Cournot conjectures.

Various approaches exist for calibrating the price cost margin. The majority break the direct link between the price cost margin and the perceived elasticity of demand as specified in equation (3.3). The reasons are numerous and are driven both by data issues and theoretical motivation. Primarily, it comes from modellers not wishing to adopt the pure monopolistic competition approach described above as it is not felt that it is representative of the competitive situation that they wish to model. For example, Harris (1984) assumes that oligopolists set mark-ups as the weighted average of the monopolistic price and the tariff-inclusive price of import competing goods. This is because the objective of his model is to examine reductions in trade barriers. Devarajan and Rodrik (1989, 1991) define the inverse price cost margin in the domestic market as the product of the endogenous number of firms and the industry price elasticity of demand. Dixit (1987, 1988) found that in a partial equilibrium model when using calibration method 2, with exogenous value of n_0 and m_0 calibrated values of σ were often unrealistic. However, introducing an additional conjectural variation parameter allows σ to be set exogenously. Gasiorek *et al.* (1992) and Harrison *et al.* (1996, 1997c) define the price cost margin as an inverse function of the endogenous price elasticity of demand perceived by the representative firm. Gasiorek *et al.* (1992) assume that aggregate demand is isoelastic, while Harrison, *et al.* (1996, 1997c) employ the Armington (1969) specification and assume that domestic and imported goods are imperfect substitutes. The Harrison, *et al.* (1996, 1997c) approach assumes constant Cournot conjectures, the conjectures being endogenously calibrated. Such an approach is not unusual: somewhere along the line virtually all approaches where CGE modelling is applied to imperfect competition issues assume a conjecture in some form or another. Conjectures are implicit in both the Bertrand and Cournot models, it is just that under pure Cournot conjectures there is no output response by rivals. Despite the insight that the inclusion of conjectural variation parameters can provide, in all of these approaches the firm's perceived elasticity of demand is independent of any conjectural variation parameter expressed in the model. However, according to De Santis (2002) the price cost margin is inappropriately derived, the elasticities of demand that the firm perceives in the domestic and import markets are not independent of conjectural variation parameters. It has already been noted that the conjectural variation approach states that firms form expectations about the action of other firms; this is the opposite to the approaches described above which assume that firms do not respond to the actions of other (1996, 1997c) model and devises a way in which the conjectural variation can be endogenously calibrated within the CGE model. Thus, it is possible to incorporate in the modelling framework a situation whereby the perceived elasticity of demand in domestic and export markets does depend upon strategic expectations amongst firms. In this way, an extra component is added to the link between the price cost margin and perceived elasticity of demand.

Few researchers have adopted this approach, where the conjectural variation parameter differs explicitly from pure Cournot, largely because of the complexity of calibration. Furthermore, there is no widespread conclusion in the industrial economics literature (where the conjectural variation approach originated) as to its usefulness. For example, Daughety, (1985) argues that the approach is *ad hoc*; Tirole (1988) notes that from the perspective of theoretical rigour, the conjectural variation approach is unsatisfactory, 'as it does not subject itself to the disciplines imposed by game theory'. In particular, Makowski (1987) notes that strategic responses require a temporal setting. From the perspective of theoretical rigour, the conjectural variations approach is clearly unsatisfactory, as the resulting equilibrium is not a Nash equilibrium.

However, as Francois and Roland-Holst (1997) point out, there have been significant advances in the theory of repeated games. Ferrel and Shapiro (1990) and Schmalensee (1989) show that the conjectural variation approach is an approximate solution which emerges from the equilibrium of a dynamic oligopolistic game. Also, as previously stated, the conjectural variation approach allows the continuum between perfect and monopolistic competition to be explored and consequently it is widely used by empirical industrial economists such as Cowling, (1976); Cowling and Waterson (1976); Slade, (1987); Machin and Van Reenen, (1993). The conjectural variation approach is also widely used in a range of partial equilibrium trade models: examples include, Krugman (1987), Dixit (1987, 1988), Smith and Venables, (1988) and

Baldwin and Krugman (1989). While the theoretical rationale for including explicitly modelled conjectural variations is weak, Helpman and Krugman (1989) argue that the justification for the inclusion of conjectural variations in empirical studies is that they can give helpful indications of what policy impacts might be when industry conduct is specified.

Therefore, alternative specifications of imperfect competition and increasing returns to scale are compared in this thesis. The approach of De Santis (2002) is thus compared with the approach of Harrison, *et al.* (1996, 1997c). The former is chosen because it appears to be a rational approach to examining strategic interaction, while the latter is a special case of the De Santis (1999, 2002) model[20]. De Santis (2002) of course compares the two approaches empirically; however, the model is highly stylised and conducted in a static framework.

The specification of increasing returns to scale and imperfect competition used by both Harrison, *et al.* (1994, 1996, 1997) and De Santis (2002) is (B7) in Table 3.2. The detailed equations for this approach are given in chapter 4.

The Use of Dynamics in CGE Models

The arguments for the incorporation of dynamics into the modelling framework are given in section 3.2.2, and the appeal of models which can predict the future outcomes of policy scenarios is obvious. However, until the mid 1990s the majority of CGE models were static in nature. In fact, Greenaway *et al.* (1993) note that criticism was directed at CGE models prior to 1984 because they did not take adequate account of dynamics. However, to some extent this criticism was fair, as the trade-theoretic basis for CGE models had not developed sufficiently. This is largely due to the fact that trade theory is heavily influenced by the interests of policy makers, who are concerned with inter-country/commodity rather than inter-temporal allocation effects.

Palstev (2000) notes that dynamic CGE models can give reasonably accurate predictions if there are no structural changes or shocks to the economy. However, a number of assumptions need to be made about a wide range of parameters, for example, the rate of economic growth, population change, depreciation. These assumptions do mean that dynamic CGE models are somewhat removed from reality. Nonetheless, decisions still need to be made about the future and CGE models provide solid microfoundations and a rigorous theoretical and analytical

[20]The conditions under which this occur are explained in chapter 4.

structure which are capable of forming a solid basis for such decision making.

Early applied dynamic general equilibrium models tended to have only one sector (Auberach and Kolitkoff, 1987, Perroni, 1995 and Kolitkoff, 1998), emphasizing the impact of tax changes on long-run growth, investment, savings and capital formation (Bhattari, 1999). More disaggregated dynamic CGE models have only begun to appear fairly recently, due to the reasons cited above and the past lack of computing power. Approaches to dynamic modelling tend to vary distinctly according to the coding language, the solution method and/or the preferences of the associated theorist/modeller. While there are several well tested approaches, few have the same starting point or core underlying equations. Devarjan and Go (1998) and Ginsberg and Keyser (1997) both provide good introductions to dynamic modelling. Ianchoivchina and McDougall (2000) provide an explanation of the dynamic GTAP approach[21] and Dixon and Rimmer (2002) provide a similar style outline of the MONASH Model[22]. The Overlapping Generations Approach (OLG) to CGE modelling is well documented by Madsen and Sorensen (2002) as part of the Danish Rational Agents (DREAM) model; they also attempt to model the non-steady state. For the purposes of this thesis the 'Rutherford[23]' approach is adopted due to its (relatively) higher degree of documentation (Lau *et al.*, 1997 and Palstev, 2000) and its ease of implementation in MPSGE.

The range of applications of the models to policy issues is wide ranging and often multiple, due to the fact that these models are constructed by project teams (DREAM, ECOMOD[24], GTAP, MobiDK, MONASH), rather than individuals. This partly reflects the effort involved in constructing models of this nature, but is also influenced by group members bringing different types of expertise i.e. technical skills vs local implementation knowledge. In addition, these models are continually growing in size, complexity and accuracy due to these types of collaborations. It is worth noting that the MONASH model has developed these linkages over a significant period of time. Specialist forecasts in areas such as the domestic macroeconomy, Australian economic policy, world commodity markets, international tourism, production tech-

[21]The Global Trade Analysis Project (GTAP) is a multi-country CGE model and database. Initial introductory documentation can be found in Hertel (1995) or on the web at http://www.gtap.agecon.purdue.edu/

[22]Monash is a development of the ORANI model (Dixon *et al.* 1982). For details of Monash see Adams *et al.* (1994).

[23]Much of the 'Rutherford' approach can be found documented as part of the core model developed by the team involved with the MobiDK project. See http://www.mobidk.dk/

[24]http:\\www.ecomod.com

nologies and consumer preferences have been incorporated (Dixon and Rimmer, 2002). A great deal of additional information is imposed as exogenous constraints on the model so as to simulate effectively the changing structure of the economy. While this approach and the dedication of the modelers should be commended, and in principle adopted for all dynamic modelling cases, in some cases it is no substitute for timely and up-to-date data (the MONASH model is based on IO tables from 1987).

The introduction of dynamics into CGE models was heavily influenced by the following factors (Devarajan, 2001). Firstly, as early as 1982 it was noted that analytical inconsistency was prevalent in static CGE models (Srinivasan, 1992). Static CGE models incorporate complex optimisation procedures to determine producer-consumer 'within-period' allocation decisions. However, 'intra-period' decisions such as savings and investment are determined in a myopic rather than optimising fashion. Devarajan (2001, p. 1) points out that "in a sense, the equilibrium prices of these models were not in an equilibrium over time, so that policy conclusions derived from them were suspect".

Secondly, some of the questions that static CGE models are designed to answer are more suited to dynamic models (Devarajan, 2001). Dahl *et al.* (1994) implemented a CGE model of the Cameroon to look at optimal import tariff structures. In this model, the calculations of the optimal import tariff resulted in the highest tariff being levied on capital goods imports, as that was the nearest thing to a lump sum tax. However, increases in the import tariff on capital only lowered investment. The model did not pick-out any consequent welfare changes due to it having a fixed capital stock. Therefore, in order to evaluate the impact of lowering tariff rates on capital and consumer goods as in the example cited, and a number of other key trade policy questions, a dynamic CGE model is needed.

Thirdly, despite strong theoretical and empirical evidence supporting trade liberalisation, most static CGE models only measure the welfare gains of tariff elimination at around 1% of GDP. Such estimates are considered very small considering the scale of the trade liberalisation. This point was first noted in the introduction of Srinivasan and Whalley (1986), but adverse results of this nature still appeared in subsequent papers for example, de Melo and Tarr (1990, 1992, 1993) and Harrison, Rutherford and Tarr (1997b, 1997c). Thus it was seen as a potential source of embarrassment for trade liberalisation programmes who were using CGE analysis at the forefront of their analytical agenda (for example, Uruguay round, NAFTA). Authors such as Thomas, *et al.* (1991) claim that static models were not able to capture the dynamic gains from trade and it was thought that dynamic CGE models were more appropriate tools of analysis.

Several different types of specifications exist for modelling intertemporal behavior in dynamic CGE models. The four main approaches are discussed below.

- Recursive Model

Recursive dynamic models is characterised by a series of individual one-period simulations. They are characterised by the following intertemporal behaviour:

1. The recursive model is a savings-driven model. Households optimise current utility subject to the current budget constraint. Households maximise the present value of current and future utility, using the endogenous annual savings as one of the instruments.

2. Savings are determined by current, income, and are used to purchase domestic or imported investment goods from some or all sectors (so that increased savings lead to increased aggregate demand, *cetris paribus*).

3. The investment goods do not add to the capital stock until the end of the current period, the net effect on the capital stock in the next period being determined by the physical depreciation of the current stock and the inflow of new investment goods.

4. The budget constraint is only applied to the present value of all periods and not for each individual period, so that intertemporal borrowing of funds is assumed possible. Interemporal borrowing implies rational behaviour. But forward looking behaviour is limited to being determined between investment periods, rather than over the full time horizon. Each simulation is linked by the capital stock. The total capital stock and investment are determined in each period using a fixed savings ratio. The fixed savings ratio is determined as a proportion of income. As income changes due to the policy counterfactual so to will capital and investment. Using the new investment level and capital stock the model is then solved for the next period. This means that the model can be solved as a series of simulations.

Examples of recursive dynamic models include Adams and Parmenter (1995), Ianchovichina and Mc Dougall (2000) and Walmsley and Hertel (2000).

- Comparative Steady State

Comparative Steady State (CSS) CGE models estimate the long-run impacts of trade liberalisation without going to the effort of constructing a fully dynamic model for example, Harrison, Rutherford and Tarr (1996, 1997a) and Francois *et al.* (1996), and so are merely extensions of comparative static models. These models seek neither to describe the adjustment path following a trade policy shock nor to evaluate the welfare gains from the subsequent adjustment to a higher steady-state growth path. Instead their objective is to "evaluate the upper bound on welfare gains in a Solow type model" (Rutherford and Tarr, 1999 p. 14).

The adjustment mechanism to which these models adhere is as follows. Assuming an exogenously set rate of return on capital, the cost of producing an investment good and the capital stock in the benchmark equilibrium are optimal. Any increases in the rate of return on capital would increase investment until the marginal productivity of capital is driven down to the initial equilibrium ratio of the rate of return on capital to the investment good. A trade policy change induces a new equilibrium as it is assumed that it brings with it a more efficient allocation of resources. This implies that a fixed capital stock is no longer optimal; the rental rate of capital is held constant and the stock of capital is allowed to vary to reduce the marginal productivity of capital until it returns to the long-run equilibrium ratio.

- The Ramsey Model

The Ramsey model of optimal economic growth is the most common specification in dynamic general equilibrium models. Applications of steady state growth Ramsey model include Goulder and Summers (1989) who study the policy effects of changes in corporation tax on investment financing structures in the US; Devarajan and Go (1998) who use the model to evaluate alternative trade shocks in the Phillipines;and Rutherford and Tarr (2001) who use a dynamic Ramsey model for Chile to assess the impact of tariff reduction on welfare. The Ramsey model is the approach adopted in this thesis for reasons explained below; it is similar in structure to that used by Rutherford and Tarr (2001) for their Chile assessment. A detailed description of the model is given in chapter 4.

The Ramsey model contrasts distinctly with the recursive dynamic approach in that it assumes an infinitely lived agent with perfect foresight operating in a world of certainty. This approach has a distinct advantage over recursive and CSS models in that consumers maximise their utility based not only on current utility but on their expectations of future events. The determination of the capital stock is endogenous. Two artificial capital production sectors are modeled in order to facilitate the transition of capital flows. The first production sector transforms the existing capital stock into capital inputs for the production sectors and next period capital stock. The second sector transforms investment into next period capital stock. The initial endowment of capital is calibrated from the benchmark dataset, while the final period capital stock is determined by a transversality condition. The representative household in this model has an intertemporal budget constraint, consumption in all periods being constrained by household income over the inter-termporal horizon (which effectively determines the households wealth). Household income is determined by the returns it gets from labour and capital.

- The Overlapping Generations Approach

Another modelling approach to CGE dynamics is the overlapping generations approach (OLG). These models analyze the general equilibrium properties and growth dynamics of economies inhabited by finitely lived population cohorts that differ in age. OLG models started with Samuelson's (1958) and Diamond's (1965) theoretical work on two-cohort models. A small number of models do adopt this approach and they can provide insight into inter-generational issues such as pension reform. However, such models are complex to build, have large data requirements and only have a very primitive treatment of inter-generational transfers.

In the same vein as the Ramsey models, OLG models also assume perfect foresight and certainty. The intertemporal treatment of capital is also similar to that of the Ramsey model. The fundamental difference is in the treatment of households. The model is split into generations of representative households. Households are distinguished by an age parameter, which is often the age of the working male/female. Few distinctions, if any, are made about household cohorts, and most models assume that all households of a certain age have two children which are assumed to be adult equivalents in consumption. Household size and working status are determined over the planning horizon by probability of death and average retirement age.

Children will also leave the household and form new households, usually at age 18. Bequests are usually made when a household reaches a certain age and then it is effectively dissolved (Knudsen *et al.* 1998). This approach is particularly useful if the policy issue that is being modelled has a significant impact on inter-generational transfers. However, imposing the strong assumptions relating to inter-generational transfers is not appropriate unless the focus of the evaluation relates to an issue where inter-generational transfers are all important. In the case of this thesis it is felt that the increased complexity and the adoption of further assumptions relating to the OLG does not contribute significantly to the understanding of the policy issues that are discussed.

A dichotomy exists between the Ramsey dynamic and the Recursive dynamic. The Ramsey model assumes perfect foresight and rational expectations, while the Recursive model assumed no foresight and adaptive expectations. As Dellink (2000) points out, it is not intuitive to imagine that agents have no foresight whatsoever and take no long-term view of their decision making process (see Solow, 1974). Empirical estimates by authors such as Srinivasan (1982) and Ballard and Goulder (1985) suggest that consumers do consider the future in their decision making process but do not maximise their utility over the infinite horizon. Therefore the Ramsey model and the recursive model sit at two extremes in the decision making process.

An alternative specification of the forward-looking model as suggested by Dellink (2000) would be to assume that consumers maximise their discounted utility based on current prices and expectations of the future (and reconsider their actions in the next period when expectations change). This can be done in a temporary equilibrium framework or using the theory on incomplete markets. These models are closer to reality in this respect, but it is extremely difficult to find good expectations functions for future prices and profits, therefore there has been no real attempt at this approach in the literature.

Rutherford and Tarr (1999) point out that the results generated by a Ramsey based dynamic model may not necessarily differ significantly from those of a static model. In an analysis of Chile's trade policy options on accession to MERCOSUR and NAFTA (Harrison, Rutherford and Tarr 1997a) the principle result is that the dynamic model does not produce significantly different gains from trade liberalisation than a static model. Thus they conclude that typical Ramsey dynamics do not lead to results which reveal large welfare gains as a result of trade liberalisation. In these models the increases in the long run capital stock that might be induced by trade liberalization come at the expense of foregone consumption and reduced welfare during the transition.

A possible solution to this problem is to implement a CSS model to estimate the upper bound. However, this type of calculation does not provide a suitable solution as it ignores the cost of foregone consumption necessary to obtain the larger capital stock and the capital expansion acts as an endowment. Hence, Rutherford and Tarr (1999) infer that potential welfare gains represent the upper bounds of potential welfare gains in a long-run classical Solow type growth model.

Following their conclusions about this class of model, Rutherford and Tarr (1999) implement an alternative formulation and consider a dynamic model with IRTS. The inclusion of IRTS transforms the standard dynamic Ramsey model into an endogenous growth model. Their intuition is based on Romer (1994) who states that if trade liberalisation is to be modeled correctly, then the impact of the number of varieties available following its implementation should be analysed. The crux of this idea is that following the liberalisation, there will be a larger variety of imported intermediate inputs which will allow producers to choose inputs that more closely resemble their production requirements. This will lead to productive efficiency gains for the producers. This hypothesis is supported by several sources, including Cabellero and Lyons (1992), Coe, Helpman and Hoffmeister (1997) and Feenstra *et al.* (1999). A hypothetical 10% decline in the import tariff coupled with an equivalent government revenue replacement in their model produces Hicksian welfare gains in the region of 10.6% over the time horizon. These large welfare gains arise in the model because the benefits from the additional imported varieties outweigh the losses from the decline in domestic varieties. When the experiment is repeated for a model with CRTS without the variety effect, the welfare gains drop to around 0.5%. Thus the result illustrates the importance of choosing the correct type of dynamic structure.

The calibration of dynamic models is a complex procedure. The majority of dynamic CGE models are calibrated to the (stationary) steady state. The only exceptions to this are Knudsen *et al.* (1998) and Wedener (1999) who calibrate for the non-steady state with an installation costs function. However, this is only one variable of the CGE model and does not represent complete non-steady state calibration. This approach is only at its early stages in the literature and its benefits remain to be seen.

When solving the dynamic Ramsey model, it is assumed that agents with perfect foresight optimise before the end of period zero, making plans for all future periods. The model then solves for all periods over the horizon until the steady state is reached. The value of firms, the wealth of households and the shadow prices of capital are then solved for the end of period zero also.

The model is calibrated such that the dynamic path is determined by a set of exogenous variables that are calibrated from the benchmark dataset. This implies that the base year data are added to the model as a constraint. There are essentially five steps to this process (Bhattari,2003):

1) A linkage needs to be specified between the price of the investment good in period t and the price of the capital stock in period $t+1$. This linkage is specified subject to depreciation (δ) and the rental rate of capital (r).

2) A linkage needs to be specified between the benchmark rate of return to capital and the level of depreciation

3) A relationship needs to be specified between the future and current price of capital.

4) An equilibrium relationship needs to be specified between capital earnings (i.e. value added from capital) and the cost of capital.

5) A relationship must be specified between investment and capital earning on the balance growth path.

Details of this calibration process are given in chapter 4 section 4.4.8.

The Incorporation of Foreign Investment into CGE Models

The role of FDI in facilitating services trade has already been discussed and shown to be an essential feature of tourism trade modelling, yet only a few attempts have been made to account for the role of foreign investment in CGE models. Following an extensive search, this section discusses virtually all attempts to model FDI in an explicit manner in CGE models. Most of these studies are focused on issues relating to services trade liberalisation, and can be categorised into three groupings. Firstly, some modelers do not model FDI explicitly, but when examining the impact of services trade liberalisation the reduction of barriers to FDI is implicit

(Brown, Deardorff and Stern, 1996; Dee, Geisler and Watts 1996; Brown, Deardorff, Fox and Stern, 1995). These studies use Hoekman's (1995) estimates of service sector tariff equivalents; as a proxy for barriers to FDI. However, it is noted by Dee, Hardin and Holmes (2001) that these models fail to capture key features associated with FDI i.e. the fact that foreign affiliates typically benefit from assets held by the MNE investor, or any of the benefits associated with the increase in foreign service varieties associated with the FDI. They also assume that all factors participate in their country of origin rather than be employed in the recipient country's factor markets. However, Brown, Deardorff and Stern (1996) argue that these factors are still part of the source country's factor markets and their origin or location does not matter when determining equilibria. Such an approach has an appeal as it does not require the CGE model to be restructured to incorporate FDI. Nonetheless characteristics of this nature need to be modelled explicitly rather than incorporated into the activities of domestic firms.

The second set of studies do not model either FDI or trade liberalisation explicitly (for example, Bora and Guisinger, 1997; Donovan and Mai, 1996; McKibbin and Wilcoxen, 1996; Martin and Yanagishima, 1993; Siksamat, 1999). In studies of this type, investment liberalisation is assumed to affect some variables in a specfic way, for example, the extent of capital mobility. These implied effects are then modelled. McKibbin and Wilcoxen (1996) consider an increase in total factor productivity a conceivable side-effect of services trade liberalisation. Therefore the productivity of both domestic and foreign firms operating in the liberalised sectors increases. Higher rates of return in these sectors mean that domestic factors of production will be attracted towards these sectors and there will be a subsequent inflow of FDI.

Siksamat (1999) models FDI in a similar way but does not consider trade liberalisation. A multi-regional model of the Thai economy is built, which is based on the structure of the ORANI model. A medium-term increase in FDI is considered; in order to represent this as a counterfactual, the model is shocked with a reduction in the exogenously set rate of return which is assumed as a consequence of a foreign capital inflow. There are three key consequences of a shock of this nature: a deterioration in the current account, a increase in the domestic price level and an increase in the capital-labour ratio. However, the decline in the rate of return does not accurately reflect the economic conditions in the Thai economy, so a second simulation is undertaken. It is assumed that the government directs foreign capital towards Bangkok; thus the government demand for infrastructure in the Bangkok region of the model is set exogenously and positively shocked.

The final set of studies attempt to incorporate FDI into CGE models in a theoretically consistent manner. Markusen, Rutherford and Hunter (1995) model the impact of trade liberalisation on the North American (NA) car market under two alternative scenarios, one with MNE activity and the other without (national activity). MNE activity is modelled by recording the production patterns of NA car manufacturers, consisting of firms operating in Canada, USA and Mexico. Under the national activity scenario, arbitrage between plants owned by the same company is not permitted; therefore a car produced in Mexico which is imported to the US constitutes an erosion of the US firms' market share. In the MNE activity model, if the car produced in Mexico was produced in a plant owned by a US firm and subsequently imported into the US, this would constitute an increase in the US firms', market share. Markusen *et al.* (1995) assume that MNEs maximise profits in terms of global markets, rather than regional markets. Dee, Hardin and Holmes (2001) question the suitability of this assumption since it may well be the case that some foreign affiliates make their own production and output choices. Markusen *et al.* (1995) conclude that in the presence of MNE activity, the potential benefits of trade liberalisation are reduced. This conclusion is based on a hypothesis developed in a theoretical model relating to the principle of market share erosion/gain described above. Holding imports from the Rest of the World constant, an import from Mexico to the USA in the MNE model lowers the NA firms' perceived elasticity of demand and raises mark-ups, while in the national model the same import has the reverse effect.

Abrego (1999) also takes explicit account of FDI in a trade-liberalisation context. Abrego looks at the optimal taxation strategy for a country that receives FDI, in this case Costa Rica. Data for FDI flows are taken from national accounts and UNCTAD estimates and stocks are calculated on the same basis. Foreign capital is then incorporated in a sub-nest of capital in the value-added nest. It is assumed that MNEs pay a standard 20% tax rate on their profits (this is consistent with current government policy towards MNEs in Costa Rica, except for those firms operating in enterprise zones), and repatriate 100% of any surplus. Counterfactuals imposed on the model aim to compute the impact of completely eliminating all tariffs, and also compute an optimal tariff structure for the economy in the presence of foreign capital taxation. When foreign capital is taxed and tax credits are offered to countries with bilateral trade agreements in place, the elimination of import tariffs is found to have a negative impact on the Costa Rican economy. The consequential impact is that foreign capital moves out of the economy (as it is no longer protected by tariffs) and the loss of tax revenue associated with this capital is larger than the traditional reallocation benefits associated with free trade. However, optimal tariffs are found to be non-zero but small, reflecting the low proportion of MNE activity in the Costa Rican economy. It is likely that the impact of such policies would be much larger if assessed on an inter-temporal basis and in an economy with a larger amount of MNE activity.

Siddiqui and Kemal (2002) also take an alternative approach to modelling foreign capital inflows. The focus is primarily on changes in the distribution of factor returns in the presence of a foreign capital inflow and trade liberalisation. The model is driven by foreign savings, which are set exogenously as the difference between foreign currency earnings and the import bill. Increases in foreign savings are assumed to lead to increases in the demand for investment. Several types of foreign capital are included in the model: remittances to households from overseas, foreign capital transfers to governments (aid) and foreign savings. The counterfactuals imposed on the model are very large, for example, a 70% increase in foreign capital inflows and complete tariff liberalisation. Results show that as foreign savings rise, the demand for investment rises and the rate of return on capital rises. The consequence is an increased demand for imports, while rises in factor prices cause export sectors to contract. Those households (rich) which work in capital intensive industries will benefit the most, while those in labour intensive sectors (poor) will not be fully compensated by the factor price rises and income declines. On this basis they conclude that foreign capital inflows can lead to an inefficient allocation of resources.

Petri (1997) uses an adapted version of the GTAP model to investigate FDI liberalisation scenarios for the APEC group of countries. An input structure is implemented that identifies inputs obtained from parent firms. This provides insights as to the division of the production process between parent firms and their subsidiaries. "Subsidiaries that perform a limited part of the production process abroad need extensive intermediate imports from home; those that localise the production process in the host economy do not need such specialised imports" (Petri, 1997 p. 8). Petri estimates these production shares from FDI survey data, while local content sources are estimated as a residual of valued added and inputs sourced from parent companies. Export shares, i.e. when FDI is used as an export platform for generating sales in a third market, are also calculated in the same way. Petri's data set indicates that foreign production primarily plays a role in manufacturing goods provision as opposed to primary goods or services provision. Counterfactuals used in the study are based on Hoekman's estimates and are designed to simulate the impact of tariff liberalisation on FDI. Petri notes that in some instances, for example, the USA and Canadian service sector, the Hoekman based estimates of tariff protection may be too high and thus any results may overstate the benefits of liberalisation.

Petri's model is multi-regional and can incorporate the trade effects of this type of liberalisation. As taxes on FDI are reduced, MNE profits will increase.If it is assumed that these gains are passed on to consumers in terms of lower prices, competition will increase and so too will the demand for inputs in both the host and recipient countries. It is clearly beneficial to have a model of this nature as it allows more of the features of trade liberalisation to be captured. But it does however, require some significant assumptions relating to both data and theoretical structure. Dee, Hardin and Holmes (2001) argue that it may be better to examine such issues in a single country model as this would limit information requirements and model assumptions; it does however, only allow the unilateral effects of trade liberalisation to be evaluated.

