POOLING TIME SERIES AND CROSS-SECTIONAL DATA AN APPLICATION TO TURKISH EXPORT DEMAND ANALYSIS

A THESIS

SUBMITTED TO THE DEPARTMENT OF MANAGEMENT
AND GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
OF BILKENT UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION

By
A. Süreyya Ural

February 1989

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I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

Assistant Prof.Dr.Kürşat Aydoğan(Principal Advisor)

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

Assistant Prof.Dr.Fatma Taşkın

I certify that I have read this thesis and that in my opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Business Administration.

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ABSTRACT

POOLING TIME SERIES AND CROSS SECTIONAL DATA: AN APPLICATION TO TURKISH EXPORT DEMAND ANALYSIS

A. Sureyya Ural
Master of Business Administration in Management
Supervisor : Assistant Prof. Dr. Kursat Aydogan
February 1989

In this study, Pooling of time series and cross sectional data is used for constructing a demand model for the Turkish Exports. Two regression models are employed and compared by their fitness to the proposed pooling arrangements and demand relations. 25 Year time series (1963-1986) and cross sectional data covering top 10 exporters from Turkey are used for this purpose. Multiple regression analysis is conducted over different pooling arrangements and properness of pooling and fitness of model is tested by means of a series of F tests.

Keywords: Pooling Time Series and Cross Sectional data, Multiple Regression, Covariance Model, Least Squares, Dummy Variables, F tests.

ÖZET

Zaman Serileri ve Kesitsel Verilerin Birleştirilmesi: Türk İhracatina Taleb Analizi Üzerine Bir Uygulama

A. Süreyya Ural
İşletme Yonetimi Yüksek Lisans
Tez Yoneticisi : Yard. Prof. Dr. Kursat Aydogan
Subat 1989

Bu çalisma zaman serisi ve kesitsel verilerin birleştirilmesi ve Türk ihracatina talep modellerinin mukayesesi ve birleştirme şekilleri incelenmiştir. Bu amaç için iki regresyon modeli kurulmuş ve bunlarin değişik birleştirme gruplari için uygunluklari bir birleri ile mukayese edilmiş ve birleştirmenin geçerliliği test edilmiştir. Bu analizler için 25 senelik bir zaman serisi (1963-1986) ve Türkiyeden en çok ihracat yapan 10 ülke kesiti incelenmiştir. Çok değişkenli regresyon analizi uygulanarak ve elde edilen sonuçlar dir dizi F testi ile denenerek hem birlestirmenin hemde modelin uygunlugu arastirilmistir.

Anahtar Kelimeler: Zaman Serisi ve Kesitsel Verilerin Birlestirilmesi, Cok Degiskenli Regresyon, Kovaryans Modeli, En Kucuk Kareler, Dummy Degiskenler, F testleri.

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I owe great deal of thanks to my parents for their continuous support.

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1.0 INTRODUCTION:

This study aims to construct a linear demand model for the Turkish export on the pooled time series and cross sectional data. Two regression models are utilized for this purpose in determining properness of pooling and the models are compared in terms of their fitness to the proposed application and their possible advantages in each different pooling arrangement. This study in essence does not aim to come to conclusions on the very complex mechanisms of Foreign Trade but attempts to make use of such data to show advantages and possibilities of pooling data and model selection for that pupose. Export data is used in this study on the basis of suitability of the characteristics of export data and export demand function for the above mentioned analysis.

This study is composed two phases, first phase was studying Turkish export characteristics and possible variables to be used to construct the export demand model. In that part of the study possible variables are included to the demand function however only the basic and theoretically most significant ones are kept for the analysis in order to simplify the model for the main purpose of this study.

At later phases the data is grouped in different arrangements in a progressive manner untill a sound and justified pooling arrangement is achieved. Comparison of the models used is made at every step where a new pooling arrangement is examined.

A brief overview of the Turkish export trends and recent changes in foreign trade policies are presented in the following sections, in order to familiarize ourselves with the environment where the data is actually generated and for reaching correct reasoning for the model required for the puroses of this study.

1.1 Recent Export Performance :

Export income is one of the most important sources of income of the economy. It is even a more critical matter for the countries with large foreign trade deficits and therefore, it is essential that new markets be found to ensure its increase, that new undertakings be made, and that new incentives be provided. The importance of the export revenue has been well understood and aggressive actions toward expanding the export income have been taken in the recent years. Turkey's export income has showed a tendency to increase. The graph 1.5 depicts the changes in Turkish foreign trade trends. It can be observed that after 1980 a major change in the export trend takes place.

The factors that have effected demand to Turkish exports were numerous. These variables that have impact on the export performance of a country, compose of wide spread factors from domestic political and economic decisions, to international trade and economic affairs. Changes on these factors will effect export performance of that country. Changes in the economic policy after 1980 had positive influence on the export performance of Turkish exporters. (I.T.O. 1986)

Among the various newly set regulations to activate foreign trade and to develop higher export performances, the industrialist groups find that incentives given to the export sector were the most fruitful in terms of progress achieved in that area (ISO,1987).

The Trade and Industry Associations shared the view that Turkish export performance showed a successful pattern in comparison to the world conjuncture. The government estimate of 8.700 million dollar worth of 1986 exports have been actualized as 7.456 million dollar, which is approximately 6.3 % less than 1985 export values. The export revenue have increased 61 % in US dollars in 1981, 22 % in 1982, 0.3 % decreased in 1983, and increased 24.5 % in 1984, and 11,5 % in 1985, contrary to the world trends. In table 1.1 a list of export and import constant dollar values are given for the last 25 year period.

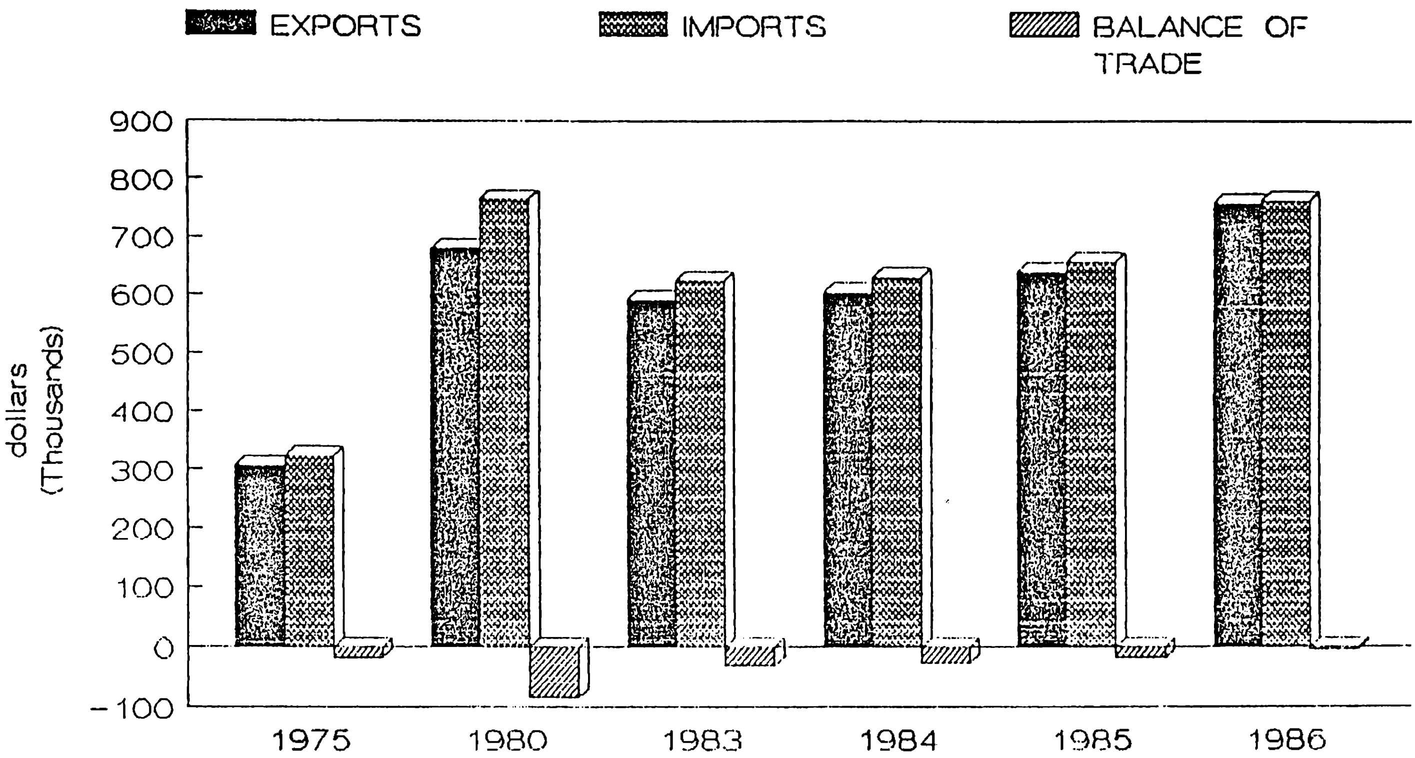
The world foreign trade values in different country groups are presented in table 1.1 . Comparing the export trends in those country groups' to Turkish export performance (table 1.2) it may be observed that between the period 1980 and 1983 the developed countries had 13 % less exports, developing countries had approximately no change while Turkish exports had a 16 % increase. Similarly increasing treads are observed between the 1984 and 1986 period.

Table 1.1 WORLD FOREIGN TRADE(*) (Million Dollars)

