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Price and Income Elasticities of Export and Import and Economic Growth in the case of the Republic of Macedonia

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Price and Income Elasticities of Export and Import and Economic Growth in the case of the Republic of Macedonia

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Abstract

The purpose of this empirical research is estimation of the long-term price and income trade elasticities and their practical application in Thirlwall's economic growth model in the case of the Republic of Macedonia. The estimation is based on ARDL modeling, as one of the most used procedures for testing the cointegrating relationship between variables. The results confirm the existence of long-term relationship between export and import demand and relative prices and income. There is an evidence for high import elasticity on domestic income changes and relatively significant export elasticity to changes in the world income. The estimated price elasticities are lower, with the imports being more sensitive on price variations than the exports. In other words, domestic economic agents are more sensitive to price changes than foreigners are. The higher income elasticity of import than the income elasticity of export points out the trade balance deterioration. Practical application of the estimated income elasticity of import in the Thirlwall's economic growth model shows that the growth rate of the Macedonian economy is determined largely by balance of payment constrains, or it depends on export growth rate and significantly is reduced by high income elasticity of import.

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I. Introduction

The process of global economic integration followed by financial and trade liberalization induces balance of payments' deterioration and high current account deficits in most of the developing countries. The elimination of balance of payments disequilibria mostly rely on structural adjustment IMF programs, which involve measures such as devaluation of the domestic currency, reduction of the public consumption, limited expansion of domestic credits, increased taxes, salary limitations etc. The success of devaluation, as a measure of exchange rate policy, a priori, depends on export and import price elasticities, i.e. on whether Marshall-Lerner condition is met¹ (Gafar, 1995). At the same time, the high export elasticity means higher prospects for success of the real devaluation for generating the export revenues (Senhadji & Montenegro, 1998).

However, with consumer income continuously growing, the modern literature marginalizes the importance of the price elasticities and their role in achieving the competitive advantages. This statement is convincing especially for rich countries, where consumer decisions rely on quality, technology's superiority and advanced services. Considering this, countries that try to improve competitiveness of non-price characteristics of export (captured through the income elasticity of the export demand), create an environment for higher economic growth (Nilsson, 2005). Thus, the higher the income elasticity of exports, the greater their role is in achieving economic growth.

The import demand sensitivity on changes in domestic income and relative prices has a significant implication to the economic developments as well. As Sinha (2001) mentioned, in conditions of income rise in the import country, if the price elasticity of the import is high, the import demand will rise significantly, which will be reflected in a trade balance deterioration. Nevertheless, if domestic income rise and the domestic production rise in the same time, then the import may decline. Regarding to the prices, the higher foreign than domestic prices will contribute to a fall in the import.

According to everything mentioned above, it is important to conclude that the estimation of the export and import sensitivity to the price and income changes is an important feature for macroeconomic policy. "It is important to estimate price and income elasticities because they can be applied to many relevant macro-economic policy issues: the effect of both monetary and fiscal policies and expenditure switching policies (such as exchange rate, subsidy and tariff policies) on a country's balance of payments, the impact of external balance restrictions on domestic policy measures, the international transmission of changes in economic activity and prices and the employment effects of changes in own or partner countries' trade restraints" (Algieri, 2004, p.1).

The trade elasticities' estimation has a practical use in macroeconomic models for projection of the economic growth. Namely, the relationship between export and economic growth is widely explored topic in the economic literature. Their strong correlation is confirmed in many analyses. The estimation for relationship of the export, i.e. the long-term relationship of the trade balance equilibrium and the economic growth is derived through the conventional equations for export and import demand, which are based on Thirlwall's Law. Thus, beside the primary goal of this analysis – the estimation of prices and income elasticities of the Macedonian

¹ The success of devaluation depends of the fulfillment of Marshall-Lerner condition, which can be expressed as $(M/X) |e_m| + |e_x| > 1$, where M and X are the values for the import and export, and e_m and e_x are the price elasticity of the import and of the export.

export and import, the estimated elasticities will be used in Thirlwall's model. Thus, the economic growth of the Republic of Macedonia will be estimated through the export growth rate and the income elasticity of the import.

The structure of this analysis is the following: the second section gives a literature review on the Thirlwall's law; the third section explains the methodological aspects of the estimation of the equations for export and import demand and the reasons for selection of the ARDL model. The empirical results are presented in the next section, with an emphasis on a practical application of the estimated income elasticities in a Thirlwall's model framework, trying to explain the low growth of Macedonian economy. Discussion and conclusions are left for the final section.

II. Model for Economic Growth based on Balance of Payments Constrains – the basic foundations of the Thirlwall's Model

Since 1979, the Thirlwall's Law is important alternative for explaining the growth differences between developed, as well as between developing countries. According to Thirlwall, the relationship between the growth rate of a country and its balance of payments is the fundamental law for growth. Thus, the long-term trade balance equilibrium is the basic assumption for achieving growth in an open economy. It is assumed that the international capital flow and the interest payments are balanced in the long run, thus, given stable exchange rate, the long-term economic growth of an open economy is limited by the export growth rate and the income elasticity of the import. Nevertheless, in spite of the long-term validation of this law, the practice shows that the capital flows and the interest payments are limiting factors for the balance of payments equilibrium (Barbosa-Filho, 2001). Thus, the original Thirlwall's model, which assumes strong current account equilibrium, in recent analyses is based on sustainable capital nominal flows (Thirlwall and Hussain, 1982), fixed current account deficit, or some level of debt expressed as GDP percent (McCombie and Thirlwall, 1997; Barbosa-Filho, 2001; Moreno-Bird, 1998-99).

Thirlwall's Law is based on Harrod trade multiplier (1933)² and as a post Keynes alternative for economic growth has demand in its focus. According to Thirlwall, the driving force for economic growth is the growth rate of the effective demand, while the supply is generally reacting passively. Furthermore, the balance of payments set limits to the growth of effective demand and therefore the long run growth rate can be explained by the Harrod trade multiplier (Bairam and Dempster, 1991). Opposite to Harrod trade multiplier, which is static, Hussain (1999, p. 109) explains the Thirlwall equation as a "basic dynamic Harrod trade multiplier". Thirlwall's Law for economic growth argues that the long-term growth of the national income is determined by the ratio of the export growth rate (x) and income elasticity of the import (π); $y=x/\pi$.

Thirlwall's Law is often expressed in these terms: "In the long-term, no country can grow faster than the rate consistent with the balance of payments equilibrium on the current account unless it can finance ever-growing deficit which, in general, it cannot" (Verdier-Chouchane, 2005, p.495). According to Davidson (1997), cited by Ferreira and Canuto (2003), Thirlwall's Law is one of the most significant analytical contributions of Post Keynesian open economy growth theory. "This approach provides an elaboration of the rationale for the export-led growth

² Harrod trade multiplier specifies that the income level (Y) in open economy is a relation of the export level (X) to marginal propensity for import (μ): $Y=X/\mu$.

theory and also confirms the applicability of Keynesian principles to long term economic growth. Nevertheless, it is essentially a partial equilibrium approach in that it argues that the fundamental determinant of the growth of any particular country lies in the growth of its export and this, in turn, is determined primarily by the exogenously given growth of world income" (McCombie, 1993, pp. 471-472).

This economic growth model, based on balance of payments constraints, argues that the countries have different growth rates because of the different demand growth. Namely, the basic reason for demand constraints in open economy is the balance of payments. Thus, if demand grows faster than the growth of domestic capacity, than it leads to balance of payments deterioration (import rise), and the domestic supply will not be fully utilized, the domestic investment will fall, the technological progress will slow down, which lead to fall in the productivity and in the competition of domestic export. This will deteriorate again the balance of payments equilibrium, and it will continue the magic cycle. Opposite of this, if the demand grows up to the level of the existing capacity, without encountering balance of payments problems, then the demand pressures will determine capacity growth, i.e. new investment in capital stock and increasing technological growth.