Markusen, Rutherford and Tarr (2000) develop both a small-scale dynamic and a static CGE model to investigate the impact of producer services associated with the transfer of FDI. They are primarily interested in the knowledge transfer that is traditionally associated with FDI transfers or services trade in general. These services are considered to be intermediate inputs in the production process, for example, management consulting, knowledge and labour intensive, differentiated by firm and possibly nationality; produced with IRTS and subject to high or prohibitive transaction costs due to foreign ownership barriers. The model does not use "real data", but does serve to provide some interesting insights as to trade liberalisation effects. Again FDI is not modelled explicitly, but a general variable is proxied which relates to features such as "specialised technical expertise, advanced technology, management expertise and marketing expertise" (Markusen *et al.*, 2000 p. 9). A price index is then associated with this set of MNE imports and is varied to reflect relative terms of trade effects; lower values of this index means that this expertise can be imported more cheaply. Expertise of this nature has obvious productivity effects on recipient firms and national output. One of the more interesting results of the static model is that if recipient countries have restrictions which force MNEs to hire a certain percentage of local skilled labour, this bids up the price as this type of labour is used relatively intensively in expertise related production, and may lead to lost national income and hurt the factors of production the expertise is attempting to assist.

Gillespie *et al.* (1991) take an innovative approach to modelling foreign capital inflows in a regional context. The model is set in a regional context and is relatively small scale, but does include an interesting innovation with regard to the treatment of FDI recipient sectors. The manufacturing sector is split into two components, domestically owned manufacturing and foreign owned manufacturing, results are then compared accordingly. The counterfactual takes a dual shock approach to illustrate a stimulus equivalent to a 20% increase in the stock of foreign investment. This approach assumes that there will be a concurrent increase in output and employment of 3% and exports will increase by 3.97%. Foreign owned capacity also increases by 3%. Such an approach differs from other attempts in that it represents a bottom-up counterfactual as opposed to a top down counterfactual by assuming preconceived outcomes. While interesting, such an approach is ruled out for Spain as no practical estimates exist for the knock-on effects of increases in FDI on other key economic variables.

Another interesting aspect of the Gillespie *et al.* (1991) approach is the assumption of a labour augmenting productivity spillover arising from increase in FDI. This magnitude of the spillover is determined by econometric estimated from Barrell and Pain (1997) who show that a 1% increase in FDI can lead to a labour efficiency stimulus of 0.27%. This efficiency shock reduces costs in the FDI recipient sector and leads to increased capacity and output expansion and generates increased employment in the model. This is a particularly interesting experiment as the consensus in the FDI literature is largely in favour of productivity spillovers associated with FDI and such an outcome is consistent with the OLI paradigm described earlier in this section. Unfortunately, attempts to replicate the Barrell and Pain (1997) analysis in Spain are generally inconclusive about the scale of efficiency spillover effects (Barrios *et al.* 2002).

Macroeconomic Closure in CGE Models

In order to be able to obtain a solution for a CGE model, the number of equations that need to be solved must equal the number of endogenous variables. If this balance is to be achieved some key variables occurring endogenously in the model must be constrained.[25] In economic terms, this process is more commonly referred to as macroeconomic closure. In the Walrasian context whereby decisions are based on optimising behaviour, the closure problem becomes one where macroeconomic constraints induce behavioural change in microeconomic agents. In order to implement this exogenous constraint, balancing equations need to be added to the model (Ginsburgh and Keyzer, 1997). While CGE models are relatively flexible in the type of closure that can be used, they are also highly sensitive to the choice of closure. The choice of closure rule is down to the preferences of the modeller and is determined by their own theoretical and/or empirical understanding of the associated issues.

CGE models tend to have three key macro balances. They are the current account balance, the government balance and the investment-savings balance. A range of different options are available to the modeller with regard to each and are discussed below.

The closure that has attracted the most attention in the literature is the investment-savings balance. The literature on this subject is quite limited and is split into two: a theoretical discussion of possible closure rules and different alternative empirical applications. The theoretical discussion was initiated by Sen (1963). Sen's paper discusses four alternative types of closure: neoclassical, neo-Keynesian, Johansen and a general theory approach to income distribution. Additional investment-savings closure types are available, a summary can be found in Thissen (1999).

Sen (1963) discussed the closure problem within the context of a small model. The model is specified as follows: there is one good produced by constant returns to scale technology, two factors labour and capital (labour supply is fixed). Depreciation and capital accumulation are assumed away in this short-run model. Alternative savings behaviour exist depending on the source of income (labour and profits). The model can be represented as follows (Thissen, 1999):

[25] The closure problem can effective be reduced to determining which key macro variables are endogenous and which are exogenous.

$$X = f(l,k) \tag{3.5}$$

$$w = \frac{\partial X}{\partial L} \tag{3.6}$$

$$PX = rK + wL \tag{3.7}$$

$$S = s_p rK + s_w wL \tag{3.8}$$

$$I = \bar{I} \tag{3.9}$$

$$S = I \tag{3.10}$$

$$N = \bar{N} \tag{3.11}$$

Good X is produced by a neoclassical production function f and has price P. Investment is determined from some initial level I. Labour (L) and capital (K) are paid according to their marginal products with wages (w) and the rate of return to capital (r). S is savings and s_p and s_w relate to the savings ratio for profits and labour income. This gives 7 independent equations for 6 endogenous variables X, I, S, N, w and r and the system is 'overdetermined'. The problem of overdetermination emerges as it is not possible to have full employment given that investments and real wages are paid their marginal product. This problem can be solved in a number of different ways by imposing a closure on the model. Several different alternatives exist according to different "schools of thought". These are summarised below, following closely the discussions of Sen (1963), Rattsø (1982) and Thissen (1999).

Table 3.3: Schools of Thought on Macro Closure

Neoclassical Closure	This approach drops Equation 3.9. Investment is no longer set exogenously, instead it is endogenised and set equal to planned private, government and foreign savings. This assumption is that investment is set equal to savings at a level such that full employment still exists. All non government savings rates are fixed. To implement this, Lofgren *et al.* (2002) suggest that the quantity of each commodity in the investment bundle is multiplied by a flexible scalar to ensure that investment cost equals savings value.
Neo-Keynesian/Kaldorian Closure	This approach drops Equation 3.6. This is effectively a forced savings model. It is no longer accepted that the real wage is equal to the marginal product of labour. Instead the forced savings mechanism is created by fixing the nominal wage rate, equality between savings and investment is brought about by a change in the income distribution. Equation 3.8 now becomes: $S = s_p rK + s_w (W/p)L$, where P is the endogenous price level and W is the exogenously set wage rate.
General Theory Closure	This approach assumes that Equation 3.11 is dropped, which in turn allows unemployment. Again, variations in the level of output and unemployment will make the savings and investment markets clear.
Johansen Closure	The approach assumed that Equation 3.8 is dropped. Fiscal policy becomes endogenous and government spending or taxes bring about full employment. This is an investment driven closure.

All of these schools of thought adopt different subsets of a range of different closure rules, these are detailed in Table 3.4 below.

Table 3.4 Alternative Closure Types

Savings-Investment Closure		
S1	**Fixed Investment (percentage)**	Real investment quantities are fixed. The savings of households and institutions are adjusted by the same percentage rate to generate the requisite volume of savings. It is assumed implicitly that the government can implement policy that can generate the required amount of savings.
S2	**Fixed Investment (scalar)**	Again, real investment quantities are fixed. However, savings adjust according to a flexible scalar
S3	**Fixed Savings**	This is the classic savings driven closure. All savings rates are fixed. A flexible scalar is applied at the commodity level to ensure that investment adjusts to meet required savings.
S4	**The Loanable Funds Closure**	When savings and investment are in equilibrium there is an implicit modelling of financial markets. An alternative approach suggested by Taylor (1991) is to let savings be the supply of loanable funds and investment be the demand for loanable funds, supply and demand are then balanced by the interest rate.
S5	**Balanced Funds Closure**	This is variant of the investment driven closures and is described by Lofgren *et al.* (2002). Consumption adjusts across all components of the economy (household, government, investment) rather than just a selected few (government, investment). So adjustments are spread across the economy. The savings rates of these institutions are then scaled so as to generate enough savings to finance investment.

Government Closures		
G1	**Fixed Revenues**	Government savings, as defined by the difference between government revenues and expenditures, are flexible and tax rates are fixed.
G2	**Flexible Revenues (percentage)**	Government savings are fixed and tax rates adjust to restore equilibrium. This is undertaken by allowing tax rates to adjust endogenously by an equivalent number of percentage points.
G3	**Flexible Revenues (scalar)**	Again, government savings are fixed and tax rates adjust to restore equilibrium. This is undertaken by multiplying tax rates by a flexible scalar.
Current Account Closures		
C1	**Fixed Current Account Deficit**	Under this specification the real exchange rate is flexible while the current account deficit, which is akin to foreign savings in most models is fixed. This implies that the trade balance is also fixed since other items in the external balance are also fixed.
C2	**Fixed Real Exchange Rate**	Under this specification the real exchange rate is fixed and is indexed to the model numéraire, while foreign savings and hence the trade balance are flexible.
C3	**Fixed Nominal Exchange Rate**	Under this specification the nominal exchange rate is fixed and is indexed to the model numéraire, while foreign savings and hence the trade balance are flexible.

A range of distinct possibilities exist. For example, it is possible to fix government revenues and savings and allow government expenditure to fluctuate. Alternatively, uniform percentage changes, as opposed to scalar changes, can be applied to the balanced funds closure (S5). However, this discussion must be treated with some caution. It does not exhaust the debate regarding the full range of closure rules. It merely presents some of the key differences in closure approach and some possible solutions. In addition, the table does not present the full extent of each closure rule.

Ultimately the choice of closure depends explicitly on the context of the analysis. There have been many variations of closure rules although they are rarely specified explicitly by the modellers and the focus of the CGE literature is issue/policy based. Attention is regularly lavished on the structural equations in the CGE model, even sometimes on the most basic elements in the CGE model. Yet rarely is a rationale for the choice of closure rules strongly developed. Moreover, there are only a few instances where closure rules are actively tested. Shoven and Whalley (1984) recognise the need for different closure rules and the need to tailor models to policy-specific issues, but also highlight that this limits their comparability.

The standard "classic" closure is the neoclassical closure. This is observed in many early models by key authors in the CGE field (for example, Johansen 1974, De Melo and Tarr, 1992, Shoven and Whalley 1992, Hertel 1997). In these models government expenditure is also fixed in real terms (**G1**) and is determined by fixed tax rates, with government savings as the residual. The model then treats the government deficit or surplus as being sourced in the loanable funds market; consequently increases in government expenditure "crowd-out" private investment. The balance of trade is also fixed, meaning that the exchange rate is flexible (**C1**).[26] As for Table 1, investment is savings driven and is equal to the sum of private, government and foreign savings.[27] The neoclassical model assumes full employment, meaning that aggregate real income is fixed. Under the neoclassical closure rule, two key equilibrium concepts ensure closure is complete. Firstly, there must be flow equilibrium in product and factor markets i.e. supply must equal demand. Foreign trade may be included and equilibrium is brought about by the real exchange rate (the relative price of domestic and foreign goods). The second equilibrium is the savings investment equilibrium, where the supply of investment depends on household income, the government deficit and an exogenous capital inflow. Again, supply is equal to demand in the investment market.

Some models choose to deviate from the neoclassical closure and choose an independent investment function. One way to do this is to set aggregate investment exogenously and let the economy adjust in an optimal way to meet this investment target. Another alternative is to invoke a Keynesian closure. This is best described by Robinson (1991). Under this closure the

[26]Most trade focused CGE models introduce the exchange rate in terms of a ratio between domestic and foreign currency. But the currency is not a money asset, and the exchange rate is not a pure financial variable. The exchange rate works via defining it as a ratio of changes in the relative prices of traded and non-traded goods.

[27]In the GTAP model, the neoclassical closure is invoked in a multi-regional context. GTAP has a global bank to link investment and saving around the world, so capital flows move freely around the world. Therefore, when at equilibrium, global investment equals global saving. Thus, the closure principle adopted by GTAP allows a difference between investment and saving within each region.

labour market is not in equilibrium, although firms remain on their demand curve for labour. If investment increases, savings must rise accordingly and household income must rise accordingly. The real wage is endogenous, but rather than seeking to clear the labour market, it adjusts to generate the requisite amount of investment. Thus the real wage adjusts to drive the multiplier process. In order to increase employment, the real wage falls to increase labour demand and generate the increased investment needed to finance investment. Taylor (1990) proposes a variant on the Keynesian closure. Under this approach output is determined by demand, so an exogenous increase in investment would lead to an increase in employment, output and income via a multiplier process. The real wage need not fall, so long as production capacity is greater than output. These two closures lead to quite different outcomes with regard to an increase in investment. The former Keynesian closure is not thought to be appropriate for use in this thesis due to the fact that when positive exogenous demand/FDI shocks are applied to the tourism sector later in this thesis it would be unrealistic to expect the real wage to fall. Further, Taylor's (1990) variant assumes that firms hire labour and capital in fixed proportions. However, this does not allow for deviations in the returns on factors and factor substitution.

Government closure is the same in all models; government expenditure is fixed in order to ensure fiscal neutrality. The percentage change approach as described under rule **(G2)** in Table 3.4 is implemented. Under this approach, tax rates do not change, although tax revenues can change, depending on how the counterfactual influences aggregate demand. If government revenue were to increase as a result of the counterfactual, the government-household balance would re-equilibriate via a positive transfer from government to households. This transfer would be welfare increasing and is equivalent to a lump-sum tax. If the reverse were to occur and government revenue fell then there would be a welfare reducing lump-sum tax on households in order to finance fixed government consumption. This assumption is thought to be useful regarding the nature of the simulations invoked on the model. It is designed to highlight the impact of the proposed counterfactual on the government finances and the need for possible fiscal adjustment. There is no rationale to expect government expenditure or tax rates to automatically change in response to a policy shock, particularly if the shock is unanticipated.

In CGE models where trade plays a key role, the equilibriating approach of the real exchange rate is all important. This has a particular influence on the investment-savings closure. Several approaches exist (Robinson, 1991). For example, Devarajan and de Melo (1987) model a scenario relating to the situation in Cote d'Ivoire where the currency was tied to the French Franc. The government at the time borrowed from France in order to finance its deficit. To replicate this scenario, Devarajan and de Melo (1987) assume that government expenditure and investment are set exogenously, while tax rates are fixed and government revenue and household savings do not equate to their equivalent expenditures. Therefore a government expenditure deficit and an investment savings deficit occur, these deficits are financed by foreign borrowing. Under this approach the exchange rate is flexible and the trade deficit is fixed. This is effectively akin to the Johanson (1960) closure.

Robinson and Lofgren (2005) point out that there is little difference at the macro level between the fixed current account closure (**C1**), the fixed exchange rate closure (**C2**) and the fixed nominal exchange rate closure (**C3**). When the real exchange rate is flexible (**C1**) and varies endogenously, there is a fixed inflow of foreign savings. The real exchange rate is measured as the price of non-traded relative to traded goods. The domestic price level is chosen as the numéraire for this model so that variations in the domestic price level brought about by a policy shock affect the ratio of domestic-currency price of imports and exports to that of domestic sales. As Lofgren *et al.* (2002) point out, *ceteris paribus*, foreign savings are specified at a new exogenously set lower level. This yields a depreciation in the real exchange rate which would correct the situation by reducing expenditure on imports and increasing export earnings (and in the case of this model, foreign tourism consumption). Alternatively, when the real exchange rate is fixed and is indexed to the model's numéraire (**C2**), and there is an exogenously specified depreciation in the real exchange rate, imports fall, exports rise and this would yield a reduction in foreign savings to re-equilibriate the trade balance. If there is a fixed nominal exchange rate (**C3**) and this was exogenously reduced, a similar effect would occur to that observed in (**C2**). If the nominal exchange rate were exogenously reduced then this would yield a change in the real exchange rate and imports would fall, exports would rise and foreign savings would be endogenously reduced. While the macro outcomes of these closures are largely similar, (**C2**) and (**C3**) yield changes in foreign savings as a result of a policy shock.

Invariably the domestic price level will change under a specified counterfactual which will yield changes in output and hence investment. Adelman and Robinson (1988) point out that this may come at the expense of domestic savings. The extent to which this occurs depends on the openness of the economy in question and the relative intensity of domestic and foreign savings in the benchmark. By introducing flexible foreign savings, the burden of adjustment to investment changes is now spread across both household and foreign sectors as opposed to just households (as is the case in **C1**). In the Adelman and Robinson (1988) results, the adjustment of foreign savings is larger in each instance than the adjustment in domestic savings. This is thought to be unrealistic in the Spanish case, despite the fact that it is an open economy with significant amounts of FDI. Polo and Valle (2004) highlight a potential pitfall in modelling tourism demand in the case of neoclassical closure with a fixed exchange rate. When investment is driven by savings, a fall in tourism demand will lead to a significant deterioration of the current account and an increase in foreign saving. This could lead to an unrealistic increase in investment in an economy highly dependent on tourism. Blake (2000) avoids this result by fixing the current account surplus. Fixing the current account surplus means that the real exchange rate is flexible. Such a closure rule might lead to an expansion in export producing sectors via the depreciation in the real exchange rate resulting from the decline in tourism demand. Such an outcome is not considered unrealistic in Spain due to its significant expansion in domestic output in recent years. On this basis closure (**C1**) is adopted for the external balance.

Another key closure is the intertemporal closure (Robinson, 1991). Expectations can be adaptive, rational or model-consistent and models can be solved either recursively, for all time periods simultaneously or sequentially. The choice of closure is dependent on the nature of the policy shock. An adaptive expectations approach can be useful for analysing short-run adjustment. But there is little consistency between intra-period solutions. Rational expectations model assume consistent expectations which may not be ideal, but allow the modeller to distinguish between anticipated and unanticipated shocks and give good insights as to medium and long-term behaviour. It is also arbitrary as to how quickly agents can achieve consistent expectations; in many cases it is not unreasonable to assume that this occurs in a single period, especially when that period is measured as one year. Therefore, for the purposes of this thesis, rational expectations closure is preferred as it allows evaluation of long-term structural changes in the economy and gives a reasonable insight as to how agents deal with anticipated and unanticipated shocks.

Differences in closure exist between the static and the dynamic models used in this thesis. In the static CGE model the neoclassical investment-savings closure is used. There is a fixed savings rate which determines the level of investment. Under this closure the change in the capital stock is linked directly to changes in GDP associated with the counterfactual. The supply of capital is dictated by the following equation:

$$K_1 = K_0 \left(\frac{Y_1}{Y_0} \right) \tag{3.12}$$

where K_0 and K_1 refer to the benchmark capital stock and the post counterfactual capital stocks respectively and Y_0 and Y_1 represent benchmark and post counterfactual output respectively. On this basis, investment is allocated between sectors based on the sectoral rate of return to capital goods. Changes in investment are related to changes in the capital stock as follows:

$$I_1 = I_0 \left(\frac{K_1}{K_0} \right) \tag{3.13}$$

where I_0 and I_1 refer to the benchmark level of investment and the post counterfactual level of investment respectively. This closure implies that following a policy shock, subsequent changes in the relative prices of labour and capital mean that proportional changes in sectoral investment will occur; i.e. if the cost of capital fell in a particular sector, the rate of return would rise and it would experience a net investment inflow at the expense of sectors with a higher cost of capital.

However, in the dynamic model a more complex equilibriating process is used. The dynamic model seeks to maximise intertemporal utility. Savings rates are no longer fixed and the neoclassical closure assumption is dropped. Instead, savings and investment are determined simultaneously in order to maximise welfare. Effectively, savings are determined as a residual of consumption, and investment demand is determined by sectoral capital returns. Welfare is a function of, amongst other things, consumption (as specified by minimum requirements in the household linear expenditure system), savings and investment.

Under this approach, savings and capital stocks are endogenous. The real rate of return to capital is also fixed in the long run and there is an implicit assumption that the stock of capital adjusts in the counterfactual to return to its steady state level. In the dynamic CGE model it is assumed that households have perfect foresight (i.e. rational expectations) and that the no Ponzi condition is met.[28]

Factor Market Closure

In general, CGE models include two factors of production, labour and capital, although some versions do incorporate land (Hertel, 1997).[29] Factor market closure describes the treatment of the factors of production in the model and how they move between sectors. The large majority of CGE models are specified so that the factors of production are able to move freely between sectors, and where identified, regions. This might be appropriate for a neoclassical long-run CGE model (Robinson, 1991), but is not useful for modelling adjustment processes. The structure of the model is dependent on its focus. As Robinson (1991, p. 1512) points out, when looking at distributional issues it is "obviously crucial to specify as much detail as possible in order to capture the chain of causation that moves from shocks and policy responses, which largely hit product markets, through changes in wages, profits and employment, and finally to the distribution of income". While this approach is attractive, it is not possible to reconcile households and the functional distributions of activities at the time of writing this thesis, given the current state of Spanish data.[30] Further, the focus of this thesis is not on the distributional impacts of tourism expenditure, it is on the structural economic changes that it invokes, so evaluating such changes is not crucial to this thesis. This precludes analysis of income distribution in the Spanish model. In as much as this method is useful, it has also been superseded to a large extent by the growing links between CGE and microsimulation models; see for example Agénor *et al.* (2002); Bourguignon *et al.* (2002); Cockburn, (2001); and Cogneau and Robilliard, (2000). Approaches and techniques are still under development, and in some cases (for example, with regard to economic growth) are in their infancy. This literature is still at a stage where it is not clear what links are most appropriate and feasible Davies (2004).

While household and factor market disaggregation are useful in CGE modelling, it is more important to address the workings of factor markets. Neoclassical CGE models assume flexible

[28] No Ponzi condition whereby the present value of a household's asset holdings cannot be negative at the limit i.e. the intertemporal budget constraint must be met.

[29] Returns to land are sometimes featured in input-output tables. However, this is not the case for Spain.

[30] Labour differentiated by education type is supplied in the 1990 SAM for Spain, but this is felt to be too outdated to use. There is not enough publicaly available data to construct a household model.

wages and prices, full employment and fully functioning markets. However, perfectly flexible labour markets are likely to overstate economic growth yet understate income growth. However, assuming completely immobile labour (either between regions or sectors) is likely to lead to underestimates of economic growth and overestimates of household income effects (Partridge and Rickman, 2004). Robinson (1991) also points out that in models with perfectly mobile factor markets, structural shocks will have virtually no impact on model results relating to GDP and welfare in the short to medium run. Hence, Robinson (1991) defines an alternative class of model which is refers to as a "micro structuralist" CGE model. The fundamental premise of this model is that there is wage rigidity, restrictions on factor mobility, rationing and non-profit maximising behaviour by firms. However, such models do not conform to the neoclassical paradigm and there is also no consensus about the specification of micro structuralist models. While the rationale for such features is strong, Robinson (1991, p. 1512) concludes that the modeller should "proceed with caution and diffidence, adding only such micro complications as are needed to tell the macro story and keeping a clear view of the equilibriating mechanisms at work". A significant amount of structural rigidity can exist in labour markets. Therefore, a specification whereby labour is able to move freely between sectors (and regions) is often unrealistic. It was noted in chapter 2 that the Spanish labour market is rigid due to high levels of union activity and an immobile labour force, where young workers are tied to their family. This poses the question of what is the most effective way of modelling structural rigidity in the labour market?[31]

Harrigan *et al.* (1996) define four alternative types of labour market closure in a regional CGE model for Scotland. They do this in the context of a regional labour subsidy across all sectors in their model.

- *Fixed Nominal Wage Closure:*

Under this closure the nominal wage is fixed exogenously. The rationale for this is that regional nominal wages are determined in the national market (Harris, 1991; Roper and O'Shea, 1991). When a labour subsidy is introduced, a wedge is driven between the cost of wages to the

[31] Other microstructuralist features such as imperfect competition and adjustment costs are also discussed in this thesis.

employer and the amount actually paid to the employee. Under this closure the labour subsidy will lead to an increase in labour demand as labour is now cheaper to employ. Consequently the costs of production fall and so too does the consumer price index (CPI), which means that the real wage increases.

- *Fixed Real Wage Closure:*

Under this closure rule, the real wage is not affected by labour demand. Following the introduction of the subsidy nominal wages will fall, again making labour cheaper to employ. Again the CPI falls but the fixed real wage holds as the reduction in the CPI is equivalent to the reduction in the nominal wage.

- *Real Wage Bargaining:*

Under this closure rule the regional real wage is directly related to workers' bargaining power. In turn this means that it is inversely related to the regional unemployment rate. The labour subsidy of course reduces the nominal wage paid by employers which means that labour demand rises. However, this in turn drives up the real wage and in turn the nominal wage rises. The CPI also increases with the nominal wage which, in turn, affects labour supply due to wage bargaining. The wage bargaining curve is determined by econometric coefficients determined by Layard *et al.* (1991). Under this closure rule a lower level of employment and a higher real wage are observed as compared to the fixed real wage results.

- *Extreme Insider Model:*

Under the extreme wage bargaining position the cost of labour for the firm actually rises, despite the subsidy. The subsidy provides a fiscal stimulus and leads to an increase in the demand for labour. However, union intervention drives up the cost of labour until labour demand reaches zero.

Some CGE models use a more basic approach to unemployment treatment, in that labour supply is determined by an equation based on the real wage and the elasticity of labour supply. So that labour enters/exits the labour market at a rate determined by changes in the real wage and the associated supply elasticity. This approach is more commonly known as the endogenous labour supply approach. A useful example of this approach is de Melo and Tarr (1992) where leisure is incorporated as a component of the household utility function. Annabi (2003) illustrates that this approach can be adapted to incorporate a minimum amount of leisure.

Another useful closure is that described by Blake *et al.* (2002). This approach resembles the 'new growth theory 'as described by Mankiw, Romer and Weil (1992), in that it allows for human capital appreciation in the growth process. This closure treats labour in a similar manner as capital and is particularly suited to dynamic modelling. The long-run growth rate of output per worker is determined by the exogenous growth rate of technological progress, this is akin to the explanation given in Romer (1992). Thus, human capital per worker grows at rate g, which is the same rate as capital growth in the benchmark. The approach also assumes a degree of labour market rigidity. Rigidity occurs due to the fact that due to structural unemployment workers will not instantaneously seek employment in a different area of work or sector. Neither can they be directly re-employed without loosing some productivity. For example, it is not straightforward for an agricultural worker in the north of Spain to be re-trained as a hotel worker in the south of the country, if the tourism sector expands and the agricultural sector contracts as the result of an exogenous shock. Some agricultural workers will not have an immediate desire to work in the tourism sector and may seek jobs in parts of the agricultural sector that are not contracting as rapidly as others, perhaps for lower real wages. Other agricultural workers will seek to move into the tourism sector in search of higher real wages. However, a degree of re-training that will be required which is akin to an adjustment cost, see Ju (2001) for an explicit evaluation of a possible adjustment process. During this period of retraining, there will be a loss of productivity for the recipient firm. Further, unemployment is also incorporated in this approach, using the endogenous labour supply function.

In terms of choosing a labour market closure for the Spain model, the approach of Blake *et al.* (2002) is considered the most suitable. This choice is made because of the absence of a recent and robust labour supply elasticity available for the Spanish economy either for the national or regional level. Further, supporting econometric evidence equivalent to Layard *et al.* (1991) as used in Harrigan *et al.* (1996) is also not available. The importance of the labour market in this thesis is somewhat secondary and its parameters are not subject to exogenous shocks. Nonetheless, the Blake *et al.* (2002) approach explicitly captures the structural rigidity of the labour market described in chapter 2, that other closures do not do in such a direct fashion. It also captures human capital accumulation which can give insights as to how the economy responds to policy shocks ceteris paribus and in turn how policy can be tailored to facilitate human and/or physical capital accumulation.

3.5.3 Issues in Modelling Ownership and Location

So far it has been noted that the analysis of services trade can be better facilitated by accounting for increasing returns to scale, product differentiation, non-storability and the consideration of economies of scale, scope and sunk costs. By building such features into CGE models and incorporating international capital mobility the predictive power and accuracy of the model increases significantly. However, the way that these features are incorporated can have a significant impact on the results generated by the model, (Dee, 2001). These issues are discussed below.

The Nature of Economies of Scale

We must ask ourselves whether economies of scale are regional or global Dee (2001). or more practically speaking, if we differentiate between domestic and foreign service firms are they substitutes at the margin? Such an assumption has a significant influence over the models nesting structure. If economies of scale are global then we would not differentiate between domestic and international producers hence all firms appear in a single nest in the preference structure. However, if they differ significantly between domestic and international producers, or even by alternate source countries or domestic regions then a multiple layers nesting structure is required. Also, if economies of scale are global they will be much larger than if they are regional, (Dee, 2001).

Francois *et al.* (1996) argue that economies of scale are global. In their GTAP based model they choose a monopolistically competitive structure, whereby firms specialise in particular product varieties (Krugman, 1980 and Ethier, 1982). Francois *et al.* (1996) note that as monopolistic firms specialise in the production of intermediates, greater returns are realised since they have access to a broader range of inputs. Hence economies of scale can be realised globally since the gains from specialisation can be further realised when the intermediate goods are traded. For example, as a firm specialises it is likely to see its fixed costs rise (possibly through increased investment in R&D), increased global sales can help disseminate these centralised fixed costs over a broader market base.