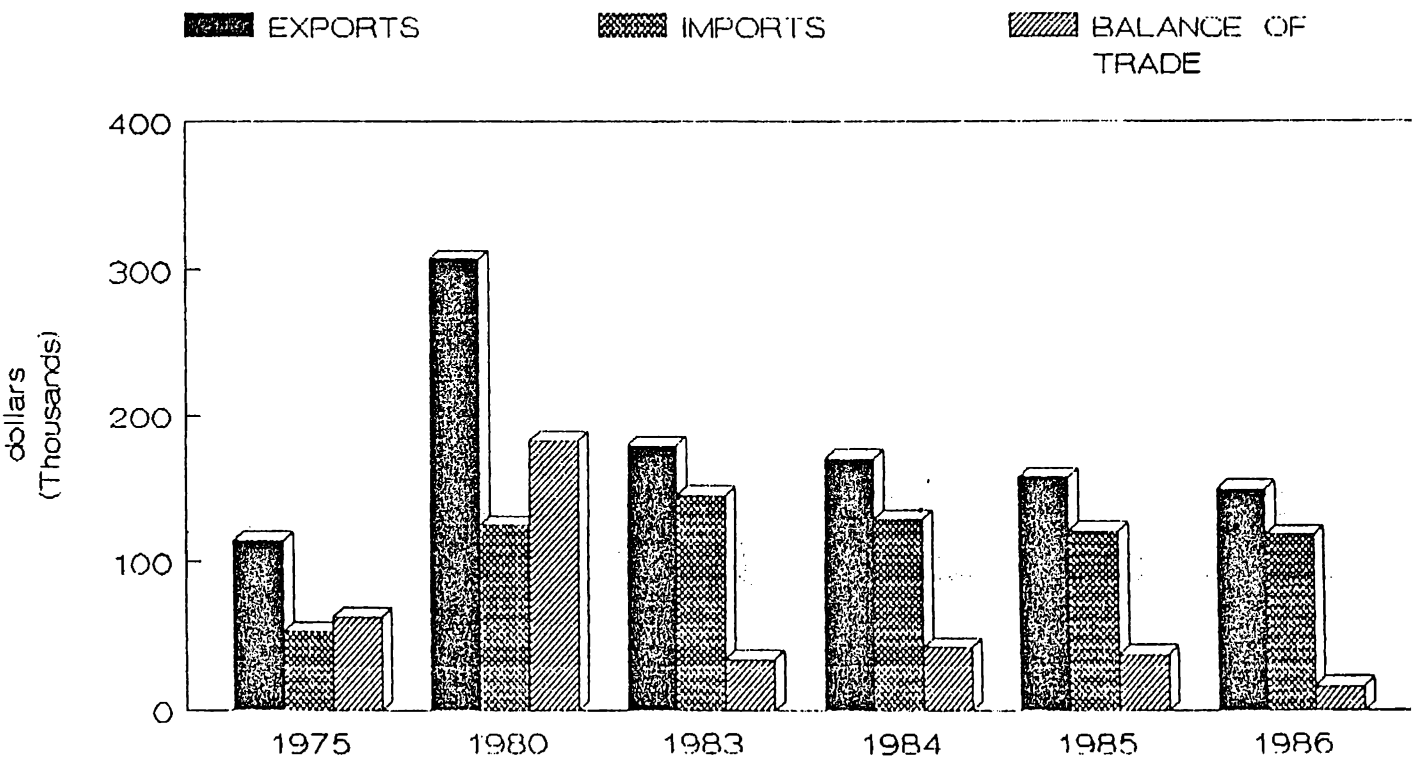
		1975	1980	1983	1984	1985	JAN-JUNE
WORLD	Export	907124	2055312	1890796	1997373	2045935	1099448
	Import	877063	1997812	1813430	1906803	1938153	1047724
	FTB	-30061	-57500	-77366	-90570	-107781	-51725
DEVELOPED COUNTRIES	Export	607886	1406563	1232159	1338073	1385692	772612
	Import	575068	1251524	1148270	1220512	1265465	715106
	FTB	-32819	-155039	-83889	-117561	-120227	-57506
DEVELOPING COUNTRIES	Export	196993	463420	463669	460315	440581	213401
	Import	215472	569353	462162	483080	469604	229225
	FTB	-18479	-105933	-1507	-22766	-29023	-15824
OPEC (1) COUNTRIES	Export	51983	124545	144924	128131	120039	58820
	Import	113900	306723	178981	169480	156727	74259
	FTB	61917	182178	34058	41349	36688	15439
UNDERDEVELOPED COUNTRIES (2)	Export	7153	15952	14647	14616	14469	6372
	Import	3501	7771	6560	7540	6763	3350
	FTB	-3652	-1181	-8087	-7076	-7706	-3022
CENTRALLY PLANNED COUNTRIES	Export	102245	185330	194968	198986	219663	113436
	Import	86524	176937	202998	203212	203066	103393
	FTB	-15721	-8393	8030	4225	-16577	-10043
EUROPEAN ECONOMIC COMMUNITY	Export	323813	765901	623346	629886	657738	381619
	Import	307386	680745	591371	602421	639375	379900
	FTB	-17427	-85156	-31975	-27465	-18364	-1719

(1) Algeria, Equator, Gabon, Indonesia, Iran, Irak, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Venezuela
(2) Afghanistan, Bangladesh, Benin, Botswana, Burundi, Central Arab Republic, Chad, Democratic Yemen, Habeshistan, Gambia, Guinea Haiti, Lesotho, Malawi Sudan, Somali, Uganda, Tanzania, Niger, Upper Volta
(*) Monthly Statistical Bulletin January 1987, United Nations.
(**) OPEC and Underdeveloped countries included in Developing countries.

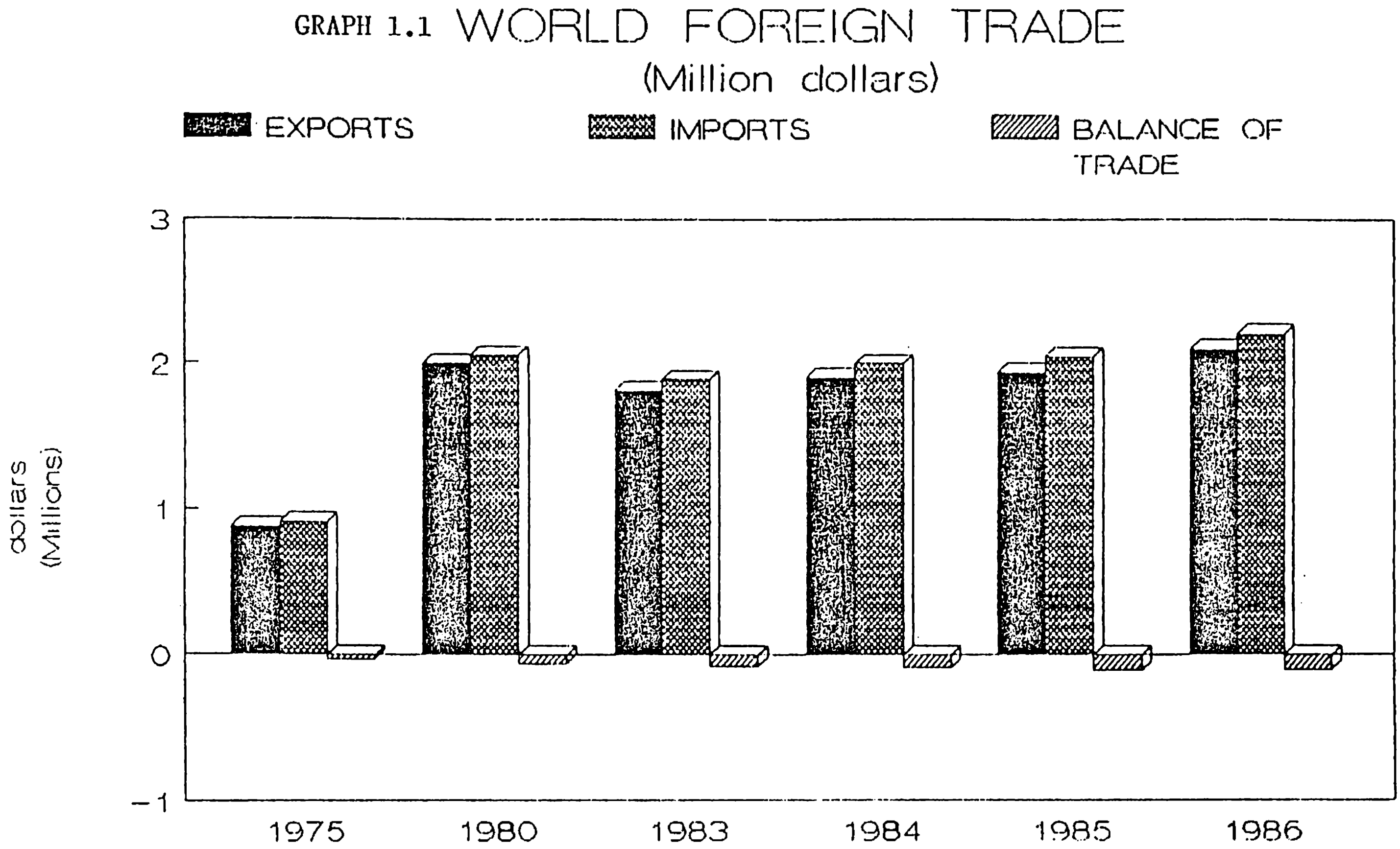
GRAPH 1.3 EUROPEAN ECONOMIC COMMUNITY



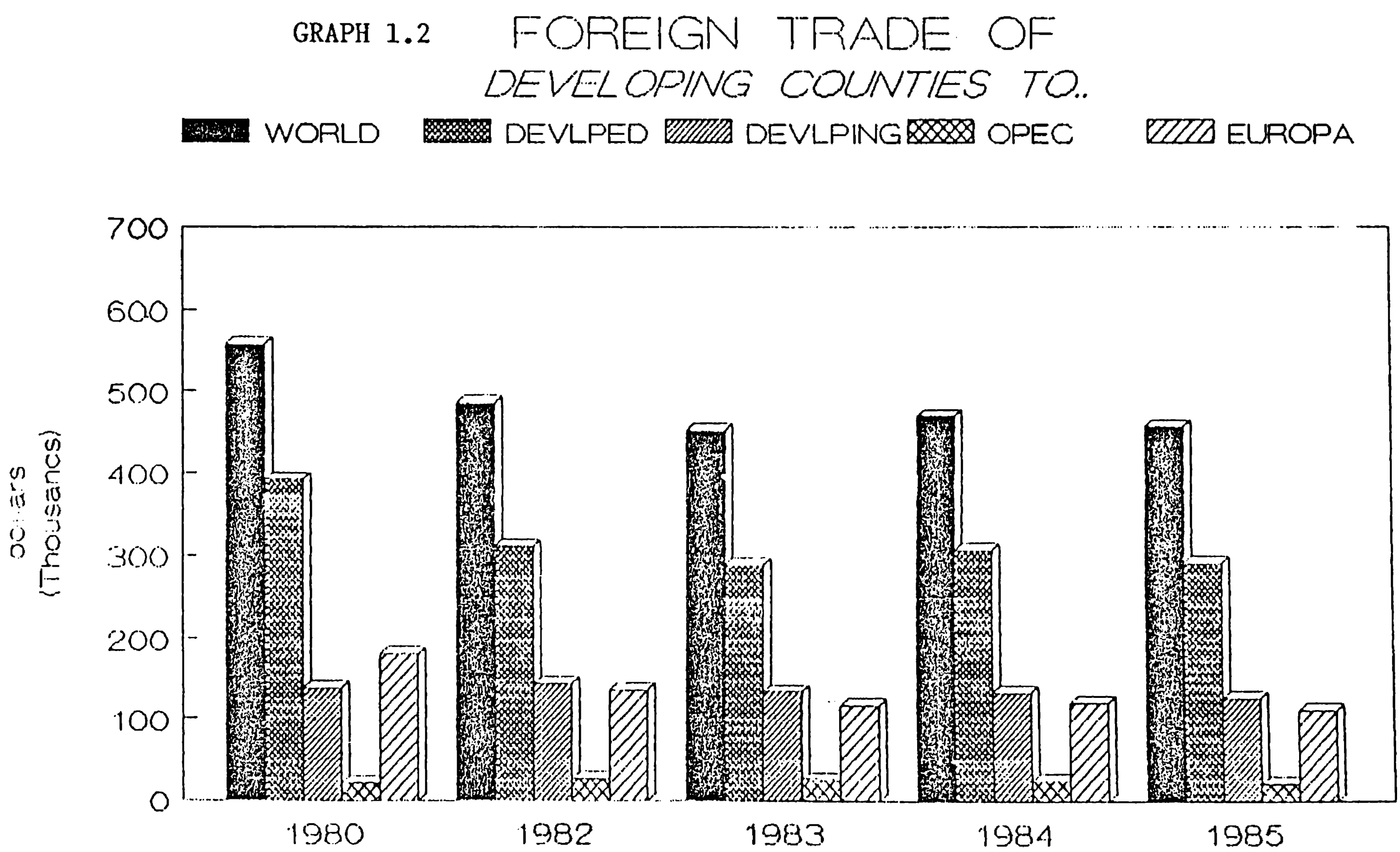
GRAPH 1.4 OPEC
(Million dollars)



GRAPH 1.1



GRAPH 1.2



The decrease in export earnings in 1986 may be accounted for the decrease in raw petroleum prices, forcing especially Iran and Irak to lower their exports from Turkey. However this decrease is compensated, and in 1987, between the period January november Turkish exports reached to US $ 8,985.925, value which was a 20.5 % increase.

