Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

MASTER THESIS

The Impact of Devaluation through Price and Non-Price Competitiveness on Trade Balance

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Academic Year: **2013/2014**

Declaration of Authorship

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Prague, May 13, 2014

Signature

Acknowledgments

I would like to express my deepest gratitude to prof. Ing. Michal Mejstřík CSc., who provided me with ample guidance during the writing process, and especially for his invaluable recommendations and comments, as well as for his encouraging attitude.

I also would like to thank my family and friends for their unconditional support and belief throughout the entire duration of my studies.

Abstract

This thesis examines the relationship between the real exchange rate and trade balance in eight countries with different level of development for the period 1991-2012. Using merely exchange rate to improve the trade balance refers to price-competitiveness and relies on the satisfaction of Marshall-Lerner condition. Additionally, we articulate the influence of other underlying factors, defined as "non-price competitiveness", proxied with capital stock variable. A Vector Error Correction Model, based on Johansen's Methodology was implemented in our two econometric specifications. The key findings of the classical trade model indicate that M-L condition is met in five countries and devaluation of domestic currency would improve their trade balance in long run. VECM results from second model, which extended the traditional imperfect substitutes framework to include non-price competitiveness factor, shows pronounced influence of product quality on trade balance, capital stock variable being significant in most of the cases. The results show that trade balance reacts to both changes in relative prices and product differentiation, thus non-price competitiveness factors must not be neglected by policy makers. Our findings also indicate the existence of J-curve pattern, as reflected by short-run coefficients, meaning that trade balance does not immediately improve after currency devaluation or change in product quality.

JEL Classification	F4, F11, F12, F14
Keywords	Exchange rate, Trade balance, Devaluation, Price and Non-Price Competitiveness, VECM, Marshall-Lerner condition.

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Acronyms

BPI	Producer Price Index
CPI	Consumer Price Index
FEER	Fundamental equilibrium of real exchange rate
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GIIPS	Greece, Italy, Ireland, Portugal and Spain
ICT	Information Communications Technology
IMF	International Monetary Fund
IRF	Impulse Response Function
M - L	Marshall - Lerner
NAFTA	North American Free Trade Agreement
NEER	Nominal Effective Exchange Rate
NERV	Czech Government's National Economic Council
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
R&D	Research and Development
R-A	Resource – Advantage
REER	Real Effective Exchange Rate
TB	Trade Balance
ULC	Unit Labor Costs
VAR	Vector Autoregression Model
VECM	Vector Error Correction Model
WEF	World Economic Forum
WTO	United Nations Conference on Trade and Development
WTO	World Trade Organization

Master Thesis Proposal

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Defense Planned:	June 2014

Proposed Topic:

The impact of devaluation through price and non-price competitiveness on trade balance

Topic Characteristics:

On the background of the last economic events, the strategy of using currency devaluation in order to improve the trade balance has been perceived as a weak maneuver for small economies that largely rely on imports. A relevant example is the case of Latvia and Ireland – countries that used the internal devaluation as a measure against the economic recession, but in the end resulted in a domestic demand collapse and absence of competitiveness enhancement. The reason behind this is that the international supply chain dispersion implies that countries-importers of components (i.e. Japan) would meet the adverse effect of devaluation on their exporter's costs side and competitiveness. On the contrary, for countries adopting the appreciation of currency strategy, they would experience lower costs and will be hedged against currency changes, by removing any pressure to increase the prices in target markets. Thus, the purpose of the study is to answer what effect would have the devaluation of the currency for commodity exporting countries on one hand, and for high tech countries on another hand. For the analysis, national statistics data for International Trade provided by www.stats.oecd.org will be used.

The call for a deeper research in this topic was born after remarking a lack of recent studies that might had occur from absence of data in the past or the speed of successiveness of this type of reforms after the last recession.There have been a couple of attempts to study the phenomena in the paper about "export-imports responses to devaluation, experience from 60's" and the famous paper about competitive devaluation published in 2000 by G. Corsetti. Nowadays, the process of devaluation of the currency is gaining magnitude and represents a new goal for such countries as China, Japan, USA, otherwise called "big tyrannies". In this context, the thesis aims to evaluate the factors of price and non-price competitiveness and their influence on long-term development of the countries. Moreover, the thesis will assess the response of merchandise exports and imports to devaluation in domestic currency, by articulating the case for free-floating exchange rates.

In addition, the research would focus on non-price competitiveness determinants, such as quality of products, technological advance, industry specialization etc., which will help separate the countries in 2 or more groups and make the analysis authentic. Moreover, the assumption that non-price factors are more important in offsetting external imbalances and through internal devaluation will lead to a temporary

productivity gains and increase in exports, but to a deeper decline in long term horizon, would help to depict the main conclusions of the thesis.

Hypotheses:

1. Own price elasticity of demand is variable for countries with homogenous products and those with differentiated products and depends on the position of specific country in the international trade.
2. Using devaluation of domestic currency as an economic policy can lead to improvement of trade imbalances.
3. The increase in exports through the devaluation of the domestic currency would lead to a further decline and slower productivity growths
4. Non-price factors: inadequate institutions, infrastructure and underutilization of innovation potentially threaten competitiveness of the countries.

Methodology:

The empirical study will determine the response to temporary currency devaluation among the countries with different exchange rate regimes using time series model. For this purpose, countries will be split according to their GDP, Global Competitiveness Level and other relevant factors for our study. In order to estimate the influence of currency devaluation on competitiveness and economic growth, a simple regression will be used, including also additional variables, and dummies if necessary. As econometric methodology, VAR and VECM will be used, because it shows the impulse responses of total imports generated by fluctuations in exchange rates. First, I will estimate the price elasticities of imports and exports in selected countries and observe if the Marshall-Lerner condition is met. Then, the dependent variable representing the total imports/exports will be regressed on other factors such as: real GDP, REER and dummies for one-time events.

In addition, using cross-country indicators along with model sensitivity analysis we will test if there is any heterogeneity across the studied countries. This will help us to detect if the mentioned above tactics (devaluation) will end as being gainful for individual economies.

Outline:

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1. Differentiation of international commodity trade
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II. Empirical analysis

4. Data description
5. Model specification
6. Sensitivity analysis

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Author **Supervisor**

1 Introduction

It has been for long time in the attention of policymakers the argument about whether the appreciation or depreciation of exchange rates would improve the trade position of a country and this issue was discussed not only in the time of golden standard or fixed exchange rates regimes. The interest in this field augmented after the disruption of Breton Woods (1973) and with the advent of floating regimes. Furthermore, the last economic events and debates about incessant trade imbalances and misallocation of trade measures, which are considered to be very restrictive by policymakers, have revived an interest of better analysis of the relationship between the exchange rate and trade balance. Although the number of studies in this area is largely expanding, the impact of exchange rate on trade balance is still an open and contestable topic. The existing literature does not provide a definite guidance on the direct effect of exchange rate on current account, as a cause of limited number of assumptions that cannot be applied in all the cases. The most popular theory on the trade balance – exchange rate relationship is the elasticity approach. In particular, the behavior of different exchange rate systems relies on specific price elasticities and moreover, the fortitude of a currency counts on the amount of relative price regulations. These price adjustments are an indispensable measure for redressing the trade imbalances and most are a plausible reason of euro crisis.