However, as previously discussed Ethier and Horn (1991) have noted that services are often tailored to the individual needs of consumers. In practical terms it is easy to see how such a concept might lead to a service supplier incurring additional fixed costs in order to understand local market characteristics or regulatory frameworks. Dee (2001) provides us with a useful example, which can easily be adapted for the tourism sector. Suppose an international hotelier wanted to set up in an overseas location, before they did so they would need to investigate the accounting, employment and taxation regulations of that country, they may well have to investigate local bylaws regarding hotel construction and operation. In models where hoteliers establish regional outlets and those outlets acted as individual profit centres, the fixed costs of obtaining knowledge relating to overseas local markets would be offset against the regional outlet rather than the global chain. If a hotel chain had not considered the characteristics of the local market before establishing an outlet then it may be the case that customers would not view the establishment as a suitable substitute at the margin.

Based on these considerations Dee and Hanslow (2001) treat economies of scale as regional in all markets based on the assumption that even global producers tailor there products to meet the needs of local producers,for example, McDonald's change the flavour and content of Big Macs to suit local tastes. While Markusen, Rutherford and Hunter (1996) illustrate that the welfare effects of trade liberalisation differ significantly when firms coordinate their decision making processes over regional locations.

Ownership vs Location The consumer has to make a clear choice between ownership and location. Substitutes can either be chosen on the basis of ownership and then location or vice versa, but as Dee (2001) points out, which way round should it be?

Petri (1997) develops a CGE model whereby consumers allocate demand between domestic and foreign varieties based upon their ownership and then their location. For example, Japanese consumers could purchase American cars from U.S. subsidiaries located in Japan, or from any other global location. The model assumed that the Japanese consumer sees American cars as a closer substitute, no matter where they are purchased, than a domestically produced alternative. Petri makes an important point in that FDI does not merely promote increased production of a commodity in the host economy; it also changes how the products of that economy enter world demand. Petri does however, point out many of these linkages will be inactive at any given time. If the model is implemented in this way then it enforces on the model the assumption that the elasticities that govern choices among different sources of regional varieties are very high. Thus, *ceteris paribus*, price differences across alternative sources of the same variety are high. So, in turn, firms have to absorb substantial differences in regional production into their profits, and profit differences subsequently drive investment allocations.

Dee and Hanslow (2001) operate the alternative choice structure, returning to the example of the Japanese car buyer. In their model it is assumed that a domestically produced car is a better substitute for an American car purchased from overseas. The reason for not following Petri's treatment stems from the results which emerged from his model, some of which differ significantly from conventional trade theory. Petri simulates a reduction in tariffs in the APEC trading block. Despite the trade liberalisation, output declines in the manufacturing sector in some of the APEC regions. If Petri's decision tree is followed, consumers must choose between the output of a domestic firm and the output of a foreign firm, irrespective of where these firms are located. The foreign firm will have an outlet in the host nation and in its home nation, both of which can be accessed by the domestic consumer but only goods purchased from the latter will attract a tariff. Depending on relative shares there is no guarantee that the price of the foreign good will be dominated by the removal of the tariff or by changes in the cost structure of the foreign outlet. The results of the simulation indicate that in a model with such a structure the price of the overseas aggregate rose relative to the domestic aggregate in response to the tariff cut. Thus, resources moved into the domestic protected sector as its protection was removed. Consequently allocative efficiency deteriorated and there was an overall welfare loss.

3.6 Conclusion

This chapter has sought to provide an extensive review of the literature associated with the interaction between tourism and services trade. The importance of recognising key characteristics of the service sector such as non-storability and product heterogeneity has been identified. While modelling solutions such as CGE models with imperfect competition and dynamics have been discussed as possible solutions to such problems. The extensive impact that tourism has on the economy is also discussed. The direct and indirect effects of tourism related expenditure are considerable and difficult to measure. Therefore, the use of a CGE modelling approach is seen to be justifed so as to attempt to capture the major economic effects of tourism impacts. It can be seen in the review of the literature that few dynamic CGE models have been built with increasing returns to scale. Further, none yet have attempted to implement the extensions suggested by De Santis (1999, 2001) with regard to conjectural variation parameters. Discussion of the literature also reveals that so far, attempts to incorporate foreign direct investment in CGE models have been quite simplistic and there is certainly scope for improvement in this area. The next chapter looks at the underlying equations relating to the CGE model that is constructed as part of this thesis.

Chapter 4

A Computable General Equilibrium Model of Tourism in Spain

4.1 Overview

The purpose of this chapter is to describe the key data sources and model equations that will be used in the various models throughout this thesis. While three different models are constructed, the core equations, elasticities and closure rules differ only slightly. The model presented in this chapter explains the national model for Spain used in the next Chapter. The differences between the core model and the various regional models are given in the opening sections of the relevant chapters.

4.2 The IO Database

This next section details the core datasets used in the construction of the CGE models in this thesis.

4.2.1 Structural Linkages and the Social Accounting Matrix

The fundamental data source for a CGE model is an Input Output (IO) table. This dataset is a subset of, and represents the majority of, the Social Accounting Matrix (SAM). The IO dataset set embodies many of the structural features of the SAM, although it contains slightly less institutional detail (Reinert and Roland-Holst, 1997). It is the SAM that represents the major linkages captured in the CGE model. IOs/SAMs embody one of the fundamental principles of economics: for every income receipt in the economy, there is a corresponding expenditure outlay. An IO/SAM is a matrix based on the macroeconomic accounts and the detail and dimensions are limited by the aggregation of these accounts. The general IO/SAM format is that incomes are shown in the rows of the matrix and expenditures are shown in the columns. IO/SAMs are useful in that they provide information about the interrelationships between production sectors, and give details of related data on value-added, government and household consumption, imports and exports. While a SAM is the preferred data source for CGE models, very few countries actually produce an official SAM. They are not a mandatory requirement under the UN system of national accounts or for Eurostat, the EU statistical agency. Further there is little consensus amongst statistical institutions as to what actually constitutes a SAM.

Unfortunately, as with the majority of countries in Europe, an up to date officially produced SAM is unavailable for Spain. A 16 sector, 11 household SAM was produced for Spain for the year 1990 by the Spanish national statistical agency the Instituto Nacional de Estadistica (INE). Components of the 1990 SAM were updated to 1995 in a later study, although a full SAM is not publicly available for that year. It is felt that the 1990 SAM is too out of date to produce up to date policy relevant information, particularly with the changing nature of the value added blocks and the intermediate use coefficients. Therefore, the fundamental relationships in the SAM can be inferred from the IO tables and, where possible, reconciled with published data from the national accounts. At the time of writing this thesis the INE had published IO tables relatively infrequently with a lag of several years. The most recent available was the 1996 IO table (IO-96) which is published for 110 sectors. The IO-96 also includes an equivalent supply matrix and supplementary information on distributors margins and taxes on products (which largely consists of VAT).

Figure 1 presents a stylized SAM as per Robinson (1991) and Sadoulet and de Janvry (1995), this is representative of the standard SAM used in the majority of CGE models and is broadly representative of the SAM used in this thesis. This particular SAM defines six balanced expenditure-receipt accounts for the major economic actors in the model: the activities, commodities, and factors (labour and capital) accounts; the current accounts of the domestic institutions, divided into households and the government, the capital account and the rest of the world account.

The accounts in the SAM are as follows:

- Activity (Production) Accounts: In this column, A represents intermediate goods and raw materials, which are the Leontief coefficients in the supply and use tables. Intermediates are purchased to produce commodities. The remainder of total payments represents payments to the factors of production in terms of wages $\mathbf{Y_L}$ and capital rental $\mathbf{Y_K}$. Part of the value added is payable to government via taxes on products or indirect taxes $\mathbf{T_X}$. The expenditures for row 1 refer to sales to the domestic market and exports (**E**).

- Commodity Accounts: These represent the domestic product market. Commodity accounts produce both domestically produced and imported goods. Import tariffs are also included. Expenditures on commodities are purchased by institutions i.e. households and the government (**G**). Households purchase commodities for non-tourism consumption $\mathbf{C_N}$ and domestic tourism consumption $\mathbf{C_T}$. Commodities are also purchased for investment purposes **I**, which is more commonly known as Gross Fixed Capital Formation (GFCF). Foreign tourists (**FT**) also consume domestically produced commodities.

- Factor Accounts: Factors receive payments in terms of in terms of wages $\mathbf{Y_L}$ and capital rental $\mathbf{Y_K}$. These revenues are distributed to households net of taxes on production, which is an aggregate of capital and labour taxes $\mathbf{T_L}$ and $\mathbf{T_K}$. Labour taxes are net of social security contributions.

Figure 4.1: The Stylised Spanish SAM

	Expenditures									
Receipts	Commodities	Activities	Labour	Capital	Households	Government	World	Capital	**Total**
Commodities		A			C_N, C_T	G	FT	I	**Domestic Demand**
Activities	D						E		**Production**
Factors:									**Gross Domestic Product at Factor Cost**
Labour		Y_L							
Capital		Y_K							
Institutions:									
Households			Y_L-T_L	Y_K-T_K		Transfer	Transfer		**Household Income**
Governments	T_M	T_X	T_L	T_K	T_H				**Government Income**
Rest of the World	M				Outbound				**Imports**
Capital Account					S_H	S_G	S_F		**Total Savings**
Total	**Absorption**	**Total Payments**	**Wages**	**Profits**	**Household Income**	**Government Revenue**	**Foreign Exchange Earnings**	**Total Investment**	

- Institutions: The two institutions in this model are households and governments. Firm transfers are modeled implicitly i.e. rather than firms receiving profits and distributing them to households and government and investment, this is all done directly through the household mechanism. Household incomes include returns from factors and transfers from government. Household consumption consists of tourism and non-tourism consumption. Residual savings are transferred to the capital account. The government account is distinct from administrative activities included in the activity accounts. The government account engages in expenditure, net residual income is transferred to households and remaining savings are transferred to the capital account.

- Savings-Investment Account: The government capital account is separate from that of private institutions. The capital accounts collect savings from households $\mathbf{S_H}$ and governments $\mathbf{S_G}$ together with net foreign capital transfers (also called foreign savings) $\mathbf{S_F}$. It is these savings that finance GFCF and changes in stocks (**I**).

- The Rest of the World: The domestic economy receives payments for exports **E** and foreign tourism **FT** and pays for imports and holidays abroad (**Outbound**). The current account deficit is covered by net foreign capital inflows $\mathbf{S_F}$. As pointed out by Sadoulet and de Janvry (1995), it is rare for asset accounts to be included in SAMs. If the foreign currency used by the Spanish economy increases, then the amount of foreign borrowing will increase and the real exchange rate will depreciate. As pointed out by Sadoulet and de Janvry (1995) the fact that foreign borrowing matches the current account deficit is a standard result of national accounting. They also point out that "in the SAM framework, it is a mathematical necessity that if all other accounts are balanced, then the last one will also be in equilibrium".

Three different models are used in this thesis and each is based on its own SAM dataset. Supplementary information is used to improve the quality of the SAMs where possible. However, data which are available at the national Spanish level are not always available at the regional level. Further, regional CGE modeling requires different data components. Hence, the three models do differ in structure. Nonetheless, there are common steps that are taken in all three models, particularly in order to expand the number of tourism sectors in the model. The aggregation and rebalancing processes are described for each model in turn.

The various data sources have been aggregated to 16 economic sectors for the purpose of this thesis. The reason for this aggregation is twofold. Firstly, models with large numbers of sectors are difficult to implement in both a dynamic and regional context, as the number of variables in the model dimensions is greatly increased as a result of either multiple time-periods or regions; this capacity is limited by the GAMS[1] solver. Secondly, in order to reconcile the regional input-output tables used in Chapter 6, a relatively high level of aggregation had to be used as the IO tables differ significantly between the autonomous communities for which they were available.

4.2.2 The Spanish National Dataset

The IO-96 is a 110 sector product x industry Supply Use Table (SUT) at constant basic prices. It is a relatively standard SUT with an equivalent imports use matrix and associated make matrix. A stylistic representation of the IO-96 use table is given in Figure 4.2 below. The main matrix (A) contains the input-output structure[2], which shows both the imported and domestically produced goods. In the case of the regional model used in Chapter 6 an additional section is incorporated into all regional tables so as to distinguish between imports from other Spanish regions and imports from abroad. Other columns in IO-96 give details of the final demands of private/household consumers (**PRICON**) and government (**GOVCON**). Additional data on the expenditures of domestic tourists (**DTOUR**), and foreign tourists (**FTOUR**) are added to the table (the method of which is discussed below) The inclusion of tourism expenditures allows tourism to be evaluated in terms of the demand-side, rather than by tourism characteristic sectors. Further sectoral information is given relating to capital investment i.e. gross domestic fixed capital formation (**GDFCF**), inventories (**INV**) and exports – both to the EU (**X_EU**) and the rest of the world (**X_ROW**). Information is also given on interelations between the different accounts in term of value added, this is termed the **transactions** matrix and is separately sourced from the institutional accounts component of the national accounts. The instititional accounts also give details of the balance of foreign trade, net foreign capital flows

[1]The CGE models used in this thesis are constructed in the GAMS/MPSGE programming language. GAMS is the main software tool for CGE modellers.

[2]This is identical to the matrix A given in the Spanish SAM in Table 4.1.

and the level of foreign savings necessary to cover this shortfall.

Expenditure on the factors of production is given in the sub-matrix **V**. This includes the returns to labour, capital and the associated net production tax/subsidy and taxes on products which comprise largely the value added tax (hence the label **VAT**). Additional detail is given in relation to the total supply of imports and associated tariffs in sub-matrix **M**, in the case of the regional tables. Trade flows between regions are incorporated as well as imports from the EU and from the rest of the world.

Figure 4.2: The Stylised IO Table

		Production Activities	Final Demand Activities									Total Demand
			Expenditure				Stocks and Investment		Exports			
			Private Consumption	Government Consumption	Domestic Tourism Consumption	Foreign Tourism Consumption	Gross Domestic Fixed Capital Formation	Inventories	Regional Exports	Exports to EU	Exports to ROW	
Goods	Domestic Goods	A	PRICON	GOVCON	DTOUR	FTOUR	GDFCF	INV	PRICON	X_EU	X_ROW	D
	Inter-regional Goods											
	Imported Goods											
Value Added	Compensation of Labour	V	Institutional Transactions									
	Operating Surplus											
	Taxes on Production											
	Taxes on Products (VAT)											
Total Output		O										
Imports	Imports - Rest of Spain	M										
	Imports											
	Imports Tariffs											
Total Supply		S										

Before the IO-96 is aggregated to 16 sectors, several adjustments are made. Firstly, the emphasis of this thesis is on tourism, so effort is made to disaggregate the IO-96 to reflect characteristics of the tourism sector where possible. To do this, the IO-96 is merged with a precursor to the Spanish TSA, a tourism orientated input output table for the year 1992 (TIOT-92). The TIOT-92 is a 50 sector IO table, which follows a similar format to the IO-96, except for the fact that it does not have a make matrix or details of taxes on products or distributors' margins. There is also no information on tariffs. The TIOT-92 is particularly useful as it has specific details of accommodation products and associated industry output. Data relating to the hotel, hostel, camping and 'other accommodation' products are provided in the tables. It also provides details relating to the components of domestic and foreign tourism consumption.

The coefficients for accommodation products from the TIOT-92 are used to split the hotels sector in the IO-96. In order to do this the IO-96 is aggregated to an equivalent 47 sector level (i.e. 50 sectors minus the hotel sector but including hostel, camping and 'other accommodation' sectors) and then the hotel sector is disaggregated accordingly. This is done within the conventions of the internationally recognised Sectoral Industry Classification (SIC) codes. In addition to this, an important component of the general equilibrium model used in this thesis is the determination of tourism consumption proportions. These are determined for both foreign and domestic tourism consumption. The proportions are taken directly from the 50 sector TIOT-92 which gives details of these proportions explicitly. Thus the 110 sector SUTs are aggregated to an equivalent 50 sector level and domestic tourism proportions are allocated accord to those in the TIOT-92. Domestic tourism is extracted from the household consumption column and foreign tourism is extracted from the exports column depending on the proportions of EU and Non-EU visitors. This is consistent with the construction of the TIOT-92 and the representation of exports from tourism characteristic sectors.[3]

The next step in augmenting the SAM addresses a common problem in CGE modeling. As has already been noted, IO data are not prepared annually by the INE, but there is a need to use recent and consistent data to support policy analysis (Robinson *et al.*, 2001). A standard approach is to start with a consistent IO table and then update, given new information on row and column totals, but no up-to-date information on the flows within the tables. The proposed augmentation is to update the IO-96 to the year 1999, the year for when, at the time of writing this thesis, national accounts data are most readily available. 1999 was felt to be a fairly atypical year in the Spanish economy, it is shown in Chapter 2 that output growth was fairly stable based on the previous year. Choosing the base year of a CGE model is always difficult, generall modelling convention dictates that the most recent year for which and IO table or SAM is produced is chosen as this year provides the most upto date picture of the economy and in particular the most recent input-output coefficients. There will of course be volatility between years in terms of key economic variables. However, CGE modelling is designed more to give an indicative description of structural economic outcomes, where particular volatility occurs, results should be caveated accordingly.

Column totals for the IO-96 are published annually as part of the national accounts. These

[3]A more detailed discussion is given in section 4.2.5.

include a breakdown of factor returns, taxes on production and final demand data. Further sectoral data are also available for final demands (consumption, investment, government expenditure, exports) and imports. Data are also published regarding GDP using the income-expenditure calculation method. Several different iterative balancing techniques were considered in order to undertake the updating process; the RAS approach (Gunluk-Senesen and Bates, 1988), the quadratic approach (Schneider and Zenios, 1990) and the cross entropy (CE) approach (Robinson *et al.*, 2001). The quadratic approach is largely dismissed as it is rarely used in the economics literature. A comparison by Harrigan (1990) notes that the superiority of the CE and quadratic approaches cannot be proved in terms of the relative superiority of the closeness of estimates. However, Golan *et al.* (1996) note that the quadratic measure adds unwarranted information to the estimation procedure, while the principles of information theory which should largely be applied to matrix balancing techniques state that only relevant information should be used. On this basis we proceed with a comparison of the RAS and CE approaches. McDougal (1999) notes that the RAS and the entropy approach are equivalent 'or friends' when the CE method uses a single objective measure (cell coefficients measured relative to the sum of all flows in the IO/SAM and weights are row or column sum values which are treated symmetrically) as opposed to using the sum of column cross entropies (i.e. differences) normalized relative to the column totals.

Robinson *et al.* (2001) compare the RAS approach and the cross entropy approach and point out that intuitively the RAS method tries to maintain the value structure (flow-dependent) while the CE method tries to maintain the coefficient structure (column-coefficient dependent). Robinson *et al.* also point out that if the purpose of producing an updated IO/SAM is to obtain improved estimates of column coefficients, or to provide share coefficients for a CGE model, the CE method is preferred. However, if the primary interest is in obtaining information regarding nominal flows i.e. row and column coefficients are equally important, then the RAS approach is intuitively more appealing. Robinson *et al.* test whether a significant difference exists between the two methods given that RAS is a special case of CE and find that while differences are not vastly significant, the intuition above is supported.

On this basis, the CE approach is chosen because of the importance of the coefficient structure for the CGE model and the nature of the data available is primarily orientated towards updating column coefficient totals. Also, in practice, it is easier to impose binding constraints using the CE appraoch and generate a solution than using the RAS method. The binding constraints used, relate to additional information regarding the final demand block and tourism consumption data from the TSA. Further binding constraints relate to the institutional accounts which give details of household, firm and government savings and the current account balance. These are also used to constrain the CE balancing. The outcome is such that binding constraints are fixed while the structural differences between the prior (IO-96 revised SAM) and the new SAM are minimized on the residual sections. In the same way, the newly computed row and column totals from the revised IO matrix are then imposed on the make matrix and it is rebalanced using the CE method again. Once the data are updated using this approach it is virtually complete and the revised SAM is then aggregated to 16 sectors to complete the updating process. Finally, the data were converted into Euros at the European Central Bank irrevocable conversion rate at which Spain joined the single currency in January 2001. This conversion rate appears consistent with adjusted data published by the INE for 1995 in Euros. This table is used for the Spanish analysis in Chapter 5. A full copy of the table is given with the data CD attached to this thesis.

Table 4.1: Summary Results From the Spanish Supply Use Table

	GDP (% of total) (1)	Share of Labour Returns (2)	Share of Capital Returns (3)	Capital-Labour Ratio (4)	Proportion of Foreign Tourism in Final Demand (5)	Proportion of Domestic Tourism in Final Demand (6)	% of Exports in Final Demand (7)	% of Imports in Final Demand (8)	% of Intermediate Imports (9)	Average Effective Tax Rate (%) (10)
1 Agriculture	4.1%	5.6%	3.2%	0.5	2%	3.1%	33.3%	8.5%	5.0%	-10.7%
2 Manufacturing	28.9%	25.6%	32.1%	1.0	1%	1.1%	18.3%	10.0%	12.1%	10.5%
3 Hotels	2.8%	3.3%	2.0%	0.5	47%	31.2%	0.0%	0.0%	1.5%	7.6%
4 Hostels	1.0%	1.1%	0.8%	0.6	54%	37.2%	0.0%	0.0%	2.3%	8.2%
5 Camp Sites	0.1%	0.1%	0.0%	0.4	40%	32.7%	0.0%	0 0%	3.4%	7 8%
6 Other Accomodation	3.0%	1.7%	4.5%	2.1	31%	9.6%	0.0%	0 0%	4.2%	13.7%
7 Restaurants	5.5%	6.9%	3.5%	0.4	19%	28.7%	0.0%	0.0%	1.3%	7.8%
8 Air Transport	0.4%	0.4%	0.7%	1.4	30%	24.2%	21.8%	4.7%	9.0%	-15.7%
9 Land Transport	4.8%	6.1%	4 4%	0.6	1%	8.0%	17.6%	1.1%	3.3%	-12.0%
10 Sea Transport	0.9%	0.8%	1.1%	1.1	4%	2.5%	55.5%	1.0%	3.1%	-1.4%
11 Travel Agents	0.4%	0.5%	0.3%	0.4	8%	63.9%	3.4%	1.4%	2.7%	8.1%
12 Passenger Transport Supporting Services	0.4%	0.4%	0.5%	1.1	18%	24.7%	4.1%	0.2%	4.0%	10.2%
13 Car Rental	0.3%	0.3%	0.4%	1.3	17%	15.2%	3.9%	2.8%	1.0%	13.5%
14 Leisure	1.5%	1.7%	1.3%	0.6	19%	45.8%	0.1%	0.0%	6.9%	9.9%
15 Public Sector	10.7%	14.3%	6.0%	0.3	0%	0.3%	0.7%	0.0%	3.7%	6.3%
16 Other Services	35.3%	31.1%	39.4%	1.0	1%	1.1%	13.4%	2.7%	3.9%	11.0%
17 Total	100%	100%	100%	-	-	-	-	-	-	-

Source: Adapted from the 1996 SUT for Spain

Table 4.1 shows a summary of data from the updated IO-96 table aggregated into the sixteen sectors used in the CGE model. Column 1 gives details of the GDP share of each of the sixteen sectors modelled. It can be seen that the services sector (35.3%) is the largest single sector in the aggregated SUT. Following the disaggregation the hotel sector accounts for 2.8% of national GDP, while the other accommodation sector accounts for 3.0%. The restaurants sector accounts for 5.5%. Colums 2, 3 and 4 give details of the earnings attributable to capital and labour in value added and the capital labour ratio. The majority of sectors in the Spanish economy are labour intensive, particularly those related to tourism. The "other accommodation" sector is shown to be the most capital intensive, as most of its earnings come from the capital stock i.e. buildings. Columns 5 and 6 give details of the proportions of domestic and foreign tourism consumption in final demand. These are discussed in detail later in the section with regard to determining whether sectors are tourism characteristic or not. Columns 7, 8 and 9 give details of the trade structure and show the proportion of exports in final demand, the proportion of imports in final consumption and the proportion of intermediate imports. It can be seen that the agriculture and manufacturing sectors are the most exposed to international trade fluctuations, baring the the tourism sectors. Finally, column 11 gives details of the average effective tax rates for taxes on production. It can be seen that the agriculture and some transport sectors receive large government subsidies.

Aggregate figures from the adjusted national and regional SAMs are given in Table 4.4 and discussed later in this section.

4.2.3 The Regional Dataset

The regional CGE model is also based on the Spanish national SUT for1996 (IO-96) discussed above. Additional input-output tables were obtained for four autonomous regions of Spain, but for different base years, these are: Andalucía (1995), the Canary Islands (1992), Castilla y León (1995) and Madrid (1996). A structural comparison of the various Spanish regional IO tables is documented in Fontela *et al.* (1999). Although more regional IO tables exist for Spain, it was only possible to obtain four of them either due to reasons of confidentiality (as was the case of the Balearics) or due incompleteness (e.g. Valencia). Tables for the four regions that were obtained, are very different in structure. A quantitative way of illustrating the alternative structure of input-output tables is to use the Le-Manse similarity index. [4] Results are presented from Fontela *et al.* (1999) in Table 4.2 below:

Table 4.2: Le Manse Similarity Indices for the Spanish Regional Input Output Tables

	Year	Number of Sectors	Le-Manse Similarity Indices		
			Canary Islands	Castilla y León	Madrid
Andalucia	1995	89	78.65	76.26	80.49
Canary Islands	1992	59		79.8	78.93
Castilla y León	1995	57			79.24
Madrid	1996	57			
Rest of Spain	1995	70			

Source: Adapted from Fontela *et al.* (1999)

The Andalucía-95 IO table has 89 sectors, the Canaries-92 has 59 sectors, while Castilla y León-95 and Madrid-96 both have 57 sectors. The Spanish table is supplied by the Instituto Nacional de Estadistica, while the tables for the autonomous communities are supplied by regional statistical offices. All IO tables are product x industry format at producer prices. Aggregation differences exist between the regional IO tables due to alternative construction techniques and different regional policy needs. The table for Castilla y León reflects its status as a key industrial heartland of Spain, while the Canaries table is more focused on food production, as this is an important domestic production sector due to the remoteness of the Islands, while the table for Madrid is organised in favour of the service sector, reflecting the importance of financial transactions in this region. The general format of the regional IO tables follows that of the IO-96, however, some additional features are incorporated to capture features of inter-regional trade. Each table includes an additional use matrix to capture intermediate goods imported from other regions and from abroad and related final demand activity. The imports section of the regional matrices also includes goods imported into the stated region in Spain

[4] The Le Manse index is close to 100 in cases of high similarity

from the aggregate of other Spanish regions. Further to this there is an additional column which includes exports from the stated region to an aggregate of other Spanish regions.

As in the case of the Spanish national table, several adjustments are made to the regional tables. Two key steps are undertaken. Firstly, in the same way as for the IO-96 the regional IO tables are adjusted to incorporate the tourism characteristic sectors using coefficients for the TIOT-92. Secondly, the reaggregated tables are updated to the base year of 1999 using published regional accounts data. These steps are described below.

Due to the fact that the regional IO tables are aggregated to emphasize the main products produced by the regional economies, matching sectors with the TIOT-92 and then disaggregating out the tourism characteristic sectors is not as straightforward as with the IO-96. Details of the sectors which represent aggregates of tourism characteristic industries are given in Table 4.3. It can be seen, for example, that the Castilla y León-95 and Madrid-96 tables do not have separate restaurant and hotel sectors, and that Madrid does not have a leisure sector. On this basis, sectors from the regional IO table are reconciled with the TIOT-92 according to the SIC. Coefficients from the TIOT-92 are then used to estimate tourism characteristic sectors and domestic and foreign tourism consumption in the final demand block. This method is an accepted practice in CGE modeling and is used widely for the large global CGE models such as GTAP and by various governments.

Table 4.3 Tourism Characteristic Sectors in the Benchmark Dataset

	Restaurants	Hotel	Hostel	Camping	Other Accommodation	Travel Agents	Leisure
Andalusia-95	X	X	-	-	-	-	X
Canaries-92	X	X	-	-	-	-	X
Castilla y León-95	Combined		-	-	-	-	X
Madrid-96	Combined		-	-	-	-	-

Following these adjustments, the regional IO tables are aggregated to match the annually published regional accounts at the 30 sector level[5]. As part of annual regional accounts, data are published for returns to factors and taxes on production and GDP. Some data are also available in relation to household consumption. In the same way as for the IO-96 these data are used to update the regional IO tables. The CE method is again used to balance the tables, although household consumption and supplementary data regarding regional government expenditure are the only binding constraints. Data were then aggregated to a consistent 16 sector level.