In the table 1.1, the trends in foreign trade for various

significant groups of countries are depicted. Also in the graphs 1.1 to 1.4 the changes in world trade are shown. In 1986 world trade has increased 13 % and the world imports have a growth rate of over 10 %. Examining movements within the world trade, it is observed that majority of this activity is on the developed countries and not within the under-developed or developing country groups. The OPEC countries had increased their imports only 2.6 % while their exports have decreased 3.4 %. Turkish exports, on the other hand, have been following the increasing trend recently. In the table 1.2 and from the graph 1.5 the changes in the Turkish Exports and Imports are presented. A change in the rate of growth after the year 1980 is noticeable.

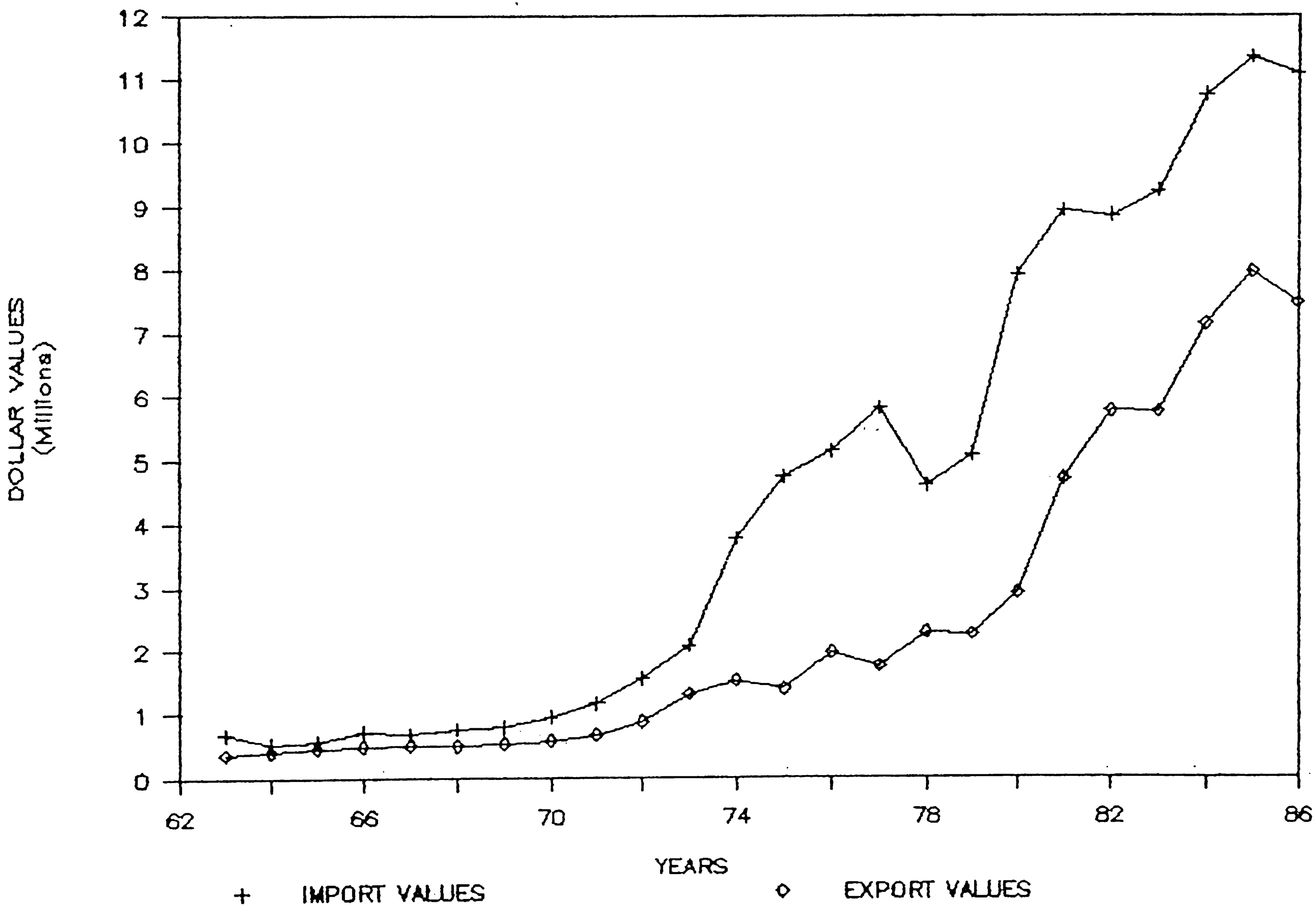
A brief survey of international trade is sufficient to see the complexity of the issue. The increases and decreases are effected by many factors of which some are quite complex and some are not easy to identify.

Table 1.2

TURKISH EXPORT AND IMPORT VALUES
(1000 DOLLAR)

YEARS	IMPORT	EXPORT	FOREIGN TRADE BALANCE
1963	687616	368086	319530
1964	537396	410771	126625
1965	571952	463738	108214
1966	718269	490507	227762
1967	684668	522334	162334
1968	763663	496419	267244
1969	801235	536833	264402
1970	947605	588476	359129
1971	1170841	676601	494240
1972	1562553	884968	677585
1973	2086214	1317082	769132
1974	3777558	1532181	2245377
1975	4738558	1401075	3337483
1976	5128646	1960214	3168432
1977	5796277	1753026	4043251
1978	4599024	2288162	2310862
1979	5069431	2261195	2808236
1980	7909364	2910121	4999243
1981	8933373	4702934	4230439
1982	8842481	5745973	3096508
1983	9235001	5727833	3507168
1984	10756922	7133603	3623319
1985	11343375	7958009	3385366
1986	11104770	7456724	3648046

TURKISH EXPORT AND IMPORT VALUES



Graph 1.5

1.2 Overview to the Design of the Study :

The export demand function is a function where apart from the possible general variables like exchange rate, gross national product (GNP) etc, variations due to differences specific to each country and/or each period may become a statistically significant factor influencing the demand function. Similarly, demand to the Turkish exports may be assumed to be governed by the factors common to all those general variables but at a rate significantly different for each country. The same argument is true for time vise variances which may be quite complex for capturing by simple general variables. These changes among different countries and periods may limit pooling of time series and cross sectional data unless proper model selection is achieved. Two independent variables are used in the analysis. These explanatory variables are the Gross National Product of countries studied and rate of Exchange between Turkish lira and the currency of the importing country. These variables are shortly referred as GNP and EXCH, in the following sections. In order to satisfy linearity these variables are used in the logarithmic form.

For this study a data set that had both time series and cross sectional variances, together with theoretically sound but reasonably simple function were required. In that order, a 25 year time series and 10 country cross sectional data set for export values are utilized on two linear regression models namely ordinary least squares (OLS) and least squares dummy variables (LSDV) models .

The countries that are used in the analysis have been selected according to their past import performance from Turkey. The data set contains the ten countries that have ranked as the top ten importers of Turkish goods.

[illegible] this [illegible] demand for [illegible] will [illegible] nations [illegible] of the importing [illegible].

[illegible] a positive relationship between the demand for [illegible] Turkey in year t, and the exchange rate between [illegible] and the currency of the importing country [illegible]

[illegible]ypothesis simply takes [illegible] the fact that [illegible] goods get, higher quantity [illegible] demanded [illegible] more attractive as their price for the [illegible]

[illegible] model is a better estimator of the actual [illegible] Turkish exports.

[illegible] of cross sectional and time series data [illegible] method for the analysis of [illegible] demand [illegible]

2. HYPOTHESES:

The following hypotheses have been defined for this study. In the following sections the validity of these hypotheses will be analyzed.

H_1: There exists a positive relationship between the Exports from Turkey in the year t and GNP (Gross National Product) of the importing country in the year t.

In formulating this hypothesis, it is assumed that demand for exports from country P will increase by the growth of gross national product of the importing country.

H_2: There is a positive relationship between the demand for Exports from Turkey in year t, and the Exchange rate between Turkish lira and the currency of the importing country in year t.

This hypothesis simply takes in to account the fact that cheaper the Exported goods get, higher quantity to be demanded. The export goods get more attractive as their price for the importer reduces.

H_3: The LSDV model is a better estimator of the actual demand pattern to Turkish exports.

H_4: The pooling of cross sectional and time series data is appropriate method for the analysis of Export demand to Turkish goods.

3.0. THE THEORY:

This study makes use of a multiple regression analysis on pooled cross-section and time series data. The Study employs *Covariance* (LSDV) and OLS models. In the following sections, description and basics of multiple regression, models used and pooling of time series and cross section data, are presented.

3.1. Multiple Regression:

When the examined dependent variable has the posibility of dependence on more than one independent variable, a multiple regression methodology is employed to estimate the model in order to offer explanations on partial effects of each variable in the equation. The use of the methodology enables the researcher to see the effect of changes in one variable while all others are held constant. A typical regression may take the following form.

$$E(Y)_{it} = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon$$

where;

- Y : is the dependent variable
- $E(Y)$: is the expected value of the dependent variable
- α_0 : is the constant term (the intercept)
- β_i : is the slope coefficient of independent variable X_i
- X_i : is the independent variable
- ϵ : is the error term

This equation indicates that observed values differ from this equation by the error term ϵ . The coefficients β_i are the partial derivatives of the E(Y) with respect to X_i. Due to this property these coefficient are sometimes refered as partial regression coefficients. The dependent variable Y is often called regressand and the right hand side variables are called regressors.

Multiple regression analysis measures the effect of a small change in the independent variable X_i on Y while keeping effects of other variables constant. By this capability, the methodology differs from regressing Y on each X_i, and ignoring the effects of the other variables .