Thirlwall's export-led economic growth model is based on the assumption that the export expansion stimulates the economic growth of the country, without leading into a deterioration of the balance of payments. Nevertheless, the same rates of export growth in different countries do not produce the same rates of economic growth, because of the existence of different income elasticities of import demand (Moudud, 2000).

The practical elaboration of this approach is confirmed (and has been well documented) with the development of the Asian tigers and the actual economic expansion of China. Namely, since 80's and 90's of the previous century, a lot of developing countries shifted from internal oriented policies (import substitution polices) to the external oriented development policies, through the export promotion of the industrial products (Abbot and De Vita, 2002).

Thirlwall's model consists of two main equations (Bairam and Dempster, 1991):

$$X = (P_d/P_f)^\eta Z^\varepsilon \quad (1) \text{ and}$$

$$M = (P_d/P_f)^\phi Y^\pi \quad (2)$$

where parameters ε , π , $\phi > 0$ and $\eta < 0$, X , M , Y , Z are export, import, domestic income and world income, respectively, (P_d/P_f) is the ratio of domestic prices to foreign prices measured in common currency, η and ϕ are price elasticities and ε and π are income elasticities of export and import, respectively. If we take the natural logarithms of Equations 1 and 2, the differencing form of the equation is expressed as:

$$x = \eta(p_d - p_f) + \varepsilon z \quad (3) \text{ and}$$

$$m = \phi(p_d - p_f) + \pi y \quad (4)$$

where the small letters denote the growth rates of the relevant variables.

Thirlwall's law assumes the existence of current account equilibrium ($X=M$), which implies:

$$\eta(p_d - p_f) + \varepsilon z = \phi(p_d - p_f) + \pi y^* \quad (5)$$

Rearranging Equation 5, it can be calculated the domestic income growth rate, taking into account the balance of payments constrains.

$$y^* = [(\eta - \phi) / \pi] (p_d - p_f) + (\varepsilon / \pi) z \quad (6)$$

Combining Equations 3 and 6 leads to second definition for y^* :

$$y^* = -(\phi / \pi) (p_d - p_f) + (1 / \pi) x \quad (7)$$

According to Thirlwall (1974, 1980b, 1982) and Kaldor (1978), cited by Bairam and Dempster (1991)³, the relative prices measured in common currency are constant over time, $(p_d - p_f) = 0$. Thus, if the terms of trade are unchanged and if the capital flows are insignificant (McCombie), than the growth rate y^* , consistent to the balance of payments equilibrium, can be expressed as:

$$y = y^* = (\varepsilon / \pi) z = (1 / \pi) x \quad (8)$$

Equation 8 suggests that y (domestic income growth rate; GDP growth rate) is determined by Harrod trade multiplier $(1 / \pi)$ and export growth rate x (where $x = e^* z$). Taking into account that the both income elasticities (ε and π) reflect the non-price aspects of the competition (quality, delivery, effectiveness of the marketing and distribution), then the more competitive country in external trade, will has ε higher and π with lower value.

Bairam analyses (1993, 1997) showed that in time of world economic expansion, developing countries have $\varepsilon > \pi$ and their trade balance is improving, but developed countries have $\varepsilon < \pi$ and their trade balance is worsening. Indeed, Bairam has shown that there is an inverse relationship between Harrod trade multiplier and level of the economic growth, and later, the variability of ε depending of the country's growth changes and the constancy of π . According to these results, Bairam concludes that for a long term purposes, y^* can be calculated as $(1 / \pi) x$, but not on the base of the second identity $(\varepsilon / \pi) z$. Bairam and Lawrence (2001) in their recent analysis for income elasticity's stability, which includes three countries (New Zealand, UK and Canada), confirm that the elasticities are constant for the given period of estimation and conclude that the predictive power of Thirlwall's model is still good, at least for one of the identities for calculation of y^* .

The explicit and implicit criticisms of the dynamic Harrod trade multiplier model (Thirlwall's model) for economic growth, according to McCombie and Thirlwall (1997), come from three major sources: McGregor and Swales (1985, 1986, 1991), Crafts (1988, 1990) and Balassa (1979) and Krugman (1989). The main criticisms are related to the assumption of constant relative prices (terms of trade). Namely, McGregor and Swales argue that actually this assumption makes the model indistinguishable from standard neoclassical models based on supply and argue that the economic growth is not constrained by the balance of payments but by insufficient supply. Crafts and Balassa have similar points of view, whose arguments rely on limited supply. According to them, the differences in the export growth, hence in the "apparent" income elasticities, are solely due to differences in the commodity composition of export.

³ Bairam (1991) through the estimation of the export and import equations of 11 Asian countries determines that the price elasticities of export and import are statistical insignificant for most of the analyzed countries, with wrong signs and significantly lower than the income elasticities.

However, McCombie and Thirlwall demote this argumentation and stress out that the empirical results have shown that this determinant is not important for the disparities in the actual elasticities.

Krugman has established a trade model in which he finds a systematic relationship between the growth rates of the countries and the relative income elasticities of the export and import and calls it 45-degree rule, which implies that as the country's growth rate is changing, its income elasticities change as well. He claims that differences in long-term growth among the countries are determined by the differences in total factor productivity growth and he does not relate this growth with balance of payments constraints. Krugman's model is based on the assumption of proportionality between the number of produced products and the effective labor force in one country. According to him, one country has a more intensive growth and increasing share of the world markets if the labor force growth increases the production growth and export growth faster than other countries. McCombie and Thirlwall accept Krugman's arguments partially, but they disagree with the assumption that faster growing economies, with higher labor force growth rate, have higher export, regardless the characteristics of products. Namely, for higher elasticity of export demand, it is not enough only to have increased supply or export variety (in case of decreased world demand), but in many cases the elasticity is significantly determined by the characteristics of products. The obvious example for this is the contrast between income elasticity of the production of primary products and the production of industrial products, where primary products elasticity tends to be less than 1 ($\eta < 1$), while most industrial products have an income elasticity greater than 1 ($\eta > 1$).

III. Methodology

The estimation of the trade elasticities is based on conventional equations for export and import demand. In the earlier econometric analyses for trade elasticities, the stationary properties of the series were not considered and the equations were estimated by the OLS method. Thus, some authors think that such estimated coefficients, even if they are significant, can be "spurious" estimates, which lead to wrong conclusions about the long-term relationships (Caporale and Chui, 1999). However, the recent econometric analyses use more sophisticated econometric approaches for testing cointegration. The concept of cointegration refers to a long run equilibrium relationship between two or more variables. Namely, the economic interpretation of the cointegration is that if two or more variables are in long run equilibrium relationship, even the series themselves in short run may deviate from the equilibrium, they will move closer together in the long run equilibrium. That means that a non-stationary variable might have a long run relationship with other non-stationary variables if the deviation of this long run relationship is stationary, which implies that these variables are cointegrated and it does not create a spurious regression. In economic literature, the most widely used methods for estimating cointegrating relationships between variables are: residual based Engle and Granger (1987) test; Johansen (1988, 1991) test and Johansen and Juselius (1990) test; Fully modified OLS procedure (FM-OLS) developed by Phillips and Hansen (1990); Autoregressive Distributed Lag Modeling Approach (ARDL) developed by Pesaran and Shin (1995, revised 1997), Pesaran and Pesaran (1997) and Pesaran, Shin and Smith (1999); as well as Dynamic OLS procedure (DOLS) developed by Stock and Watson (1993).