Tables for the four regions were initially deducted from the Spanish national table to provide a Rest of Spain region. The result of using a simple subtraction process proved to be inadequate due to a number of resulting negative cells, therefore the Rest of Spain table had to be re-balanced to remove these entries as they are inconsistent with Input-Output theory. The approach of Robinson and El Said (2000) was used to remove negative entries and rebalance the table. The RAS approach was not considered for this as it cannot deal with negative entries.

As previously noted, all the regional IO tables include data on imports and exports from other regions in Spain, including a use matrix of these imported goods. Obviously this use matrix is absent from the Spanish national table, so it must be estimated for the new rest of Spain region. The key binding constraint on this table is that it must counter balance the interregional trade deficit/surplus generated by the other regions. There is effectively no prior information to undertake a balancing procedure to construct this matrix so an assumption of symmetry is taken. The coefficients from the equivalent matrix in each region are summed and weighted according to their share of regional GDP. These coefficients are then used as a prior to construct the regional matrix. As we are primarily interested in the flows in this instance, the RAS method is used to rebalance this matrix. This matrix refers to domestically produced goods, so is deducted from the domestic use matrix for the 'rest of Spain' region.

4.2.4 Macro Balances

Tables 4.4a and 4.4b provide information relating to the key macro balances in various SAMs used in this thesis. The estimated GDP for Spain in 1999 is approximately half a trillion Euros (€512,097 million) at constant prices. The largest region which is separately modelled is

[5](Contabilidad Regional de España: Base 1995, various years, INE 2000)

Madrid[6], which accounts for approximately 16.5% of national GDP. In fact out of all the regions in the Spanish regional accounts, Madrid has the largest regional economy. The second largest region is Andalucía which accounts for approximately 12.7% of national GDP. While the other regions Castilla y León and the Canaries contribute much smaller shares to national GDP, 5.5% and 4.6% respectively. In the regional CGE model used in Chapter 6 the four regions modelled account for approximately 40% of national GDP.

In terms of factor use, the Spanish economy is predominantly labour abundant. Returns to labour are approximately €250 billion, while returns to capital are approximately €202 billion. Of all the regions in the model, the Rest of Spain are the most labour intensive, with a capital labour ratio of 0.77 as compared to the whole of Spain which has a ratio of 0.80. When calculating GDP at factor cost, taxes on production are also included and are detailed at the sectoral level in the SAM. Taxes on production are given net of subsidies and include business rates, personal taxes paid by businesses (e.g. car tax) and subsidies that central government gives to specific sectors e.g. cash allocated from the common agricultural policy. Some regions also give details of social security payments, although these details are not given at the national level, returns to labour are given gross of social security payments.

Table 4.4a also gives details of the trade balance and the current account balance. In terms of traded goods and services the Spanish economy imports significantly more than it exports. Spain has been characterised with a persistent trade deficit for many years. This point was identified in chapter 2. There is volatility in the trade deficit although this has been decreasing in recent years. The current account balance is also stabilising due to more steady growth in tourism flows. Unfortunately, data from a single period cannot capture the volatilty is variables such as the current account balance or the trade deficit. However, 1999 can be accepted as a fairly stable year and a good representation of Spain in the late 1990s. It captures both the decline in current account and in unemployment that have been observed in recent years in the Spanish economy. While volaility is an important point, it should not divert from the focus of this thesis, which is to evaluate the structural linkages and impacts of changes of economic variables relating to the tourism sector. The strength of CGE modelling lies in analysing policy changes in an environment that is felt to be both indicative, yet able to highlight key structural

[6]The Rest of Spain region (ROS) is effectively a residual region and its properties are not discussed explicitly.

features of the Spanish economy and rank their importance accordingly. The same principles hold for other variables where volatility may be observed.

Most of the trade that Spain undertakes is with the EU, and this is largely a free trade area for Spain. The national trade deficit is approximately 21% of GDP. Larger regional trade deficits are observed in the Canaries (33.0%) and the Rest of Spain (22%). Most regions trade deficits are made worse when inter-regional trade is factored in. All regionsthat are modelled explcitly import more from other regions in Spain than they actually sell. The Canaries in particular have a significant inter-regional trade deficit of approximately €3 billion, meaning that the regionally adjusted trade balance is approximately €8.9 billion , this outcome is similar across all regions presented in Table 4.4a.[7] The trade deficit plays an important role in the interpretation of the model results. There is a high import content in Spain. Therefore, any fluctuation in the real exchange rate, should theoretically at least, have significant implications for domestic output. However, as seen in Table 4.1 that all sectors have an imported intermediates component, so this will dampen any potenital substitution effects brought about by a change in the relative price of imports.

Another key factor that plays a crucial role in the results of the model is the scale of foreign tourism with regard to the trade deficit and GDP. Foreign tourism consumption is estimated to be around €33.6 billion in 1999, which accounts for approximately 6.6% of GDP for the whole of Spain. This is consistent with the values given in the Spanish TSA for the year 1999. Comparing this figure with export earnings, it can be seen that foreign tourism accounts for around 30% of foreign currency earnings. The region with the largest share of foreign tourism consumption in GDP is the Canaries, with 23.5%, while Castilla y León this figure is much lower at 0.8%. Domestic tourism consumption overseas is also taken from the 1999 TSA and is valued at approximately €7.9 billion. So it can be seen that net tourism foreign currency earnings are also significant and that there is a tourism trade surplus. It can be seen that when factoring in tourism foreign currency earnings, the trade deficit improves significantly both at the regional and national level. In the Canaries, for instance, the compensatory effects of approximately €7.9 billion worth of foreign tourism consumption as opposed to only €321 million worth of outflows of foreign tourism are significant, meaning that the current account balance improves

[7]Madrid is the only region with a positive trade and current account balance throughout.

significantly to -€1.4 billion, which is 5.7% of regional GDP. In fact, foreign tourism earnings are larger than export earnings in this region In fact this is the case in most regions, in Andalucía for instance, foreign tourism earnings are nearly as large as export earnings, whereas for the whole of Spain, the foreign tourism export ratio is 0.43. Therefore, eny fluctuation in foreign tourism demand will have major implications for Spain's foreign currency earnings. Similarly, changes in the real exchange rate will have significant impacts on foreign tourism consumption and in most regions, output.

Table 4.4a: Macro Balances for the Regional and National Models

1999 Euros Millions at Constant Prices	Spain	Andalucia	Canaries	Castilla y León	Madrid	Rest of Spain
GDP at factor cost	512,097	65,145	23,324	28,255	84,633	310,740
(% of Total)		12.7%	4.6%	5.5%	16.5%	60.7%
Returns to Labour	252,233	31,806	11,063	12,927	40,698	155,739
Returns to Capital	202,394	25,259	9,759	11,879	35,731	119,766
Capital Labour Ratio	0.80	0.79	0.88	0.92	0.88	0.77
Taxes on Production	17,662	2,895	954	940	2,821	10,051
VAT	39,808	5,185	1,549	2,508	5,382	25,184
Exports	78,170	6,351	2,095	5,628	29,752	34,344
Imports	107,625	11,120	7,674	4,964	15,713	68,153
(As a % of GDP)	21%	17%	33%	18%	19%	22%
Trade Balance	-29,455	-4,769	-5,579	664	14,039	-33,809
(As a % of GDP)	-5.8%	-7.3%	-23.9%	2.4%	16.6%	-10.9%
Inter-Regional Exports	0	11,213	1,008	8,478	18,429	87,448
Inter-Regional Imports	0	22,836	4,353	9,416	19,230	70,741
Regionally Adjusted Trade Balance	-29,455	-16,393	-8,924	-274	13,238	-17,102
Foreign Tourism	33,602	5,384	7,904	260	2,711	17,343
(% of Total)		16.0%	23.5%	0.8%	8.1%	51.6%
(% of GDP)	6.6%	8.3%	33.9%	0.9%	3.2%	5.6%
Domestic Tourism Expenditure Overseas	7,946	1,055	321	461	1,363	4,746
Tourism Adjusted Trade Balance	-3,799	-12,064	-1,341	-475	14,586	-4,505
(% of GDP)	-0.7%	-18.5%	-5.7%	-1.7%	17.2%	-1.4%

Table 4.4b: Macro Balances for the Regional and National Models

1999 Euros Millions at Constant Prices	Spain	Andalucia	Canaries	Castilla y León	Madrid	Rest of Spain
Household Income	454,627	57,066	20,821	24,807	76,429	275,505
Household Expenditure (Non-Tourism)	309,724	44,863	16,010	16,388	39,823	192,640
Household Expeniture (Domestic Tourism)	34,851	4,792	2,365	1,328	2,999	23,368
(% of Total)		13.8%	6.8%	3.8%	8.6%	67.1%
(% of GDP)	6.8%	7.4%	10.1%	4.7%	3.5%	7.5%
Government Income	57,470	8,080	2,503	3,448	8,204	35,235
Government Expenditure	59,513	10,181	3,114	5,067	11,560	29,592
Government Surplus	-2,043	-2,101	-611	-1,619	-3,356	5,644
Savings	108,010	5,310	1,836	5,472	30,251	65,141
GDFCF Investment	101,813	15,969	2,851	5,375	14,002	63,617
Changes in Inventories	2,050	350	6	111	300	1,283
GDP at market prices	512,097	65,145	23,324	28,255	84,633	310,740

Household income is given as the sum of earnings from labour and capital in the value added component of the SAM. Household consumption of non-tourism and tourism goods and services is determined from commodity consumption data in the SAM (variables C_N and C_T in Figure 4.1). It can be seen that in all cases household expenditure is less than household income, which implies that there is a degree of household savings. The composition of savings is discussed later in this section. Household expenditure on domestic tourism refers to income that is earned in Spain that is also spent in Spain on tourism activity. It includes a range of activities, for example, domestic resident stays in hotel/hostel accommodation, business tourism activity, the booking of foreign holidays with Spanish travel agents and the purchase of retail products for tourism activity. It can be seen that domestic tourism consumption accounts for more GDP (6.8%) as foreign tourism activity (6.6%). This is consistent with estimates given in the 1999 TSA with earlier information in the TIOT-92. The region with the highest proportion of domestic tourism activity is Andalucía (13.8%). Castilla y León also has a significant proportion of domestic tourism consumption, it accounts for 4.7% of regional GDP, this is because this region has a significant cultural heritage.

In the Spanish national model government income consists of taxes on products, taxes on production and import tariffs. National accounts figures show that government expenditure is approximately 40% of GDP in Spain and government income is has been around 1-2% per annum lower than expenditure in recent years, while the PSBR is around 60% of GDP. However, data for government income and expenditure differ significantly in the Spanish IO-96. This is because taxes on factors such as labour and capital income are not explicitly stated in the tables, and consequently do not appear in the model. The term government expenditure refers to general government final consumption (consisting of pay, procurement and capital consumption), this total refers largely to the government departmental expenditure limits including spending on health, the armed forces and education. It does not refer to payments for pensions and social security, government debt interest, or locally financed expenditure. Hence, government income is only around 11% of GDP while government expenditure is only around 12% of GDP.

The government transfer to households is estimated to be around 0.5% of GDP which is approximately equal to the government deficit for 1999. So incorporating capital and income taxes etc., and social security payments etc., would not directly effect the results of the model. Rather it would just add to the scale of government activity not its actual economic impact given the closure rule assumed whereby government expenditure is fixed. The regional figures for government expenditure reflect spatial the distribution of centrally coordinated government expenditure. The degree of regional autonomy varies significantly across Spain, some regions such as Catalunia or the Basque have much more locally based power in terms of tax and spend decisions. However, the regions modelled do not have a significant degree of regional autonomy in terms of public finances.

Household savings equate to household income, minus household expenditure which is then adjusted by the government transfer to household, whether it be positive or negative. In all regions except for Madrid savings are positive but are less than GDFCF investment. The model is calibrated such that savings are equal to investment and the shortfall is made up from foreign savings. While GDP at market prices equates to consumption in the final demand block (households, government, tourists and exports) less imports (including Spanish outbound tourism).

4.2.5 Tourism Characteristic Sectors

Table 4.5 gives details of the tourism consumption ratios in the Spanish national dataset used in this thesis. The definition of a tourism characteristic sector is given in Table 1.1 in Chapter 1 of this thesis. It is defined as a sector where at least 25% of the industries output is consumed by tourists. In a similar way tourism related sectors are defined as sectors where between 5% and 25% of industry output is purchased by tourists. The sum domestic and foreign tourism consumption and output purchase shares and the corresponding classifications are given in Table 4.5.

Table 4.5: Tourism Characteristic Sectors in the Spain Model

	Non-Tourism Household Consumption	Domestic Tourism Consumption	Foreign Tourism Consumption	Tourism Classification
1 Agriculture	56.0%	3.1%	1.9%	Related
2 Manufacturing	45.0%	1.1%	1.1%	Unrelated
3 Hotels	16.0%	31.2%	46.9%	Characteristic
4 Hostels	8.3%	37.2%	54.5%	Characteristic
5 Camp Sites	26.9%	32.7%	40.1%	Characteristic
6 Other Accomodation	53.4%	9.6%	30.9%	Characteristic
7 Restaurants	48.1%	28.7%	19.4%	Characteristic
8 Air Transport	19.0%	24.2%	30.0%	Characteristic
9 Land Transport	58.9%	8.0%	1.3%	Related
10 Sea Transport	36.9%	2.5%	4.4%	Related
11 Travel Agents	25.2%	63.9%	7.5%	Characteristic
12 Passenger Transport Supporting Services	51.3%	24.7%	17.6%	Characteristic
13 Car Rental	55.6%	15.2%	16.6%	Characteristic
14 Leisure	17.0%	45.8%	19.1%	Characteristic
15 Public Sector	16.2%	0.3%	0.5%	Unrelated
16 Other Services	75.7%	1.1%	1.0%	Unrelated

The IO-96 has been deliberately disaggregated to reflect the tourism characteristic sectors in the model. 10 of the sixteen sectors defined in the model are tourism characteristic and a further 3 are tourism related. It can be seen that in some of the sectors that tourism accounts for nearly 100% of total product consumption. Some tourist characteristic sectors get used by locals for non-tourism activity, for example, local membership organisations may hire a meeting room in a hotel. The columns for domestic and foreign tourism consumption relate directly to columns 5 and 6 in Table 1.

4.3 Dynamic CGE Modeling

In order to make a CGE model dynamic, it is not sufficient to merely add a time subscript to all of the equations in an already solved static model (although this is a part of the process). Several assumptions need to be made about producer and consumer behavior, the terminal condition, the growth rate and the capital stock (Devarajan, 2000). The behavior of consumers and producers must be modelled so as to capture their inter-temporal decision making processes; i.e. their optimisation procedure is not based only on current prices, but also on expected future prices. In order to capture these effects, we must assume that the consumer's utility function is additively separable across time, with that utility being maximised subject to an intertemporal budget constraint, and that producers maximise the value of the firm (equal to the present value of net income).

As it is not physically possible to solve the model for an infinite number of periods, a terminal condition (T) must be specified. This model is calibrated to a steady state growth path, as is common with dynamic CGE models, see chapter 3 section 3.5.2 for details. Ideally the economy will return to the steady state growth path within some reasonable period after the counterfactual has been imposed on the model. T, will largely be dictated by the exogenous growth rate (g). If the terminal condition is set sufficiently far in the future, then g will not affect the behavior of the model in the early years, which as Devarajan and Go (1997) point out, are the years of primary interest to the modeler. In order to find a suitable value for T, Devarajan and Go run a simple counterfactual (increase the world price of exports by 10%) for $T = 5, 10, 20, 40, 60$ etc. and then choose T according to which value returns consistently to the stable steady state the fastest for a range of model outputs (i.e. consumption, investment etc.).

Whatever their structure, dynamic CGE models must satisfy the "golden rule", i.e. there is a level of the capital stock that equates the marginal product equal to the given interest rate (r). This parameter r can be thought of as the real rate of return to capital. It is different from the endogenously determined Although consistent with the majority of theoretical dynamic models, when solved numerically problems can emerge, as there is a tendency for models to almost immediately "jump" to this level of capital (Devarajan, 2000). This is known as a "bang-bang" solution, and is a common phenomenon when there are discontinuities with the control variables (in this case the investment function). However, such phenomena are inconsistent with real world behavior, so modelers tend to introduce an adjustment cost function that dampens the "bang-bang" effect. It is therefore assumed that there are real costs of installing capital. Most adjustment cost functions are based on Uzawa (1969), whereby capital installation costs depend upon the rate of gross investment relative to the existing capital stock. These tend to take the form of a quadratic function, whereby it is assumed that there is a cost to investment that is quadratic in the ratio of investment to capital stock. Alternatively, the partial putty-clay adjustment cost method of Phelps (1963) can be implemented, whereby the elasticity of substitution between old capital and other factor inputs is zero, while the elasticity of substitution between new capital and other factors is 1. Adjustment costs occur because the production technology of the firm is fixed in the short-run.

The solution of a dynamic model relies on several important assumptions. Agents are assumed to be rational and to have perfect foresight, so that expectations of future prices and variables are 'self-fulfilling' and conform to values eventually realised in the future (Go, 1994). To ensure that the prices of domestic and foreign goods are fully anticipated, lead variables, such as the exchange rate, define the intertemporal transformation rates, while variables such as the intertemporal conditions for consumption and investment ensure that the steady state adjustment path is unique.

4.3.1 The Choice of Functional Forms

The structure of the general equilibrium model depends largely on the type of policy being addressed, although most models currently in practice adopt a similar form. The bases of such models are typically variants of the early theoretical work of authors such as Johnson (1957), Harberger (1959) and Meade (1955). Most models involve a range of goods, typically more than two, while aggregating the factors of production into two broad categories (capital and labour). Intermediate good are usually represented via fixed or flexible coefficient input-output matrices.

A clear advantage associated with CGE modelling is the choice and flexibility of functional forms available to the modeller (Greenaway *et al.* 1993), although, as we have seen, the two factor structure remains popular. Shoven and Whalley (1992) offer several explanations for this. Firstly, since many policy issues have already been analysed using this framework, it seems reasonable to use the intuition gained from such work to direct numerical investigation. Secondly, the structure of national accounts data and input-output tables is consistent with the two-factor approach. For instance, most national accounts data identifies wages and operating surpluses as major cost components. Finally, the partition between goods and factors is made to simplify the computational procedure and reduce execution times .

A further issue in model design is the choice of the underlying functional forms used in CGE modelling; these vary widely, and their structure is capable of affecting end results. Functional forms must satisfy Walras's law of demand and be analytically tractable. Hence, most functional forms belong to the constant elasticity of substitution (CES) family. The choice of form is dependent on the use of elasticities in the model. Where elasticity values are available, or where reasonable estimates can be made, modellers tend to use the CES functional form or the linear expenditure system (LES). When suitable elasticity estimates are not available then modellers may revert to either the Cobb-Douglas (CD) functional form or impose fixed coefficient (Leontief) preferences.

The remainder of this section examines the details and justification of the formulation of this model.

4.4 The Structure of the Dynamic CGE Model

The model described in the next section is a single-country dynamic CGE model with increasing returns to scale (IRTS). The core model is based on the Arrow-Debreu general equilibrium framework with simultaneous Walrasian market clearing. The Harberger convention is imposed throughout this thesis. As is standard, all data used in the SAM are given in value terms, so units must be chosen for goods and factors so that unique price and quantity observations can be obtained. The concern of the CGE modeller is with the changes in values of the relative prices between benchmark and counterfactual equilibria. The approach adopted by Harberger

(1959b, 1962) and used in virtually all CGE models since is to assume that all prices are unity in the benchmark in order to assist calibration. In order to numerically implement this, the intertemporal model must be formulated in discrete time. Discounting in discrete time requires a dating convention (Devarjan and Go, 1998); hence a time subscript t is added where necessary[8]. The style of dynamic model used is the Ramsey model as discussed in Chapter 3.

We follow the notion of virtually all other dynamic modellers who discuss results and the structure of each time period (t) in the model as being one year. Such an approach is reasonable given that all of the data used in the calibration and estimation of the model is annual. However, as Gillespie *et al.* (2001) point out this notion is "suggestive" rather than"definitive" as the model is not econometrically estimated.

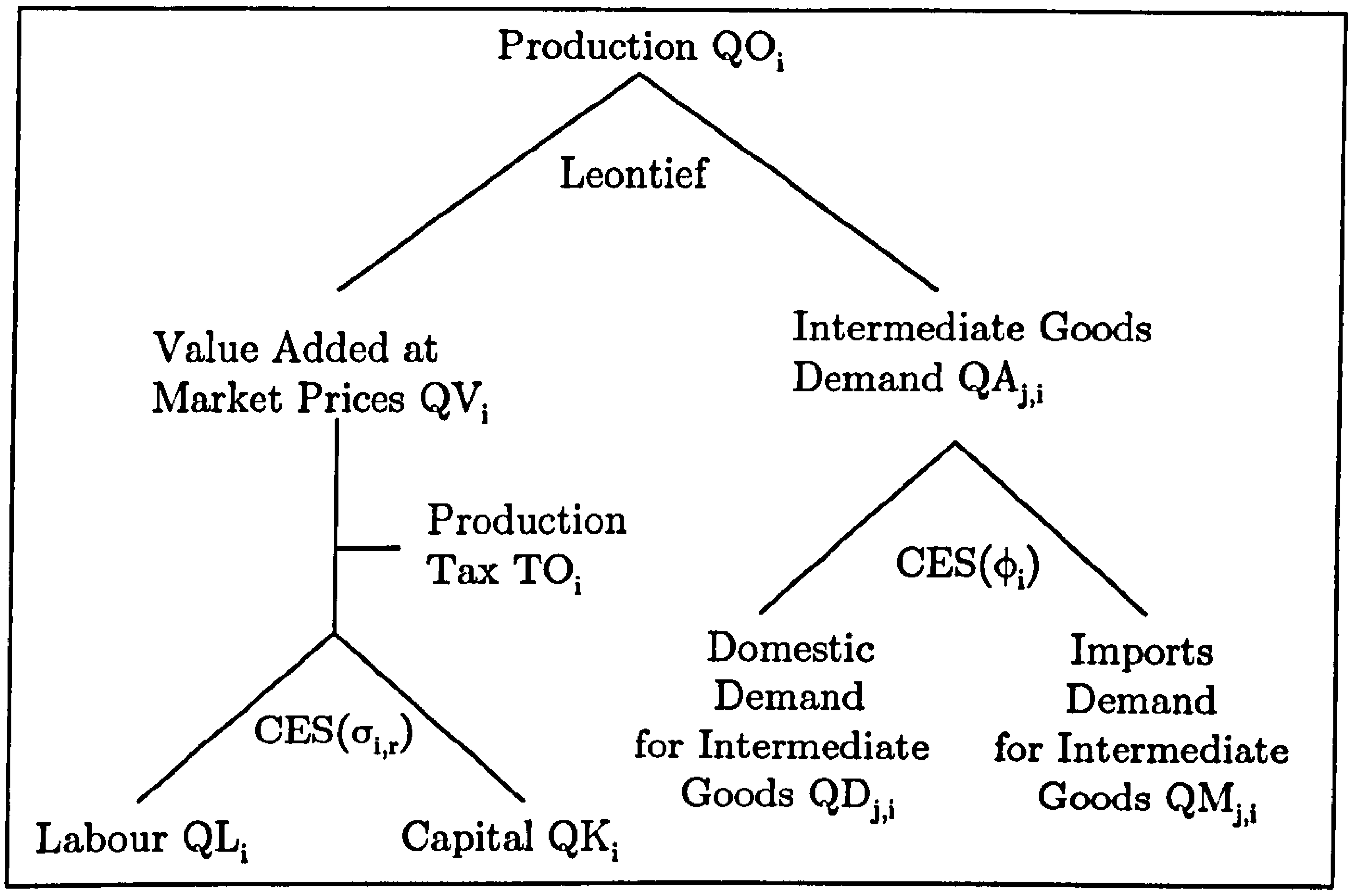
4.4.1 The Production and Output Transformation Functions

All sectors produce an output as part of the set of production goods G. Production is broken down into the demands for each good $j \in G$ and inputs $i \in G$, where $i \in j$ i.e. industry j uses product i to produce its output and in theory each industry can produce more than one product.

Production is organised into a hierarchical structure. By using this approach, the CES family of functions can be layered (nested) in order to best reflect the organisation of the economy. Different elasticities can be employed at different levels of the structure, and different functions can be used to reflect either rigidity or flexibility in that part of the economy.

[8] variables with the subscript i, t may differ across sectors and time.

Figure 4.3: The Nested Production Function



At the top level of the production structure, production is determined by the value added at market prices QV_i and the intermediate demand for each good. $QA_{i,j}$. QV_i and $QA_{i,j}$ are linked to total production QO_i by the Leontief (or fixed coefficients) functional form. The Leontief form dictates that there is a minimum requirement of inputs needed to produce a unit of output and by increasing the quantity of any one input will not increase the overall level of output unless all other inputs are increased accordingly. The Leontief functional form can be specified as:

$$QO_{i,r} = \min\left(\frac{1}{\omega_{va,i}}QV_i, \frac{1}{\omega_{j,i}}QA_{j,i}\right) \tag{4.1}$$

where $\omega_{va,i}$ and $\omega_{j,i}$ are the input shares of the good i and value added in the production of good j. As we assume rational economic behavior and profit maximising objectives for our producers, they will not employ more of the input than needed to meet the production level QO_i. The input demand functions are then specified as fixed coefficient multiples of output QO_i.

$$QV_i = \omega_{va,i}QO_i \tag{4.2}$$

$$QA_{j,i} = \omega_{j,i}QO_i \tag{4.3}$$

The general equilibrium framework imposes the assumption that firms profits are not abnormal, i.e. total revenue equals total costs. Hence:

$$PP_iQO_i = PV_iQV_i + \sum_{j\in G} PA_{j,i}QA_{j,i} \tag{4.4}$$

where PP_i represents the producer price, PV_i is the price of value added and $PA_{j,i}$ is the aggregate price of the intermediate inputs. By substituting in the input demand equations and cancelling out terms representing quantities we can obtain the dual price condition:

$$PP_i = \omega_{va,i}PV_i + \sum_{j\in G} \omega_{j,i}PA_{j,i} \tag{4.5}$$

The Leontief function has been subject to criticism as it does not allow substitution between the factors of production, which is deemed an unrealistic representation of production. However, it does not allow the ratios of intermediate goods used in production to change either. This is thought to be useful because of the lack of scope for changing the structure of production in this manner in the short-term.

A production tax TO_i, is applied to value added. Consequently we can define the relationship between the price of value added at factor cost (PF_i) and the price of value added at market prices (PV_i) as:

$$PF_i = \frac{(1 - TO_i)}{(1 - \overline{TO_i})}PV_i \tag{4.6}$$

The level of the production tax can be altered in simulations. Hence $\overline{TO_i}$ represents the benchmark level of the production tax and TO_i represents a possible simulation level. It is possible to do this if we calibrate the model using the Harberger (1959) convention, which dictates that all commodity prices are equal to unity in the benchmark. The Harberger convention imposes the restriction that each sector's marginal product of capital schedule is linear; since prices are unity, they can be viewed as marginal revenue product schedules. The total quantity of capital and labour is assumed fixed in each sector and fully employed. Hence any changes in the sectoral allocation of capital can be used to generate a measure of "social waste" associated with the imposition of a tax.