The basic assumptions of the Least Squares analysis are,

- the error terms have a mean of zero,
- the error terms have the same variance,
- different error terms are statisticaly independent
- the error terms are normally distributed
- and finally the right hand side variables are statistically independent of the error terms

The coefficients β_i and α_i, are obtained by setting up the equation to minimize the sum of squared error term. Taking partial derivatives of this equation and equating them to zero yield the "normal equations". The procedure requires the means of all variables X_i, Y, the sum of squares and sum of products, in order to use them in the calculations of the results of the above mentioned normal equations,

$$S_{ij}=\sum_{p} X_{ip}X_{jp} - n\,\bar{X}_i\bar{X}_j$$

and

$$S_{ij}=\sum_{p} X_{ip}Y_{p} - n\,\bar{X}_i\bar{Y}$$

$$S_{yy}=\sum_{p} Y_p^{2} - n\,\bar{Y}^2$$

where,

$i,j = \{1,2,3,...K\}$ and K is total number of independent variables

$p = \{1,2,.....n\}$ and n is the total number of observations

then solving the simultaneous equations given by,

$$S_{iy} = \sum_{p} \hat{\beta}_j S_{ip}$$

for all $i=\{1,2,...K\}$

then the intercept term is obtained by simple arithmetics.

The residual sum of squares, which is reffered to as the unexplained part of the regression, is expressed as:

$$RSS = S_{yy} - \sum \hat{\beta}_i \; S_{iy}$$

For all i

In search of a relation between the dependent and the independent variables, basic test statistics are to be conducted. These basic statistics are t-statistics, F statistics . R^2 value is also obtained to see the power of regression. Briefly, by the use of t statistics the existence of a systematic relationship or in other words, test of whether a coefficient of a variable is statistically different from zero may be checked.

The F statistics on the other hand, is advantageous in multiple regression where there are several independent variables, obviously testing $R^2=0$ cannot be justified with a tests on single coefficients since one would not know which coefficient to look at. The practical way to test $R^2=0$ against $R^2>0$ in the multiple regression model is the F test. F test checks the significance of all independent variables as a group. F test is a one tail test where the large values of the computed F statistic would favor $R^2>0$ against $R^2=0$.

Coefficiant of multiple determination, R^2 measures the explanatory power of the regression equation the fraction of the variation in the observed values of Y that the estimated regression equation can account for. Simply:

$$R^2 = 1 - \frac{RSS}{TSS} = \frac{RGSS}{TSS} = \frac{\sum(\hat{Y}_t - \bar{Y})}{\sum(Y_t - \bar{Y})}$$

where;

RSS: Residual Sum of Squares,

RGSS: Regression Sum of Squares,

TSS: Total Sum of squares.

The computer program employed in this study calculate the test statistics automatically.

3.2. OLS Model:

Both models used in this study are least squares models. The Ordinary Least Squares model, which the basic formulation is explained in the previous section, is the most simple and general form of the least squares model where the pooled cross section and time series data are analyized in the form given in the multiple regression section. It will provide a common intercept term, and partial regression coefficients for the independent variables. This model may be inadequate in cases where homogeneity of partial regression coefficient or in short slope homogeneity and/or intercept homogeneity are in doubt. The above mentioned assumptions are valid for this model.

3.3. LSDV [Covariance] Model:

The Least Squares Dummy Variable model which is also called as covariance model, takes into consideration the class effects, that may result due to the factors specific to each class that are ignored during formulation by any reason. This model may be used for the cases where the classes have common slopes, and different intercepts, or for classes that have different slopes but common intercept, and finally for classes which have different intercepts, different slopes. The case where both slopes and intercepts are common will mean that OLS and LSDV are practically identical and both will yield the same result.

In this study the case where slopes are common and intercepts are different will be utilized since it is the case fits to the purposes of our study. The common slopes assumption will show pooling success and the intercept difference will indicate class effect and this will be a credit for use of dummy variables to capture this class effect.

Establishing the equation for the LSDV model one must consider the F test he wishes to carry out to test structural changes. In our study we shall only look in to the case where the slopes are common and the intercepts are free to differ from class to class (in this study each country is considered as a different class). The equation for this model, when used with a computer program that generates the intercept term automatically, and for cross sectional dummy variables-only, will be constructed as:

$$Y_{it} = \alpha_1 + \alpha_2 C_{it,1} + \dots + \alpha_{(P-1)} C_{it,(P-1)} + \beta_1 X_{it,1} + \dots + \beta_{(K-1)} X_{it,(K-1)} + \epsilon_{it}$$

where, C_{it}: dummy variable that takes the value 1 or 0
α_i: is the intercept coefficient for dummy variable i,
X: is the explanatory (independent) variable,
β: is the slope coefficient for variable X_k,
ϵ: is the error term

and,

$$i=\{1,2,\dots P\},\ t=\{1,2,\dots M\},\ k=\{2,3,\dots K\}$$

where,

P is the total number of cross sectional units,
M is the total number of series units,
K is the number of independent variables +1

An obvious question with regards to covariance model is whether the inclusion of the dummy variables and the consequent loss of the number of degrees of freedom is really necessary. The reasoning underlying the covariance model is that in specifying the regression model we have failed to include relevant explanatory variables that do not change over time (and perhaps others that do change over time but have the same value for all cross-sectional units), and that the inclusion of dummy variables is a cover up of our ignorance. If in doubt, the need for the inclusion of the dummy variables may be justified by means of F tests (Kmenta,1986). To do this we need to estimate the regression equation with and without the dummy variables and compare the resulting error sums of squares by means of an F test. Similarly we are also cautious about the appropriateness of pooling of observations under the assumption of all cross-sectional units have common (same) slopes, again in that case we will estimate the regression coefficients for each cross-sectional unit and compare the error sums of squares with that obtained from the application of Least Square Dummy variables (LSDV) model, by the help of another F test.

3.4. Pooling of Time series and Cross Section Data

One major application of analysis of variance and covariance is in the problem of pooling cross-sectional and time-series data to decide on questions like whether or not to estimate the pooled regression with different degrees of pooling.

By pooling one may obtain a larger set of data and with a proper model will be able to estimate a single function instead of a number of single equations.

In search of an answer to the questions mentioned above, hypothesis for each case are tested by means of a series of F tests.
For these tests Residual Sum of Squared errors, from OLS model RSS_1, LSDV model RSS_2 and finally the individual regression RSS_i's sum for the RSS_3 are needed. These residuals and their consequent degrees of freedoms are summarized below.

		d.o.f
OLS MODEL	RSS_1	mp-k
LSDV MODEL	RSS_2	mp-p-k+1
Individual		
$\sum RSS_i$'s	RSS_3	$\sum_i (M_i\text{-}KP) - p(m\text{-}k)$

Where;

m: is the number of observations,
p: is the number of different classes and,
k: is the number of independent variables plus one.

A simple yet important indication of the above formulation of degrees of freedom is the fact that there is a limit to the number of dummy variables that can be introduced to the regression equation, for a given number of time series observations, variables and cross sectional units. Otherwise, the degrees of freedom may become negative, and calculations of F values will not be possible.

Basicaly there are three F tests to be conducted;

1. The F test for the hypothesis $H_0:\beta_1=\beta_2=....=\beta_p$ for differences of slopes between classes, will be as;

$$F_2 = \frac{(RSS_2-RSS_3)/(pk-p-k+1)}{(RSS_3)/(p(m-k))}$$

if the null hypothesis is rejected, this will indicate that there is no slope homogeneity. This result will be accounted for poor pooling arrangement.

2. The F test for differences in intercepts (conditional on slope homogeneity)

$$H_0:\alpha_1=\alpha_2=....=\alpha_p \quad \text{given} \quad \beta_1=\beta_2=....=\beta_p$$

$$F_1 = \frac{(RSS_1-RSS_2)/(p-1)}{(RSS_2)/(pm-p-k+1))}$$

Accepting the H_0 will be another evidence for properness of pooling, However, rejecting H%o may indicate that pooling is good, under LSDV model which will be the prefered model for this case.

3. the hypothesis for overall homogeneity of the relation as one regression is,

$$H_0: \alpha_1 = \alpha_2 = ... = \alpha_p \text{ and } \beta_1 = \beta_2 = ... = \beta_p$$

and the related F test will be,

$$F_3 = \frac{(RSS_1 - RSS_3)/(k(p-1))}{(RSS_3)/(p(m-k))}$$

Rejecting H_0 alone may mean rejection of pooling. However, if intercept homogeneity is rejected while the slope homogeneity is accepted, the interpretation may be in favor of pooling provided that LSDV model is used to estimate the regression equation. Furthermore rejecting H_0 will indicate denial of appropriateness of OLS model too.

To summarize, the F tests are used to test the properness of pooling and fitness of model. If the slope homogeneity is rejected the pooling arrangement is also rejected and intercept homogeneity will need not to be checked. One cannot credit any of the model in such case.

If slope homogeneity is satisfied then one need to check intercept homogeneity. If the intercept homogeneity is also satisfied this will mean pooling was properly done and OLS is sufficient as a model. However if intercept homogeneity is rejected then pooling may or may not be appropriate depending on the overall homogeneity. In that case one shall look to the overall homogeneity. If overall homogeneity is satisfied the pooling will be still appropriate and OLS will be prefered against LSDV. However, if the overall homogeneity is rejected while slope homogeneity is satisfied this will be a result in favor of LSDV model and pooling will still be appropriate.

4. METHODOLOGY:

The hypotheses that have been established are tested by using multiple regression analysis for 25 year time period and across ten countries. The ten countries, composed of USA, European and Middle East countries, which are listed below. These ten countries accounted for the 63.13 % of the foreign trade volume and more significantly they were recipients of 68.41 % of our exports, in the year 1986 (Treasury and under secretary of Foreign Trade 1987 Summary output). These top importers in the order according to their 1986 imports from Turkey, are:

- W. GERMANY
- ITALY
- IRAN
- IRAK
- U.S.A.
- SAUDI ARABIA
- ENGLAND
- FRANCE
- HOLLAND
- BELGIUM-LUXEMBOURG

These ten countries are combined in different arrangements in order to obtain best pooling group.

In the initial stage of the study, the explanatory variables were tested for significance and each was considered as a potential for improvement of the regression equation. Some of these variables such as the Raw oil Prices, proved to be insignificant, whereas some were insufficient in data, and some had weak theoretical backing. An evaluation process took place in the course of selecting the proper variables for the regression analysis. Variables that have been tried in the equation during the initial stage were :

- DGNP Change in Gnp between t+1 and t^{th} period.
- BOT The balance of P^{th} country's exports and imports.
- PETR Petroleum prices (constant for all countries)
- IMP Imports that Turkey has made to the P^{th} country.
- PREVEX Previous exports to the P^{th} country
- GNP Gross National Product of importing country
- EXCH rate of Exchange between Turkhish lira and the currency of the importing country.

The GNP variable is introduced to the equation assuming that countries having higher GNP values may have more resources (money) to spend on imported goods and that they would prefer to import from other countries. Therefore a positive relation is assumed for this variable. Similarly the DGNP variable is introduced to see if the change in GNP value better express the demand to Exports than the simple GNP value. However this variable during the study came out to be less significant and no additional improvement achieved by introducing this variable in to the equation.

The BOT the balance of trade variable was introduced assuming that countries that import more goods to Turkey would tent to export more from Turkey. However this variable did not improved the equation as expected.