Several authors (Pesaran and Shin, 1997, pp. 21-24; Caporale and Chui, 1999, p. 256; Catao and Falcetti, 2002, p. 32; Shrestha, 2006, pp. 2-3) point out the advantages of the ARDL modeling approach. Thus, the main advantage of this approach is its applicability regardless of the order of integration of the variables (the variables can be either I(0) or I(1)). As a consequence,

it is not necessary to pre-test the stationarity of the variables, which differs from the other methods where variables should be of the same order or in most cases of the first order I(1) as a condition for cointegration testing. Additionally, the ARDL method gives better estimates for small samples as compared with the FM-OLS and it takes enough numbers of lags through the process in a general-to-specific modeling framework, which captures the data generating process. Also, in case when all variables are I(1), then for calculating the long run parameters, it is not necessary to increase the number of the regressors in order to correct simultaneously the residual autocorrelation and the problem with the endogenous variables. Furthermore, the dynamic error correction model - ECM can be derived from ARDL through a simple linear transformation.

Following the recent trends in the econometric analyses, and in accordance with the sample size, which consists 31 observations (Q1.1998-Q3.2005) and the integration of the included variables, it was obvious that ARDL modeling approach is the most convenient procedure for estimating the price and income elasticities of export and import.

ARDL procedure consists of two phases with several sub-phases. The first phase considers the testing of long run relationship between the variables. The first step is estimation of ARDL error correction model. For illustration of ARDL model, we start with the simple econometric model:

$$y_t = \alpha + \beta x_t + e_t \quad (9)$$

where y_t and x_t are two different time series; e_t is a vector of residuals; α and β are the parameters in the equation. Error correction version of the ARDL model, which derives from the Equation 9, is presented as:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p-1} \beta_i \Delta y_{t-i} + \sum_{j=0}^{p-1} \beta_j \Delta x_{t-j} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + e_t \quad (10)$$

where the first part of the Equation 10, which captures β coefficients, represents the short run dynamics of the model, while the second part, which capture λ coefficients, represents the long run relationship between the dependent and explanatory variable. The equation given in this form is necessary to be determined the sufficient number of lags length, and in same time without autocorrelation.

The second step is testing the cointegrating relationship using F-test. Namely, the hypotheses $H_0: \lambda_1 = \lambda_2 = 0$ means that there is no cointegration or long run relationship between the dependent and explanatory variables, while the rejection of H_0 means that at least one of the long run coefficient is different of null, which implies of long run relationship between at least one explanatory and dependent variable. It should be mention that F critical value is non-standard value and therefore Pesaran and Pesaran (1997) have established special table of values for F statistics, where are given two sets of critical values in case of the variables are I(0) or I(1) and the test is realized as a bounds test. Thus, if the given test statistic exceeds upper critical value, then H_0 can be rejected (there is a cointegration); if the given test statistic do not exceed the lower critical value, then H_0 cannot be rejected (there is no cointegration); If the given test statistic falls between these two bounds, then the result is inconclusive. Also, it should be careful if all variables are I(0), the decision is made based on the lower bound, and if all variables are I(1), the decision is made based on the upper bound.

If the null hypothesis is rejected, then there is a long run relationship between the variables and it can be started the next phase.

The second phase is selecting the appropriate ARDL model (the optimal number of lag lengths) and calculating the long run coefficients. In this phase, it should be determined the optimal ARDL model (p, q) through the criteria for model selecting: Schwartz-Bayesian Criteria (SBC) and Akaike's Information Criteria (AIC)⁴. The next step includes the calculation of the long run coefficients based on the selected ARDL model and the last step includes the estimation of ECM model, actually the integration of long run and short run dynamics of the parameters. ECM term is a speed of adjustment or the equilibrium correction coefficient, and it indicates how fast can be adjusted back the long run equilibrium between the variables if there is a short run shock to one of the variables.

IV. Data and empirical results

The estimation of the price and income elasticities is based on export and import demand functions or:

$$\ln X_t = \alpha_0 + \alpha_1 \ln WGDP_t + \alpha_2 \ln RPX_t + \mu_t - \text{import demand function};$$

$$\ln M_t = \beta_0 + \beta_1 \ln DGDP_t + \beta_2 \ln RPM_t + v_t - \text{export demand function}.$$

The model includes the following variables: X and M are real export and import of goods and services of the Republic of Macedonia, $DGDP$ and $WGDP$ are real domestic GDP and world GDP in Euros (as approximation for domestic and world income), RPX and RPM are relative prices of export and import (RPX is a ratio of domestic export prices to world prices, while RPM is a ratio of foreign prices of imported goods and domestic prices). All variables are in logarithmic form and on quarterly base, while μ_{it} and v_{it} are the residuals of export and import demand, respectively. α_1 and β_1 are the income elasticities of export and import, respectively, while α_2 and β_2 are the price elasticities of export and import, respectively.

The real exports and imports are computed by deflating the exports and imports values (in millions of Euros) with export and import prices. Domestic real GDP is calculated as ratio of nominal GDP⁵ to GDP deflator (2000=100), using the same GDP deflator for all four quarters of the respecting year. The data source for export and import data (value), domestic export and import prices, CPI, GDP (in Denars) and GDP deflator is the State Statistical Office of the Republic of Macedonia, the world export prices are calculated in Research Department in NBRM, GDP and GDP deflator of the trade partner countries included in the calculation for world income are from the International Financial Statistics - IFS, except for Serbia (the source is the Republic State Office of Serbia). All other calculations for the model purposes are made in NBRM.

In accordance with the data available, the model is based on 31 observations for the period from Q1.1998 to Q3.2005.

⁴ SBC is known as the criterion which selects the smallest possible lag length, while AIC selects the maximum relevant lag length.

⁵ Regard that GDP data on quarterly bases, published by State Statistical Office (SSO), are by constant prices and base year 1997=100, the nominal GDP data on quarterly bases is calculation made by Research Department in NBRM.

The world GDP calculation is based on weighted arithmetical sum of the seven most important trade partners of the Republic of Macedonia (countries in which the Republic of Macedonia the exports the most), expressed through the following formula 11:

$$WGDP = \sum_{j=1}^{n=7} a_{ij} Y_{jt} \quad (11)$$

where a_{ij} is the normalized share of the trade partner j in the export of the country i , i.e. the Republic of Macedonia, Y_{jt} is the real GDP of the country j . The weight structure is based on average share of trade partners in Macedonian export in the period 1998-2006, and as the most important trade partners were chosen: Serbia, Germany, Greece, Italy, Bulgaria, Croatia and USA, which joint share is around 75% of total export. The real world GDP ($WGDP$) is calculated on base of the GDP data of each country (by constant prices, expressed in respecting national currency). The sources for GDP data of the countries are the International Financial Statistics (IFS) and the national statistics, and the GDP values in domestic currency were converted in Euros and deflated GDP deflator (2000=100) for each country respectively, and it was used the same GDP deflator for all four quarters of the respecting year⁶.

The relative export prices are calculated as a ratio of domestic export prices to world prices. The world prices are calculated at NBRM, i.e. WXPI for the Republic of Macedonia⁷ are weighted price index in which structure are included the world stock exchange prices (transformed in indexes) of raw materials and products with the largest structure share in Macedonian export: cotton, tobacco, lamb, iron ore, nickel, steel products and zinc. The normalized weight structure is fix for the whole period and it is derived from the share of these raw materials and products of Macedonian export in 2005. The both price series (domestic and foreign) are rebased with base year 2000=100, and the quarterly data are calculated as an average of the months in respective quarter.