In our current study, we make the assumption that there is a specific relationship between the real exchange rate, the price elasticity of imports and exports, and their subsequent demand. Therefore, the outcome of a country's economy will be dependent on the price elasticity of demand, both: for exports and imports. If given that the price elasticity for imports is inelastic at certain level, this means the country depends on the imports of different materials and commodities from other countries. On another hand, if the price elasticity of exports is elastic, it means that the given country produces such goods for which there are available substitutes in countries from the rest of the world. In this context, the movements of the exchange rates will lead to changes in the relative price of exports and imports. This phenomenon reflects how competitive the producers in a certain country are. However, producers from all over the world compete on both price and the quality of products, which are known for the terms: "price competitiveness" and "non-price competitiveness". The price competitiveness issue illustrates in fact the monetary

approach to the balance of payments, which has been developed after 70's and states that the process of devaluation of a currency would first lead to a collapse in the trade balance, and after a certain period would improve it. This is captured by J-curve phenomenon on short-run. Nonetheless, policymakers still argue about the positive effect of depreciation of a currency on the trade balance. They consider that only if the Marshall-Lerner condition is satisfied, the trade position will ameliorate, and this is valid for long-term adjustment only. Economists have had contradictory opinions about J-curve and many of them support the idea that in short-run the trade balance will deteriorate, but this effect could be different for both developed and developing countries. There is evidence over the history, about the improvement of trade balance using the economic lever of currency devaluation: Italy (1992-1993), Mexico (1994-1995), Poland (2009). Still, it is necessary to mention that there are two means, through which a real devaluation of currency will positively rectify the trade balance. Primarily, the exports should increase, due to the fact that domestic products will become cheaper after the depreciation, compared to the foreign ones. Secondly, the imports quantity will decrease, because it will more expensive for a country to import. Nowadays, however the monetary approach to the trade balance does not provide an implicit gain anymore, due to stringent development of trade markets and international competitiveness. Entities are reoriented to the quality and diversification of goods and the classical trade model does not fit the current economic conditions. Therefore, our study extends the traditional trade model in order to cover the non-price competitiveness factor, which aims to provide more reliable estimates of trade elasticities and elucidate the role of exchange rate in restoring global trade imbalances.

The purpose of this thesis is to investigate the connection between the real exchange rate and trade balance during 1991:I to 2012:IV time period. Covering a sample of eight countries with different level of development, we expect to encounter a long-term relationship among our trade balance, exchange rates and non-price competitiveness determinants. For our purpose, an imperfect substitutes model will be used with two econometric equations, for price and non-price competitiveness factors. We follow the econometric framework to the modeling of trade elasticities using Johansen approach and Vector Error Correction Model (VECM), proposed by Johansen and Juselius (1990). This multivariate cointegration technique is feasible, because it captures the long-run relationships between our variables and at the same time, performs better than other empirical methods by incorporating additional lags, even in the case when errors are not normally distributed or dynamics are not known

(Algieri, 2013). The cointegration approach will be applied in both models, first model will emphasize the Marshall-Lerner condition and estimate whether the bilateral depreciation can improve the trade balance and second model will allow to investigate the significance of quality of products variable. In the end, an impulse response function will show the short-run development of trade balance in response to exchange rate movements and product differentiation.

This paper is organized as follows: Chapter I presents an overview of international competitiveness, by discussing price and non-price competitiveness factors, and shortly describes the set of countries as classified according to GCI. Chapter II provides theoretical background, explaining the BRM model and Marshall-Lerner condition in detail, and also presents the literature overview. Chapter 3 introduces the dataset and equations, empirical methodology used and techniques. The estimation results and concluding remarks are outlined in Chapter 4. Reference list and annexes, containing regression results and tests performed are presented in the last part of the document.

2 Insights on competitiveness at global level

2.1 Overview of international competitiveness

According to the definition provided by OECD, competitiveness is defined by the "ability of companies, industries, regions, nations or supranational regions to generate, while being and remaining exposed to international competition, relatively high factor income and factor employment levels on a sustainable basis" (Hatzichronologou, 1996). Nonetheless, potential competitiveness of entities operating in a certain country is not influenced only by some subjective characteristics. This potential is essentially represented by uncontrollable conditions that can affect its functioning (natural and geographic conditions, other competing entities, global economy and financial cycle) and by changes in activities of national governments and administrations, that are possibly affecting EU internal market conditions (Mejstrik *et al.*, 2011).

On the background of recent economic development, international trade has become the central issue in the economic growth of most of the countries. It is widely known that economies nowadays rely preponderantly on the trade sector. Moreover, international competitiveness is one of the most important aspects of international trade and in most of the cases it is the key point in the successes and failures of economies, which are maximizing their economic potential using international trade levers. In this context, international trade may be an engine that drives economic growth of nations, but international competitiveness represents the fuel that empowers that engine (Harrison, 1999). Economies compete in maintaining a certain level of competitiveness that will assure them the desired market shares, necessary to support an increase in income, revenues and employment.

Scientists have had meanwhile two perceptions of international competitiveness: micro aspect and macro aspect. The micro aspect is represented by the competition at firm level and to what extend it is reflected by international market shares. Conversely, the macro aspect refers to competitions between nations. A relevant definition of competitiveness from macro perspective has been provided by the President's Commission on Industrial Competitiveness (1985), who states that

"competitiveness of a nation is not an end but a means to an end; its ultimate goal is to increase the standard of living of a nation under free and fair market conditions through trade, production, and investment." The definition makes reference to production, which is also a firm characteristic of competitiveness, therefore the main idea is that there is a thin line between micro and macro perspective of international competitiveness, as many relevant factors can help contribute to both entities' and nations' trade performance. There have been many measures and definitions of competitiveness, but there is no unique interpretation adopted by all the scientists. Some of the authors articulate the level of exchange rate or overall level of productivity as the main indicators, while other emphasize country's growth rate or technological leadership (Boltho, 1996, Fröhlich, 1989). Nonetheless, there is no question that international competitiveness is indispensable to a nation's well-being.

The theory states, on another hand, that export performance and competitiveness of each country are closely interrelated. Specifically, the export performance of a country depends on its competitiveness or even more often competitiveness is directly perceived as a major part of the export performance of the country. This argument applies not only during "good weather", but is even more important in times of crisis (Mejstrik *et al.*, 2011). In addition to the environment (economy, education, institutions, mobility) the government must allow for dynamic smooth adjustment in the economy as a reflection of changing comparative advantages. Furthermore, in the context of globalization, we can remark an increase in global exports relative to global income. In particular, countries examine their exports and imports growth perspective as shares of national income. This means that bigger volume of global production of goods and services are traded abroad, rather than sold domestically. Therefore, as a result of global crisis, we are witnessing a long-run tendency of increase in global integration through trade, or at least this is a temporary trend. It can be noticed in Figure 2.1, that after the recession from 2009, world trade has quickly restored and at the end of 2010, it settled back at its pre-crisis values. Emerging countries have been the engine of world trade improvement. In 2010, the trade volume in emerging economies augmented by 13% and is now at much higher level than it was in 2008. As concerns developed nations, their trade volume increased by approximately 10% last year, which only attained the level they had at the beginning of 2007.