Petroleum prices were considered as a variable since especially for the petroleum producing Arab countries its increase would suggest more resources to import goods from other countries on of which was Turkey. However, its increase and decrease also meant increase and decrease of GNP of those countries. This raised the problem of multicollinearity, which is the problem encountered with variables that one of which is a linear combinations of the other.

The variable PREX was considered on the assumtion that a "Learning by Doing" mechanism exists and improves export performance. Although this assumption would come out to be significant, its quite high correlation with the export values, caused its elimination from the function.

In aggregate studies as this study, certain level of correlation among the explanatory variables is inevitable. Keeping many variables that are correlated with each other would only complicate the matter rather than to explain it better. Finally, lesser but useful right hand side variables are utilized considering the main purpose of this study.

Discarding these variables but the Gnp and Exch, of course in no way suggests that they may be meaningless in any other form under a different method of analysis, nor does it invalidate any other study that have used such variables in the above mentioned form.

To summarize, the selected variables are the variable GNP which is the Gross National Product of importing country, and the EXCH which is the Exchange rate between Turkish lira and currency of the import ing country.

4.1. Data:

Data on the Export values in dollars have been obtained from the Prime Ministry, Treasury and Foreign Trade Under Secretary, Data Collection and Processing Department. The documents (the computer outputs of Turkish foreign trade values sorted country wise, in terms of country groups like OPEC, EEC etc.) contained the export figures for all countries, country groups, continents etc. together with the import figures, percentages and performance orders.

The data on the Gross National Product and Exchange rate, are obtained from the International Financial Statistics of the International Monetary Found. The GNP values are indexed values of the US dollar amounts, and the Exchange rates are calculated by converting exchange rates in currency per Turkish Lira (e.i. 1 DM=12 TL). The exchange rates are the period averages of each year.

4.2. The Model:

There are two different models in this study. The first is the Ordinary Least Squares model. Given P countries and M observations on the variables, the OLS model for the ten country is set up as :

$$\log(EXP)_t = \alpha_0+\beta_1\log(GNP)_{it}+\beta_2 Log(EXCH)_{it}+\epsilon_{it}$$

where $i=\{1,2,3,....P\}$; and $t=\{1,2,3,....M\}$,

for P countries and M years

β_i's are the regression parameters,

ϵ_{it} is the error term.

Since a linear multiple regression analysis is adopted in this study the independent variables and the dependent variables are arranged in logarithmic form. By this the linearity assumption is satisfied.

F tests are conducted in order to test the overall significance of the regression equation exhibited above. In order to test the significance of individual regression coefficients t tests are carried out. All t tests are one-tail tests with the null hypotheses of, $\beta_i=0$ for all $i=\{1,2\}$; and the alternative hypotheses of $\beta_i>0$, since the expected relationship between the variables on the right side of equation and the left are positive. This model is employed for the three pooling groups to be defined in the next section.

The second model is the Least Squares Dummy variable model (LSDV) which is also called Covariance model. The model utilizes P-1 dummy variables for the P countries pooled, in order to better estimate the effect arising from country differences. The LSDV model by definition has no common intercept term, this characteristic of the model may arise problems if the computer program utilized calculates intercept term automatically. Having P-1 dummies enables one to overcome the problem of automatic intercept calculation of the statistical program. Then the α_0 term in the equation is the first country's intercept term.

The LSDV model is then take the form,

$$\log(EXP)_t = \alpha_0+\alpha_1 C_{1t,1}+..+\alpha_{(p-1)}C_{1t,(p-1)}+\beta_1\log(GNP)_{1t}+\beta_2 Log(EXCH)_{1t}+\epsilon$$

where;

$C_{1t,p}$ is the country dummy variable (1 or 0)
α_i: the intercept term for country i
β: is the slope coefficent
ϵ: is the error term

In the most general form, including dummy variables to capture both time variance and cross sectional variance is possible however including these dummy variables induce loss of degrees of freedom. In this study although initially dummy variables were included for both time and cross sectional variance, time dummy variables are dropped due to calculation limitations for F tests with reduced degrees of freedom. Therefore only country dummy variables are used in this study.

4.3. Pooling of data:

As it was referred to in previous sections this study utilizes pooled time series-cross sectional data. The virtue of this approach comes from the enlargement of the sample size considerably. As a result, a single pooled regression that has the superiority of accommodating higher precision than a number of different regression. However the pooling, if done inappropriately, has the risk of introducing aggregation bias which may result in erroneous estimates. In our study the tests mentioned on the Theory section are conducted to test the appropriateness of pooling (Yavas and Vardiabasis,1987).

In order to test the appropriateness of pooling, first the usual t and the F tests are conducted. Secondly, covariance analysis is employed to test the structural changes over the different pooling groups. The study contains three different pooling arrangements. First arrangement is the pool composed of all ten countries, second, is the seven European countries (including USA) of the initial set excluding Iran, Irak, Saudi Arabia, third is the five countries selected after examining results of the above two and the individual country regressions. F tests that have been formulated in the theory section are employed in conjunction with the analysis of variance procedures.

4.4 Analysis Tools:

In this study the Statistical Package for Social Sciences, (SPSS) Personal Computer version has been utilized to analyze the data. For data preparation and calculations computer programs such as Lotus and Eureka have been employed to assist the analysis.

The SPSS program is utilized for selection of significant variables at the first stage. The program it self tests and selects each variable proposed according to their T values. The variables that do not contribute to the equation are eliminated from the equation. Forward and

Backward selection routines are used for this purpose.

5. RESULTS OF THE STUDY:

The results of the multiple regression analysis, on different pooling arrangements for the cross sectional units are presented in this section. The order of presentation of results are as follows.

First, the results of multiple regression of individual countries which will be needed for the calculation of *F* values are presented. Following the individual regressions, the results of the pooled regression of time series and cross sectional data for all ten countries are given. Thirdly depicted are the findings of the pooling arrangement of seven countries excluding Iran, Irak, Saudia Arabia. This arrangement is named as *EURO 7* however, this group contained USA data. The last results belong to the arrangement which is the subset of previous group Euro 7, and it consists of Germany, Italy, England, France, Holland, this grouping is constructed after observing the results of the other regression and F tests as well as individual regression results. This last group have been labled as *EURO 5*.

The form of the regression equation is same for all pooling arrangements with only difference in the number of cross section dummy variables. The number of country dummy variables are one less of the number of countries involved in that arrangement for each run. The number of time series observations (m), nuber of counries included for that trial (p) and finally number of independent variables plus 1 (k) is given on the Anova tables together with the residual sum of squares, degress of freedom and mean square values.

The results of each different pooling arrangement is also presented in a grafical presentation. For the construction of these graphs actual export values used in the study are plotted against each other on both axis. This, as expected formed the 45° line representing the actualization level. The values obtained from the estimated demand function of each trial, corresponding to the actual export values are ploted against to these. Closer the model estimated values positioned against the 45° line the better the regression shall be.

5.1.1. Individual Country Regression :

Each country that has been used for this study is initially studied individually. Multiple regression results are obtained for each country alone. These results were required for evaluating validity of the proposed relations for each country used in the study and for obtaining the individual residual sum of squares to be used in the calculations of F tests summarized in previous sections. The results of these regression runs are depicted in the table 5.1.. As these results will be common to all other analysis they will not appear on the regression results of above mentioned pooling arrangements.

All of the individual regression have high adjusted R^2 and significant F values. The estimated coefficients are comparable in their magnitudes and exhibited signs are in agreement with the hypotheses . Having these results provided necessary conditions for continuing with the analysis and use the results of individual regressions in the analysis for the pooled cases.

The coefficient β_1 indicate that one unit increase in log GNP would increase Log of Export value by 2.915 for Germany while keeping the variable log EXCH constant. Similarly a 0.3415 unit increase in log export value will be expected for a unit increase in log exchange rate.

Graphs 5.1 and 5.2 depicts the values obtained from individual regression equation for each country against the actual export values for that country. In the graph 5.1 values obtained from all ten counrtry are plotted. In the graph 5.2 only the values from EURO 5 arrangement are plotted in order to be able to compared the results with the results of EURO 5 when the data is pooled (graphs 5.5 and 5.6) The distribution of points along the solid line (which is a 45 degree line) indicates how well the regression has explained the actual variation of the data in a different way.

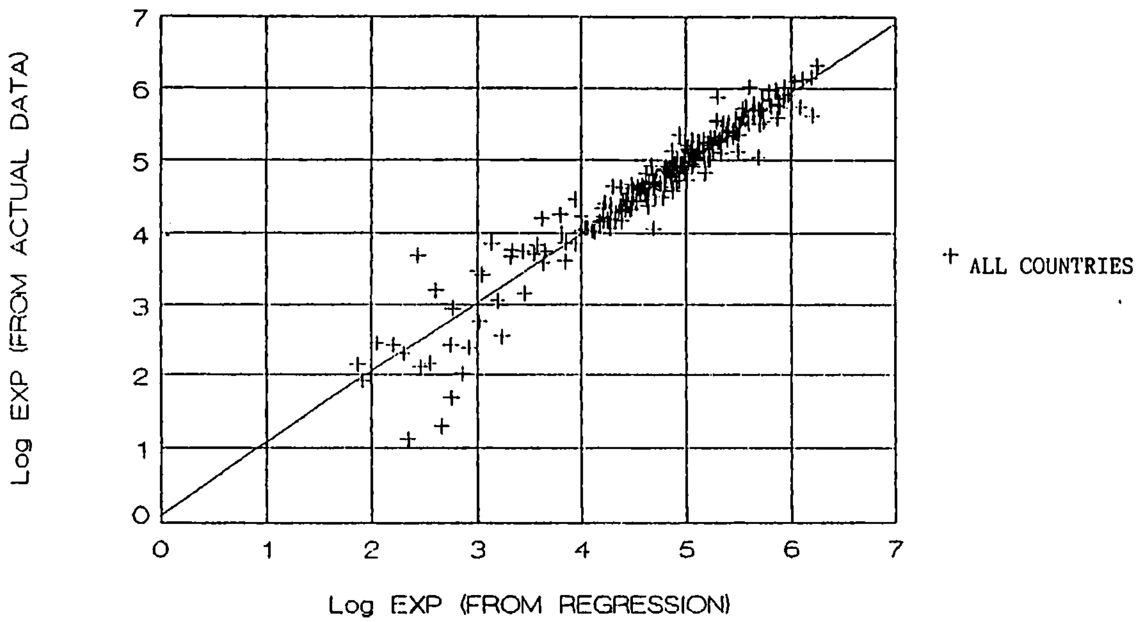
Table 5.1, Individual Regression Results