Relative import prices are ratio of import prices to domestic prices, i.e. Consumer Price Index (CPI- through which the domestic inflation is measured), whereas the chained CPI indexes are based on 2000=100, and the quarterly data are calculated as an average of the months in respective quarter, while the import price series is rebased with base year 2000=100.

Despite the fact that the ARDL procedure does not require pre-testing for time series stationarity, the Augmented Dickey-Fuller test (ADF test) was applied to for determine the order of integration of the variables⁸. ADF test was applied to all the included time series, on level and their first difference, without intercept or trend, with intercept, and with intercept and trend. The tests show that more of the series are non-stationary on level, and stationary on first difference, or I(1), except for the series of the export and domestic income. The results are presented in Table 1.

⁶ IFS is publishing GDP data for Greece on quarterly base from Q1.2001, thus for the period Q1.1998-Q4.2000 it was used average quarterly distribution from the GDP yearly data.

For Serbia, the quarterly distribution of GDP by constant prices 2002=100 was used on the yearly GDP data by current prices for the period 1999-2005, and such nominal GDP data on quarterly base was deflated by GDP deflator 2000=100 (calculated as ratio of nominal GDP to GDP by constant prices 2002=100 on yearly base, and after that rebased with base year 2000=100). Regard of the unavailable data for 1998, the calculated quarterly data for 1999 was used for 1998.

⁷ For more information, see the NBRM Annual Report 2006, Annex 5 "World Export Prices Index (WXPI)", pp. 47-48.

⁸ The unit root test was made by using EViews 5 econometric software.

Table 1
ADF test results

ADF test	H ₀ : unit root			
variable	t-statistic	level of significance		order of integration
LX	-5.7828	1%	none	I(1)
LM	-3.8938	1%	intercept	I(0)
LDGDP	-3.3343	10%	intercept and trend	I(0)
LWGDP	-4.5868	1%	none	I(1)
LRPX	-5.2570	1%	none	I(1)
LRPM	-5.0358	1%	none	I(1)

After the unit root testing, the estimation of the equations for export and import demand of the Republic of Macedonia, through the ECM version of ARDL model was implemented⁹. Bearing in mind the different order of integration of the variables in the import demand function, it seems that ARDL model is appropriate for estimating the import elasticities. Thus, using general-to-specific modeling framework procedure, models with different number of lag lengths for the differenced variables were constructed (the same number of lag length was used for all variables), which for quarterly data is recommended to start with four lag lengths. The diagnostic analysis pointed out that the most fitted equation for import demand is the equation with three lag lengths¹⁰:

$$\Delta LM_t = \beta_0 + \beta_{11}\Delta LM_{t-1} + \beta_{12}\Delta LM_{t-2} + \beta_{13}\Delta LM_{t-3} + \beta_{21}\Delta LDGDP_{t-1} + \beta_{22}\Delta LDGDP_{t-2} + \beta_{23}\Delta LDGDP_{t-3} + \beta_{31}\Delta LRPM_{t-1} + \beta_{32}\Delta LRPM_{t-2} + \beta_{33}\Delta LRPM_{t-3} + \lambda_1 LM_{t-1} + \lambda_2 LDGDP_{t-1} + \lambda_3 LRPM_{t-1} \quad (12)^{11}$$

After estimation of the Equation 12, we test the existence of cointegration relationship between the variables, i.e. we test the hypothesis H₀: $\lambda_1 = \lambda_2 = \lambda_3 = 0$. The calculated F statistics is 5.72, and exceeds the upper bound of Pesaran critical values, meaning that the null hypothesis can be rejected, i.e. there exists a cointegrating relationship between the variables.

Table 2
Results from the cointegration test

H ₀ : $\lambda_1 = \lambda_2 = \lambda_3 = 0$	
statistics	probability
F(3, 14)=5.7244	0.009
CHSQ(3)= 21.6136	0.000
Pesaran critical values	
intercept and no trend; k=2	
level of significance: 0,05	
I(0)	I(1)
3.79	4.85

After the cointegration was established, the real ARDL model can be determined. For selecting the optimal number of lag lengths for each variable, the Akaike's Information Criteria was used, given that the model based on AIC criterion gives a smaller standard error than the model based on SBC (Pesaran and Pesaran, 1997; Shrestha, 2006; Aalexiouu and Toro, 2006).

⁹ For all other estimations of the ARDL model, Microfit 4.0 econometric software was used.

¹⁰ In the estimated equation for import demand (which includes three lag lengths), there was no serial correlation of the residuals, the functional form is good, no specification bias and no heteroscedasticity.

¹¹ The notation Δ in equation means the difference of the logarithmic values.

Thus, according to AIC criterion, the selected ARDL model for import demand is ARDL (1,0,2), or:

$$LM = \beta_0 + \beta_1 LM_{t-1} + \beta_2 LDGDP_t + \beta_3 LRPM_t + \beta_4 LRPM_{t-1} + \beta_5 LRPM_{t-2} \quad (13)$$

The results of ARDL (1,0,2) model show that there is a normal distribution of the residual and no autocorrelation. According to the ARDL (1,0,2) results, the long run coefficients were estimated, or price and income elasticity of export. The long run coefficients are presented in Table 3.

Table 3
Long run coefficients based on ARDL (1,0,2) model of import demand

Estimated long run coefficients based on ARDL procedure			
Dependent variable LM (logarithm of import)			
28 observations (Q4.1998-Q3.2005)			

Regressor	Coefficients	Standard error	T-statistics [probability]
LDGDP	3.4765	0.70979	4.8979[.000]
LRPM	-1.6418	0.39453	-4.1614[.000]
CON	-17.5095	4.8557	-3.6060[.002]

The results show that the import income and price elasticities are 3.48 and -1.64, that they are statistical significant (at 1%) and have the right signs of the coefficients. It means that in the long run, if domestic income (GDP) rises by 1%, then the import demand will increase for 3.48%, while if relative import prices rises for 1%, than the import will decrease for 1.64% (higher foreign prices than domestic prices determine import fall, or lower domestic than foreign prices lead to import decrease). Namely, the results illustrate that the Macedonian import is highly sensitive to the domestic income changes, which means that if the domestic income grows, than the domestic economic subjects increase their demand, which determine import growth. Nevertheless, if we take into consideration the structure of the Macedonian import (Annex 1), a large part of the import demand are products for reproduction (raw materials and semi-final products, mineral oil and final products for reproduction – iron and steel), which also dominate in the Macedonian export. According to this, the additional domestic income generates import rise for goods for production, that on large part are exported.

The sensitivity of the import to the prices is significant, but it is lower than the income elasticity, which means that a large part of the foreign products and services are imported regardless of the variability of their prices (because of unavailable domestic substitutes).

In order to compare the calculated elasticities, a comparative analysis was made. This analysis is based on several papers for developed countries or combination of developed countries and developing countries or countries from specific geographical region. Unfortunately, in the literature, there is no analysis on this issue from our region countries, thus, the more adequate comparison is unavailable. The comparative analysis shows that for a large number of countries, the coefficient of income elasticity of the import does not exceeds 2, while the price elasticities are very low, i.e. the countries have price non-elasticity ($\phi < 1$), especially developed countries. Calculated price and income elasticities of the Macedonian import are similar with those of the developing countries, which can be seen from the tables in Annex 2.