4.4.2 The Value Added Block

In a similar way to the production block, the relationship between the quantities of value added at market prices (QV_i) and at factor cost (QF_i) is:

$$QF_i = \left(1 - \overline{TO_i}\right) QV_i \tag{4.7}$$

Value added at factor cost is determined by the following CES function:

$$QF_i = A_i \left[\gamma_i QL_i^{((\sigma_i - 1)/\sigma_i)} + (1 - \gamma_i) QK_i^{((\sigma_i - 1)/\sigma_i)}\right]^{(\sigma_i/(\sigma_i - 1))} \quad \text{where } 0 < \sigma_i, < \infty \tag{4.8}$$

where QF_i represents value added at factor cost, which is a composite of labour inputs (QL_i) and the composite of foreign and domestic capital inputs. In order to derive constant input factor demands, we must minimise the cost function subject to equation (4.8). For the factor demand case the cost function can be represented as:

$$PF_i QF_i = PL_i QL_i + PK_i QK_i \tag{4.9}$$

The derivation of the factor demand functions are given in Appendix A of this Chapter and are presented below for capital and labour.

$$QK_i = \frac{PV_i QV_i \left((1 - \gamma_i)/PK_i\right)^{\sigma_i}}{PL_i^{1-\sigma_i} \gamma_i^{\sigma_i} + PK_i^{1-\sigma_i} (1 - \gamma_i)^{\sigma_i}}$$

$$QL_i = \frac{PV_i QV_i \left(\gamma_i / PL_i\right)^{\sigma_i}}{PL_i^{1-\sigma_i} \gamma_i^{\sigma_i} + PK_i^{1-\sigma_i} (1 - \gamma_i)^{\sigma_i}} \tag{4.10}$$

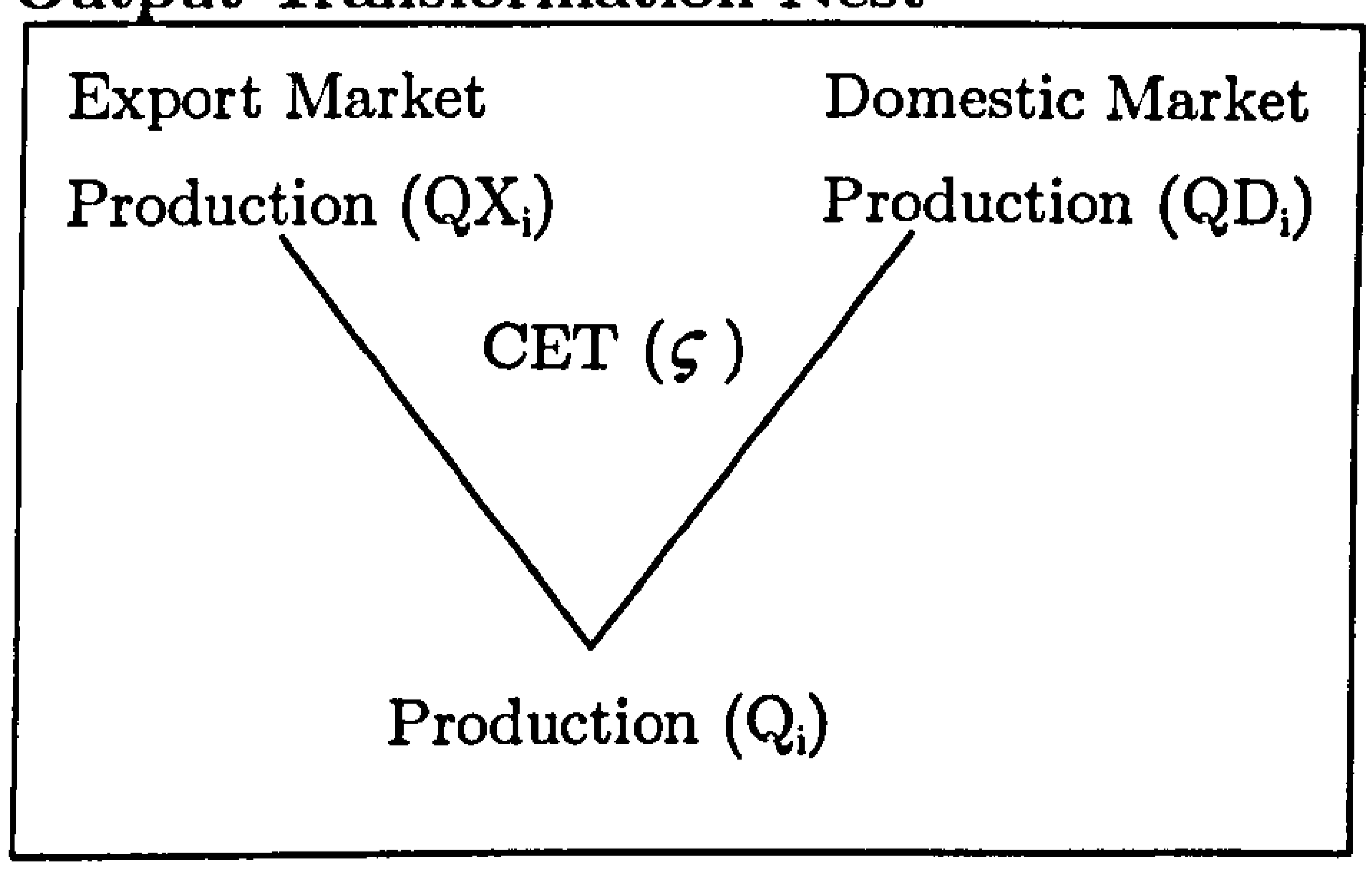
We can also obtain the dual price index:

$$PF_i = \frac{1}{A_i} \left[\gamma_i^{1-\sigma_i} PL_i + (1 - \gamma_i) PK_i^{1-\sigma_i}\right]^{1/(1-\sigma_i)} \tag{4.11}$$

4.4.3 Supply Behavior

We assume that within industry i a typical firm s faces fixed costs FC_i and marginal costs MC_i which are assumed to be independent of output. Each firm produces two differentiated commodities, one of which is supplied to the domestic market QD_{is} and the other is supplied to an export market QE_{is}. The corresponding prices of these goods are denoted PD_{is} and PE_{is}. The determination of the supply of output is represented by a constant elasticity of transformation (CET) function. The CET function has an identical algebraic format to the CES function. However, where the CES function specifies output as a function of inputs, the CET specifies that inputs are a function of outputs. Therefore where the CES function implies an elasticity of demand, the CET function implies an elasticity of supply. In this specification the CES elasticity of transformation is represented by ς_i (where $0 < \varsigma_i < \infty$) and determines the degree to which producers might switch production between goods for either the domestic or export markets as a result of a relative price change. The nested structure of the output transformation nest is given in Figure 4.4.

Figure 4.4: The Output Transformation Nest



The CET function can be written as:

$$Q_i = Z_i \left[\delta_i QE_i^{(\varsigma_i - 1/\varsigma_i)} + (1-\delta_i)\, QD_i^{(\varsigma_i - 1/\varsigma_i)}\right]^{(\varsigma_i/(\varsigma_i - 1))} \tag{4.12}$$

where δ_i is the share of exports in total output and Z_i is the shift parameter for the transformation function. The value of total supply in the economy is equal to the sum of the gross value of domestic and exported goods:

$$P_iQ_i = PE_iQE_i + PD_iQD_i \tag{4.13}$$

A key inequality which must be satisfied in any Arrow-Debreu general equilibrium model is the zero-profit condition. The zero profit condition requires that all activities must earn zero profits, if they are operated at a positive intensity (i.e. the value of inputs must at least equal the sum of outputs (Palstev, 2000). Firms are of course assumed to be profit maximisers, maximising subject to production constraints. The zero profit function of the a representative firm, Π_i can be written as:

$$\Pi_i = PE_{i,s}QE_{i,s} + PD_{i,s}QD_{i,s} - MC_i\left(QE_{i,s} + QD_{i,s}\right) - FC_i \tag{4.14}$$

where:

$$\begin{aligned} MC_i &= A_i\left[\gamma_i PL_i^{((\sigma_i-1)/\sigma_i)} + (1-\gamma_i)\, PK_i^{((\sigma_i-1)/\sigma_i)}\right]^{(\sigma_i/(\sigma_i-1))} \\ &\quad + \sum_j P_j a_{j,i}^d + \sum_j PM_j a_{j,i}^m && (4.15a) \\ FC_i &= n_i\left(PL_i\overline{L_i} + PK_i\overline{K_i}\right) && (4.15b) \end{aligned}$$

The marginal cost function consists of the price of value added per unit of output, payments to final goods used as intermediate inputs ($\sum_j P_j a_{j,i}^d$ - where $a_{j,i}^d$represents the input-output coefficients for domestic supply of intermediate goods) and payments to imported goods used as intermediate inputs ($\sum_j PM_j a_{j,i}^m$ - where $a_{j,i}^m$represents the input-output coefficients for imported supply of intermediate goods). The definition of the marginal and fixed cost functions are taken from Chatti (2003). However, variants of these functions have been used widely in the literature (Devarajan and Rodrik, 1990; Nguyen and Wigle, 1990; Hertel and Swaminathan, 1996; Marcoullier *et al.*,1999; De Santis, 2002). They are effectively variants of the dual approach to IRTS calibration as detailed by Marcoullier *et al.* (1999).[9] The fixed cost function

[9]Harrison *et al.* (1994,1996 and 1997) bypass this step and source the cost disadvantage ratio directly from an external source as calculated by Pratten (1988). Francois and Roland Holst (1997) take a similar approach but use proxy estimates based on Pratten's approach.

comprises of the fixed portions of labour and capital per firm ($\overline{L_i}$ and $\overline{K_i}$ per firm), which are multiplied by the number of firms n_i. The determination of this function is somewhat ad hoc (Harris, 1984) despite the various approaches as little is known about the values of $\overline{L_i}$ and $\overline{K_i}$. Most models assume a ratio from capital and labour returns in the value added block. Chatti (2003) and De Santis (2002) assume a value of 0.4, Harris (1984) does not declare a value. We infer from Nguyen and Wigle, (1990) that the value is 0.5. The value given by Devarajan and Rodrik, (1990) is not directly comparable. A parameter value of 0.4 is chosen for this thesis so as to be consistent with De Santis (2002). It also yields results that are within acceptable limits for the calibrated mark-ups. However, sensitivity testing of the value of this parameter shows that it does not have a crucial impact on the calibrated mark-ups. It is only a small component of the equation for determining rival conjectures between firms as given in equations (4.39) and (4.40).

The parameters $\overline{L_i}$ and $\overline{K_i}$ enter the fixed cost function in the same proportion as their shares in value added. This approach follows that of Chatti (2003), Swaminithan and Hertel (1996) for the GTAP model and Rutherford and Palstev (2000). This approach is consistent with the findings of Domingo (2003) who considers the competitive structure of various components of the tourism and realted service sectors across Europe. Domingo (2003) discusses the features of these industries and notes that the proportional structure of factor inputs are observed in the fixed costs of firms. Traditionally capital is thought to be the main source of fixed costs. However, the majority of the sectors in the Spanish economy are labour intensive. Therefore is would be inappropriate to use a fixed cost function dominated entirely by capital. The relative determination of the fixed cost function has little impact on the calibrated parameters in the model. The scale of fixed costs and the subsequent impact on mark-ups have more impact, rather than their composition. Further, the model assumes freedom of entry and exit. Firms will enter the market to contest mark-ups when they rise above benchmark levels, and they will leave the market when they fall below benchmark levels. This is thought to be a reasonable assumption given that Spain, and the tourism sector in particular is characterised by large numbers of small businesses offering differentiated products often with significant proportions of unsalaried workers, who are paid in kind. This assumption is thought to be more realistic in the Spanish case than the alternative proposition of entry and exit costs as calibated to the fixed cost function.

Each industry (j) is assumed to be monopolistically competitive, meaning that individual firms produce unique varieties of good j, and hence are monopolists within their chose market niche. Given the demand for each variety as reflected in equation (4.24), the demand for each variety is less than perfectly elastic (Francois and Roland-Holst, 1998). However, while firms are able to price as monopolists, free entry drives their mark-ups to zero, so that pricing is at average cost. This implies that $PD_{i,s} = AC_{i,s}$.Further, the first order conditions of equation (4.14) yield the price cost margins for the domestic market:

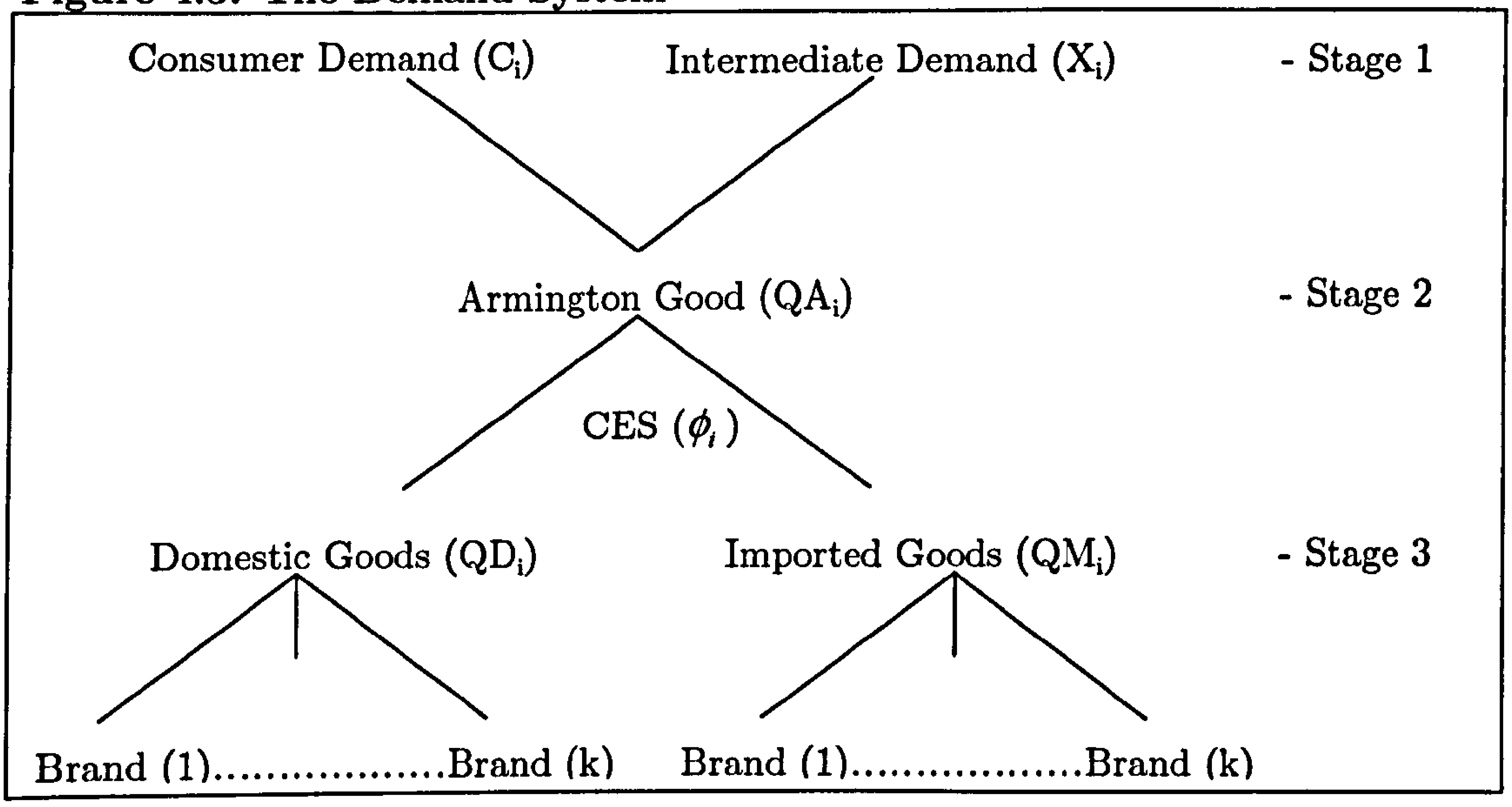
$$\frac{PD_{i,s} - MC_i}{PD_{i,s}} = \frac{1}{\left|\varepsilon_{i,s}^{d}\right|} \qquad \text{where } \varepsilon_{i,s}^{d} < 1 \tag{4.16}$$

where $\varepsilon_{i,s}^{e}$ and $\varepsilon_{i,s}^{d}$ are the respective price elasticities for export and domestic demands perceived by the domestic firm s. Equation (4.16) represents the Lerner Index of market power $(P.MC/P)$ which endogenously sets the price mark-up over marginal cost.

4.4.4 Demand Behavior

The CGE model is characterised by a three stage demand system following De Santis (2002) which is depicted in Figure 4.5. At stage 1, the demands of both consumers and intermediate industries are satisfied by the supply of the composite commodity. At stage 2, the aggregate demand for the composite commodity is specified by an Armington function which includes domestic goods and imports, so that competition exists between domestic and foreign firms. At stage 3, having chosen their allocation of domestic and imported goods, consumers purchase a variety of each, so that competition exists among domestic firms and among foreign firms. This implies that the expectation of a foreign (domestic) firm about the behavior of another foreign (domestic) firm with regard to their own actions is formed at stage 3; while the expectation of the reaction of foreign (domestic) firms to domestic (foreign) firm behavior is formed at stage 2.

Figure 4.5: The Demand System



At the first stage the final demands of the representative consumer C_i and the intermediate demands of industries X_i are satisfied by the supply of composite commodities. Consumer demand is represented by a Cobb-Douglas utility function and is discussed in detail in Section 4.4.7 below.

Industry level intermediate demands are specified according to the following equation:

$$X_i = \sum_j a_{j,i} Y_j \tag{4.17}$$

Goods market demands are modelled using a CES Armington function whereby QA_i represents the demand for the intermediate good, while $QM_{j,i}$ and $QD_{j,i}$ are the input demands for the domestic and imported goods, $B_{j,i}$ is the scale parameter, α_i[10] is the share parameter for domestic goods in intermediate production and ϕ_i is the elasticity of substitution between imports and domestic goods.

$$QA_i = C_i + X_i = B_i \left[\alpha_i QD_{j,i}^{(\phi_i - 1/\phi_i)} + (1 - \alpha_i) QM_i^{(\phi_i - 1/\phi_i)} \right]^{(\phi_i/(\phi_i - 1))} \tag{4.18}$$

[10] It should be noted that in all cases of the CES function, the share parameters sum to 1 i.e. in this case $\sum_i \alpha_i = 1$

The Armington (1969) assumption, whereby domestically produced and imported goods are treated as being qualitatively different, is used in most trade models. In CGE models products are often differentiated on the basis of geographic point of production as well as by their physical characteristics, with "similar" products being close substitutes in demand. Japanese manufactures are thus treated as qualitatively different products from US or EU manufactures. This assumption of product heterogeneity by region is used to accommodate the statistical phenomenon of cross-hauling in international trade data and to exclude complete specialisation in production as a behavioral response in the model.

The main reason for the use of the Armington assumption is that in many SAMs we observe cross-hauling (the simultaneous importing and exporting of the same good). This can only be accommodated by assuming that goods are differentiated or that there is oligopolistic competition. If we assume differentiated goods, then we may either assume that we have (many) firms each producing a different variety of a good or, as with the Armington assumption, that the "importable" good is differentiated by its country of origin, so that domestic and imported varieties are not perfect substitutes for one another.

In order to derive input demands we must minimise the cost function subject to CES equation 2. For the Armington demand case we present here, the cost function can be written as:

$$PA_iQA_i = PD_iQD_i + PM_iQM_i$$

Following the method used to derive the factor demand functions given in equations (A-16) and (A-14) it is possible to obtain:

$$QD_i = \frac{PA_iQA_i\,(\gamma_i/PD_i)^{\phi_i}}{PD_i^{1-\phi_i}\gamma_i^{\phi_i} + PM_i^{1-\phi_i}\,(1-\gamma_i)^{\phi_i}} \tag{4.19}$$

$$QM_i = \frac{PA_iQA_i\,((1-\gamma_i)/PM_i)^{\phi_i}}{PD_i^{1-\phi_i}\gamma_i^{\phi_i} + PM_i^{1-\phi_i}\,(1-\gamma_i)^{\phi_i}} \tag{4.20}$$

Under the Armington assumption we assume that the goods are differentiated, so we assume that in equation (4.19) we normalise $PM_i = 1$ and in equation (4.20) $PD_i = 1$. We can then rearrange the factor demand functions as follows, proceeding for QM_i:

$$\begin{aligned}
QM_i &= \frac{PA_iQA_i(1-\gamma_i)^{\phi_i}}{PM_i^{\phi_i}\gamma_i^{\phi_i}+PM_i(1-\gamma_i)^{\phi_i}} \\
QM_i &= PA_iQA_i\frac{(1-\gamma_i)^{\phi_i}}{PM_i^{\phi_i}} \\
QM_i &= PM_i^{-\phi_i}QA_iPA_i^{\phi_i}(1-\gamma_i)^{\phi_i} \qquad (4.21)
\end{aligned}$$

In the same way, we can obtain the reduced form factor demand function for QD_i:

$$QD_i = PD_i^{-\phi_i}QA_iPA_i^{\phi_i}\gamma_i{}^{\phi_i} \qquad (4.22)$$

The Armington price is given as follows:

$$PA_i =_i \left[\alpha_i^{\phi_i}PD_{j,i}^{(1-\phi_i)} + (1-\alpha_i)^{\phi_i}PM_i^{(1-\phi_i)}\right]^{(1/(\phi_i-1))} \qquad (4.23)$$

The third stage industries purchase a variety of domestic goods and imports. These are represented using the Dixit-Stiglitz 'love of variety' function defined over n and k goods respectively:

$$QD_i = \left[\sum_{s=1}^{n} QDD_{i,s}^{(\nu_i-1)/\nu_i}\right]^{\nu_i/(\nu_{i-1})} \qquad (4.24)$$

$$QM_i = \left[\sum_{s=1}^{k} QMM_{i,r}^{(\nu_i^m-1)/\nu_i^m}\right]^{\nu_i^m/(\nu_{i-1}^m)} \qquad (4.25)$$

where ν_i and ν_i^m represent the elasticities of substitution between the n domestic varieties and k imported varieties respectively and $QDD_{i,s}$ and $QMM_{i,r}$ denote the output of each domestic brand (s) and foreign brand (r). The different varieties enter into the function symmetrically; i.e. if all varieties have the same price then equal quantities will be consumed, and the function has the property that the increment of an additional variety, while keeping total consumption constant, increases utility. The standard Dixit-Stiglitz assumption is that, *ceteris paribus*, additional varieties decrease the output of each firm, thus raising the costs of production and increaseing the utility of the consumer. Given equations (4.24) and (4.25), we can derive the output of the domestic and imported brand and their associated prices indices in the same way to obtain:

$$QDD_{i,s} = PD_i^{\nu_i} PDD_{i,s}^{-\nu_i} QD_i \tag{4.26}$$

$$PD_i = \left[\sum_{s=1}^{n} PDD_{i,s}^{(1-\nu_i)}\right]^{1/(\nu_i-1)} \tag{4.27}$$

$$QM_{i,r} = PM_i^{\nu_i^m} QM_i \left(PMM_{i,r}\left(1+t_i\right)\right)^{-\nu_i^m} \tag{4.28}$$

$$PM_i = \left[\sum_{s=1}^{n} \left(PMM_{i,r}\left(1+t_i\right)\right)^{(1-\nu_i^m)}\right]^{1/(\nu_i^m-1)} \tag{4.29}$$

where $PDD_{i,s}$ denotes the price of the domestic brand s, $PMM_{i,r}$ denotes the price of the foreign brand r, and t_i is the ad valorem tariff rate.

4.4.5 Modelling the Strategic Interaction Among Firms

Virtually all specifications of CGE models with imperfect competition include some assumption about a conjecture. This is observed in the discussion in chapter 3 in Table 3.2. Most models specify Cournot conjectures. The Cournot model is traditionally interpreted as a conjectural variation model. In the model the firm can control quantity and choose its output level; the demand curve then determines price. In the specification of the CGE model, firms have perfect foresight, so they know how rivals will respond to their quantity setting strategy.

All previous CGE modelling approaches have assumed a fixed exogenously specified or calibrated conjecture. No approach to date has assumed a sequential game whereby firms make rational, endogenously determined decisions based on multi-period decisions. However, critics of the approach such as Stigler (1964) point to the fact that the value of the assumed conjecture is arbitrary and that oligopoly behaviour can be best explained by alternative cartel type models. As well as being ad hoc, equilibrium is not achieved via a credible strategy and intra-period decisions may be based on inconsistent beliefs or actions.

Such criticisms of the conjectural variations approach are common, well rooted in economic theory and are understood. Nonetheless, conjectures are implicit in the specification of imperfect competition in CGE models. As firms are trying to protect mark-ups, a firm's behaviour will be determined by the preservation of its mark-up, and rival firms' actions or the behaviour of new entrants will be implicit in this decision making process. Even in the most basic specification of imperfect competition in the CGE model conjectures are implied, whether the response is zero, as defined by Cournot or neutral, in that firms expect rivals' output to change by equivalent amounts to their own. Reality is somewhat different from this assumption. The firm's decision making process is complex and they may not always make assumptions regarding rivals' behaviour with perfect foresight. However, as pointed out by authors such as Dellink (2000), an expectations function sophisticated enough to deal with behaviour does not yet exist in CGE modelling. Therefore, no matter how primitive the conjectural reaction function, CGE modellers must effectively make do with variants of the Bertrand/Cournot model which incorporate fixed assumptions about conjectures. The view of Helpman and Krugman (1989) has already been noted, namely that while this assumption is somewhat inelegant, it is important to test the influence of it with regard to the model results. Further, such specifications can give helpful insights as to what policy impacts may be when the strategic interaction of firms is considered.

The influence of the conjectural variation parameter on the results of the CGE model will be tested. The approach of De Santis (2002) is adopted as this has the most robust treatment of conjectural variations within a CGE context. Effectively, different extreme points can be considered with alternative specifications of the model. A standard constant returns to scale CGE model with perfect competition can be compared to a specification of an increasing returns to scale model with imperfect competition. The influence of the alternative speficiations on the model results can be compared and the associated policy conclusions drawn from it. If significant deviations between the model results occur, then it is clear that further research needs to be undertaken with regard to the role of firm expectations and behaviour. However, it will be shown that the test undertaken in this thesis demonstrate that that the conjectural variation parameter, or the specification of imperfect competition for that matter, has little impact on the results. Thus it will be shown that it is possible to concur with other authors such as Willenbockel (2004) who conclude that it is more important to include an imperfect competition specification per se, rather than to be overtly concerned with regard to its structure. On this basis, the method of De Santis (2002) is applied and alternative model structures are compared accordingly to establish the viability of this proposition.

The approach advocated by Helpman and Krugman will be followed in this thesis. The specification of an imperfectly competitive context for firms actions is a closer reflection of the operations of firms in the Spanish economy than that of perfect competition (see for example, Fildago and Victoria, 2001).

Following De Santis' (2002) approach to the modelling of the strategic interaction amongst firms, the price elasticities for export and domestic demands ($\varepsilon^e_{i,s}$ and $\varepsilon^d_{i,s}$) depend on the perceived effect of the firms action on domestic supply. It has been shown in equation (4.16) that the absolute inverse of these parameters represents the Lerner index. In this next section, we show that $\varepsilon^e_{i,s}$ and $\varepsilon^d_{i,s}$ are functions of the conjectural variation parameters i.e. the way in which domestic and foreign firms will respond. To do this we follow the approach of De Santis (2002) which is an adaptation of Harrison Rutherford and Tarr (1996, 1997c). This derivation is based on the assumption that both domestic and foreign firms incorporate into their own decision making their own conjectures about how other firms will respond to their own changes in behaviour. As noted above, we will examine whether the assumptions that are made concerning the nature of the firms decision making make a significant difference to the results obtained. Such tesing is innovative in the context of CGE modelling.

The model incorporates four different output conjectures, De Santis (2002):

- μ_i = the conjectural reaction of foreign firms to the domestic firms' action in the domestic market, i.e. it is the rate of change of output of the domestic firm anticipated by the foreign firm in response to its own change.
- μ^m_i = the conjectural reaction of domestic firms to the foreign firms' action in the domestic market
- λ_i = denotes the conjectured reaction of rival domestic firms
- λ^m_i = denotes the conjectured reaction of rival foreign firms

The conjectures are all quantity, as opposed to price conjectures and their derivation is given below.