Individual Regression Analysis

Country	β_0 Const	β_1 Log Gnp	β_2 Log Exch	Adj. R^2	F
GERMANY	-0.4627 (0.618)	2.9151 (0.341)	0.3109 (0.041)	0.974	458.17
ITALY	1.1921 (0.960)	2.3850 (0.453)	0.4870 (0.087)	0.911	123.73
IRAN	-2.2784 (1.641)	3.5271 (0.809)	0.9557 (0.235)	0.802	49.75
IRAK	-4.8093 (1.218)	4.6165 (0.892)	0.4422 (0.254)	0.850	69.01
U.S.A.	2.6916 (0.933)	1.0179 (0.529)	0.3197 (0.070)	0.855	71.99
SAUDI A.	-1.7852 (0.333)	2.6839 (0.226)	0.9532 (0.086)	0.965	677.89
ENGLAND	-0.4756 (1.315)	2.4113 (0.729)	0.3882 (0.076)	0.867	79.27
FRANCE	0.2379 (0.415)	2.3164 (0.232)	0.2897 (0.043)	0.968	362.87
HOLLAND	-0.9977 (1.441)	2.8107 (0.303)	0.2767 (0.052)	0.979	563.69
BELG-LUX.	1.6139 (0.823)	1.6254 (0.614)	0.3536 (0.078)	0.886	94.48

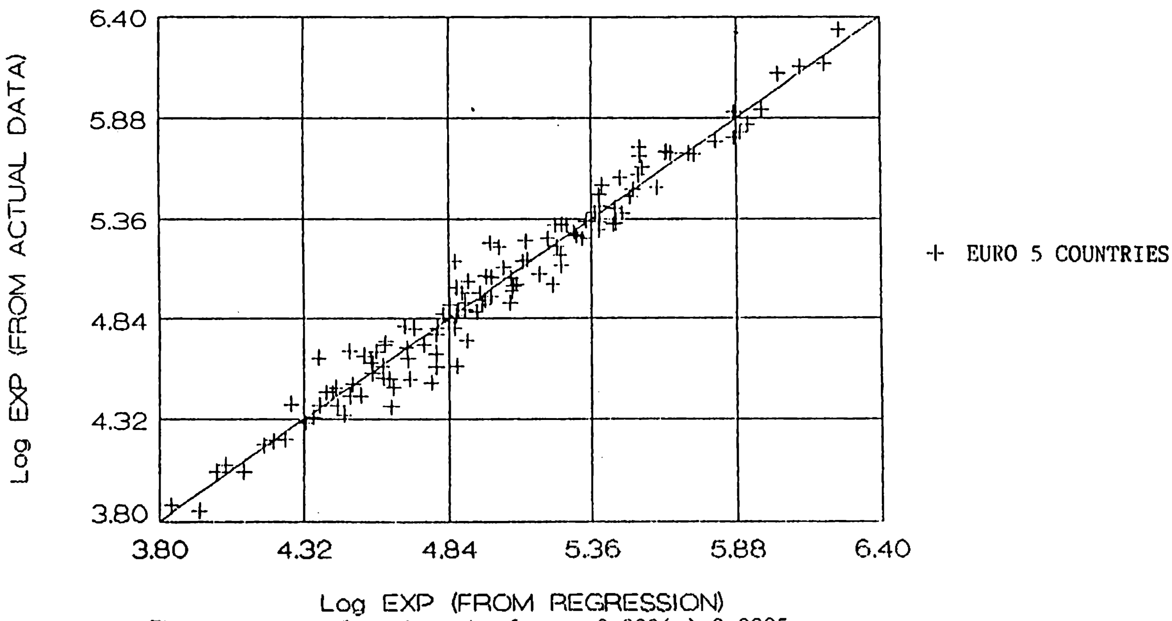
Standart Errors in Parenthesis

INDIVIDUAL COUNTRY RESULTS
AGAINST THE ACTUAL EXPORT VALUES



The regression line has the form y=0.974(x)+0.108 .

INDIVIDUAL COUNTRY RESULTS
AGAINST THE ACTUAL EXPORT VALUE



The regression line has the form y=0.999(x)+0.0005 .

5.1.2. All Countries :

The first pooling arrangement has the combination of all ten countries where 25 by 10 data points are included in the analysis.
The regression results obtained are presented in table 5.2..

Table 5.2, Regression Results for All Countries

All Countries					
	α_C	β_1	β_2	Adj	
Model	Const	Log Gnp	Log Exch	R^2	F
OLS	-4.1159 (0.377)	4.6327 (0.201)	0.1050 (0.026)	0.720	321.95
LSDV		3.8107 (0.215)	0.3282 (0.047)	0.863	144.16
Standard errors are in the parenthesis					

The coefficients β_1 and β_2 are the marginal contributions of the independent variables Log Gnp and Log Exch. When the data for all ten countries are pooled the R^2 values came out to be 0.72 for OLS and 0.86 for LSDV which is rather an indication of a weak regression.

The regression results for both OLS and LSDV (Covariance) model find the Exchange variable and the Gnp as significant. At the same time, one might note the improvement in the adjusted R^2 values, going from OLS to LSDV model. However, a slight reduction in the significance level for the beta coefficients is observed in return for this increase in R^2.

Constructing the analysis of variance table 5.3, we get the following residual sums of squares:

Table 5.3, Analysis of Variance table for All Countries Pooled

Anova Table			
Model	Residual Sum of Squares	Degrees of Freedom	Mean Square
OLS	$RSS_1=57.640$	$mp-k=247$	0.2333
LSDV	$RSS_2=27.131$	$mp-p-k+1=238$	0.1140
	$RSS_3=17.818$	$p(m-k)=220$	0.081
	$RSS_1-RSS_2=30.509$	9	3.3898
	$RSS_2-RSS_3=9.313$	18	0.5174
	$RSS_1-RSS_3=39.822$	27	1.4749
where $m=25$; $p=10$; $k=3$			

The F tests conducted by utilizing the calculated values are;

a) For slope homogeneity,

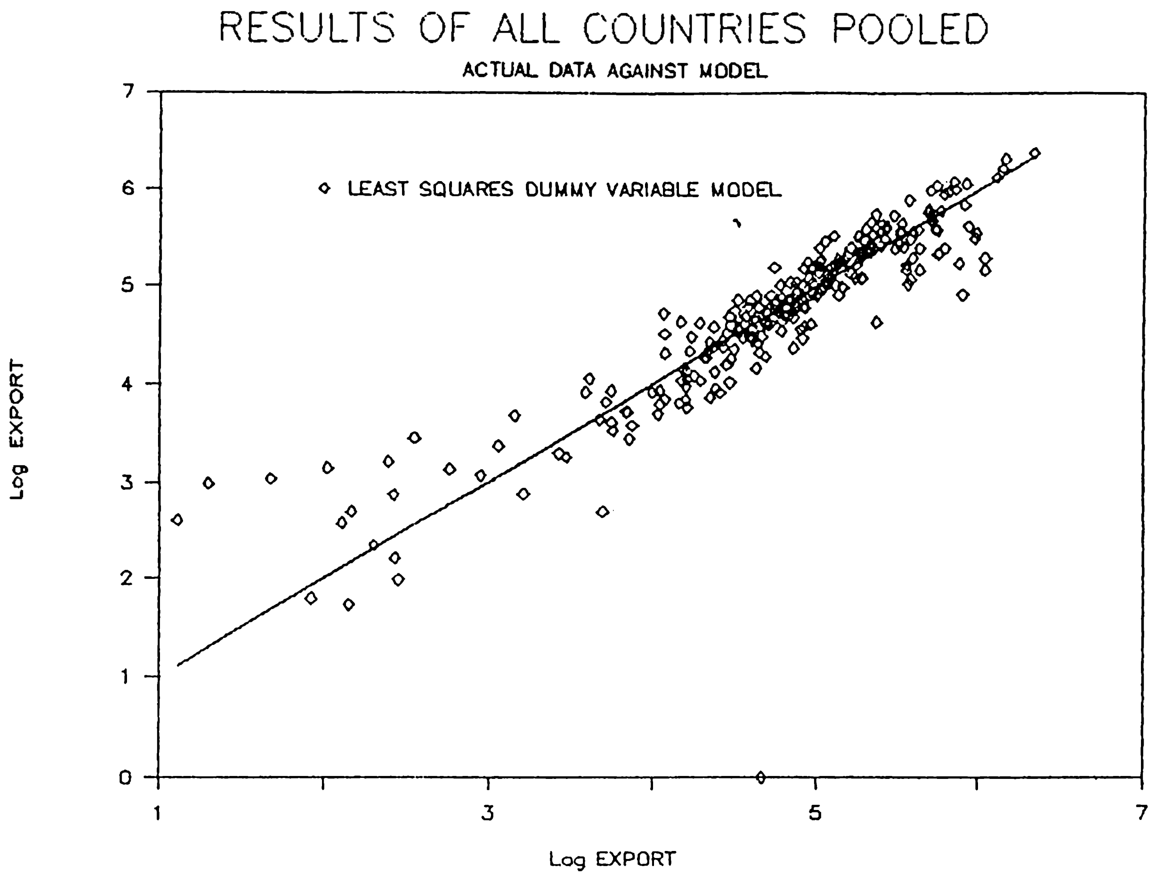
$F^*_2 = (0.5174/0.081) = 6.387$ and the F critical value from the F distribution tables is, $F_{c\ 0.99}(18,220) = 2.03$, since the F critical value is less than F calculated, we reject the hypothesis that the slopes are common for all countries at the 99 % level. This result suggests that pooling is not so appropriate when all ten countries are pooled together.

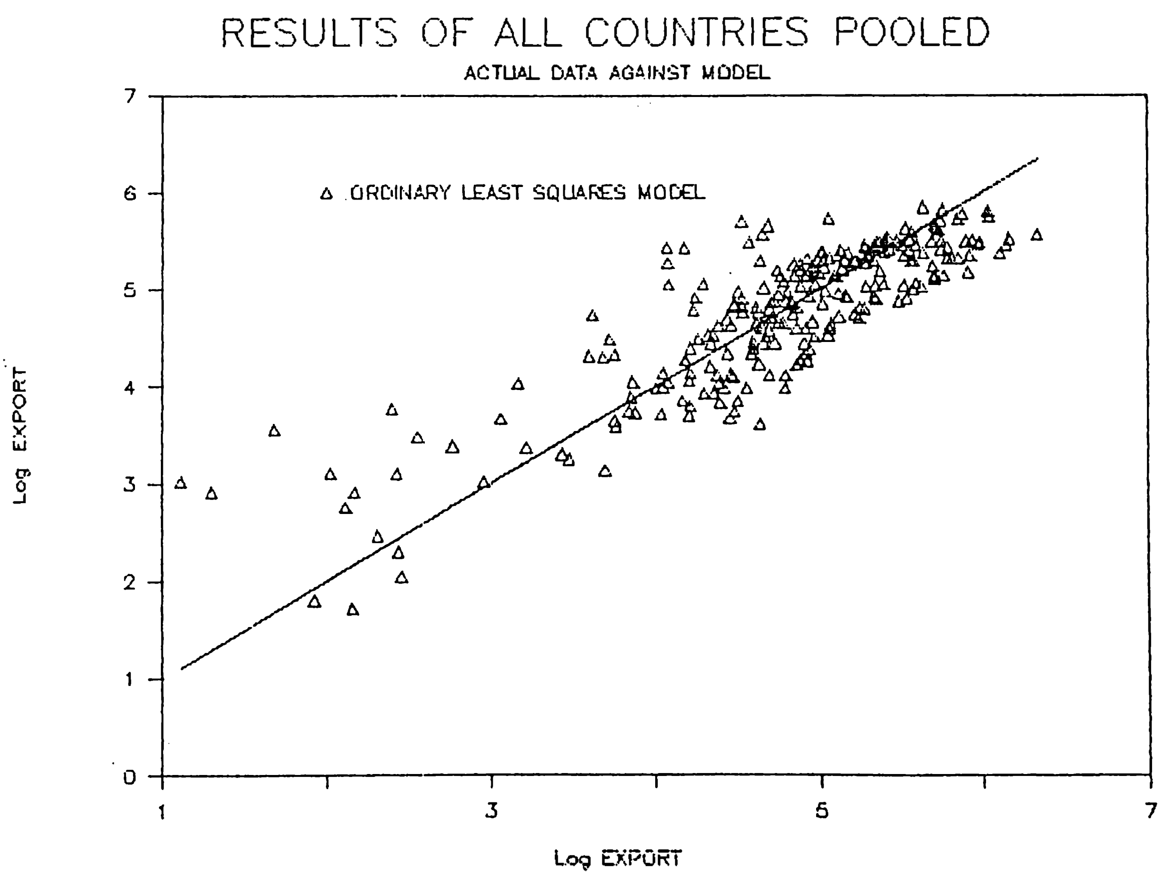
It is trivial to calculate the F_1 value after rejecting the slope homogeneity since the F_1 test is a conditional test that requires common regression slopes.

b) The test for overall homogeneity is,

$F^*_3=18.21$ and the $F_{c\ 0.99}(27,220) = 1.79$

Since, F^*_3 is larger than F_c the overall homogeneity hypothesis is also rejected. Therefore proposed pooling arrangement is not appropriate.