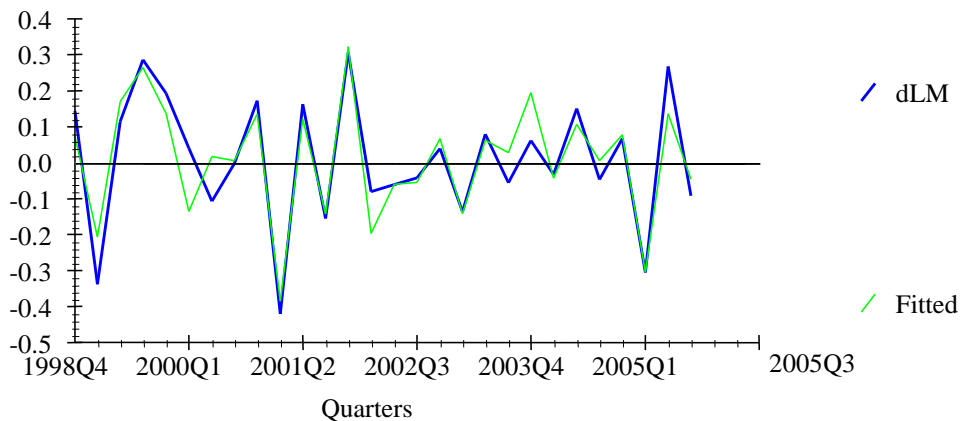
The short run dynamic of the model and speed of adjustment coefficient are shown in Table 4.

Table 4
Short run dynamic and ECM term based on ARDL (1,0,2)

ECM specification of the ARDL model			
ARDL (1,0,2) selected on base of AIC criterion			
Dependent variable DLM (difference of import logarithm)			
Regressor	Coefficients	Standard error	T-statistics [probability]
dLDGDP	2.3928	0.32658	7.3270[.000]
dLRPM	-1.3901	0.32372	-4.2941[.000]
dLRPM1	0.55145	0.34489	1.6018[.123]
dCON	-12.0516	2.3236	-5.1867[.000]
ecm(-1)	-0.68829	0.10569	-6.5126[.000]
ecm=LM-3.4765*LDGDP+1.6418*LRPM+17.5095*CON			
R-squared 0.83593			

The results show that only the variable dLRPM1 (the difference of logarithm of import relative prices with one quarter time lag) is not statistical significant (at 10% level of significance). On the other hand, short run changes in domestic income (dLDGDP) and in the relative import prices (dLRPM) are statistical significant (at 1% level of significance), which points out that they significantly influence the short run import change. That means that import reacts immediately to changes in domestic GDP and to the changes of relative prices. The coefficient in front of the error correction term (ECM), which is speed of adjustment, is significant and shows fast adjustment to the long run equilibrium. Namely, around 69% of the disequilibrium in the previous period (quarter) is adjusted back to the long run equilibrium in the current period. In other words, in absence of changes in other variables, the high coefficient indicates fast adjustment to the long run equilibrium between the variables.

Graph 1
Short run dynamic of the import demand (realized and estimated)



The same procedure was implemented to the equation for the export demand function of the Republic of Macedonia. There were determined four periods as maximum number of lag lengths and the hypothesis for no cointegration between the variables was rejected (F statistics is

8.9>4.85). This confirms that there is a long run relationship between the import (LX), from one side, and world income (LWGDGP) and the relative export prices (LRPX), from the other side. According to AIC criterion, ARDL (2,3,4) model was selected, which is presented through the Equation 14:

$$LX = \beta_0 + \beta_1 LX_{t-1} + \beta_2 LX_{t-2} + \beta_3 LWGDGP_t + \beta_4 LWGDGP_{t-1} + \beta_5 LWGDGP_{t-2} + \beta_6 LWGDGP_{t-3} + \beta_7 LRPX_t + \beta_8 LRPX_{t-1} + \beta_9 LRPX_{t-2} + \beta_{10} LRPX_{t-3} + \beta_{11} LRPX_{t-4} \quad (14)$$

According to the diagnostic tests for the ARDL (2,3,4) model, the hypothesis of no serial correlation could be rejected, suggesting a possible bias in the obtained coefficients. However, we were unable to 'get rid' of the serial correlation even by selecting different lag structure. Bearing in mind that the model shows a good functional form, normal distribution of the residuals and no heteroscedasticity, as well as the fact that the obtained coefficients are in accordance with the economic rationale, we do not consider the potential serial correlation as a serious problem. However, we reserve the right to improve the specification in the future. The results for the long run coefficients for income and price elasticities of the export are shown in Table 5.

Table 5
Long run coefficient based on ARDL (2,3,4) model

Estimated long run coefficients based on ARDL procedure			
Dependent variable LX (logarithm of export)			
27 observations (Q1.1999-Q3.2005)			

Regressor	Coefficients	Standard error	T-statistics [probability]
LWGDGP	1.5101	0.36515	4.1354[.001]
LRPX	-0.7273	0.31394	-2.3169[.035]
CON	-14.5335	4.9398	-2.9421[.010]

The results show that income and price elasticity of the export are 1.51 and -0.73, respectively, they are statistical significant (at 1% and 5% level of significance, respectively) and have the expected signs. That means that on long term, if the world income rises 1%, than the Macedonian export demand will increase 1.51%, while if relative export prices rise 1%, the export will decrease 0.73% (higher domestic prices than foreign prices determine export fall). This points out that the Macedonian export is more sensitive to the world income changes than to the relative prices changes. It indicates that price characteristics of the Macedonian export are not the main determinant of the foreign demand, which depends more on non-price (qualitative) aspects of the export. Thus, in order for the domestic exporters to increase their export to world markets, it is necessary for them to improve the non-price aspects of the export (quality, distribution, marketing etc.) for which it was determined that there is a sensitive international capital. Regarding the high concentration of the Macedonian export only in a few group of products¹², especially products for reproduction (iron and steel and their products, oil derivatives, as well s clothes and textile which is based on processing-production), it is obvious that it is necessary to invest in qualitative aspects of the products, in order to be attracted the foreign consumers, which standard increases as the available income rises.

¹² The Herfindahl-Hirschman Index which was used to be measured the concentration of the Macedonian commodity export shows that there is no variety export supply and its value is similar to those of the developing countries. The value of Herfindahl-Hirschman Index for 2006 is 0.244 and shows a trend of small increasing of export supply variety (the values for 2005 and 2004 are 0.251 and 0.271, respectively).

From the balance of payments aspect, these results means that the favorable world conjuncture will have positive effect to the Macedonian export growth, and the price non-elasticity enables a higher domestic export prices in given high world economic growth (especially the growth of the EU countries, which are one of the largest Macedonian trade partners). These movements will have positive effect to the trade balance in a way of deficit decreasing. On the other hand, slow world economic growth will have negative effects to the demand for Macedonian products, and decreasing of the prices in given decreased demand, will not have a significant reaction of the foreign demand.

The comparative analysis of the export elasticities shows that income elasticity of the export is usually 1, while a large part of the countries are price-inelastic. The developed countries show higher income elasticity and lower price elasticity than developing countries. Thus, the export elasticities of the Republic of Macedonia are in the range of those of the developing countries.

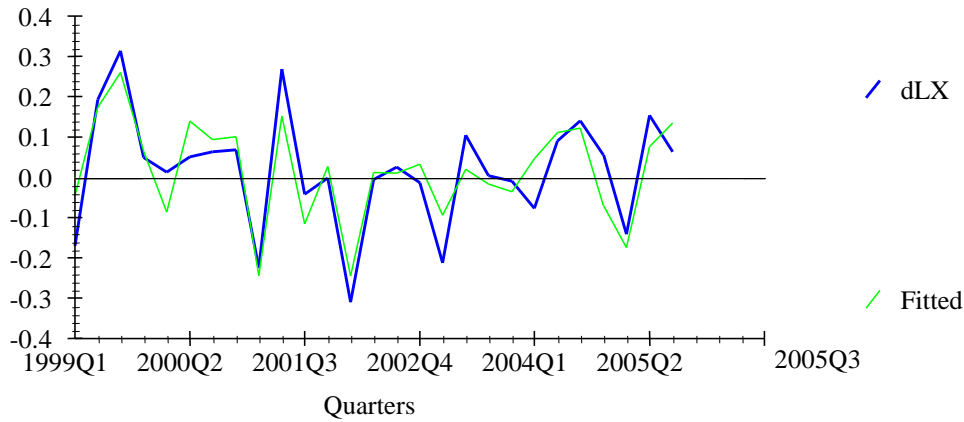
The short run dynamic of the model and speed of adjustment coefficient are shown in Table 6.