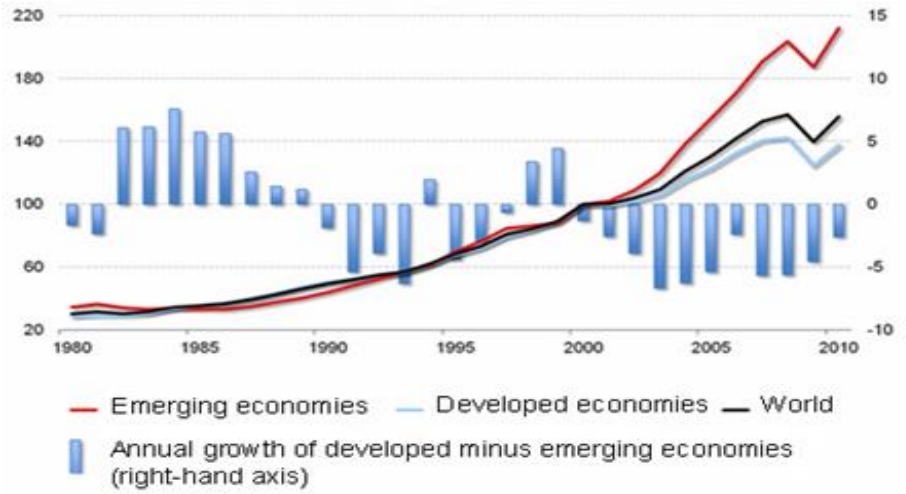

Figure 2.1: Trade volume, Index 2000=100, percentage points

Source: IMF. Trade volume is the sum of exports and imports divided by two, in real terms. Developing countries are included in emerging countries group.

2.2 Price competitiveness factors

As it has already been mentioned, competitiveness is a broad term and has many definitions. For the purpose of our analysis, we simplify the concept of competitiveness in order to obtain its measurable characteristics. Domestic firms compete internationally based mainly on product price and this type is called price competitiveness. Price competitiveness is an important indicator for small open economies, which have their own currency and a freely floating exchange rate (Mejstrik *et al.*, 2011). Any weakening of domestic currency and rising costs of maintaining the wages in line with productivity can help domestic firms to expand their shares in the world market. This would lead to an increase in the attractiveness of the country in terms of the location of production and will support its economic growth.

The competitiveness through prices of an economy reported to other countries is usually measured by real effective exchange rate (REER), which represents the development of a country's currency in real values against a basket of currencies of its trading partners. However, other measurements can be used, such as Lafay Index (Lafay, 1992), Krugman Specialization Index (Krugman, 1991), or the Balassa Index shown by comparative advantage (Balassa , Bela, 1965). In our study, we will use the real exchange rate index as a measure of price competitiveness, since it has been frequently used in the literature for different purposes, such as: determination of currency equilibrium values, shifts in cost or price competitiveness, the drivers of

trade flows or stimulant for production re-allocation from tradable to non-tradable sectors (Darvas, 2012).

The real exchange rate (REER) is calculated from the nominal effective exchange rate (NEER) and the relative prices or costs between the studying countries and their trading partners (Darvas, 2012). The most frequent price and costs measures are consumer prices indices (CPI), producer prices (PPI) indices, GDP deflator, unit labor costs (ULC), Chinn (2006). The calculus formula of REER is presented below:

$$REER_t = \frac{NEER_t * CPI_t}{CPI_t^{foreign}}, \quad (2.1)$$

Where:

$REER_t$ – real exchange rate of the country unde study and the currencies of its trading partners

CPI_t – consumer price index of country under study

$NEER_t = \prod_{i=1}^{N} S(i)_t^{w^{(i)}}$ – nominal exchange rate of country under sudy and its trading partner i, as geometrically weighted average

$CPI_t^{(foreign)} = \prod_{i=1}^{N} CPI(i)_t^{w^{(i)}}$ – geometrically weighed average of CPI indices of trading partners

$w^{(i)}$ – weight of trading partner, i and N – number of trading partners.

Real rate above 100 indicates a downward trend in the country's competitiveness against the base period. The decline in the index below 100 signifies increasing competitiveness in the countries.

The basic problem of measuring competitiveness through real exchange rate is the convergence trend of the economy caused by the growth of labor productivity, technical and operational refining products. Mathematics does not reflect this, but there is reversed causality. The real exchange rate can appreciate due to growth in competitiveness, or pushing for increase in exports. Therefore, it is necessary to distinguish between the natural, the convergence trend of appreciation course and actual loss of competitiveness. In this context, we make the assumption that the loss of competitiveness is caused by two factors, (Mejstrik *et al.*, 2011):

- The appreciation of the nominal exchange rate:

Mandel and Tomšík (2003) state that it is necessary to first determine the equilibrium point of the appreciation trend in the real exchange rate and subsequently monitor the deviations from trend, so-called "bubbles". Fundamental equilibrium of real exchange rate (FEER) is the value at which external imbalances and capital flows can be indefinitely sustained. Central banks often make forecasts about this equilibrium and usually its values vary from a country to another. In particular, if the forecast equilibrium is about 3 %, this means that an appreciation of 3 % in domestic currency will not cause a loss in competitiveness. Alternatively, a more frequent tool used by policy makers is the deprecation of currency, used in order to increase the competitiveness. This subject will be analyzed in more details in our current research.

- Growth in labor costs in excess of productivity:

David Ricardo (1817) formulated the law of comparative advantage, and according to him, the trade exchange relationships between "cheap" and "expensive" countries is made possible through their specialization of goods, and those that have the lowest production costs compared to other commodities. Each country may therefore have a comparative advantage in something. The problem is that nowadays most of economies are built on the manufacturing industry and the competition is very big. Moreover, total production of the country is composed from differentiated value-added products from different sectors. In general, the country is competitive, when growth in labor costs will not exceed growth in productivity. This ratio includes unit labor costs, therefore it is a signal of loss in price competitiveness. As concerns the analysis of unit labor costs in manufacturing industry and construction, the great recession period 2007-2010 shows a paradox: Although the Irish economy as a whole lost competitiveness, car industry companies have registered productivity growth even bigger than German ones, as a consequence of cheap labor force.

Going back to the competitiveness issue, there is an undoubtable assumption of the economic intuition, that if a domestic currency is depreciated, the export sector will improve. This happens usually because exports will become cheaper for countries dealing with foreign currency and imports will become more expensive, making the purchase of goods from abroad almost impossible. Thus, countries suffering from trade deficit can redress their trade balance by artificially devaluating their currency. As seen in the case of Eurozone (Figure 2.2), in the periods accompanied by current account deficit (2007-2010), the values of real exchange rate are quite high, which

represents the appreciation of currency. In 2010, a devaluation of 13 points of currency can be noticed on graph, (from REER of 110 to 97), which lead to improvement in current account by 0.2 percentage points in the next period.