We begin by taking logs of the inverse demand function of equation (4.26) obtaining:

$$\ln PDD_{i,s} = 1/\nu_i \ln QD_i - 1/\nu_i \ln QDD_i + \ln PD_i \quad (4.30)$$

If we differentiate (4.30) with respect to $\ln QDD_{i,s}$ it is possible to obtain the inverse of the price elasticity of demand perceived by the domestic firm:

$$\frac{1}{\varepsilon^d_{i,s}} = \frac{1}{\nu_i}\frac{\partial \ln QD_i}{\partial \ln QDD_{i,s}} - \frac{1}{\nu_i} + \frac{\partial \ln PD_i}{\partial \ln QDD_{i,s}} \tag{4.31}$$

Following De Santis (2002) we now calculate the components of (4.31). From (4.24) it is possible to obtain $\frac{QD_i}{PDD_{i,s}}$:

$$\frac{\partial QD_i}{\partial QDD_{i,s}} = \left[\frac{QD_i}{QDD_{i,s}}\right]^{1/\nu_i}\left[1 + \frac{\sum_{t\neq s}\left(QDD_{i,t}^{-1/\nu_i}\right)}{QDD_{i,s}^{-1/\nu_i}}\frac{\partial QDD_{i,t}}{\partial QDD_{i,s}}\right]$$

We know from (4.26) that $[QDD_{i,s}/QD_i]^{1/\nu} = [PDD_{i,s}/PD_i]$ and again following De Santis (2002):

$$\frac{\partial \ln QD_i}{\partial \ln PDD_{i,s}} = \left[\frac{PDD_{i,s}}{PD_i}\right]\left[\frac{QDD_{i,s}}{QD_i}\right]\left[1 + \frac{\sum_{t\neq s}\left(QDD_{i,t}^{-1/\nu_i}\right)}{QDD_{i,s}^{-1/\nu_i}}\frac{\partial QDD_{i,t}}{\partial QDD_{i,s}}\right] \tag{4.32}$$

which gives us the first component of (4.31). By using the chain rule it is possible to calculate:

$$\frac{\partial PD_i}{\partial QDD_{i,s}} = \frac{\partial PD_i}{\partial QD_i}\frac{\partial QD_i}{\partial QDD_{i,s}}$$

and combining this with (4.32) gives:

$$\frac{\partial \ln PD_i}{\partial \ln QDD_{i,s}} = \frac{PDD_{i,s}}{PD_i}\frac{QDD_{i,s}}{QD_i}\frac{QD_i}{PD_i}\frac{\partial PD_i}{\partial QD_i}\left[1 + \frac{\sum_{t\neq s}\left(QDD_{i,t}^{-1/\nu_i}\right)}{QDD_{i,s}^{-1/\nu_i}}\frac{\partial QDD_{i,t}}{\partial QDD_{i,s}}\right] \tag{4.33}$$

Substituting expressions (4.32) and (4.33) into (4.31) yields

$$\frac{1}{\varepsilon^d_{i,s}} = -\frac{1}{\nu_i} + \frac{1}{n_i}\left(\frac{1}{\nu_i} + \frac{QD_i}{PD_i}\frac{\partial PD_i}{\partial QD_i}\right)\left[1 + \frac{\sum_{t\neq s}\left(QDD_{i,t}^{-1/\nu_i}\right)}{QDD_{i,s}^{-1/\nu_i}}\frac{\partial QDD_{i,t}}{\partial QDD_{i,s}}\right] \tag{4.34}$$

At the second stage of the demand tree taking equation (4.19), a similar method can be undertaken to obtain $[QD_i/PD_i]\,[\partial PD_i/\partial QD_i]$:

$$\frac{QD_i}{PD_i}\frac{\partial PD_i}{\partial QD_i} = -\frac{1}{\nu_i}+\frac{PD_iQD_i}{(PD_iQD_i+PM_iQM_i)}\left[\frac{1}{\nu_i}-\frac{PA_i/QA_i}{\partial QA_i/\partial PA_i}\right] \left[1+\frac{1-\gamma_i}{\gamma_i}\left(\frac{QM_i}{QD_i}\right)^{-1/\phi_i}\frac{\partial M_i}{\partial D_i}\right] \quad (4.35)$$

Using the notation of De Santis, we condense some components of the equation as follows:

- $\Psi_i = \frac{PD_iQD_i}{(PD_iQD_i+PM_iQM_i)}$ represents the **domestic industry market share in the domestic market**;
- $\chi_i = \frac{PA_i/QA_i}{\partial QA_i/\partial PA_i}$ is the **absolute value of the price elasticity of aggregate demand**;
- $\lambda_i = \frac{\partial QDD_{i,t}}{\partial QDD_{i,s}}$ which, as previously stated, denotes the **conjectured reaction of rival domestic firms**, $t = 1, ..., n-1$; and
- $\mu_i = \frac{\partial M_i}{\partial D_i}$ which, as previously stated, is interpreted as the **conjectured reaction of foreign firms to the domestic firms' actions in the domestic market.**

Given the assumption of symmetry and constant conjectures, substituting (4.35) into (4.34) and the condensed components described above yields the following expression for the elasticity of demand perceived by domestic firms:

$$\frac{1}{\varepsilon^d_{i,s}} = -\frac{1}{\nu_i}-\frac{1}{n_i}\left\{\frac{1}{\phi_i}-\frac{1}{\nu_i}+\Psi_i\left[\frac{1}{\chi_i}-\frac{1}{\nu_i}\right]\left[1+\frac{1-\gamma_i}{\gamma_i}\left(\frac{QM_i}{QD_i}\right)^{-1/\phi_i}\mu_i\right]\right\} \cdot\left[1+\frac{\sum_{t\neq s}\left(QDD_{i,t}^{-1/\nu_i}\right)}{QDD_{i,s}^{-1/\nu_i}}\lambda_i\right] \quad (4.36)$$

The foreign industry is also assumed to be imperfectly competitive and in the same way as above the price elasticity of import demand perceived by the foreign firm can be derived:

$$\frac{1}{\varepsilon^m_{i,s}} = -\frac{1}{\nu^m_i}-\frac{1}{k_i}\left\{\frac{1}{\phi_i}-\frac{1}{\nu^m_i}+(1-\Psi_i)\left[\frac{1}{\chi_i}-\frac{1}{\nu_i}\right]\left[1+\frac{\gamma_i}{1-\gamma_i}\left(\frac{QD_i}{QM_i}\right)^{-1/\phi_i}\mu^m_i\right]\right\} \cdot\left[1+\frac{\sum_{t\neq s}\left(QMM_{i,z}^{-1/\nu^m_i}\right)}{QMM_{i,r}^{-1/\nu^m_i}}\lambda^m_i\right] \quad (4.37)$$

where:

- $(1-\Psi_i) = 1 - \left[\frac{PD_iQD_i}{(PD_iQD_i+PM_iQM_i)}\right]$ represents the **foreign industry market share in the domestic market;**
- $\chi_i = \frac{PA_i/QA_i}{\partial QA_i/\partial PA_i}$ is the **absolute value of the price elasticity of aggregate demand;**
- $\lambda_i^m = \frac{\partial QMM_{i,z}}{\partial QMM_{i,r}}$ which, as previously stated, is the **conjectured reaction of rival foreign firms**, $z = 1, ..., k-1$; and
- $\mu_i^m = \frac{\partial D_i}{\partial M_i}$ which, as previously stated, is the **conjectured reaction of domestic firms to the foreign firms' actions in the domestic market.**

Equations (4.36) and (4.37) represent the inverse price elasticity of domestic (import) demand perceived by the representative domestic (foreign) firm. These equations define the price cost mark-ups in the model. However, these are complex equations and it is not easy to gain direct insights. Therefore we follow DeSantis (1999) and take the total differential of the perceived elasticity of demand. Due to the relative similarities in the equations and interpretation, only the total differential of (4.36) is reported:

$$\partial\left(\frac{1}{\left|\varepsilon_{i,s}^{m}\right|}\right) = \frac{(\lambda_i - 1)}{n_i^2}\mathbf{A}_i\partial n_i + \frac{1}{n_i}\mathbf{D}_i\left\{\mathbf{B}_i\left[\left(\frac{1}{\chi_i} - \frac{1}{\nu_i}\right)\partial\Psi_i - \frac{\Psi_i}{\chi_i^2}\partial\chi_i\right] + \mathbf{C}_i\partial\left(\frac{QD_i}{QM_i}\right)\right\} \quad (4.38)$$

where:

$$\begin{aligned}
\mathbf{A}_i &= \frac{1}{\nu_i} - \frac{1}{\phi_i} + \Psi_i\left[\frac{1}{\chi_i} - \frac{1}{\nu_i}\right]\mathbf{B}_i \\
\mathbf{B}_i &= 1 + \frac{1-\gamma_i}{\gamma_i}\left(\frac{QM_i}{QD_i}\right)^{-1/\phi_i}\mu_i \\
\mathbf{C}_i &= \frac{\Psi_i\left[\frac{1}{\chi_i} - \frac{1}{\nu_i}\right]1-\gamma_i}{\nu_i.\gamma_i\left(\frac{QM_i}{QD_i}\right)^{\phi_i/(1-\phi_i)}\mu_i} \\
\mathbf{D}_i &= (n_i - 1)\lambda_i + 1
\end{aligned}$$

$\mathbf{A}_i$, $\mathbf{B}_i$, $\mathbf{C}_i$, $\mathbf{D}_i$, do not have a significant literal interpretation. However, they assist greatly in the calibration of the parameters in the model. The model is calibrated such that:

1) $\nu_i > \phi_i > \chi_i$ - the elasticity of substitution between domestic varieties is greater than the Armington elasticity, which is greater than the aggregate sector price elasticity of demand,

2) $\mu_i \geq 0$ - the conjectured reaction of foreign firms to the domestic firms' actions in the domestic market is greater than or equal to zero.

3) $(1 - n_i)^{-1} < \lambda_i < 1$ - the conjectured reaction of rival domestic firms must be less than 1 and greater than $(1 - n_i)^{-1}$.

then the following conditions will hold (De Santis, 1999):

- domestic mark-ups will fall as new firms enter and contest the market if $(\lambda_i - 1)\,\mathbf{A}_i$
- a larger absolute price elasticity of aggregate demand implies a larger absolute perceived elasticity of demand of the domestic firm if $\mathbf{B}_i\mathbf{D}_i > 0$
- a rise in market share of the domestic industry implies a rise in mark-up in the domestic market if $\mathbf{B}_i\mathbf{D}_i > 0$
- a rise in domestic sales relative to the import volume will lead to a rise in domestic mark-ups if $\mathbf{C}_i\mathbf{D}_i > 0$

While these calibrated restrictions are quite strict, they are important for the interpretation of the results.The approach used in this thesis is similar to those used by Harrison, Rutherford and Tarr (1997) and Blake (1998) amongst others. There are, of course, differences between their approach and that of De Santis (2002). Both approaches set μ_i exogenously; while Harrison, Rutherford and Tarr (1997) and Blake (1998) set $\lambda_i = 0$ exogenously to represent Cournot conjectures between firms. However, De Santis (2002) calibrates these conjectures endogenously. Effectively the approaches of Harrison, Rutherford and Tarr (1997) and Blake (1998) are a special case of De Santis (2002) and De Santis (1999) proves this accordingly.

Following the derivation of these parameters, the conjectural variation parameters λ_i and λ_i^m can be endogenously calibrated. The conjectural variation parameter determines the reaction of a firm in terms of quantity setting in terms of the action of another firm. A quantity will be changed if the competitive agent conjectures that it will be to its advantage. Again we follow the method of De Santis (2002), whose method of calibration of the conjectural variation parameter is presented below:

$$\lambda_i = \left\{ \frac{n_i^0\left(CPM_i - \frac{1}{\nu_i}\right)}{\frac{1}{\phi_i} - \frac{1}{\nu_i} + \Psi_i\left[\frac{1}{\chi_i} - \frac{1}{\nu_i}\right]\left[1 + \frac{1-\alpha_i}{\alpha_i}\left(\frac{QM_i}{QD_i}\right)^{-1/\phi_i}\mu_i\right]} - 1 \right\} \left(n_i^0 - 1\right)^{-1} \tag{4.39}$$

$$\lambda_i^m = \left\{ \frac{k_i^0\left(CPM_i - \frac{1}{\nu_i^m}\right)}{\frac{1}{\phi_i} - \frac{1}{\nu_i^m} + (1-\Psi_i)\left[\frac{1}{\chi_i} - \frac{1}{\nu_i}\right]\left[1 + \frac{\alpha_i}{1-\alpha_i}\left(\frac{QD_i}{QM_i}\right)^{-1/\phi_i}\mu_i^m\right]} - 1 \right\} \left(k_i^0 - 1\right)^{-1} \tag{4.40}$$

The conjectural variation parameters μ_i and μ_i^m are set exogenously and are varied according to the alternative model scenarios given in later chapters, ϕ_i is taken from the GTAP database and values are given in Table 4.2 below, following Rutherford and Tarr (1997b) ν_i is assumed equal to 5. n_i^0 is proxied by taking the inverse of the Herfindahl index and the number of foreign (imported) varieties is set equal to the number of domestic varieties ($n_i^0 = k_i^0$). Details of these parameter values are also given in Table 4.2 below. CPM_i denotes the calibrated cost price margin, which is assumed equal to the cost disadvantage ratio for both domestic and foreign firms. The cost disadvantage ratio is simply a measure of unrealised scale economies (de Melo and Tarr, 1992) and for the purposes of this model, is determined using the standard equation as given in Francois and Roland-Holst (1998):

$$CDR = \frac{AC - MC}{AC} \tag{4.41}$$

If the $CDR > 0$then there are unrealised economies of scale, if $CDR < 0$ there are diseconomies of scale and if $CDR = 0$ then the firm is operating at the minimum efficient scale. Also in equations (4.39) and (4.40) α_i are the CES share parameters as given in equation (4.18) and are calibrated accordingly see (Blake, 1998). χ_i can be derived by again following De Santis (2002) using equation (4.18) as follows:

$$\chi_i = -\frac{\partial Q_i}{\partial PI_i}\frac{PI_i}{Q_i} = -\frac{PI_i}{Q_i}\left(\frac{\partial X_i}{\partial PI_i} + \frac{\partial C_i}{\partial PI_i}\right) = -\frac{PI_i}{Q_i}\frac{\partial X_i}{\partial PI_i} + \frac{C_i}{Q_i} \tag{4.42}$$

Since a Leontief specification is assumed between value added and intermediate inputs (given in equation 4.1) then $\frac{\partial X_i}{\partial PI_i} = 0$; i.e. that intermediate demand does not change according to price and intermediates and value added are used in fixed proportions. Thus χ_i is calibrated according to the relationship between consumption and $\frac{C_i}{Q_i}$ which is determined from the relevant IO tables.

The conjectural variation parameters can assume a range of values. These are discussed in the context of the endogenously calibrated parameters λ_i but the same interpretation also holds for $\mu_i, \mu_i^m, and \lambda_i^m$ except that the context is different with respect to rival foreign and domestic firms. When $\mu_i = \mu_i^m = \lambda_i = \lambda_i^m = 0$ Cournot conjectures are implied; under this scenario a firm will believe that its output will have no impact on industry output. That is, as specified by Kamien and Schwarz (1983, pp 192) "each firm behaves as if its rivals will not alter their levels of output in response to change in its own choice of output". However, if output is increased, we assume that the firm will lower its price in order to sell its additional production. But for Cournot conjectures to hold i.e. that rivals do not change their output, then it is implicit that firms assume that the rivals must correspondingly lower their prices in order to sustain their current output levels. The nature of calibrated parameters in this model infer that the conjectural reaction function is linear[11]. The following outcomes can also be observed:

- If $0 < \lambda_i < 1$, then firms expect their changes in output to be followed to a lesser extent, implying corresponding changes in rivals' prices are assumed to be smaller. Under this scenario, if firm s decides to increase its output it conjectures that rival firm t will increase its output but by a smaller amount. Thus firm s would expect to gain market share. However, when firm s decides to reduce output, rival firm t will reduce output by a lesser amount and firm s will lose market share.

- If $\lambda_i = 1$, a perfectly competitive scenario when firms expect their changes in output to be followed exactly, implying corresponding changes in rivals' prices, will also be followed exactly.

- If $\lambda_i > 1$, firms expect their changes in output to be followed by a greater extent, implying that corresponding changes in rivals' prices are assumed to be larger. If firm s decides to increase output it would expect rival firm t to drop price by more so as to increase

[11]The Cournot assumption of a conjectural variation of zero implies that the reaction function in this instance is horizontal.

output by more and gain market share. However, if firm s expects that rival firm t will increase output as well, it is likely to drop its price by even more so its perceived demand curve is becoming more elastic. Hence the market is operating as if it is becoming more competitive. However, if firm s decides to reduce output, then it conjectures that firm t will reduce output by more. When a firm is considering reducing output, it expects to be able to charge a higher price. But if it expects its competitors to reduce output by more, it will raise price still further. Thus firm s's perceived demand curve will appear to be more inelastic and the market is operating as if it is becoming less competitive.

- In cases where $-1 < \lambda_i < 0$, $\lambda_i = -1$ and $-1 < \lambda_i$, firms expect that rival firms will respond to a change in their output in the opposite fashion. Take the scenario where $-1 < \lambda_i$ for example, if firm s is considering increasing output, it will expect rival firm t to reduce output by a larger amount, however, if it is considering reducing output, it would expect its rival to increase output by a larger amount.

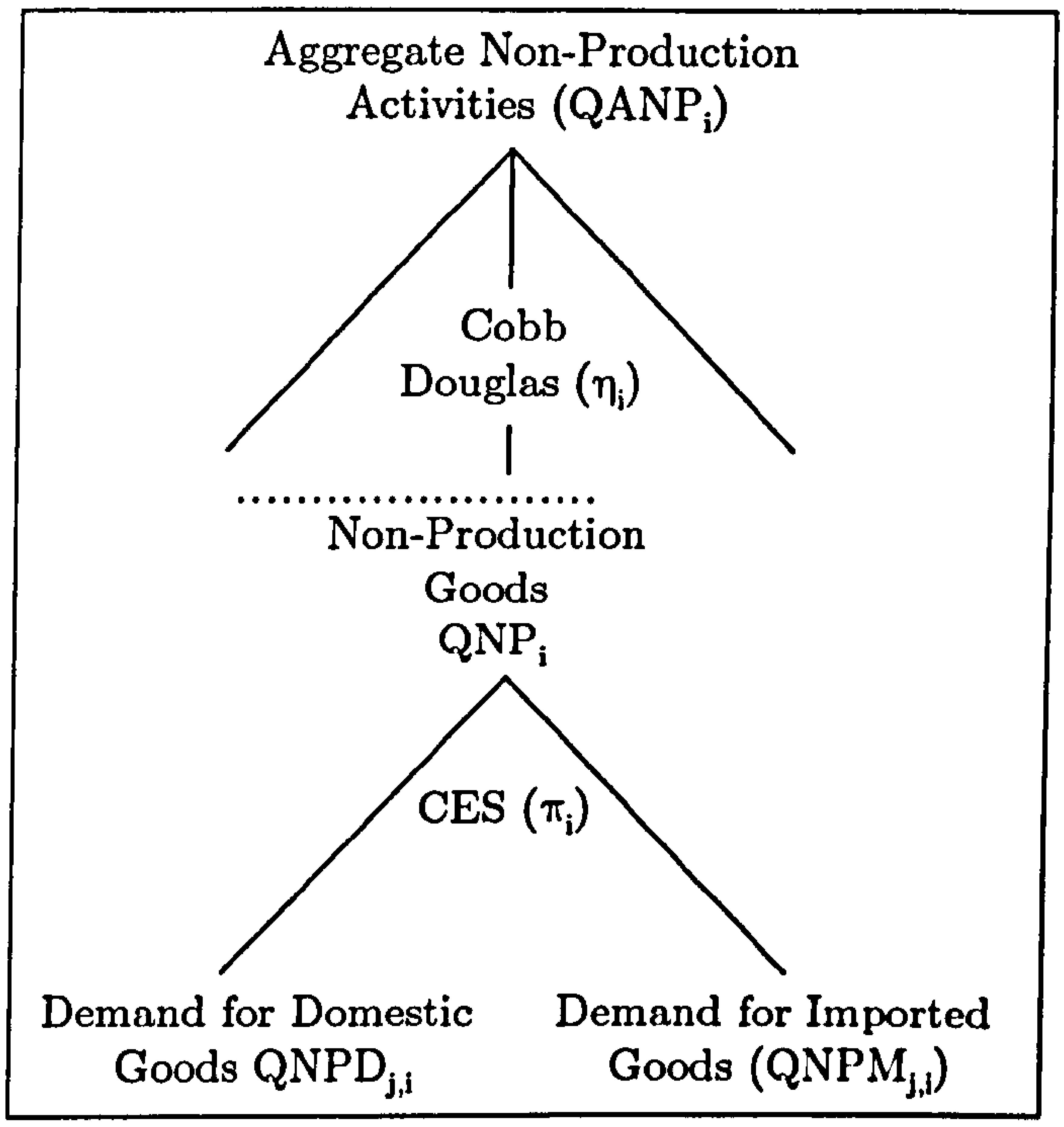
Given the elasticities and calibrated paramters used in this thesis, the size and sign of the output conjectures vary. Therefore, the parameter values for each conjecture are given in Appendicies to each chapter to assist with the interpretation of the model results.

The issues surrounding the application of constant conjectures have been discussed in chapter 3. Conjectures in this model are fixed and are constant, and this may lead to irrational behavior in the model. While this point is fully acknowledged the approach undertaken in this thesis is to try to understand the influence that such assumptions might have on short-term behavior in the model and also to examine the sensitivity of the model specification to such assumptions i.e. is the conjectural variation assumption important and does it significantly influence the results of the model? Is there any evidence to suggest that the conjectural variation parameter has a role to play in the development of theory and application associated with CGE models and imperfect competition?

4.4.6 Non-Production Activities

There are a range of activities that do not fall into the production category. The set consists of five elements: private consumption (PC_i), government consumption (GC_i), inventories (INV_i) domestic tourism (DT_i) and foreign tourism (FT_i). The aggregate of these non-production activities is represented by $QANP_i$ at the top of the nested production function shown in Figure 4.6.

Figure 4.6: The Non-Production Activities Nest



$QANP_i$ is specified as a Cobb-Douglas function:[12]

$$QANP_i = N_i \prod_{j \in G} QNP_{j,i}^{\eta_{j,i}}$$

where N_i is the scale parameter and $\eta_{j,i}$ are the share coefficients. The Cobb-Douglas function

[12]As in the case of the CES function, all share coefficients must sum to one, i.e. the Cobb-Douglas function exhibits constant returns to scale. The assumption of constant returns to scale implies that the input price ratio defines the ratio in which all inputs are used.

is more flexible than the Leontief function because it allows substitution between inputs. As in the previous cases of the Leontief, CES and CET functions, we can derive the input demand conditions. For the Cobb-Douglas function we have the following zero-profit condition:

$$QANP_i PANP_i = \sum_{j \in G} QNP_{j,i} PNP_{j,i} \tag{4.43}$$

As in the CES case we partially differentiate output with respect to inputs to obtain the marginal products:

$$\frac{\partial QANP_i}{\partial QNP_{j,i}} = \eta_i N_i \frac{QANP_i}{QNP_{j,i}}$$

We are able to obtain a similar expression for some other good k, where $k \in j$ and $g \in i$:

$$\frac{\partial QANP_g}{\partial QNP_{k,g}} = \eta_g N_g \frac{QANP_g}{QNP_{k,g}}$$

Again we set the result equal to the marginal cost (input price):

$$PNP_{j,i} = \eta_i N_i \frac{QANP_i}{QNP_{j,i}} \text{ and } PNP_{g,k} = \eta_g N_g \frac{QANP_g}{QNP_{k,g}} \tag{4.44}$$

As in the CES case we divide one expression by the other, and rearrange to obtain one input quantity in terms of another:

$$\frac{PNP_{j,i}}{PNP_{g,k}} = \frac{\eta_i}{\eta_g} \frac{QNP_{j,i}}{QNP_{k,g}} \Longrightarrow QNP_{j,i} = QNP_{k,g} \frac{\eta_i}{\eta_g} \frac{PNP_{j,i}}{PNP_{g,k}} \tag{4.45}$$

This expression can be substituted back into the original expenditure constraint equation (4.43) so that we have:

$$QANP_i PANP_i = \sum_{j \in G} QNP_{k,g} \frac{\eta_i}{\eta_g} \frac{PNP_{j,i}}{PNP_{g,k}} PNP_{j,i}$$

rearranging gives:

$$QANP_i PANP_i = QNP_{k,g} \frac{PNP_{j,i}}{\eta_i} \sum_g \eta_g \tag{4.46}$$

where the η_g may be normalised so that $\sum_g \eta_g = 1$. We can then derive the input demands and the dual price index:

$$QNP_{j,i} = \eta_i \frac{QANP_i NPP_i}{PNP_{j,i}} \tag{4.47}$$

$$QNP_{k,g} = \eta_g \frac{QANP_g NPP_g}{PNP_{g,k}} \tag{4.48}$$

$$PANP_i = N_i^{-1} \prod_{j \in G} PNP_{j,i}^{\eta_{j,i}} \tag{4.49}$$

The elasticity of substitution for the Cobb-Douglas function can also be derived by differentiating (4.45):

$$\frac{PNP_{j,i}}{PNP_{k,g}} = \frac{\eta_i}{\eta_g} \frac{QNP_{j,i}}{QNP_{k,g}} \implies \frac{QNP_{j,i}}{QNP_{k,g}} = \frac{\eta_i}{\eta_g} \frac{PNP_{j,i}}{PNP_{k,g}}$$

$$\frac{\partial (QN_{j,i}/QN_{k,g})}{\partial (\eta_i/\eta_g)} \frac{\eta_i/\eta_g}{QN_{j,i}/QN_{k,g}} = \frac{\eta_i}{\eta_g} \frac{PN_{j,i}/PN_{g,k}}{QN_{j,i}/QN_{k,g}} = 1 \tag{4.50}$$

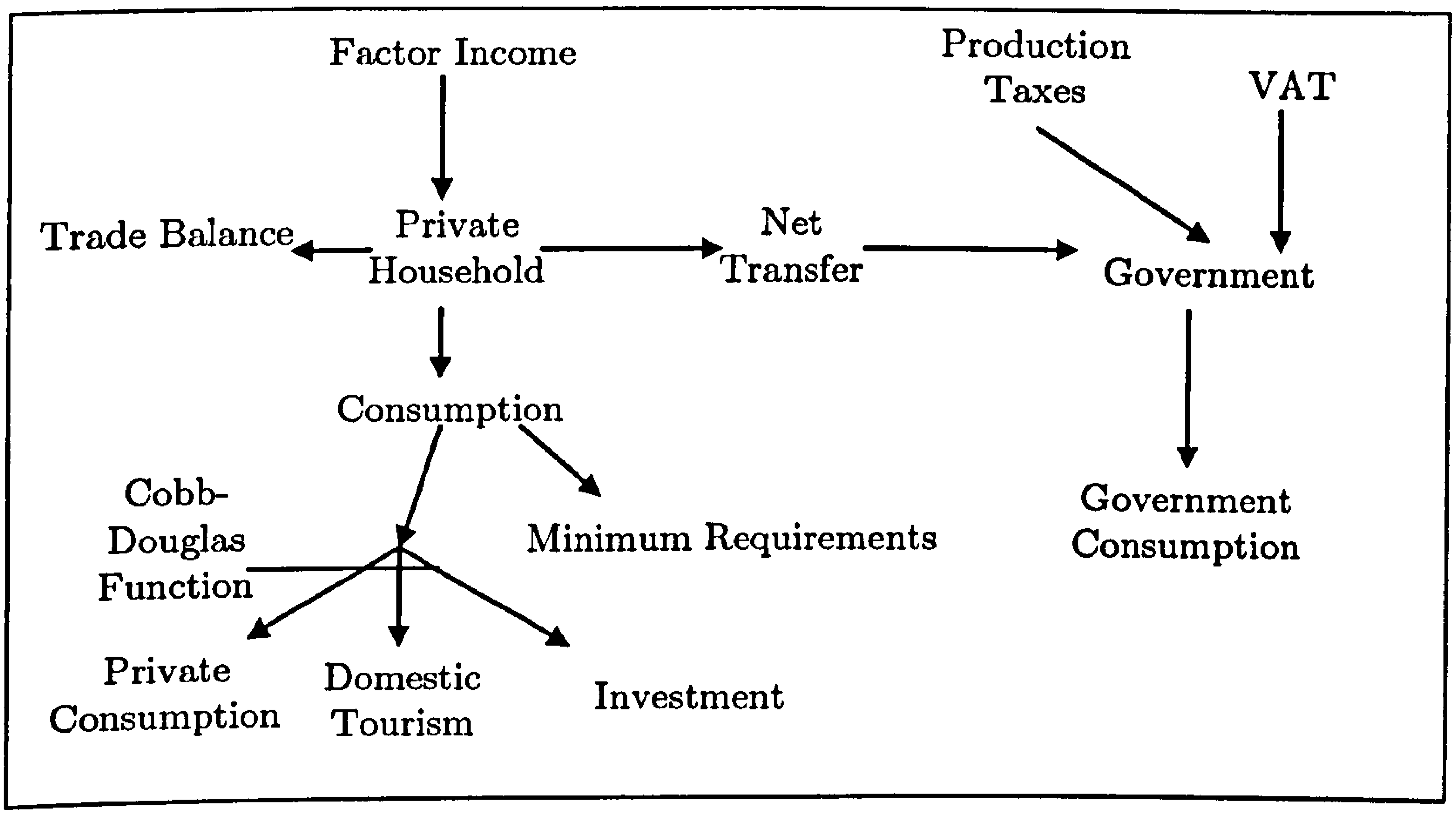
From this we see that the elasticity of substitution in the Cobb-Douglas function is unity, hence a 1% change in relative prices will lead to a 1% change in relative quantities, and expenditure shares are independent of prices.

4.4.7 The Consumer's Intertemporal Maximisation Problem

Two representative agents are assumed in the model, a private household and the government, both of whom consume goods and services. The interactions between the private household and the government are given in Figure 4.6

The private household receives all factor income, pays a net transfer to the government, purchases foreign currency (which finances the trade balance) and consumes three goods produced by non-production activities: non-tourism consumption, domestic tourism, and investment (savings). The net transfer to the government includes all forms of personal and corporate direct taxation minus transfer receipts by the household (such as social security and state pensions). The benchmark level of transfer is calculated as a residual from the database. It is important to maintain fiscal neutrality when modelling. This means that private utility (the utility index of private consumption) has little direct meaning if government consumption changes. An increase in government consumption, for example, will use real resources that will reduce private utility because the resources are then unavailable for private consumption, but the increased provision of public goods itself increases welfare. Without specifying a social welfare function that determines how welfare is determined from private utility and government consumption, it is important to keep government consumption constant. Therefore, any increase or reduction in real government revenues is transferred to or from the household by varying the net transfer. Private utility can then be used as a proxy for social welfare.