Table 6
Short run dynamic and ECM term based on ARDL (2,3,4)

ECM specification of the ARDL model			
ARDL (2,3,4) selected on base of AIC criterion			
Dependent variable DLX (difference of export logarithm)			
Regressor	Coefficients	Standard error	T-statistics [probability]
dLX1	0.29927	0.19064	1.5698[.135]
dLWGDP	2.6497	0.67424	3.9299[.001]
dLWGDP1	0.56056	0.77006	0.72794[.477]
dLWGDP2	1.5849	0.84899	1.8669[.079]
dLRPX	-0.12456	0.31804	-0.39165[.700]
dLRPX1	0.13841	0.29205	0.47390[.642]
dLRPX2	-0.030147	0.27421	-0.10994[.914]
dLRPX3	0.73921	0.25337	2.9174[.010]
dCON	-9.6999	4.7714	-2.0329[.058]
ecm(-1)	-0.66742	0.19149	-3.4853[.003]
ecm=LX-1.5101*LWGDP+0.72734*LRPX+14.5335*CON			
R-squared 0.75132			

The results show that only short run change in world income (dLWGDP) has an influence on the short run dynamics of the export at the 1% level of significance. The other short run changes (including those with time lags) do not have effects to the export on short term. The error term coefficient is significant and shows fast adjustment back to the long run equilibrium. Thus, almost 67% of the disequilibrium in the previous period, derived by the short run changes, adjusts back to the long run equilibrium in the actual quarter.

Graph 2
Short run dynamic of the export demand (realized and estimated)



Empirical elaboration of Thirlwall’s model in the case of the Republic of Macedonia

As mentioned before, the economic growth in the Republic of Macedonia can be estimated through the Thirlwall’s model. Namely, during the Q1.1999-Q3.2005 the economy grew at average rate of 2.2%, while the export grew at average rate of 8%. Thus, if we do not consider income elasticity of the import, the growth rate of the Republic of Macedonia estimated only through the export growth will be higher. However, the actual growth rate significantly differs from the export growth, which can be explained with the high import elasticity to the domestic income changes ($\pi=3.48$). The following calculations show the explanation:

$$y=y^*=(1/\pi)x \quad \text{or} \quad 2.2\%=2.3\%=(1/3.48)*8\%$$

Thus, the computed growth rate, taking into account a balance of payments constrains, is 2.3% and is near to actual growth rate. This clearly shows that the economic growth of the Republic of Macedonia is significantly determined by the external trade developments, i.e. by the export growth rate and by high income elasticity of the import. Thus, if the Macedonian export rises or if the income elasticity of the import falls, than the GDP growth rate will increase.

V. Conclusion

The main purpose of this paper is to estimate long-term price and income elasticities of export and import demand, which have not been analyzed for Macedonia, yet. The practical application of the estimated elasticities provides insights about the determinants of the economic growth of the Republic of Macedonia. For that purpose, the Thirlwall’s model was used.

The estimation of price and income elasticities is based on conventional equations for export and import demand and the estimations are done using econometric analysis for cointegration, i.e. Autoregressive Distributed Lag Modeling approach (ARDL).

The results show high sensitivity of the Macedonian import to the domestic income changes and significant but smaller sensitivity to the relative prices changes (foreign/domestic prices). The export also shows significant income elasticity, but small, i.e. non-elasticity to the

relative prices changes (domestic/foreign prices). Those results indicate that the domestic economic subjects are more sensitive to the price changes than the foreign economic subjects. The analysis shows that the income elasticity of import is higher than the income elasticity of export ($\pi > \varepsilon$), which indicate to trade balance deterioration.

The high import response to the domestic income changes demonstrates that income growth determines the domestic demand, which in turn provokes a significant import demand. However, the large part of the import demand is for products for reproduction, which dominate in the Macedonian export's structure as well. It means that the additional domestic income which generates an import growth, at the same time generates the export growth. On the other hand, Macedonian export has lower elasticity to world income growth, which partially can be explained by export orientation. The great part of the Macedonian export is directed toward manufacturing sectors that recently have depressed world demand (Gutierrez, 2006).

Those findings point to the conclusion that the restructuring of the Macedonian production is essential. The supply policies should be directed toward export increase (through export diversification), production of non-import dependent products (exploitation of the domestic resources or use of competitive advantages), and exports of high added value goods and services or final products. The final effects of those measures will be higher growth, higher income elasticity of export and lower income elasticity of import that will lead to trade account improvement.

Additionally, it is necessary to improve of non-price aspects of exports. Thus, given price inelasticity of exports, it is obvious that the foreign buyers do not consider the price of the Macedonian products when making their decisions. The Macedonian exports need to compete with quality based on world standards, successful promotion, and good delivery. At the same time, the domestic consumers' respect for domestic products quality should be increased. That will contribute to higher domestic production and fall in imports.

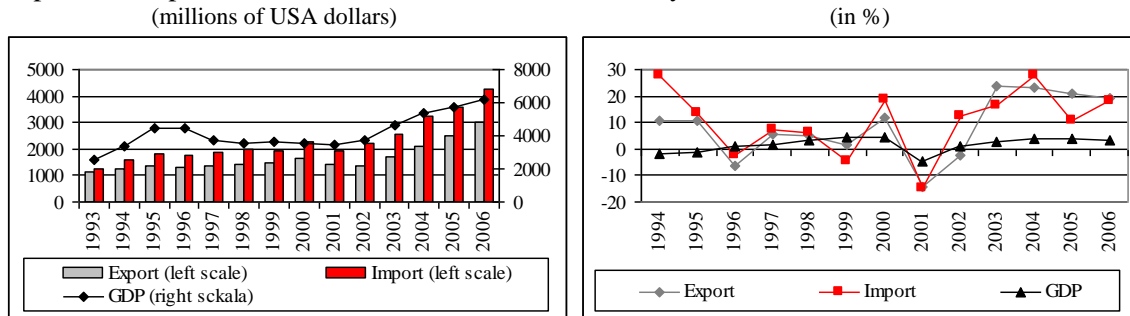
Thus, the revision of the current macroeconomic policy of the Republic of Macedonia is essential. It should be devoted more to export's encouragement. The macroeconomic management should actively manage the trade elasticities and should create a policy that will raise the value of ε and reduce the value of π . Finally, it will relax the balance of payments constrains and eventually will accelerate the economic growth of the country.

However, although the most of the findings match reality, the price inelasticity of export should be approached with caution. Thus, the further improvement of the export demand equation is essential in order to resolve the problem of serial correlation. This notation is only one of the future research proposals.

Appendix 1

Graph 1

Export and import of commodities and GDP* and their dynamics



* Estimated data for 2006.

Source: National Bank of Republic of Macedonia and State Statistical Office of Republic of Macedonia.