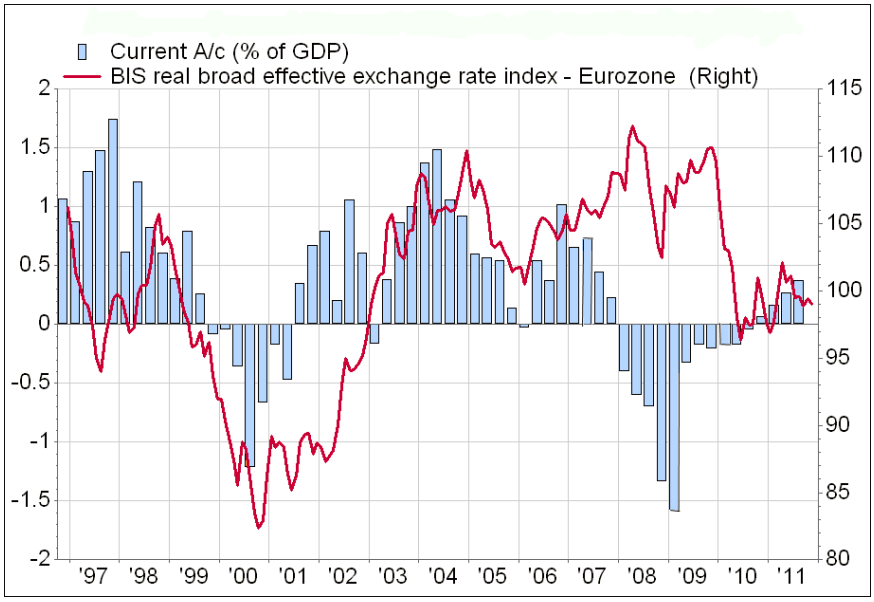

Figure 2.2: Eurozone Current Account Balance and Real Exchange Rate

Source: Davies, 2011

Even though this remedy helped many economies recover, latest studies registered some failures. These failures have been motivated by the idea that there are other factors influencing competitiveness, apart from the price-competitiveness ones. Modern economists claim that price competitiveness factors should go hand in hand with non-price competitiveness ones. This issue is will be discusses further in the thesis.

2.3 The exchange rate as trade policy instrument

It is a current mainstream of economic thinking to investigate the relationship between the exchange rate misalignments and international trade, as the exchange rates might indirectly influence the decisions of government with respect to different policies, mainly those closely related to international trade. [1] There are two aspects of exchange rate maneuvers: overvalued currency, which is a characteristic of

[1] Eichengreen and Irwin (2009) suggest that protectionism in the early 1930s was at least as much a consequence of governments' exchange rate policies as a result of the collapse of aggregate demand.

developing countries and often leads to protectionist trade policies, for example anti-dumping measures (Frieden, 1997; Knetter and Prusa, 2003) and the undervalued currency, which expands the production of non-tradable goods. In the first case, trade policies authorities intervene and help to recompense for an overvalued currency outcomes. In particular, domestic companies that suffered losses in competitiveness caused by appreciation of exchange rate may opt for more restrictive trade policies.

In the general model about trade, it is assumed that a "domestic country" produces three types of goods: export commodities, import commodities and a non-tradable good (Chipman, 2007). Moreover, in countries with fixed exchange rates regime, the monetary authorities are regularly implementing policies in order to maintain stable a home price index for all the three type of goods. In the case when a country's trade account is balanced, Keynes proposition about devaluation holds:

$$10\% \text{ devaluation} = 10\% \text{ import tariff} + 10\% \text{ export subsidy} \qquad (2.2)$$

Keynes's proposition (1981), states that an appreciation of domestic exchange rate could be brought by the same percentage of import tariff and export subsidy. In the situation when government authorities are unable to use exchange rates as policy instruments, an increase in protectionist measures are implemented, especially in times of crisis and very often this restrictive measures fail to be reduced when the recession is over.

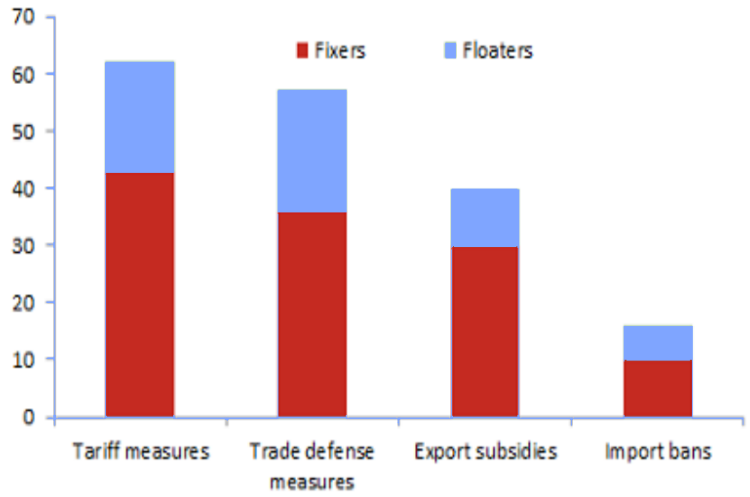

Figure 2.3: Number of countries that implemented discriminatory trade policy measures in times of Great Recession.

Source: Irwin and College, 2011

Figure 3.2 shows that about 60 countries used tariff on imports in order to redress their weakening currency and the majority have fixed regimes of exchange rate. Also, about 40 of them have provided export subsidies as severe measure. Moreover, such actions as "import substitution" and "export promotion" were adopted by Latin American countries and resulted in overvalued currencies. The economic experience, show however, that the action of governments in maintaining an overvalued currency lead to the impediment of long-run growth perspectives. It is impossible to maintain stable exchange rates, internal prices and enjoy a competitive position on the stage of international trade. (Figure 2.4) It means that all three items cannot be manipulated simultaneously by the government from a small open economy and a government can choose at most two of these three actions. Economists claim that "free trade and fixed exchange rates are incompatible in the modern world, and all the modern free traders should be in favor of variable exchange rates" (James Meade, 1955). Under floating rates regimes, an exogenous transfer outside the economy will be preceded by a depreciation of currency, leading to an increase in domestic prices of tradable goods and a fall in non-tradable ones, assuring thus, the resources reallocation. "Manipulating" with exchange rates would often help governments achieve trade balance adjustments and gain competitive advantage over other economies (IMF, 2012). In addition, realigning operations of exchange rates along with more open trade markets and capital markets are the trade instruments in achieving the adjustment of trade balance (Volcker, 1978).

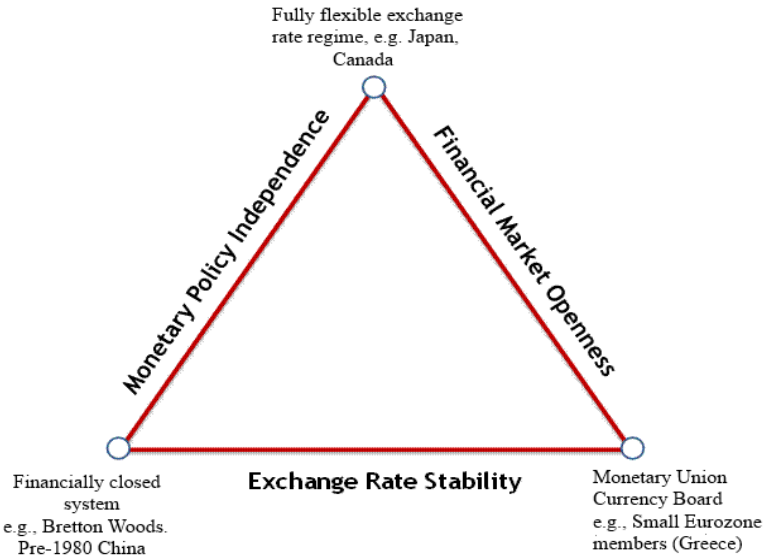

Figure 2.4: The "Trilemma" Indexes

Source: Aizenman, Chinn and Ito, 2010

2.4 Non-price competitiveness factors

In the general approach to price competitiveness, real effective exchange rate is a useful indicator because it includes the development of unit labor costs relative to foreign countries with regard to the development of their own exchange rate. However, this indicator depends on restrictive assumptions and does not fully reflect another dimension of competitiveness. Thus, if we lose the comparative cost of advantage, what are the other types of competitiveness we can compensate with? The identification of this issue has already been mentioned in the World Economic Forum, which annually publishes the Global Index of Competitiveness. The structure of WEF GCI index consists of 12 pillars of competitiveness:

Basic requirements:

- Institution
- Infrastructure
- Macroeconomic Environment
- Health and primary education

Efficiency enhancers:

- Higher education and training
- The efficiency of the market for goods and services
- The efficiency of the labor market
- The development of the financial market
- Technological readiness
- Market size

Innovation and sophistication factors:

- Business sophistication
- Innovation

Without an adequate filling of all 12 pillars, a full development of the country's competitiveness cannot be achieved. To summarize the factors affecting the competitiveness index they are divided into three levels: basic, efficient and innovative. Without the basic conditions concerning the "extensive" growth of capital and labor force, it would be very difficult to increase the efficiency or innovation. Therefore, this basic level, which includes institutional pillars and pillars of macroeconomic stability, are in fact the factors that determine the effective and innovative level. For most of the governments, the main goal is to strengthen their economies and assure the development using the model based largely on cheap labor force, whereas the great involvement of real innovation is often only declared (Mejstrik *et al.*, 2011). It is considered that relative prices of exports become weaker on the global market, because of all the various factors that have reducing power over price. This emphasizes the idea that price-competitiveness factors do not play the major role anymore, there are other issues to pay attention at. Therefore, the delimitation between price and non-price competitiveness has become crucial in the analysis of a country's export strategy (Piercy, 1982).

As it has already been mentioned, the macroeconomic theory was unable to take due respect of the factors regarding the quality competition, because it has been primarily orientated on the quantities and prices, therefore it is necessary to use various proxy variables to reflect the fast dynamism and of quality of production (Mejstrik, 1989). Their influence on internationally exposed firms has been mentioned in the literature after '70's. The classical studies about competitiveness started slowly to incorporate in their measurement the non-price approach of competitiveness, by adding such notions as: marketing intangibles, product added-values. The recent economists articulate the importance of the following variables: trustworthiness, tacit knowledge, other specific knowledge inserted in human resource, flexibility, unofficial information, relationships with suppliers, customers preferences etc.

The recent theory of (Hunt and Morgan 1995, 1999) is lying at the base of non-price competitiveness concept and has been named "the resource advantage theory of competition" (R-A). It is a wide used theory due to its vast approach to all intangible resources that a firm has and therefore, does not comprise only the marketing feature, but also takes into consideration the performance of firm on the international market. Figure 2.5 shows the gaining and maintaining mechanism of competitive advantage, developed by Hunt and Morgan (1995, 1996).

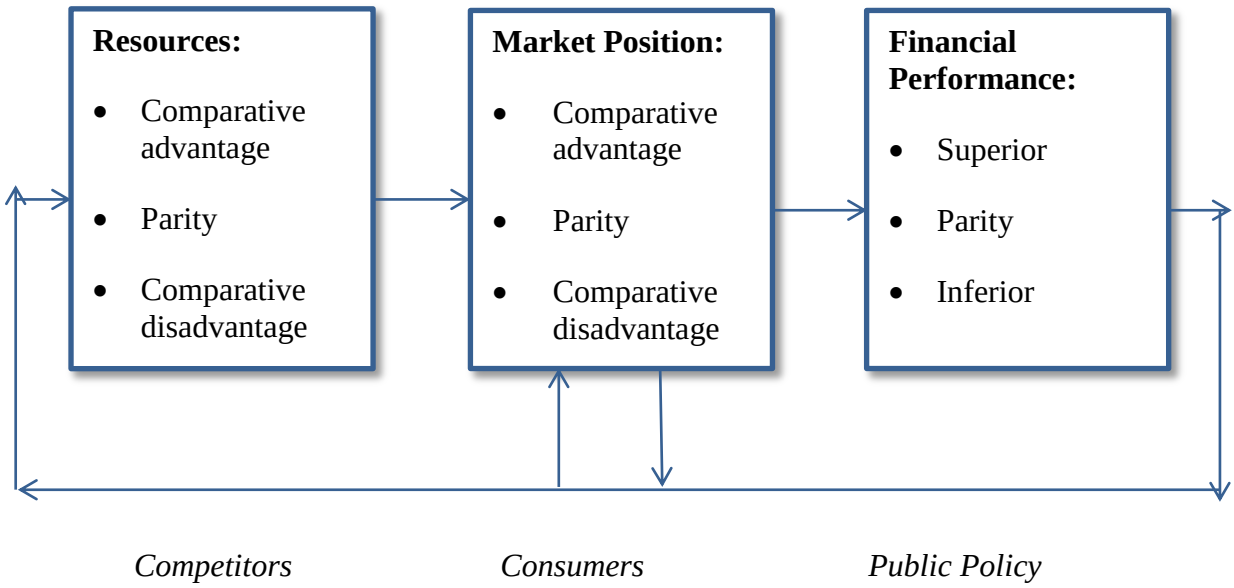

Figure 2.5: A Schematic of the Resource-Advantage Theory of Competition

Source: Hunt and Morgan, 1996.

Dividing all the factors in two groups is often a difficult task, due to unmeasurable features, permanent development and differentiation. Figure 2.6 provides a classical representation of a market position in R-A Theory, by including non-price competitiveness factors also, as they represents a potential source of competitive advantage for firms. However, in order for these factors to become a source of competitive advantage, they must be valuable or enable creation of value (Fahy, Smithee 1999), otherwise they are not a potential source of advantage (Barney, 1991).

Figure 2.6: The Matrix of Market Position in R-A Theory

Source: Hunt and Morgan, 1995.

The most recent approach to non-price competitiveness representation was made by NERV Team in 2011 and is considered useful by the authors, as it reflects the nature

of competitiveness, which mostly makes abstraction from the real effective exchange rate and other standard macroeconomic indicators. As follows, we introduce the pyramid of competitiveness based on the pillars from World Economic Forum, which contains the basic assumptions of competitiveness (Figure 2.7). The pyramid was built based on the example of Czech Republic, but it can be elaborated for any country, using the appropriate data. In the case of CR, innovative factors, such as the number of scientific institutions are subject to favorable long-term construction blocks based on both fundamental factors and their effectiveness, and therefore we find the up in the top of the pyramid. The most important indicators of competitiveness can be found in the higher conerstands of the pyramid (Mejstrik *et al.*, 2011). On the other hand, corruption, high government debt or inefficient institutions are not good building blocks for competitiveness.