RESULTS OF ALL COUNTRIES POOLED
ACTUAL DATA AGAINST MODEL
◇ LEAST SQUARES DUMMY VARIABLE MODEL
Log EXPORT
Log EXPORT
0
1
2
3
4
5
6
7
1
3
5
7


RESULTS OF ALL COUNTRIES POOLED
ACTUAL DATA AGAINST MODEL
△ ORDINARY LEAST SQUARES MODEL
Log EXPORT
Log EXPORT
0
1
2
3
4
5
6
7
1
3
5
7

The regression coefficients obtained from both models are used to build the regression equations for OLS and LSDV models. The actual data points against the model results are depicted for two models in graphs (5.3) and (5.4).

The 45^0 line in the graphs formed by entering actual Export (log) values for both axis and ploting the model values against them. The closer the points to the line the better the model fitts to the actual data (a different presentation of the R^2 value). As observed from the graphs, although the pooling in the analysis found out to be poor, still the LSDV model has a better fit to the actual data than the OLS model.

5.1.3. Euro Seven :

Pooling the data in different country groups is as discussed in the previous sections, is a progressive procedure. One need to try many different combinations in order to justify pooling of time series and cross sectional data. At this stage the analysis will be carried out on the seven European countries, that were explained in the methodology section. The results of the regression analysis are summarized below.

Table 5.4, Regression results of Euro 7 group.

Euro 7					
Model	α_0 Const	β_1 Log Gnp	β_2 Log Exch	Adj R^2	F
OLS	-2.4297 (0.538)	3.8486 (0.284)	0.0324 (0.022)	0.616	140.73
LSDV		2.2429 (0.172)	0.3319 (0.025)	0.933	306.03

Standard errors are in the parenthesis

The regression analysis for the OLS model calculated t values for Exchange rate variable as 1.437 and found it to be significant only at 15 % level. Whereas, the Gnp variable had 13.535 as t value and found out to be quite significant. On the other hand for the LSDV model calculated t value for the Exchange variable as 13.1 and found it as significant also together with the Gnp variable.

It is also important to note that there has been a substantial increase in the adjusted R^2 value for LSDV as 0.933 compared to the value obtained in the previous case of 0.863 and a decrease in the R^2 of the OLS model from 0.72 of previous case's to 0.616. This result is in favor of the LSDV model over the OLS.

From the residual sum of squares obtained and presented in the table 5.5, relevant F values are calculated for each homogeneity verification.

Table 5.5, Analysis of Variance table for EURO 7 group.

Anova Table			
Model	Residual Sum of Squares	Degrees of Freedom	Mean Square
OLS	$RSS_1=16.255$	mp-k=172	0.0945
LSDV	$RSS_2= 2.721$	mp-p-k+1=166	0.0164
	$RSS_3= 2.096$	p(m-k)=154	0.0136
	$RSS_1-RSS_2=13.534$	6	2.255
	$RSS_2-RSS_3= 0.625$	12	0.0521
	$RSS_1-RSS_3=14.159$	18	0.7866
where m=25; p=7; k=3			

The F values calculated are compared with the table F_c (critical F values) values.

$F^*_2 = 3.83 > F_{c\ 0.99}(12,154) = 2.3$ and therefore the hypothesis of common slopes are again rejected. Rejection of the common slopes hypothesis indicate that each country in the pooling group have significantly different trends in terms of the independent variables gnp and exch. Therefore proposed pooling arrangement is inappropriate and a new grouping is necessary. Although this pooling combination have not yielded the desired outcome, a significant improvement on the F_2 value is achieved. This improved F_2 value is an encouragment for further trials.

Finally, the $F^*_3 = 60.51$ value is obtained for the required test of overall homogeneity and compared with the $F_{c\ 0.99}(18,154) = 1.87$. The overall homogeneity is therefore rejected. Rejection of overall homogeneity suggests that pooling was indeed inappropriate.

5.2.4 Euro five Group:

Another arrangement is made for the pooling of time series and cross sectional data. The five European countries, have been selected out of the Euro 7 group with respect to their slope coefficients and R^2 values estimated from individual regression analysis. The countries included in this group are Germany, Italy, England, France, and Holland. On the basis of these and studying the results of the previous pooling arrangements the Euro five group is established as the third arrangement.

The table 5.6 exhibits the regression results for this run.

Table 5.6, Regression results of Euro 5 group.

Euro Five					
	α_0	β_1	β_2	Adj	
Model	Const	Log Gnp	Log Exch	R^2	F
OLS	-3.4207 (0.646)	4.3998 (0.341)	-0.0222 (0.026)	0.622	103.0
LSDV		2.5088 (0.173)	0.3462 (.026)	0.954	432.51
Standard errors in parenthesis					

The regression results suggest that LSDV model is a better fitting model than OLS . Obviously the R^2 has increased from 0.6 to 0.95 in LSDV model, and secondly the Exchange variable that had been insignificant in the OLS model with a negative slope coefficient of - 0.022 and t significance at 40 % level, had also become significant and had positive

slope coefficient of 0.346, in the LSDV model. These findings provided support to the LSDV model as it also agreed with the theoretical expectations.

Table 5.7, Analysis of variance table for Euro 5 group.

Anova Table			
Model	Residual Sum of Squares	Degrees of Freedom	Mean Square
OLS	RSS_1=12.972	mp-k=122	0.1018
LSDV	RSS_2= 1.452	mp-p-k+1=118	0.0123
	RSS_3= 1.245	p(m-k)=110	0.0113
	RSS_1-RSS_2=11.52	4	2.88
	RSS_2-RSS_3= 0.207	8	0.0258
	RSS_1-RSS_3=11.727	12	0.9772
where m=25; p=5; k=3			

The F values are then calculated to test related homogeneity hypothesis

$F^*_2 = 2.28 < F_{c\ 0.99}(8,110) = 2.69$

thus the hypothesis of common slopes is accepted. Accepting the hypothesis of homogeneous slopes brings the question of intercept homogeneity which is a conditional test on slope homogeneity. F_1 value will be calculated to see if the intercepts are significantly different from each other for different countries.

$F^*_1 = 234.1 > F^*_{0.99}(4,118) = 3.51$ hence the common

intercepts hypothesis is rejected. Rejecting homogeneous intercepts hypothesis will indicate that there are indeed significant differences between the intercepts of each country regression while their slope coefficients are significantly homogeneous.

Last test for overall homogeneity will be done by calculating the

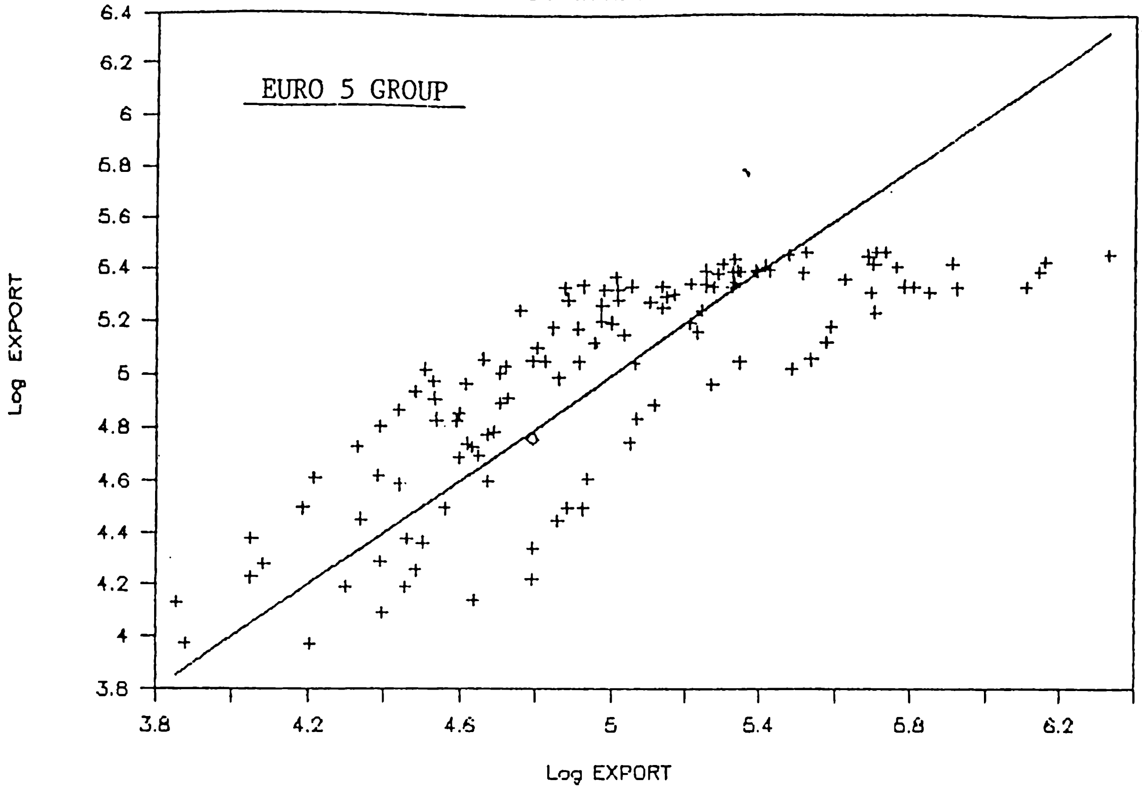
F^*_3 value,

$F_3 = 86.47 > F_{c\ 0.99}(12,110) = 2.36$,

this result rejects overall homogeneity hypothesis, indicating that there is no overall homogeneity. This result was actually an expected result since we already know that there is no intercept homogeneity. However, since we could established common slopes and see that there is indeed significant intercept (class) effect, it is possible to talk about justness of pooling and make comparison between the two models.