Table 1

Structure of commodity export and import by intended use

(in %)

	EXPORT			IMPORT		
	2004	2005	2006	2004	2005	2006
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
1. Production materials	48.6	54.3	58.0	65.0	64.9	65.2
11 Raw materials and semi-finished goods	35.1	38.4	41.6	26.8	26.4	27.1
12 Fuel	4.5	8.0	9.3	12.9	18.6	19.6
19 Finished production materials	9.1	7.9	7.1	25.2	19.9	18.5
2. Capital goods	1.8	2.0	2.1	10.7	10.8	11.2
21 Plant machinery	0.0	0.1	0.0	0.3	0.3	0.2
22 Agricultural machinery	0.0	0.0	0.0	0.3	0.2	0.2
23 Metal processing tools and machinery	0.0	0.0	0.0	0.2	0.3	0.2
24 Other tools and machinery	0.5	0.4	0.5	3.6	3.4	3.7
25 Electric motors and machinery	0.5	0.5	0.6	3.3	3.2	3.0
26 Transport equipment	0.2	0.4	0.1	0.7	1.2	1.5
29 Other capital goods	0.6	0.6	1.0	2.3	2.3	2.3
3. Consumption goods	49.5	43.7	39.8	24.2	24.3	23.6
31 Food	7.3	8.0	7.8	8.9	8.7	8.3
32 Beverages and tobacco	4.2	3.6	4.2	0.6	0.7	0.6
33 Clothing and footwear	31.3	26.2	22.7	1.3	2.4	2.0
35 Furniture	0.4	0.4	0.4	0.6	0.6	0.6
36 Textiles (except clothing)	1.7	1.4	0.9	0.4	0.6	0.6
37 Medicine, pharmacy and cosmetics	2.5	2.2	1.9	3.0	2.6	2.4
39 Other consumption goods	2.0	1.8	1.9	9.5	8.6	9.1
4. Unknown	0.1	0.0	0.1	0.1	0.1	0.1

Source: State Statistical Office of Republic of Macedonia.

Table 2
Structure of commodity export and import by SITC
(in %)

	EXPORT			IMPORT		
	2004	2005	2006	2004	2005	2006
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0
Food and live animals	7.5	8.2	8.0	11.5	10.6	9.8
Live animals	0.0	0.0	0.0	0.1	0.1	0.1
Meat and meat preparations	1.2	0.9	0.8	3.0	2.7	2.4
Dairy products and eggs	0.2	0.4	0.3	0.7	0.8	0.8
Fish and fish preparations	0.3	0.3	0.3	0.4	0.4	0.5
Cereals and cereal preparations	0.6	0.8	0.8	2.3	1.6	1.1
Fruits and vegetables	3.8	4.3	4.5	1.5	1.3	1.2
Sugar, preparation and honey	0.4	0.5	0.2	0.8	0.8	0.9
Coffee, tea, cocoa, manufacturers there of	0.4	0.4	0.4	1.2	1.2	1.2
Feeding stuff animals	0.0	0.0	0.0	0.5	0.5	0.4
Miscellaneous food preparations	0.5	0.6	0.5	1.1	1.2	1.2
Beverages and tobacco	7.5	8.0	8.0	1.0	1.0	0.9
Beverages	3.3	3.0	3.3	0.4	0.5	0.5
Tobacco and tobacco manufactures	4.3	5.0	4.7	0.5	0.5	0.4
Crude materials, inedible, except fuels	2.6	3.3	4.6	2.6	3.3	3.6
Hides, skins and fur undressed	0.3	0.2	0.2	0.1	0.1	0.0
Oil seeds and oleaginous fruits	0.1	0.0	0.0	0.2	0.2	0.2
Crude rubber (including synthetic and reclaimed)	0.0	0.0	0.0	0.1	0.0	0.0
Cork and wood	0.3	0.2	0.2	0.6	0.5	0.4
Pulp and waste paper	0.0	0.0	0.0	0.0	0.0	0.0
Textile fibers and their wastes	0.1	0.0	0.1	0.4	0.4	0.4
Crude fertilizers and crude minerals	0.9	0.9	0.7	0.3	0.3	0.2
Metalliferous ores and metal scrap	0.6	1.6	3.1	0.7	1.5	1.9
Crude animal and vegetable materials n.e.s	0.3	0.3	0.3	0.3	0.3	0.3
Mineral fuels, lubricants and related materials	4.7	8.1	9.4	13.6	19.2	20.2
Coal, coke and briquettes	0.1	0.1	0.1	0.8	0.9	0.8
Petroleum and petroleum products	4.5	7.8	8.5	10.8	15.3	16.6
Gas natural and manufactured	0.1	0.1	0.2	0.7	0.9	1.1
Electric energy	0.0	0.0	0.6	1.3	2.1	1.7
Animal and vegetable oils and fats	0.0	0.1	0.1	1.0	0.9	0.8
Chemicals	4.8	4.5	4.2	10.4	10.3	9.7
Organic chemicals	0.1	0.1	0.1	0.6	0.6	0.6
Inorganic chemicals	0.3	0.3	0.4	0.4	0.3	0.3
Dyeing tanning and coloring materials	0.5	0.6	0.7	0.7	0.7	0.7
Medical and pharmaceutical products	2.3	2.0	1.8	2.7	2.3	2.1
Essential oils and perfume materials, toilet, preparations	0.5	0.4	0.3	2.0	1.9	1.8
Fertilizers (other than crude)	0.0	0.0	0.0	0.5	0.5	0.5
Plastics in primary forms	0.2	0.2	0.2	1.5	1.6	1.6
Plastics in non primary forms	0.7	0.7	0.6	1.0	1.1	1.1
Chemical materials and products, n.e.s	0.2	0.2	0.2	1.1	1.2	1.1
Manufactured goods classified chiefly by material	32.6	33.3	35.5	23.6	29.3	29.7
Leather, leather manufactures, n.e.s and dressed fur skin	0.2	0.1	0.0	0.2	1.0	0.9
Rubber manufactures, n.e.s	0.0	0.0	0.0	0.9	0.9	0.8
Wood and cork manufactures (excluding furniture)	0.1	0.1	0.1	1.0	1.0	0.9
Paper, paperboards and articles of paper pulp	0.4	0.4	0.4	2.5	2.4	2.2
Textile yarn, fabrics, made up articles and related products	3.1	2.5	1.9	3.5	9.8	9.0
Non metallic manufactures, n.e.s	2.6	2.5	2.9	2.1	2.0	2.0
Iron and steel	24.2	26.0	27.8	10.1	8.9	9.8
Non ferrous metals, n.e.s	0.4	0.3	0.3	1.3	1.4	1.8
Manufactures of metals, n.e.s	1.5	1.4	1.9	2.0	2.1	2.2
Machinery and transport equipment	5.9	5.4	4.9	18.7	17.4	18.3
Power generating machinery and equipment	0.1	0.1	0.1	0.5	0.4	0.3
Machinery specialized for particular industries	0.2	0.2	0.2	2.1	1.9	2.3
Metal working machinery	0.0	0.1	0.1	0.2	0.3	0.3
General industrial machinery	0.3	0.4	0.5	2.7	2.7	2.5
Office machines and automatic data processing machines	0.1	0.1	0.1	1.5	1.6	1.7
Telecommunication apparatus and equipment	0.1	0.1	0.0	2.5	2.5	2.2
Electrical machinery, apparatus and appliances	3.0	2.5	2.5	2.8	2.8	2.8
Road vehicles	1.4	1.4	1.1	6.3	4.9	5.4
Other transport equipment	0.6	0.6	0.4	0.1	0.4	0.7
Miscellaneous manufactured articles	34.1	28.9	25.2	5.8	7.8	6.9
Pre fabric, buildings, sanitary plumb, heat, light fixtures and fittings	0.4	0.3	0.3	0.3	0.3	0.4
Furniture and parts there of	0.5	0.5	0.5	0.6	0.7	0.7
Travel goods	0.0	0.0	0.0	0.1	0.1	0.1
Clothing	29.3	24.4	21.2	0.9	2.1	1.7
Footwear	3.0	2.9	2.4	0.4	0.6	0.6
Scientific and controlling instruments	0.1	0.0	0.0	1.0	1.0	0.8
Photo cameras, watch	0.0	0.0	0.0	0.2	0.2	0.2
Miscellaneous manufactured articles, n.e.s	0.8	0.8	0.7	2.3	2.8	2.6
Commodities and transactions not classified in SITC	0.2	0.2	0.2	11.8	0.1	0.1
Not classified	0.1	0.0	0.1	0.1	0.1	0.1

Source: State Statistical Office of the Republic of Macedonia.