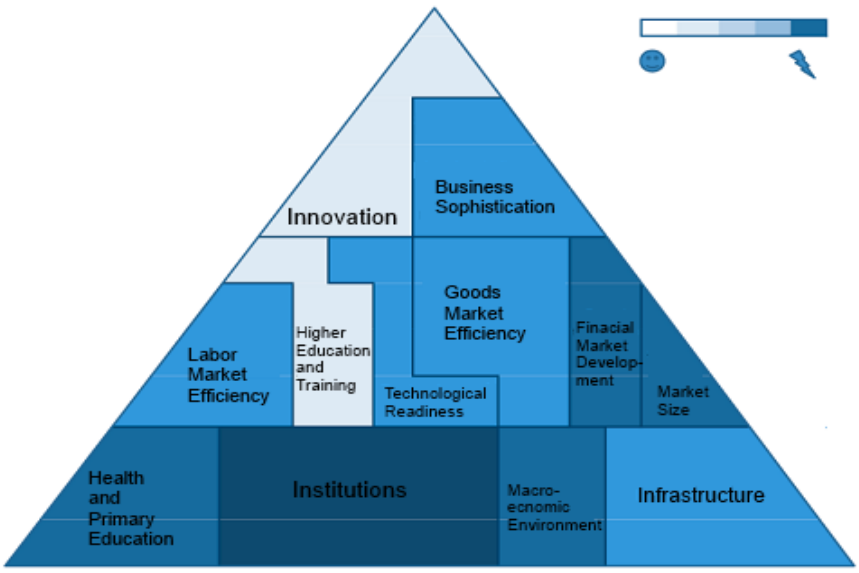

Figure 2.7: Simplified pyramid for Czech Republic, according to the GCI

Source: M. Mejstřík and NERV team, 2011

Darker color indicator is a prerequisite for worse competitiveness in comparison with the world. White reflects the best situation (indicates comparative advantage of Czech Republic according to the respective index). A combination of structure and shape of a pyramid with its color tells us a lot about a country's competitiveness. Consequently, from all the non-price competitiveness factors mentioned in the pyramid, some important key conditions for competitiveness are the innovation and product differentiation. Previous theories about the improvement of trade balances

relied on the assumption that the utility of consumers is determined only by the quantity consumed, without taking into consideration the quality or taste of the products. Therefore, these non-price determinants might be the missing element that explains the discrepancy between REER developments and exports performance (Benkovskis and Wörz, 2013).

The definition of non-price competitiveness is very vast, as it may include improvement in the quality of products and processes, better management relationships in the firm, development of distribution channels and after-sales services (Dieppe *et al.*, 2012). Consequently, non-price competitiveness factors are related both to the quality of products and to the efficiency of institutions, or in our case, of the firms. Many of studies have emphasized the idea that companies that export their products are bigger and tend to be more innovative and productive compared to the domestic firms. This is the result of their adaptation to a competitive global market, which requires permanent redefinition of management, innovation, investment schemes, such that in the end the product sophistication would lead to improvement in the non-price competitiveness. This will be, ultimately reflected in best product quality and efficiency. Furthermore, income elasticities, product quality, design, marketing, fast delivery and after sales services are just some of the factors considered by the new trade theory as the main determinants of non-price competitiveness. Further in our analysis, we will try to assess the impact of non-price competitiveness factors on the trade balance, by finding a suitable way to measure the product differentiation.

2.5 Ranking of countries according to Global Competitiveness Index

The notion about international competitiveness is recent and has become more important during the last decades, due to its impact on economic growth and development. As consequence, many competitiveness indices have shown up, which aim to rank the countries according to their competitive ability and other relevant criteria. The indices measure the success of countries in providing firms operating within their borders with an environment that sustains domestic and global competitiveness (Farrugia, 2002).

Several institutions are known for producing international competitiveness rankings, such as: World Bank, the World Economic Forum and International Institute for Management Development. There are other classifications that are not

officially published and are made by governments, consulting companies or research entities. In our current study, we chose the classification of countries according to the data provided by Global Economic Forum, as it has been widely used by many authors and comprises the largest number of countries under its analysis. The World Economic Forum publishes every year the Global Competitiveness Report, which until 2005 contained two indices: the Current Competitiveness Index and the Growth Competitiveness Index. Nowadays, the two measurements emerge into the Global Competitiveness Index. The report evaluates the productive potential, structure, institutions and policies of individual countries as drivers of economic growth in medium and long term. Global Competitiveness Index is composed from the weighted average of 12 pillars, which we have already mentioned in the previous chapter.

Classification of countries is a necessary illustration for our research because countries with different level of development have specific behavior on international trade market. It is commonly known that small emerging economies that rely heavily on commodities exports will tend to use monetary tools, such devaluation of their domestic currency in order to increase competitiveness in short-term. Contrarily, reach countries, which produce high-quality products are maintaining their exports shares due to high-performance and irreplaceable features of goods.

Table 2.1: Global Competitiveness Index Ranking of Countries, 2013-2014

Country/Economy	Rank	Score
Finland	2	5.54
USA	5	5.48
Canada	14	5.20
Belgium	17	5.13
Australia	21	5.09
Korea	25	5.01
Chile	34	4.61
Italy	49	4.41

Source: WEF, Global Competitiveness Report 2013-2014

Table 4.1 presents the classification of our selected economies according to Global Competitiveness Index. As we can see, **Finland** has the best competitiveness performance from all the eight countries, registering a score of 5.54 in 2013 and ranks on third place among 148 economies presented in the GCI report. It has the best

scores at well-functioning and transparent public institutions (1st) and they are considered "the most ethical in the world" (WEF 2013). Finland paid a strong attention to education during the past decade and also proved the ability to adapt to new technologies (18th), which helped it obtain the title of highly innovative economy.

USA also entered the top 10 most competitive countries, with an overall score of 5.48. While enjoying its image of one of the most rich and powerful country in the world, USA has been registering declining scores in global competitiveness aspect. Country's banking sector and financial markets helped her to get back on track (10th). US companies are considered to be the most innovative and sophisticated; also, it has best universities in the world top, which efficiently collaborate with R&D and business sector.

Canada is struggling to be competitive, but has a stagnating position on 14th place according to Global Competitiveness Index. The factors justifying this position are poor access to financing, government bureaucracy and the most important: insufficient innovation. Despite its big failures at technology chapter, Canada has very efficient financial markets, transparent public institutions (14th) and great infrastructure. (12th) Canada is positively exploiting its working force and has a strong focus on education and training (WEF, 2013).

Belgium occupies the 4th place in our study, and is placed on the 17th among all the countries from WEF. The not so high, but stable position has been determined mainly by impressive health indicators and primary education system. It is commonly known that Belgium has one of the best education system in the world (2nd place), and pays heavy attention to higher education and training. As concerns the private sector, the country offers great business opportunities to investors with high level of sophistication and qualified management.

Australia has been ranked on 21st place in 2013 by World Economic Forum and for the first time it has been eliminated from top 20. From all pillars forming GCI, Australia performs well only at financial markets development (7th), at other aspects it registered a constant evolution. At the same time, Australia ranks up in terms of education, quality of employers and training (15th). It also registered improvements in public deficit and showed good results regarding inflation, after struggling badly last years.