Figure 4.7: The Private Household and Government



Private consumption is modelled using the Stone-Geary linear expenditure system (LES), whereby consumers demand a fixed minimum requirement for each good, and use disposable income after the purchase of all minimum requirements to purchase goods to satisfy a Cobb-Douglas utility function. The minimum requirements for each good and for the domestic tourism aggregate are calibrated so as to achieve certain income elasticities of demand for goods and tourism.

Equation (4.51) gives private disposable income Y after the trade balance and government transfer adjustments, where $\overline{L_i}$ and $\overline{K_i}$ are fixed factor endowments of labour and capital, $\overline{TB_i}$

is the fixed trade balance, fe is the exchange rate and NT is the net transfer to government. TL_i and TK_i are income taxes on labour and capital earnings (i.e. VAT).

$$Y = \overline{L_i}PL_i\,(1 - TL_i) + \overline{K_i}PK_i\,(1 - TK_i) - \overline{TB_i}.fe - NT \tag{4.51}$$

We assume that consumers and producers are forward looking in their behavior, in that they have perfect foresight with regard to prices, resources and their income. Firms also have perfect foresight. These are a characteristics of the Ramsey dynamic discussed in chapter 3. An alternative approach would be to implement a recursive model structure. However, it is felt that this would be inappropriate for representing firms behaviour because it fails to offer any insight with regard to firm's planning in the medium to long-term investment decisions, whereas the Ramsey model does succeed in taking account of their planning behaviour as it has forward looking expectations. The major disadvantage of the recursive model is that it assumes an ad hoc adaptive expectations function, adaptive expectations are driven by changes in the savings rate which determines the pattern of investment following the shock. The savings rate is set exogenously, so agents do not take account of future rates of return or prices when adjusting to a shock. Therefore the adjustment path of any temporary shock is driven by the exogenous assumption. The Ramsey model adjustment is more realistic with its assumptions regarding to foresight so the adjustment path takes account of future rates of return and consequent price changes. Further, anticiapted and unanticipated shocks can be simulated in the Ramsey model, such shocks cannot be differentiated between in the recursive model as the adaptive expectations function cannot for any associated anticpated adjustment in terms of changing investment patterns given medium to long-term knowledge about changes in the rates of return.

The representative household maximises the discounted utility of its temporal aggregate production function

$$\max U_0 = \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^{t+1} \frac{C_t^{1-\sigma} - 1}{1-\sigma} \tag{4.52}$$

This is the standard homogenous utility function which is additively separable and is discounted according to the time preference rate ρ. σ represents the intertemporal elasticity of future consumption. The smaller σ the more slowly marginal utility falls as consumption rises i.e. there is more consumption smoothing and the more households are willing to let consumption vary over time.

The representative household faces an intertemporal budget constraint which implies that the present value of consumption cannot exceed the present value of lifetime income i.e. wealth.

$$\sum_{t=0}^{\infty} R_t^{-1} PC_t C_t = W_0 \tag{4.53}$$

where, $R_t^{-1} = \prod_{s=0}^{t-1} \frac{1}{1+r_s}$ is a discount factor, r_s represents the the interest rate at time s (i.e. the return to financial assets), PC_t is the vector of the relative price of composite consumption C_t is again a Cobb-Douglas function which is composed of sectoral consumption goods:

$$C_t = \prod_{i=1}^{n} C_{i,t}^{\beta_{i,CON}^h} \tag{4.54}$$

where $\beta_{i,CON}^h$ gives the share of expenditure on good i in consumption category CON by household h. As can be seen in Figure 4.X consumption consists of three components: private consumption $CPRI_i$, domestic tourist consumption $CDTC_i$ and savings $CINV_i$ (consumption of the investment good). W_0 represents wealth, which is the discounted flow of current income. The consumer maximises consumption subject to the wealth budget constraint, which is given by:

$$\begin{aligned} W_0 &= \frac{Y_0}{1+r_0^c} + \frac{Y_1}{(1+r_0^c)(1+r_1^c)} + \ldots + \frac{Y_t}{\prod_{s=0}^{t}(1+r_s^c)} \\ +\ldots &= \sum_{t=0}^{\infty} R_t^{-1} Y_t \end{aligned} \tag{4.55}$$

Wealth can be separated into financial and non-financial wealth. Financial wealth consists of the present value of future capital income, which is equivalent to the amount of capital which has been created (K_t) valued at its shadow price (q_t). Non-financial wealth is the discounted flow of net labour returns plus net governmental transfers and net remittances from abroad less debt service. The Lagrangian of the consumer's intertemporal allocation problem can then be given as:

$$\mathcal{L} = \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho}\right)^{t+1} \frac{C_t^{1-\sigma} - 1}{1-\sigma} + \gamma \left[\sum_{t=0}^{\infty} R_t^{-1} PC_t C_t - W_0\right] \tag{4.56}$$

The consumption function can be derived by taking the first order condition of equation (4.56) with respect to C_t and rearranging.

$$\frac{C_{t+1}}{C_t} = \left(\left(\frac{1+r_t}{1+\rho}\right) \frac{PC_t}{PC_{t+1}}\right)^{1/\sigma} \tag{4.57}$$

This shows that the forward change in consumption between two adjacent time periods can be derived as a function of their relative prices, the rate of time preference and the rate (r) at which current consumption is transformed into future consumption (i.e. the opportunity cost of savings). A large r will make future consumption cheaper, so consequently it increases (Devarajan and Go, 1998). Devarajan and Go also note that if the economy is growing according to an exogenously balanced growth rate g, then $(1+g)$ must be added to equation (4.57) to give:

$$\frac{C_{t+1}}{C_t} = \left(\left(\frac{1+r_t}{1+\rho}\right) \frac{PC_t}{PC_{t+1}}\right)^{1/\sigma} (1+g) \tag{4.58}$$

Equation (4.59) gives the income-expenditure relationship for private consumption:

$$\begin{aligned} Y &= PCPRI.CPRI \sum_{i \in G} \left(PD_i \overline{FD_i} + PM_i \overline{FM_i}\right) \\ &\quad + PCDTC\left(CDTC + \overline{FDT}\right) + PCINV\left(CINV + \overline{FINV}\right) \end{aligned} \tag{4.59}$$

where Y represents sectoral output which is equal to final demand, while $PCPRI$, $PCDTC$ and $PCINV$ are the dual price indexes of the goods used in final demand. $\overline{FD}_i$, $\overline{FM}_i$, $\overline{FDT}$, $\overline{FINV}$ are the LES minimum requirements for each domestic and imported good i, domestic tourism and investment. Minimum requirements are calculated in order to target income elasticities. Domestic tourism is calibrated to an own-price elasticity rather than an income elasticity in order to be consistent with the treatment of foreign tourism.

Using the method described in Section 4.4.6, maximising equation (4.59) subject to (4.59) allows us to determine the level of private consumption for the different goods the household consumes:

$$CPRI = \beta^h_{PRI}\frac{Y}{PCPRI} \tag{4.60}$$

$$CDTC = \beta^h_{DTC}\frac{Y}{PCDTC} \tag{4.61}$$

$$CINV = \beta^h_{INV}\frac{Y}{PCINV} \tag{4.62}$$

4.4.8 Savings and Physical Capital

Savings are dictated according to the standard national income identity $Y = C + S$ i.e. income equals consumption plus savings. Savings are the part of household income that are not consumed:

$$S_t = \sum_h s^h_t = \sum_h Y^h_t - \sum_h C^h_t \tag{4.63}$$

Economy-wide savings (S_t) are the sum of household savings (s^h_t). Once the level of household income (Y^h_t) and consumption (C^h_t) are determined, savings are automatically determined. Both consumption and savings are influenced by the interest rate and the rate of time preference. It is assumed that household savings are intermediated through financial institutions via investors, who use savings to purchase investment goods from different sectors. The investors seek to solve the intertemporal profit maximisation problem by combining goods produced in n production sectors to yield an investment good in sector i.

The unit cost of the investment good is the quantity weighted average of the prices of the combined investment inputs across all the n production sectors. A unit of investment in period t produces a unit of capital stock in period $t+1$:

$$\pi^I_{i,t} = PK_{i,t+1} - \sum_j P_{i,t}a^I_{i,j} \leq 0 \tag{4.64}$$

$\pi^I_{i,t}$ is the profit of the investment originating from sector j in period t, $PK_{i,t+1}$ is the price of capital in sector i at $t+1$, $P_{i,t}$ is the price of final goods used as intermediate inputs and $a^I_{i,j}$ are the input-output coefficients associated with the investment coefficient matrix. A unit of capital existing at the beginning of period t generates a rate of return equivalent to $r^k_{j,t}$ at the beginning of the period and yields $(1-\delta)$ at the end of the period (Bhattari, 1999a). This implies the following arbitrage condition:

$$\pi_{i,t}^{K} = (1-\delta)PK_{i,t+1} + r_{i,t}^{k} - P_{i,t} \leq 0 \tag{4.65}$$

where $\pi_{i,t}^{K}$ represents the returns to a unit of capital in sector i.

All capital assets are subject to depreciation. However, assuming new investment enters the market, the capital stock will be replenished to its original level and will increase if the amount new investment exceeds the amount the capital stock depreciates by. The benchmark capital stock ($QK_{i,t}$) is calibrated accordingly:

$$QK_{i,t} = \frac{\overline{KE_i}}{r_j^k} - I_i \tag{4.66}$$

where $\overline{KE_i}$ are the returns to capital given in the value-added block of the input-output table and $I_{i,t}$ is the level of investment given in the gross fixed capital formation column in Figure 4.1. Once the initial capital stock is determined it then accumulates between periods subject to the following equation:

$$QK_{i,t+1} = I_{i,t} + QK_{i,t}(1-\delta) \quad \text{where} \quad I_{i,t} = \sum_j I_{j,t} a_{i,j}^I \tag{4.67}$$

Output depends upon the growth in the level of sectoral employment and capital stock. When the economy is on a balanced growth path with all variables growing at the same rate, the capital stock must grow at a rate fast enough to sustain this growth. This is enforced by the following condition:

$$I_{i,T} = QK_{i,T}(g+\delta) \tag{4.68}$$

Capital prices are given by the future earnings stream of capital, so that the price of capital in any sector in time period t is given by the price of capital multiplied by the net rate of return, so that:

$$PK_{i,t} = R_{i,t} + (1-\delta)\,PK_{i,t+1}$$

where the rate of return of one unit of capital $R_{i,t}$ is given by the price of capital multiplied by the net rate of return, so that:

$$PK_{i,t} = rPK_{i,t} + (1 - \delta)\, PK_{i,t+1} \tag{4.69}$$

which gives the following relationship between prices of capital in different time periods:

$$\frac{PK_{i,t+1}}{PK_{i,t}} = \frac{(1 - r)}{(1 - \delta)} \tag{4.70}$$

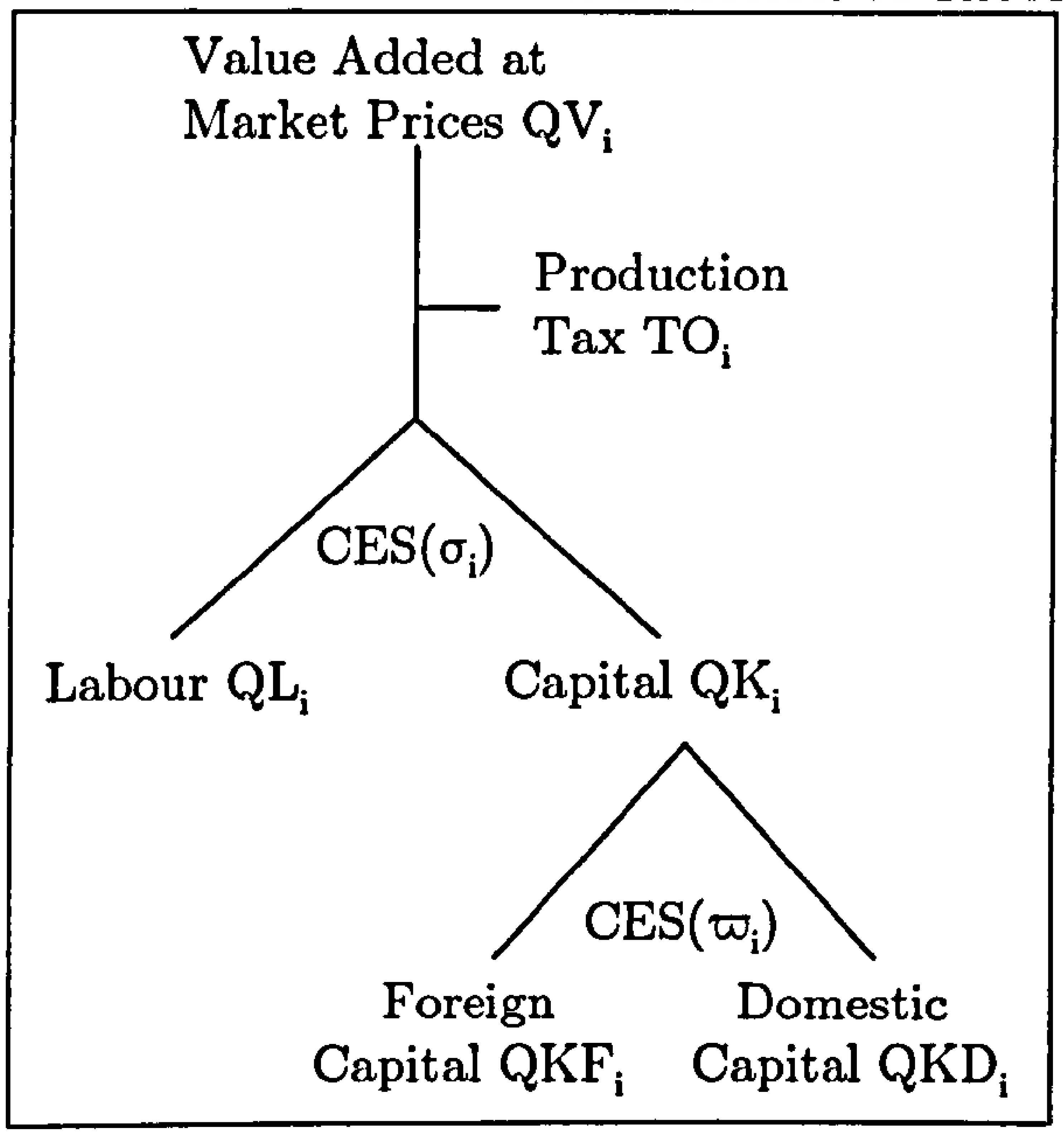
This price ratio must (if the conditions for steady-state growth hold) apply to all prices, so the same ratio exists in the based growth path for all prices in the model.

4.4.9 Foreign Direct Investment

The underlying equations for the quantity of capital have been stated in the previous section. However, in order to differentiate between domestic and foreign capital, a further nest is added to the production function presented in Figure 4.8.[13]

[13]This additional nest is only used in the Spanish model in Chapter 5, not in the Canaries or regional CGE models.

Figure 4.8: Additions to the Production Function to Incorporate FDI



It is assumed for the purposes of this model that labour cannot move between countries, but that capital is internationally mobile. As the FDI data does not permit us to identify foreign investment by country of origin, capital can only be distinguished between domestic origin and foreign origin. The corresponding aggregate capital function is given by:

$$QK_i = P_i \left[\varkappa_i QKD_i^{((\varpi_i^k - 1)/\varpi_i^k)} + (1 - \varkappa_i)\, QKF_i^{((\varpi_i^k - 1)/\varpi_i^k)} \right]^{(\varpi_i^k/(\varpi_i^k - 1))} \tag{4.71}$$

where ϖ_i^k represents the elasticity of substitution between domestic and foreign capital in the recipient country and $\varkappa_i$ is the associated share parameter and P_i is the shift parameter. QK_i represents the quantity of the capital composite in the economy which is differentiated between the domestic capital input (QKD_i) and the foreign capital input (QKF_i). Following Hanslow (2000), ϖ_i^k is set as a ratio of two times σ_i, which as defined earlier is the elasticity of substitution between capital and labour in value added. Values for the parameter σ_i are given in Table 4.10 below. The rationale for assuming this elasticity is that foreign and domestic capital are assumed to be closer substitutes than capital (whether it be foreign or domestic) and labour.

FDI is determined endogenously in the model, although it can of course be altered exogenously for simulation purposes. FDI inflows will adjust based on the rate of return to foreign capital which is specified below.

We know that benchmark values in the IO tables for returns to capital represent the total returns for domestic and foreign capital. Data supplied annually by the Banco de España detail returns to foreign capital for 62 sectors in the Spanish economy. These categories reconcile with nomenclature for the IO96 and can be incorporated in the same way in which the IO96 is matched with the TIOT92. As before, data are converted to Euro's using the European Central Bank irrevocable conversion rate. In order to distinguish between domestic and foreign returns, the Banco de España data are subtracted from the capital returns data in the value added block of the IO tables, so that domestic capital effectively acts as a residual to foreign capital. Once the returns to capital have been determined, the benchmark capital stock must be calculated. This is carried out using the calibration method described in the previous section. However, benchmark values for QKD_i and QKF_i still need to be determined. These are calibrated according to the share of domestic and foreign returns to capital as a proportion of total returns to capital i.e. where:

$$\overline{\kappa_i} = \overline{KEF_i}/\overline{KE_i} \tag{4.72}$$

where $\overline{KE_i}$ are the returns to capital given in the value-added block of the input-output table, $\overline{KEF_i}$ are the returns to foreign capital taken from the Banco de España data set and $\overline{\kappa_i}$ is the ratio of the two bench mark values. The stocks of both domestic and foreign capital are then determined by the following equations:

$$QKD_i = (1-\overline{\kappa_i})\,QK.\frac{\overline{KE_i}}{\sum_{i=1}^{n}\overline{KE_i}} \tag{4.73}$$

$$QKF_i = \overline{\kappa_i}.QK.\frac{\overline{KE_i}}{\sum_{i=1}^{n}\overline{KE_i}} \tag{4.74}$$

As is the case with domestic capital, the rate of return of one unit of capital $R_{i,t}$ is given by the price of foreign capital $PKF_{i,t}$ multiplied by the net rate of return, however, the price of foreign capital is dependent on the exchange rate fe, which is endogenously determined as the price of local currency units per foreign currency unit.:

$$PKF_{i,t} = \frac{r.PKF_{i,t}}{fe} + (1-\delta) PKF_{i,t+1} \tag{4.75}$$

which gives the following relationship between prices of capital in different time periods:

$$\frac{PKF_{i,t+1}}{PKF_{i,t}} = \frac{\left(1 - \frac{r}{fe}\right)}{(1-\delta)} \tag{4.76}$$

Foreign capital accumulates in the economy subject to the following condition:

$$QKF_{i,t+1} = \frac{FDI_{i,t}}{fe} + QFK_{i,t}(1-\delta) \tag{4.77}$$

where $FDI_{i,t}$ is equivalent to net FDI inflows as described by the FDI data in the model. The change in FDI in each period is determined by the following equation:

$$C\_FDI_{i,t} = FDI_{i,t}.FDI\_SHIFT_{i,t}.\left(\frac{r.PKF_{i,t}}{fe}\right)^{\sigma^{FDI}} \tag{4.78}$$

the change in FDI inflows $C\_FDI_{i,t}$ is determined by the initial level of FDI in the benchmark $FDI_{i,t}$ an exogenous shift parameter ($FDI\_SHIFT_{i,t}$) which can be used to increase or decrease the level of FDI in any given sector/period and the rate of return to foreign capital given as $\left(\frac{r.PKF_{i,t}}{fe}\right)$ which is adjusted for the elasticity of foreign capital supply σ^{FDI}. This parameter is taken from Young (1988) who estimates the elasticity of FDI inflows with respect to output for the USA. In the short-term Young finds this elasticity to be 1.31, while in the long-term it is found to be 1.35. For consistency we set this value at 1.35. No equivalent estimates exist for Spain, so parameter values of 1,1.5, 2 and 4 where also tested in sensitivity analysis. Differences in FDI inflows in response to changes in domestic output where marginal for parameter choices between 1 and 2. However, when the elasticity was increased to 4, increases in foreign capital accumulation where felt to be unrealistic given the scale of MNE activity in the Spanish economy.

Foreign capital accumulates based on changes in the rate of return to foreign capital (adjusted for the price of foreign currency), the elasticity of foreign capital supply and the benchmark level of the foreign capital stock. Foreign capital is free to move between sectors, it is subject to the same rules as domestic capital in that it is subject to a putty clay adjustment cost function. Consequently, a foreign investor cannot uproot existing foreign capital stock and immediately allocate it to another sector. However, new FDI inflows are endogenously by existing levels in the benchmark data set and the rate of return in the recipient sector. A higher rate of return in a particular sector will mean that foreign capital accumulated more rapidly. Like domestic investors, foreign investors are considered to be forward looking with rational expectations.

An additional repatriation constraint is introduced into the model. The level of repatriation is set exogenously. The returns to FDI are calculated accordingly and repatriated earnings $REPEARN_{i,t}$ are calculated according to the following equation:

$$REPEARN_{i,t} = QFK_{i,t}\left(\frac{r.PKF_{i,t}}{fe}\right)REPLEV_{i,t} \tag{4.79}$$

where the level of repatriation is determined by the total returns to the quantity of foreign capital in the economy $QFK_{i,t}\left(\frac{r.PKF_{i,t}}{fe}\right)$ and an exogenously set parameter $REPLEV_{i,t}$ which can take values between 0 and 1, where 0 indicates that all earnings to FDI are reinvested in the economy and 1 indicates full repatriation.

An additional productivity parameter is assigned to both domestic and foreign capital. This is set at unity in the benchmark although it can be varied exogenously, such that a greater or lesser amount of domestic or foreign capital can be used to produce the level of output in the model solution, thus proxying the effects of a less or more productive capital stock.

Equations (4.73) and (4.74) only act as a calibrated proxy for the respective stocks of domestic and foreign capital. Such information is extremely difficult to obtain and is not published formally by the INE or the Spanish central bank (the Banco de España) for either domestic or foreign capital stocks. Previous CGE models that have attempted to incorporate FDI into the model framework have either ignored calculation of foreign capital stocks altogether (Brown, Deardorff and Stern, 1996; Dee *et al.*, 1996; Brown *et al.*, 1996), estimated them on the basis of FDI survey data (Petri, 1997) or used either national accounting or institutional data (Abrego, 1999; Dee *et al.* 1999). The problem with using survey data is that it is non-specific, and is acquired from a variety of sources that cannot be reconciled in a rigorous manner (it is also unlikely that the range of surveys will provide a complete set of information for all sectors relevant to the CGE model). Moreover, even when survey data relevant to the country in question are available, they are often highly aggregated and not necessarily for the same base year. Therefore this method is ruled out. When a survey of estimates of either the stock of domestic or foreign capital in the Spanish economy was undertaken no meaningful results were found.

Dee *et al.* (1999) go to great lengths to construct a consistent framework for modelling FDI flows based on a similar approach to that used in this thesis. They seek to construct an FDI database that is consistent with the 1995 GTAP database. As there are multiple countries in the GTAP model, FDI flows between sectors and countries must be explicitly accounted for. In some instances, FDI flow data at this disaggregate level are available. However, in the majority of instances sectoral data do not exist, and only inter-country aggregate flow data exists. In these instances, flow data are disaggregated by a scaling factor for the recipient country which effectively allows the estimation of FDI stock by sector, by source country in the GTAP model. This approach is not needed in the model used in this thesis as different countries are not modelled. It is also highly arbitrary. Once the data have been disaggregated, stocks are calibrated in the same fashion as described above.

The approach used in this thesis goes one step further and actually estimates the size of the foreign capital stock in some of the tourism characteristic sectors. It was felt that by undertaking this approach a significant improvement can be made in understanding the scale and nature of MNE activity in the recipient economy. However, to calculate estimates of either the domestic or foreign capital stock in its entirety would be too large a task and beyond the remit of this thesis. In order to improve on the calibration method described above, an estimate of the foreign capital stock in the tourism sector was undertaken[14].

This was thought to be a suitable proposition as information on the vast majority of MNE activity in the Spanish tourism sector is publicly available. While no formal published government data exists foreign companies are legally bound to declare all their interests when investing

[14]Estimates of Gross Fixed Captial Formation for the tourism sector are given in the Tourism Satellite Account and are presented in the Appendix to Chapter 2. They are incorporated into the updated input-output table used in this thesis, so are therefore embodied in the calibration process. Capital stock measures are not provided in the Spanish Tourism Satellite Account as they are thought to difficult to measure.

in Spain. This information is held by the Spanish government and is collated and published on a monthly basis in articles in a trade magazine called Hosteltúr. It is the information in this publication that is used as the basis for calculating the foreign capital stock in the Spanish tourism characteristic sectors.

The ways in which MNEs can enter a foreign market are almost unlimited, combinations of investment are multiple and will vary according to MNE strategy. Definitions of FDI have been given in chapter 3 Exhibit 1. In order for a foreign investment decision to count as FDI, OECD and Spanish government definitions state that the investment stake must account for 10% or more of the recipient company. When information is taken from the Hosteltúr trade magazine it is classified so as to account broadly for a particular type of FDI so the extent for foreign ownership can be more accurately estimated. For example, when estimating the foreign capital stock, if 50% of a company is owned by a MNE and 50% by a Spanish holding company, only 50% of the company's assets are counted as foreign. Therefore, the structure of each foreign investment is examined accordingly. The objective is to distinguish between the following:

- Whether the foreign firm already as a subsidiary and is just investing on top of its current holdings.
- Is the foreign ownership share greater than or equal to 10%. If so what proportion of the capital stock has the MNE acquired.
- Whether the firm is a joint venture or not, if it is what proportion of the assets are held by domestic/foreign firms.

In order to clarify these distinctions, some broad investment categories are specified. These are presented in Table 4.6 below.

Table 4.6: Definitions of Investment

	Investment Type	Definition
1	Increased Investment	When a firm already owns 100% of a particular company and seeks to expand its operations by increased investment.
2	Direct	Direct Entrants into Spain, setting up a brand new firm.
3	Domestic, Foreign Acquisition	A company operating in Spain with significant foreign ownership/control which acquires 100% of a firm operating in Spain
4	Majority	A foreign firm which acquires a majority shareholding in a firm operating in Spain
5	Majority, Joint Venture	A foreign firm engaging in a joint venture with several other firms which has a majority shareholding (>50%)
6	Domestic, Foreign Majority	A company operating in Spain with significant foreign ownership/control which engages in a majority acquisition (>50%) of a domestic firm.
7	Domestic, Foreign, Joint Venture	A company operating in Spain with significant foreign ownership/control which engages in a joint venture with a foreign firm.
8	Minority (<50%)	A minority shareholding of less than 50%.
9	Domestic, Foreign, Minority (<50%)	A company operating in Spain with significant foreign ownership/control which engages in a minority acquisition (<50%) of a domestic firm.
10	Domestic, Foreign, Minority (<10%)	A company operating in Spain with significant foreign ownership/control which engages in a minority acquisition (<10%) of a domestic firm.
11	Domestic, Joint Venture (<50%)	A domestic firm with no apparent foreign ownership or control engaging in a joint venture with a foreign firm.
12	Minority Joint Venture (<10%)	A foreign firm which engages in a joint venture with more than one other firm, which acquires a minority shareholding of less than 10%.

	Investment Type	Definition
13	**Minority Joint Venture (<50%)**	A foreign firm which acquires a minority shareholding of less than 50% which is part of a joint venture with one or more other firms.
14	**Minority (<10%)**	A foreign firm acquiring a minority shareholding of less than 10% in a domestic firm.
15	**Domestic, Joint Venture (<50%):**	A domestic firm with no apparent foreign ownership or control engaging in a joint venture with a foreign firm.
16	**Minority Joint Venture (<10%):**	A foreign firm which engages in a joint venture with more than one other firm, which acquires a minority shareholding of less than 10%.
17	**Minority Joint Venture (<50%):**	A foreign firm which acquires a minority shareholding of less than 50% which is part of a joint venture with one or more other firms.
18	**Minority (<10%):**	A foreign firm acquiring a minority shareholding of less than 10% in a domestic firm.

For each transaction Hosteltúr records the type of investment (i.e. joint venture, acquisition), the percentage of the capital stock of a firm that is purchased, or the amount of money invested if the firm is a direct entrant. Associated sales figures are recorded where possible, and also the name and host country of the investing firms. Information is updated annually, where possible, so as to account for depreciation of the capital stock or changes in shareholdings. This publication only accounts for MNE activity, it does not account for small-scale activity i.e. foreign residents opening a small-scale tourism related business in Spain.