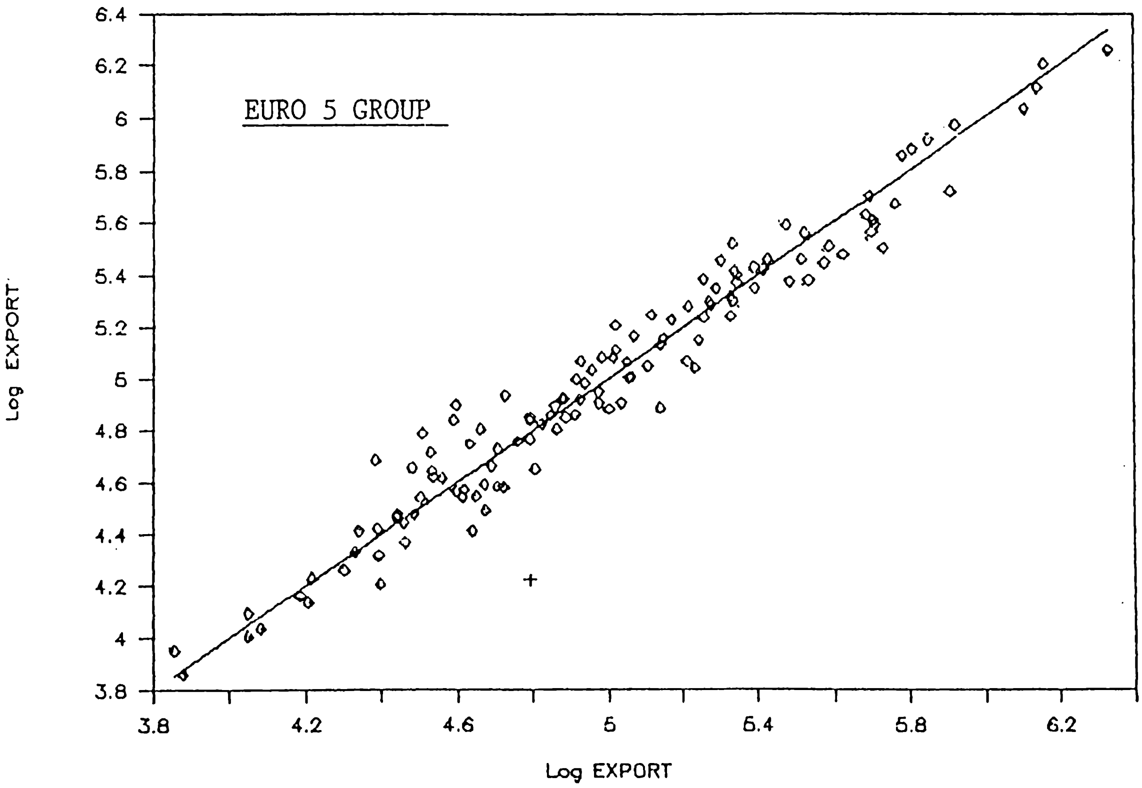
ORDINARY LEAST SQUARES RESULTS

ACTUAL DATA AGAINST MODEL



LEAST SQUARES DUMMY VARIABLES RESULTS

ACTUAL DATA AGAINST MODEL



The graph (5.4) and (5.5) given, presents the results in a graphical format. The graphical presentation may also be used to compare the results obtained from OLS and LSDV models. The distribution of estimated values around the 45° line indicate the closeness of the regression function to the actual demand. The closer the calculated values are the better their estimation power thus the better the model fitness.

The above results suggest that a LSDV is a better model for the pooled time series and cross sectional data and furthermore pooling in this form used with the LSDV model, is an appropriate arrangement.

5.3 Summary of Results :

The individual regression runs depicted in the table 5.1 showed that, the hypothesized relationship is valid. The coefficients obtained from different regressions are comparable in their magnitudes and signs of coefficients were in agreement with the

hypothesized relation. The proposed positive relations seem to hold for individual cases as well as pooled cases.

After trying different pooling groups and variables, the above exhibited results have been obtained. In short we have conducted regression analysis over three different arrangements for pooling time series and cross section data. In the final grouping a desired and proper pooling arrangement have been achieved.

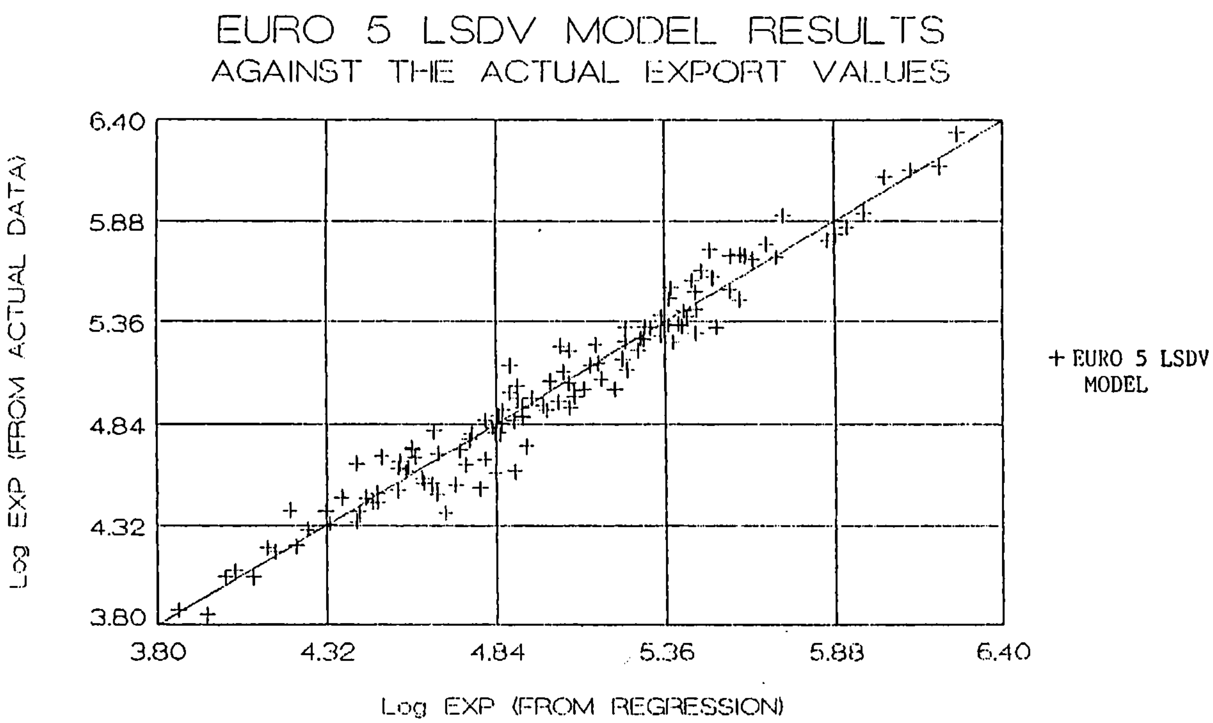
Results obtained for different pooling groups for the OLS and LSDV models are summarized in the table 5.8 It must be noted that for the LSDV model no constant term is depicted. This model utilizes different intercept terms for each country to accomodate the country effects in contrast to the OLS model. F values obtained (the smallest F value being 26 for 25 observations and 2 degrees of freedom) are quite larger than the critical values thus this also indicate that the independent variables taken as a set are significant.

The export values obtained in the section 5.1.1 from the individual regression equations of the 5 countries were plotted against actual data points (actual export values) on graph 5.2., and the values obtained from the single regression equation of the LSDV model for the EURO 5 countries are also plotted in graph 5.7. against actual data point and printed for comparison on the next page. The solid line in these two graphs are fitted by an other regression and the coefficients calculated are shown on these graphs. Examining these equations, one would see that both are the equation of the 45 degree line. In simple terms, by utilizing pooled data and LSDV model it is possible to obtain a higher precision in a single equation then what one may obtain from a set of equations regressed for that same group

Table 5.8., Summary of Regression Results

OLS MODEL Regression	α_0	β_1	β_2	R^2
All Countries	-4.116	4.633	0.105	0.720 (F=321)
Euro Seven	-2.430	3.848	0.0324	0.616 (F=140)
Euro Five	-3.421	4.399	-0.0222	0.622 (F=103)
LSDV MODEL Regression		β_1	β_2	R^2
All Countries		3.811	0.328	0.863 (F=144)
Euro Seven		2.243	0.332	0.933 (F=306)
Euro Five		2.509	0.346	0.954 (F=432)

Analyzing the overall picture, one would see that for the OLS model the explanatory power of the regression expressed by the R^2 decreases as the R^2 of the LSDV model increases when better pooling arrangements are utilized. Secondly, the F values for both models are far above the critical values thus the set of variables used together are significant.



The regression line has the form y=0.9995(x)+0.0024 .

Graph 5.7

Obviously the pooled case has the advantage of explaining the relation with a single equation whereas the results of individual regressions are obtained from different equations obtained for each country individualy.

6.0 CONCLUSIONS:

In this study different pooling arrangements on the cross sectional time series data are tested. In search of a proper pooling arrangement, two different models are employed and these models are tested against best fit also.

In general, the findings indicated strong evidence for the relationship between the Gross National Product and Exports in the logarithmic form, thus the first hypothesis have been satisfied. Exchange rate however has been ralatively less significant when compared on the basis of correlation coefficients and t values. Nearly all of the Euro 5 group dummy variables were found significant at 99 % level, which is a strengthening result for the LSDV model where the argument of common trends but different levels of influence of classes were questioned. The LSDV model have successfully achieved this and did in fact capture these systematic class effect with the pooled data. In other words, different countries have their own factors that differ their import from Turkey without significantly changing the general trend applicable to others. Therefore, when countries are grouped properly, their export demands can be regressed by one equation and pooled time series and cross sectional data may be pooled for this reason in order to achieve higher degrees of precision pooling the cross sectional and time series data. The effects coming from characteristics of each country can be differentiated by using dummy variables in order to capture these effects that could not be quantified easily.

The success of the pooling arrangement obtained at the third trial was mainly due to a controlled selection process that have been followed during the analysis. This enabled reaching to a subset that was similar in many ways. Of course, this study could have been completed without reaching any proper pooling arrangement. Then it would be interpreted as, no slope homogeneity or overall homogeneity exists. Then inclusion of the dummy variables would be unustified and pooling would be useless.

The analysis would have reached the result satisfying slope, intercept, and overall homogeneity. In such case, pooling would still be appropriate however OLS would be adequate for modelling the demand function.

Although the main purpose of this study was not to reach conclusions on the very complicated mechanism of foreign trade, the basic findings may be noted in few words. Both the exchange rate variable and the gnp variable have correlated with the export variable as hypothesized, indicating a positive relationship between the export demand and them. However the aggregate nature of the data of these variables may tend to correlate with may factors, not necessarily explaining the actual relation between these variables.

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