Although **Korea** is on 25th position in the top of GCI, it is one of the Asian countries that has been developing remarkably fast, and has absorbed many technologies and practices of doing business from advanced countries. Korea has been appreciated for its infrastructure, permanent technological adaptation and

business sophistication, therefore it is considered very innovative country. In spite of the innovation, poor access to financing and policy instability are keeping down Korea's competitiveness among other "Asian Tigers".

Chile occupies 34th position in the top of WEF, but despite this, it is considered the most competitive country from Latin America. Chile has made big progresses in combating corruption and improving macroeconomic environment, and also the current government is efficiently working. Chile is appreciated for an adequate allocation of its resources, improvement in ICT market and strong control over inflation.

On the last place in our top, there is **Italy** with a score of 4.41 and situated on 25th place. Although Italy is the least competitive in our top, it has a good position among all the countries taken into account by the Global Economic Forum. With a GDP per capita lower that it was in 2001 (33 115 US$), Italy has gained the title of "basket economy of Europe" (The Economist, 2013). Country's economy is boosted by weak financial markets, lack of business sophistication and rigid labor market. On the other hand, known for high quality products, Italy has better export shares than advanced economies on world market. Moreover, Italy is one of the best top-ranked exports in the world after Germany, according to Trade Performance Index, provided by UNCTAD/WTO.

3 The Elasticity approach to Balance of Payments

It is widely known in the economy that a real depreciation of a currency that is actively involved in trade partnerships with other countries can improve the trade imbalances. Moreover, there has been much fuss about under what circumstances the devaluation would improve the trade balance of a country. One of the first issues is to answer the following question: if there is not intervention by the central bank, how much the exchange rate could fluctuate in order to offset the trade balance by itself?

3.1 Bickerdike-Robinson-Metzler (BRM) model

The prices measured at international level are different, and this is due to particular tariffs and transportation costs, therefore firms are forced to make important decisions about whether they are willing to export abroad or not. The aggregate response of trade to such relative price shocks is called trade elasticity, one that is developed from parameters on the supply side of the economy. Nonetheless, in the end it is the consumer's choice to substitute the foreign and domestic goods.

The determination of trade elasticities based on the balance of payments has been a subject discussed by many authors in the relevant literature. Bickerdike (1906, 1920) was one of the first researchers who attempted to prove the elasticity approach of the trade balance by using partial equilibrium analysis and later continued his idea with Robinson (1947) and Metzler (1948). The BRM model represents a partial equilibrium approach of a perfect competition model, which relies on two countries (domestic and foreign) and two goods (imported and exported) (Shao, 2008). This version was considered, however, not reliable by Alfred Marshall. The model is represented in the following steps:

The trade balance in foreign currency has the following form:

$$TB_f = EX_f - IM_f \tag{3.1}$$

The effect of devaluation on trade balance is reflected as a change and is captured by the equation:

$$\Delta TB_f = \left(p_f \Delta EX_f + EX_f \Delta p_f\right) - \left(p_f \Delta IM_f + IM_f \Delta p_f\right) \quad (3.2)$$

Where the imports and exports are denoted by:

$$Z_{fIM} = p_f IM \quad (3.3)$$

$$Z_{fEX} = p_f EX \quad (3.4)$$

Replacing equations (3.3) and (3.4) in (3.2), we get the following results:

$$\Delta TB_f = Z_{fIM}\left(\frac{\Delta EX}{EX} + \frac{\Delta p_f}{p_f}\right) + Z_{fEX}\left(\frac{\Delta IM}{IM} + \frac{\Delta p_f}{p_f}\right) \quad (3.5)$$

We can proceed to the estimation of imports and exports demand and supply, which are defined by the equations below:

$$e_{EX} = \frac{\Delta EX}{EX} \Big/ \frac{\Delta p_{hf}}{p_{hf}} \text{ Home elasticity of exports supply} \quad (3.6)$$

$$\eta_{EX} = \frac{\Delta EX}{EX} \Big/ \frac{\Delta p_f}{p_f} \text{ Foreign elasticity of exports demand} \quad (3.7)$$

$$e_{IM} = \frac{\Delta IM}{IM} \Big/ \frac{\Delta p_{hf}}{p_{hf}} \text{ Foreign elasticity of imports supply} \quad (3.8)$$

$$\eta_{IM} = \frac{\Delta IM}{IM} \Big/ \frac{\Delta p_{hf}}{p_{hf}} \text{ Home elasticity of imports demand} \quad (3.9)$$

Knowing that foreign currency is expressed by the home currency and the exchange rate, we have:

$$p_f = p_h r \quad (3.10)$$

We can use the foreign currency equation together with the previous ones, in order to define the change of trade balance after a depreciation of currency, assuming it has small values:

$$\Delta TB_f = Z_{fEX}\,\frac{\eta_{EX}-1}{1+\left(\frac{\eta_{EX}}{e_{EX}}\right)} + Z_{fIM}\,\frac{\eta_{IM}\left[1+\left(\frac{1}{e_{IM}}\right)\right]}{(\eta_{IM}/e_{IM})+1} \quad (3.11)$$

The above condition is known as the Bickerdike-Robinson-Metzler (BRM).The equation states that the modification in the trade balance expressed in foreign currency is strongly influenced by the demand and supply of imports and exports elasticicities, and the trade in its initial volume. Nonetheless, this derivation does not

reflect completely the improve in the trade balance as a result of depreciation, due to the fact that many combinations of trade elacticities can lead to different effects.

3.2 Marshall – Lerner condition

One of the most famous conditions for the change of trade balance as a result of devaluation of currency was proven by Alfred Marshall (1923) and Abba P. Lerner (1944), and it is known as Marhall – Lerner condition. M-L condition is a special case of BRM condition and is the most influential approach in determining trade elasticities using balance of payments. Marshall-Lerner condition aims to answer the following question: under what circumstances a real devaluation of currency (in fixed of floating exchange rates) will ameliorate the trade balance of a country? In order for the condition to be reliable, some assumptions must be met, (Rokicki, 2013):

- *Absence of net capital flows*. Only two goods are traded and the balance of payments equals to the trade balance.
- *Income is invariable*. We have full employment and ignore the influence of income on domestic and foreign goods; only prices count.
- *Price of domestic or foreign goods must be expressed in their domestic currency.*
- Foreign supply of goods has *infinite elasticity* and therefore allows the output to be determined by demand.

Last assumption of M-L condition boils down to Keynesian model, where we have the supply of each product infinitely elastic in the short-run:

$$P = \overline{P}, P = \overline{P}^*, \tag{3.12}$$

Where P is domestic price of goods, P being fixed in terms of its own currency;

Getting involved the exchange rate R (domestic/foreign units), the relative price in foreign goods versus domestic would be the following:

$$\frac{RP^*}{P} = \frac{\overline{RP^*}}{\overline{P}} \tag{3.13}$$

As our goal is to find out the net supply of foreign exchange in a market (balance of payments), we can express the trade balance in terms of foreign currency: TB^*.

Table 3.1 illustrates the mechanism of exchange rate influencing the balance of payments and how the foreign exchange rate is directly reflected in the trade balance.