Table 4.7 gives an example of the data provided in the Hosteltúr trade magazine. Not all of the available information is presented for each observation, but the particular data used for calculating the capital stock are. Take row 1 for example. Club Mediterranee (Club Med) resorts are an international hotel brand, with hotels outlets across Europe. We know that Club Med is a French company, due to prior industry knowledge, but Hosteltúr confirms this for us in the origin column of Table 4.7. Club Med France already have existing operation in Spain and already owns 100% of the capital of its resorts in Spain. Column 6 confirms this, where it shows that Club Med operations in Spain are not a joint venture, but solely owned by the parent company (this can also be inferred from the fact that the purchaser and the recipient have the same name). Column 5 shows that in 1998 Club Med France invested €19.8 million in its Spanish operations. This transaction would be classified as Increased investment in Table 4.6.

Row 2 shows that the Italian company Blunit International acquired 100% of the Spanish company Club Paradise Aqualandia for €101 million. This is an example of direct acquisition as given in Table 4.6. Rows 3 and 4 show a joint venture between the UK company Acorn SP Corporation and the Spanish company Sonco Canarias who acquired the Spanish company C.M. Hoteles. Acorn SP Corporation bought 60% of the capital for €12 million, while Sonco Canarias bought 40% of the capital for €8 million. The transaction is a joint venture with the MNE taking the majority share holding. This would be classified as investment type 6 in table 4.6 which is "Domestic, Foreign Majority". Row 5 shows the German company Nur Touristic taking a 40% minority shareholding in the Spanish company Creativ Hotel Buenaventura for €9.02 million. This would be classified as "Domestic, Foreign, Minority" according to the definitions given in Table 4.6. Finally rows 6 and 7 show what appear to be two German investors acquiring two separate stakes in Europe Cadena Hoteles. Axel Gassmann has bought 52% of the company for €0.7 million, while his co-investor has bought 20% of the company for €0.3 million. This would again be classified as "Domestic, Foreign, Minority" according to the definitions given in Table 4.6.

Table 4.7: Example of FDI Data from the Hosteltúr Dataset

	Recipient	Purchaser	Origin	Capital Investment (Euros Millions)	Proportion of Capital Stock Owned/ Purchased
1	CLUB MEDITERRANEE, S.A. (CLUB MED)	CLUB MEDITERRANEE, S.A.	France	19.8	100.00%
2	CLUB PARADISE AQUALANDIA, S.L.	BLUNIT INTERNATIONAL, S.A.	Italy	101	100.00%
3	C.M. HOTELES, S.A.	ACORN SP CORPORATION	UK	12	60.00%
4	C.M. HOTELES, S.A.	SONCO CANARIAS, S.A.	Spain	8	40.00%
5	CREATIV HOTEL BUENAVENTURA, S.A.	NUR TOURISTIC, GMBH (NECKERMAN	Germany	9.02	40.00%
6	EUROPE CADENA HOTELES, S.A.	GASSMANN, AXEL FRITHJOF	Germany	0.07	52.00%
7	EUROPE CADENA HOTELES, S.A.	GASSMANN, G. FREDERIK	Germany	0.03	20.00%

Source: Adapted from Hosteltúr Magazine, various editions between 1998-2000.

These data represent just some of the transactions taken from the Hosteltúr publication. Data were collected on a range of activities including foreign investment in hotels, restaurants, air transport, sea transport, travel agents, car rental and the leisure sector. The leisure sector is a highly aggregate sector and consists of a range of activities such as casino's theatres and membership organisations, the majority of which are covered by the Hosteltúr publication. Data were not available for the following tourism characteristic sectors used in the model : hostels, campsites, other accommodation and passenger transport supporting services. In terms of hostels and campsites this is not thought to be problematic. Hostels are generally classified as small, 3* or less family run establishments. They are predominant across Spain and are commonly referred to as "pensions". It is unlikely that a MNE would be interested in the activities of these firms, in the same way campsites. It may be possible that foreigners living in Spain might choose to open a pension or a campsite, but this is not the type of foreign investment that this thesis is examining. A similar explanation applies to the "other accommodation" sector. The "other accommodation" sector consists largely of second homes, many of which are owned by Spanish people and are let out as holiday rentals. Many foreigners own these types of properties and holiday villas are an extremely popular choice for both foreign and domestic tourists. A significant amount of foreign activity does occur in this sector. But it has little to do with capital acquisition. Many holding agencies exist that coordinate summer lettings of villas for both domestic residents and foreigners that own villas in Spain. While these agencies may well be foreign owned and orientated towards particular overseas markets, they have few capital assets as they do not actually own the properties that they let out. Large purpose built villa complexes also exist entirely for letting purposes. But these are usually owned by large hotel chains and are classified in the hotel sector. Passenger transport supporting services is more complex, information on this sector is not recorded in the Hosteltúr publication, yet it is know that there is significant foreign investment in this sector from the FDI flow data from the Banco de España. Therefore this parameter is calibrated rather than calculated in the benchmark dataset.

Data were recorded for the years 1998, 1999 and 2000. This was felt to give a reasonably accurate representation of the foreign capital stock as information on each investment transaction is recorded in the magazine annually, if the investment position is unchanged then this too is also noted. So by analysing data for two years the change in the tourism capital stock between 1998 and 1999 can be calculated. Data for 2000 were evaluated as a check and also allows missed observations to be picked up (although instances of this were rare). In all 436 observations were recorded from the magazine representing foreign investment decisions by multinationals. However, since data is recorded annually (many were repeated with updated information), data were recorded for a total of 256 firms in the Spanish tourism sector which have some kind of foreign ownership. The recorded data are presented in Table 4.8 below:

Table 4.8 Recorded Foreign Capital Stock Values by Type of Investment

	Hotels	Restaurants	Air Transport	Sea Transport	Travel Agents	Car Rental	Leisure
Increased Investment	2.64	40.97	0.00	0.00	0.00	7.33	0.00
Direct	168.70	54.83	0.90	9.02	12.69	0.00	3.84
Domestic, Foreign Acquisition	48.10	31.97	3.37	0.00	2.74	0.00	4.21
Domestic, Foreign, Joint Venture	5.28	0.59	1.72	0.00	16.23	0.00	0.00
Domestic, Foreign	39.92	0.00	12.57	0.00	0.00	0.11	1.49
Domestic, Foreign, Minority (<50%)	113.21	0.00	0.00	0.00	1.40	0.00	60.66
Domestic, Foreign, Minority (<10%)	0.10	0.00	0.00	0.00	0.07	0.00	0.00
Domestic, Joint Venture	89.20	0.00	0.00	0.00	0.00	0.00	0.00
Majority, Joint Venture	9.94	0.00	0.00	0.00	0.00	0.00	61.76
Majority	42.73	17.18	1.84	1.22	8.39	0.30	3.49
Minority Joint Venture (<10%)	81.16	0.62	0.00	0.00	0.00	0.00	0.00
Minority (<10%):	1.23	0.00	71.21	0.00	0.01	0.00	0.00
Minority Joint Venture (<50%):	16.61	24.73	0.19	0.00	0.04	0.00	3.40
Minority (<50%)	10.60	1.07	29.38	0.00	2.11	0.00	7.02
Total	629.42	171.95	121.18	10.24	43.68	7.74	145.86
Observations	106	58	7	2	55	7	21

Data in Table 4.8 should be interpreted as the total economy stock of foreign capital *in 1999*. This is not flow data. For example, it can be seen from the car rental sector that a significant proportion of MNE activity takes place via 'increased investment'. This represents the stock of capital held by foreign firms who have entered the Spanish car rental market in previous years and done so by setting up a new company under the heading of an international brand. The underlying data reveal that this represents large international companies such as Avis or Hertz increasing or replenishing their existing capital stock in Spain.

It can be seen that the leisure sector experiences the largest foreign capital stock, most of it taking place as part of investment consortia; as joint ventures, or with MNEs taking minority shareholdings. The hotel sector also accounts for a significant proportion of the foreign capital stock. Again this largely consists of large hotel chains buying shares in existing Spanish hotel chains and rebranding them. Restaurant activity is dominated by the activities of large corporations such as MacDonalds, Burger King or Pizza Hut either entering directly or acquiring Spanish firms and re-branding them. Many of these businesses are run as franchises once the associated property is acquired.

Once these values have been determined they are then substituted into the model. Table 4.9 shows how these calculations affect the structure of the benchmark dataset. Columns (1) and (3) represent values of the domestic and foreign capital stock as determined by the calibration method presented above. Columns (2) and (4) represent the values of the capital stock based on the calculations given in the Table 4.8 above. Where determined values of QKF_i are taken directly from Table 4.8, then the **total** capital stock is calculated using the calibration method. QKF_i is then subtracted from this calibrated value and QKD_i is then determined from the residual. This method is only used for the tourism sectors. Where there are blank cells in columns (2) and (4) the calibrated values as given in columns (1) and (3) are used.

Table 4.9: Calibrated and Calculated Foreign and Domestic Capital Stock Parameters

	QKF_i Calibrated (1)	QKF_i Calculated (2)	QKD_i Calibrated (3)	QKD_i Calculated (4)
Agriculture	0.40%	-	99.60%	-
Manufacturing	17.27%	-	82.73%	-
Hotels	11.32%	11.64%	88.68%	88.36%
Hostels	0.00%	-	100.00%	-
Camping	0.00%	-	100.00%	-
Other Accommodation	0.00%	-	100.00%	-
Restaurants	0.35%	0.54%	99.65%	99.46%
Air Transport	6.06%	28.10%	93.94%	71.90%
Land Transport	4.34%	-	95.66%	-
Sea Transport	5.77%	9.46%	94.23%	90.54%
Travel Agents	8.82%	31.96%	91.18%	68.04%
Passenger Transport Supporting Services	17.86%	-	82.14%	-
Car Rental	8.25%	8.00%	91.75%	92.00%
Leisure Sector	10.60%	21.27%	89.40%	78.73%
Services	14.07%	-	85.93%	-
Public Sector	0.00%	-	100.00%	-

It can be seen from Table 4.9 that the stock of foreign capital relative to the stock of domestic capital varies significantly between sectors. Stocks in the restaurant sector are low. There is a large volume of restaurants in Spain and the scale of MNE activity is small. The travel agents sector also incorporates the activities of foreign tour operators, hence a relatively high level of foreign activity.

There are significant differences between the calculated and the calibrated values in some sectors. While the calculated values for the hotels, restaurants, sea transport and car rental sectors appear to be quite close to the calibrated values differences exist in other sectors. This is particularly noticeable in the Air Transport, Travel Agency and Leisure sectors. For example, in the Travel Agency sector the calculated value for QKF_i represents 31.96% of the total capital stock, while the calibrated value represents 8.82% of the total capital stock. In each incidence the calculated capital stock is larger than the calibrated capital stock. This implies that either the set rate of return on capital (r), which is set at 5% in the model, is too high for FDI, or too low for domestic capital in these sectors.

Once the stock of FDI has been calculated flows of FDI are based on the aggregated Banco de España dataset for 1999. Investment in the model is determined in a similar way to capital stocks. Domestic investment data are taken from the gross fixed capital formation column of the IO table, FDI flow data is then subtracted from this to give the proportion of foreign investment in the benchmark. Investment originating from the foreign capital stock is then based on this share parameter.

4.4.10 Human Capital and Training

Human capital is treated along similar lines to the treatment of physical capital, and the parameters in the models are calibrated to achieve the same steady state growth path, with the same ratio of prices in different periods, and the same net rate of return to investment (training) as in the physical capital component of the model. The differences between human capital and physical capital are that as the firm undertaking training does not "own" labour, a part of the labour it trains leaks from its employment in subsequent time periods, and is employed in other firms, which may or may not be in the same sector. The price of labour (the human capital equivalent of $PK_{i,t}$) must therefore only include earnings for labour that will stay in the same firm; earnings of labour that subsequently leave the firm are external to the firms decision to train.

Two parameters, δ_L and β^S are chosen to calibrate the human capital **fluctuations.** δ_L is the depreciation rate of labour, and is the proportion of the labour force that will leave their current firm in the subsequent year. δ_L is set equal to 1.5% per annum following the estimates of human capital depreciation in Spain by Arrazola and de Hevia (2004). β^S is the proportion of the labour force that will leave their current firms and find employment within the same sector, and, following Blake *et al.* (2003) is chosen to be $\beta^S = 0.2$ unless otherwise specified. This parameter is not econometrically estimated, but has been tested extensively and has performed well in a number of studies[15]. It is also thought to be realsitic, given that a large number of workers in Spain are unsalaried, they will often have no formal training and will be relatively immobile. A third parameter β^U, describes the portion of workers that find employment in other sectors of the economy, and is calibrated as a residual of the first two parameters:

$$\beta^U = (1 - \delta_L) - \beta^S \tag{4.80}$$

The rate at which sector specific human capital $L_{i,t}$ appreciates is then given by:

$$L_{i,t} = (1 - \delta_L) L_{i,t-1} + T_{i,t} \tag{4.81}$$

where training $T_{i,t}$ is performed using only inputs of sector specific human capital, and comes on-line in the subsequent time period.

The price of human capital $PL_{i,t}$, is the value of present and future earnings of each unit of labour in industry i is given as:

$$PL_{i,t} = W_{i,t} + (1 - \delta_L) PL_{i,t+1}$$

The ratio $W_{i,t}/PL_{i,t}$ is calibrated so that labour prices follow the same growth pattern as capital prices, and all other prices in the steady-state growth path.

Private households receive income from (i) labour in each time period that can be transformed to work in any sector (ii) labour specific to sector i that has been trained in and has left employment in that sector, and (iii) labour that moves from its' sector of employment to another sector. The first of these accounts for natural growth of the labour force and new entrants to the workforce, and is calibrated to achieve steady state growth. The third source of extra labour income is multiplied by a factor of $\vartheta = 0.85$ in the first period that accounts for the fact that labour changes sector of employment will lose a portion of its' skill level, because that skills that have been accumulated are not all relevant to other sectors of the economy. Again this parameter choice is arbitrary, but has performed well in sensitivity tests.

Workers will enter the labour market when the real wage increases and they will leave when

[15] Blake et al. (2003) and Blake and Gillham (2005a, 2005b and 2005c).

it declines. The entry/exit rate of workers into the labour market is determined by the labour supply elasticity which is set at 0.6 following estimates for Spain by Fernandez-Val (2003). Due to high levels of unemployment in Spain and the fact that the share of tourism in GDP is only 12%, the labour supply is not constrained beyond the labour supply elasticity as even a radical policy shock could not draw in all of the estimated 1.7 million workers [16] actively seeking employment in Spain.

4.4.11 Government Consumption

The government receives all indirect tax revenue plus the net transfer from the household, and purchases the aggregate good from the government non-production activity. As noted above, government fiscal neutrality is ensured by endogenising the net transfer to maintain the original level of real public consumption. This is necessary because in a neoclassical framework without public goods, public consumption does not contribute to welfare so an increase (decrease) in the overall tax level must reduce (increase) private welfare. With fiscal neutrality, this problem is removed.

Government revenue GR is calculated in equation (4.82) as revenue from domestic indirect taxes, and VAT:

$$GR = \sum_{i \in G} (TO_i PP_i QO_i + QL_i PL_i TL_i + QK_i PK_i TK_i) \tag{4.82}$$

The net transfer from households to government is determined by the difference between government expenditures and revenues:

$$NT = CGC.PGC - R \tag{4.83}$$

where CGC and PGC are the consumption of and price of the government consumption "bundle" of goods. CGC is fixed in order to ensure fiscal neutrality.

[16] Source INE (2005)

4.4.12 Markets

Three types of markets exist in the model, domestic goods markets, imported goods markets and factor markets. In addition a constraint is imposed on the model to ensure that the consumption of non-production activities equals their use. Equilibrium in the domestic goods market is obtained when domestic production (QQ_i) is equated to the sum of intermediate and final uses plus the private household's minimum requirements.

$$QQ_i = \sum_{j \in G} QD_{i,j} + \sum_{j \in N} QD_{i,j} + \overline{FD_i} \tag{4.84}$$

Equilibrium in the market for imported goods market (M_i) is dependent on the sum of intermediate imported goods and final use imported goods plus the private households minimum requirements.

$$M_i = \sum_{j \in G} QM_{i,j} + \sum_{j \in N} QM_{i,j} + \overline{FM_i} \tag{4.85}$$

From equations (4.84) and (4.85) it is inferred that $QD_{i,j}$ and $QM_{i,j}$ represent demand above the minimum requirements.

Equilibrium in the factor markets is obtained by equating the exogenously specified total supply with the sum of the demand from the production sectors:

$$\overline{K} = \sum_{i \in G} QK_i \tag{4.86}$$

$$\overline{L} = \sum_{i \in G} QL_i \tag{4.87}$$

4.4.13 Exports

Export prices of goods are fixed in terms of world prices,so the domestic price PX_i, is equal to the world price multiplied a single exchange rate fe:

$$PX_i = fe.\overline{PX_i} \tag{4.88}$$

Export quantities can vary, and can take any value that ensure that equation (4.88) holds. Note that QX_i and PX_i are linked to domestic prices and quantities through the CET function given in equation (4.12)

4.4.14 Foreign Tourism Demand Function

A constant elasticity of substitution parameter is used to give tourism exports:

$$CFT = \overline{CFT}\left(\frac{PFT}{fe}\right)^{\Gamma} \tag{4.89}$$

where $\overline{CFT}$ is the base level of foreign tourism exports, and Γ is the price elasticity of demand for foreign tourism. Foreign savings will increase when net FDI inflows are positive.

4.4.15 Balance of Trade

A further constraint on the model is the balance of payments, which equates the exogenously sets foreign savings ($FSAV$) with net exports, including tourism and FDI:

$$FSAV = \left(\sum_{i \in G} \overline{PX_i}.QX_i - \overline{PM_i}QM_i\right) + \overline{CFT}\left(\frac{PFT}{fe}\right) + C\_FDI_{i,t} \tag{4.90}$$

If the model is specified without FDI then the parameter $C\_FDI_{i,t}$ is removed from the equation. The balance of trade constraint then becomes the familiar external closure rule of fixed trade balance. The rationale for fixing the trade balance is usually that foreign savings will not change following a simulation; so fixing the trade balance holds the other components of the balance of payments constant. When FDI is changed as part of a simulation, other foreign savings must be kept constant for the same reason - there is no reason to expect that domestic residents' savings abroad would change. With a change in FDI, equation (4.90) does not mean that fixed trade balances are fixed, but that they are exogenously set to mirror the change in FDI.

4.4.16 Adjustment Costs

An additional characteristic of the dynamic CGE model is that it is extended to incorporate the adjustment costs of capital installation. A range of different adjustment costs have been identified in the literature. For the purposes of this thesis we are primarily concerned with costs that arise from the internal activities of the firm[17]. Internal adjustment costs refer to the output that the firm forgoes by diverting resources – capital and labour – from production to investment activity. The primary internal adjustment costs accrue through planning and installation.

Two distinct approaches for modeling capital adjustment costs exist in the literature. The first approach was defined by Phelps (1963) and is known more commonly as the "putty-clay" adjustment cost function. The putty clay assumption implies that once a piece of capital equipment has been installed, the capital labour ratio embodied in that asset does not change during the asset's lifetime. The putty clay assumption is often referred to as ex post fixed proportions i.e. factors of production are substitutable only ex ante whereas in the ex-post production function, the coefficients are fixed. Therefore it is assumed that installed capital is immobile and that the elasticity of substitution between a fixed proportion of old capital and other factor inputs is 0, and that the elasticity of substitution between the residual fraction of old capital and other primary factors is 1. For the purposes of the CGE model, the ratios of Lau, *et al.* (1997) are used and the proportion of "old" immobile capital is fixed at 90% and the remainder of new mobile capital is a residual at 10%.[18]

The net capital stock accumulation is determined by investment (either domestic or foreign) and the rate of depreciation. Investment will enter the economy from time period $t = 0$ onwards. However following a policy shock in $t = 0$, the rate of return to capital will vary between sectors and consequently capital will be redeployed in sectors in $t = 1$ where returns are higher, up to the point where marginal factor returns equate to zero. However, to prevent a 'bang-bang' type solution whereby a small differential in the rate of return between two sectors can lead to large amounts of capital being redeployed in the higher return sector, the adjustment cost function is imposed. The adjustment cost function dictates that in $t = 1$ only a fixed portion of the total capital (10%) can be redeployed in the sector where returns are higher. Capital is then not fully deployed in the sector until beginning of the next time period. The same holds in $t = 2$ following the determination of the capital stock by equation (4.78).

[17]External adjustment costs also exist and arise when a firm is a monopsonist in the capital goods market. In this instance the monopsony occurs when capital is highly firm specific and consequently faces a rising supply price for capital goods.

[18]Unfortunately other authors using this approach do not give the ratios of putty-clay capital.

The alternative method of incorporating adjustment costs in CGE models is known as the quadratic adjustment costs method. This method is attributed to Uzawa (1969). Capital installation costs are dependent on the rate of net investment relative to the existing capital stock and a 'speed of adjustment parameter'. The installation cost function is positively correlated with the level of net investment and the speed of adjustment, but inversely correlated with the size of the existing capital stock.

Both functions have their relative merits and associated limitations. In both instances there is an assumption that marginal adjustment costs rise with investment, which is an attractive proposition theoretically but difficult to justify in practice due to indivisibilities of factor inputs and the often fixed cost nature of adjustment processes. Nonetheless, there is little doubt about the need for adjustment cost functions in models that incorporate investment. With both types of model, the types of outcomes are the same in that the pattern of dynamic adjustment with respect to capital is smoother when installation costs are modeled (Lau, *et al.*, 1997), although the scale of such results is dependent on the degree of calibration. However, in terms of considering the comparative suitability of the two methods no major study has been undertaken. Lau, *et al.* (1997) do implement both methods but there is little evidence to support chosen values for exogenously set parameters or associated sensitivity analysis i.e. old/new capital ratios in the putty clay specification or the adjustment speed in the quadratic specification. Nonetheless, the majority of recent dynamic CGE models do employ an adjustment cost function, for reasons discussed above (for examples see Lau, Pahlke and Rutherford, 1997; Dixon and Rimmer, 1998; and Bchir, Decreux, Guérin and Jean, 2002) although there is little consensus or discussion as to which is the best approach the overall outcomes with respect to investment smoothing are the same.

For the purposes of this thesis, the putty-clay adjustment costs function has been implemented. Largely because of its relative ease in practical application and also for comparability reasons studies that have built similar models - for example, Bchir, Decreux, Guérin and Jean (2002) have used the same approach. The fixed proportions in the putty-clay approach can also be adjusted relatively easily for purposes of sensitivity analysis. The ratios 90% for old" immobile capital and 10% for new mobile capital have been tested for their suitability prior to conducting policy simulations in this thesis and have performed well. The results of the model appear to be more sensitive to the actual imposition of a model structure that invokes adjustment costs, rather than the choice of parameter values for old and new capital. This is because it is quite rare that more than 10% of a sectors capital would be transferred between sectors in a counterfactual.

4.5 Elasticities

As with all CGE models, the elasticity parameters play a key role in the model calibration. The elasticities which form the core component of the model are taken from the GTAP model (Hertel, 1997). These are detailed in Table 4.10 and are presented for the elasticity (ϕ_i) in the CES Armington function - denoted SIGMD; the elasticity of substitution between the factors of production in the value-added CES function (σ_i) - denoted SIGVA; and the income elasticity of demand in private consumption - denoted ICEL.

The Armington elasticity determines the elasticity of substitution between domestic and imported goods. When the Armington elasticity is greater than 1, domestic goods are substitutes. It can be seen that in all sectors of the CGE model, the Armington elasticity is elastic. The elasticity of substitution between factor inputs specifies how easily technological processes can be changes in order to use more of one input and less of another in response to a change in wages or prices. A high elasticity means that an increase in the wage rate of labour will have a greater effect on the demand for capital; firms will use more capital and less labour. A lower elasticity dampens the ability of industries to respond in this way to price changes. Again all elasticities are greater than 1. The income elasticity of demand measures the change in quantity demand relative to a change in consumer's real income. The only good considered a necessity is Agriculture, which has a income elasticity of 0.333, while all other goods are considered luxuries. The lower the income elasticity demand the smaller the substitution when income falls.

The associated Herfindal indices are presented in Table 4.10 as well as adapted from Bajo and Salas (1998). Bajo and Salas calculate the Herfindal index for 68 sectors in Spain for the year 1993. Unfortunately there are no more recent estimates. Indices are given for the accommodation and restaurant sectors individually, as well as for a range of transport sectors

Table 4.10 Key Elasticity Parameters used in the CGE Models

Sector	MPSGE Abbreviation	SIGMD	SIGVA	ICEL	Herfindahl	Number of Firms
Agriculture	Agri	2.312	0.232	0.333	0.002	649
Manufacturing	Manu	2.800	1.260	1.030	0.005	200
Hotels	Hotl	1.900	1.680	1.114	0.004	265
Hostels	Host	1.900	1.680	1.114	0.004	265
Camping	Camp	1.900	1.680	1.114	0.004	265
Other Accommodation	Oacc	1.900	1.680	1.114	0.004	265
Restaurants	Rest	1.900	1.680	1.114	0.004	265
Air Transport	Atra	1.900	1.680	1.114	0.366	3
Land Transport	Ltra	1.900	1.680	1.114	0.006	157
Sea Transport	Stra	1.900	1.680	1.114	0.006	157
Travel Agents	Trav	1.900	1.680	1.114	0.001	1667
Passenger Transport Supporting Services	Supp	1.900	1.680	1.114	0.057	17
Car Rental	Cren	1.900	1.680	1.114	0.001	1667
Leisure Sector	Leis	1.916	1.260	1.117	0.057	17
Public Sector	Publ	1.916	1.26	1.117	0	0
Services	Serv	1.916	1.260	1.117	0.001	1667

Other elasticities in the model include the price elasticity of demand for tourism goods which is set at 2. This value is based on the econometrically estimated value of UK tourism arrivals into Spain of -1.93 by de Mello *et al.* (2002), which is calibrated using the Almost Ideal Demand System of Deaton and Muellbauer (1980). While the price elasticity of domestic tourism demand is taken from panel estimated for Spain by Sampol and Perez (2000) and is also valued at 2. Elasticites for the imperfect competition parameters ν_i and ν_i^m are calibrated at 2 times and 3 times the Armington elasticity respectively. The rationale for this is given in chapter 3.

4.6 Testing the Model

There are two basic consistency tests associated with the CGE model (Condon *et al.* 1987). Firstly, the solution to the CGE model should yield a balanced input-output table. The CGE model represents the circular-flow, so that there should be 'no leakages' present in the model. Hence, the corresponding sum of the row and column totals should be equal. The base year solution should produce a data set consistent with the original input-output table with all domestic and final good prices set at unity. Secondly, the model should be homogenous of degree zero in prices. This can be tested by multiplying the level of the variable that represents the numéraire by some value (usually 10). The result should show an increase in all absolute prices and nominal magnitudes.

Linear or nonlinear solution techniques can be used to solve the CGE model (Harris, 1984). The linearised method has the advantage of being simple, flexible and results are felt to be more transitive. However, this method does not reproduce the benchmark dataset and it also produced linearisation errors. By way of contrast, non-linear solution techniques are able to reproduce the benchmark dataset as there are no linearisation errors and results are felt to be more accurate. However, this method is not ideal, as in order to generate a solution, the functional forms that can be used in the model are generally limited to the CES family (Shoven and Whalley, 1992). This does have the potential to limit the theoretical consistency of the model.

Different packages are available to the modeler. These are outlined in Gooroochurn (2003). However, the preferred choice for this thesis is MPSGE (Mathematical Programming Software for General Equilibrium). MPSGE is chosen because it includes a library of functional forms used throughout this CGE model which assists calibration. The solution package used is GAMS (General Algebraic Modelling System). Due to the sheer volume of code associated with the three CGE models built in this thesis it is not discussed

4.7 Conclusion

This chapter has outlined the key data, equations and assumptions used in the CGE models presented in this thesis. The structure of the benchmark data set was outlined in Section 4.2, issues relating to model design were presented in Section 4.3 and the model equations were presented in Section 4.4.

As noted above, the structure of the CGE models varies between chapters, but where key assumptions vary or core equations differ, variations will be discussed in the opening sections of the relevant chapters. The model used in chapter 5 is essentially the same as the model outlined above, however, additional assumptions are made so that features relating to FDI can be incorporated into the model. chapter 6 uses a CGE model which incorporates various regions of the Spanish economy, this model is however static, the large numbers of variables already incorporated in the model make dynamic solution difficult given the solvers that are currently available to the user. Chapter 7 uses the same model structure as detailed in this chapter, but with a different benchmark dataset, as the model is applied at the regional level in the Canary Islands.