Appendix 2

Tables ^{/1}

Income and price elasticities of the export and import of different countries

country	period	π	ϕ	procedure	authors
Australia	1960-1999	1,30	-0,82	PH	Christopoulos&Tsionas (2003)
France	1960-1999	1,67	-0,30	PH	Christopoulos&Tsionas (2003)
Germany	1960-1999	1,96	-0,06	PH	Christopoulos&Tsionas (2003)
Italy	1960-1999	1,66	-0,41	PH	Christopoulos&Tsionas (2003)
Netherland	1960-1999	1,55	-0,20	PH	Christopoulos&Tsionas (2003)
Great Britain	1960-1999	1,83	-0,28	PH	Christopoulos&Tsionas (2003)
USA	1960-1999	2,19	-0,46	PH	Christopoulos&Tsionas (2003)

country	period	π	ϕ	procedure	authors
Argentina	1977-2002	3,66	-0,13	OLS	Pacheco-Lopez&Thirlwall (2002)
Brazil	1977-2002	1,82	0,00	OLS	Pacheco-Lopez&Thirlwall (2002)
Guatemala	1977-2002	3,78	0,18	OLS	Pacheco-Lopez&Thirlwall (2002)
Mexico	1977-2002	3,17	-0,18	OLS	Pacheco-Lopez&Thirlwall (2002)
Paraguay	1977-2002	2,48	-0,24	OLS	Pacheco-Lopez&Thirlwall (2002)
Venezuela	1977-2002	3,76	0,15	OLS	Pacheco-Lopez&Thirlwall (2002)

country	period	π	ϕ	procedure	period	ε	η	procedure	author
India	1950-1996		-0,51	AR(1)	1960-1996	0,45	-0,55	OLS	Sinha (2001)
Japan	1952-1997	0,84	-0,91	PH	1951-1996	2,34	-1,20	Coint.vectors	Sinha (2001)
Filipinas	1949-1991	0,57		AR(1)	1950-1991	0,89	-1,06	PH	Sinha (2001)
Sri Lanka	1950-1997	-0,39	-0,48	PH	1950-1996	0,90		PH	Sinha (2001)
Thailand	1953-1995	0,90	-0,20	AR(1)	1950-1995	0,82	-3,76	PH	Sinha (2001)

country	period	π	ϕ	ε	η	procedure	author
Austria	1965-1991	1,58	-0,69	2,42	-0,36	DOLS	Ghani (1997)
Germany	1965-1991	1,54	-0,47	1,83	-0,22	DOLS	Ghani (1997)
France	1965-1991	1,29	-0,43	1,86	-0,18	DOLS	Ghani (1997)
Greece	1965-1991	1,44	-0,93	1,84	-1,58	DOLS	Ghani (1997)
Italy	1965-1991	1,10	-0,49	2,11	-0,52	DOLS	Ghani (1997)
USA	1965-1991	2,09	-0,43	1,15	-0,48	DOLS	Ghani (1997)
Burundi	1965-1991	1,98	-1,34	1,47	-0,26	DOLS	Ghani (1997)
Algeria	1965-1991	2,64	1,86	0,89	-0,30	DOLS	Ghani (1997)
Indonesia	1965-1991	1,38	-1,23	1,15	-0,12	DOLS	Ghani (1997)
Iran	1965-1991	2,53	-0,04	0,42	-0,54	DOLS	Ghani (1997)
Madagaskar	1965-1991	2,40	-1,29	-0,40	-0,58	DOLS	Ghani (1997)
Somalia	1965-1991	2,41	-1,74	0,01	-1,48	DOLS	Ghani (1997)
Turkey	1965-1991	1,47	-0,07	2,70	0,28	DOLS	Ghani (1997)
Venezuela	1965-1991	2,12	-0,77	-0,40	-0,57	DOLS	Ghani (1997)

country	period	π	ϕ	ε	η	procedure	authors
Australia	1960-1992	1,18	-0,51	1,34	-0,76	ARDL	Caporale&Chui (1999)
France	1960-1992	2,06	-0,13	2,15	-0,04	ARDL	Caporale&Chui (1999)
Germany	1960-1992	2,06	-0,64	2,01	-0,10	ARDL	Caporale&Chui (1999)
Greece	1960-1992	1,58	-1,16	2,10	-1,35	ARDL	Caporale&Chui (1999)
India	1960-1992	1,55	-1,01	1,02	-2,53	ARDL	Caporale&Chui (1999)
Italy	1960-1992	1,72	-0,74	2,02	-0,47	ARDL	Caporale&Chui (1999)
Netherland	1960-1992	1,39	-0,26	1,63	-2,42	ARDL	Caporale&Chui (1999)
Great Britain	1960-1992	2,28	-0,63	1,31	-0,29	ARDL	Caporale&Chui (1999)
USA	1960-1992	1,75	-0,23	1,53	-1,36	ARDL	Caporale&Chui (1999)
Venezuela	1960-1992	1,70	-0,12	0,29	-0,63	ARDL	Caporale&Chui (1999)

country	period	ε	η	procedure	ε	η	procedure	authors
Austria	1960-1993	0,88	-0,08	OLS	0,83	-0,07	PH	Senhadji&Montenegro (1998)
France	1960-1993	0,57	-0,01	OLS	0,49	0,00	PH	Senhadji&Montenegro (1998)
Greece	1960-1993	1,32	-0,31	OLS	0,95	-0,24	PH	Senhadji&Montenegro (1998)
Italy	1960-1993	0,95	-0,07	OLS	0,80	-0,05	PH	Senhadji&Montenegro (1998)
Great Britain	1960-1993	0,61	-0,16	OLS	0,48	-0,12	PH	Senhadji&Montenegro (1998)
USA	1960-1993	0,26	-0,26	OLS	0,05	-0,03	PH	Senhadji&Montenegro (1998)
Algeria	1960-1993	0,99	-0,77	OLS	0,83	-0,09	PH	Senhadji&Montenegro (1998)
China	1960-1993	0,46	-0,78	OLS	0,24	-0,63	PH	Senhadji&Montenegro (1998)
Korea	1960-1993	1,21	-0,61	OLS	1,04	-0,52	PH	Senhadji&Montenegro (1998)
Paraguay	1960-1993	1,21	-0,88	OLS	1,11	-0,96	PH	Senhadji&Montenegro (1998)
Tunis	1961-1993	1,15	-0,17	OLS	0,54	-0,17	PH	Senhadji&Montenegro (1998)
Turkey	1960-1993	0,31	-0,69	OLS	0,06	-0,58	PH	Senhadji&Montenegro (1998)
Yugoslavia	1960-1990	0,67	-0,23	OLS	0,52	-0,19	PH	Senhadji&Montenegro (1998)

1/ Legend:

ε - income elasticity of the export;

η - price elasticity of the export;

π - income elasticity of the import;

ϕ - price elasticity of the import;

OLS - Ordinary Least Square;

PH - Phillips-Hansen fully modified OLS procedure;

Coint.vectors - Cointegrating vectors;

DOLS - Dynamic Ordinary Least Square procedure;

ARDL - Autoregressive Distributed Lag Modeling Approach.

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