Table 3.1: Influence of Exchange rate on Balance of Payments

Assumptions:		
1. No capital flows or transfers: $\boldsymbol{BOP = TB}$	Supply of foreign exchange rate determined by EXPORT earnings ↓	Demand for foreign exchange rate determined by IMPORT earnings ↓
2. PCP: Price in terms of producers' currency ; Supply elasticity $= \infty$	Domestic firms set $\overline{P}$ ↓	Foreign firms set $\overline{P^*}$ ↓
3. Exchange rate pass-through;	Price of X in foreign currency $= \frac{\overline{P}}{R}$	Price of imports in domestic currency $= ER$
4. Demand: a decreasing function of price in consumer's currency	$EX = EX_D\left(\frac{\overline{P}}{R}\right)$	$IM = IM_D\left(R\overline{P^*}\right)$
Net supply of foreign exchange = $\boldsymbol{TB}$ expressed in foreign currency = $\boldsymbol{TB^*}$ $= \boldsymbol{\frac{\overline{P}}{R} EX_D\left(\frac{\overline{P}}{R}\right) - \overline{P^*} MI_D\left(R\overline{P^*}\right)}$		

Source: Economics of International Financial Policy, Harvard Kennedy School, 2012

Defining the trade balance is the necessary for the derivation of Marshall-Lerner condition, which is shown below:

$$TB = (1/R) \quad EX_D(R) - I\,M_D(R) \tag{3.14}$$

Differentiating, we obtain:

$$\frac{dTB^*}{dR} = -\left(\frac{1}{R^2}\right)X + \left(\frac{1}{R}\right)\left(\frac{dEX_D}{dR}\right) - \left(\frac{dIM_D}{dR}\right) \tag{3.15}$$

Multiplying the equation by R^2/X , elasticities can be defined by:

$$\varepsilon_X = \left(\frac{dEX_D}{dR}\right)\left(\frac{R}{EX}\right) \text{ and } \varepsilon_M = \left(\frac{dIM_D}{dR}\right)\left(\frac{R}{IM}\right) \tag{3.16}$$

The condition becomes:

$$-1 + \varepsilon_X + \left(\frac{RIM}{EX}\right)(\varepsilon_M) > 0 \tag{3.17}$$

Assuming the initial position of trade balance is $EM = X$, the inequality reduces to:

$$-1 + \varepsilon_X + \varepsilon_M > 0 \tag{3.18}$$

This is known as the Marshall – Lerner condition:

$$\varepsilon_X + \varepsilon_M > 1 \tag{3.19}$$

The M-L condition specifies that the absolute sum of price elasticities of exports and exports must be greater than one, and this will lead to the improvement of current account (Marshall, 1923; Lerner, 1944). If plotted over time, the trade response graph yields a J-curve. This condition will be applied in our study and help us determine whether the trade balance will improve or not after the currency devaluation. For a better interpretation of the Marshall-Lerner condition and impact of devaluation, the following cross-diagram is presented:

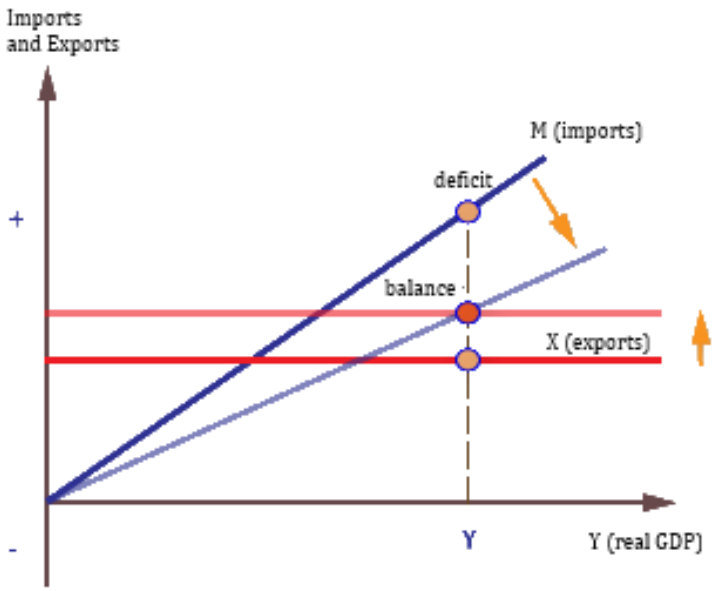

Figure 3.1: Graphical representation of devaluation

Source: Economics Online, Balance of payments problems and policies, 2014

The above graph shows that when Marshall-Condition is satisfied, import spending falls, export revenue increases as a result of devaluation and current account moves closer to the balance (equilibrium point). In addition, at the levels of existing GDP, the deficit will fall also.

3.3 Literature review

Before proceeding to the estimation of depreciation effect on trade balance using Marshall-Lerner condition, it is worth specifying the most influential research papers, which successfully proved an existing positive relationship. Most of the relevant studies have focused on the estimation of trade elasticities, by articulating the use of exchange rates and foreign trade data as the main determinants. This refers to the price competitiveness aspect of international trade and it is one of the most used approaches in the literature. The main reason for using only price competitiveness components is the unavailability of data regarding product differentiation and complexity in measuring qualitative variables. Hence, we found only few papers that attempted to measure non-price competitiveness factors and the lack of studies in this field inspired the current research.

The models measuring trade elasticities generally included some basic explanatory variables such as total amount of imports, exports and real GDP. The most recent ones highlight the use of real effective exchange rate as an important instrument in redressing trade balance. Nowadays, defining price elasticities underlines at the basis on any study about trade policies or solutions to existing debt crisis.

One of first attempts to estimate the price elasticities of developing countries (non-oil exporters), with the purpose to study the international economic relations between countries, was done by J.Marquez and C.McNeilly in 1988 using econometric instruments. The results received in the study about the dispersion in elasticities have been disputed till nowadays by many economists, reiterating that different countries have different income or price elasticities, caused by each country's development and trade balances. The mentioned countries are classified in three trade groups: food, raw materials and manufactures. The authors found evidence that the price elasticities do not differ considerably for all the groups. This comes to support the idea that the non-oil export countries are a homogenous group of countries. Mentioning in their conclusions that there are cross-country differences in elasticities, the authors claim that the use of these indicators to forecast and redress the balance of payments might be biased.

J.Imbs and I. Mejean, (2010) in the Report of European Commission measured trade elasticities and emphasized the idea that they are reflected in the supply decisions of producers. The authors focused on the demand side of the economy and tried to

estimate the trade elasticities of several countries using sectoral version of a conventional Constant Elasticity of Substitution (CES) demand. The mentioned system helps to derive the relations for price elasticities of aggregate imports and exports. Then method of Feenstra (1994) was used in order to determine the sectoral elasticities of substitution. One of the main findings of the authors is that the trade elasticities are heterogeneous among countries and this is a consequence of trade performance of each of the studied entity. After estimating the model, the authors received imposing results for price elasticities of imports and remarked that for developing countries the indices are lower than -5, but in the case of rich/developed countries the estimate is above -4. This leads to the conclusion that emerging economies have high import elasticities, whilst in OECD countries is almost close to zero. As concerns the price elasticities of exports, the estimates differ substantially across the countries and the reason behind this might be the specialization of trade by sectors and products. Therefore, the exports are more sensible to variations is the structure of international trade, which is reflected in export elasticities.

Alternatively, in the paper of Tokarick (2010), the author attempted to estimate the trade elasticities without the use of econometrics, but with the help of production theory for low, middle and upper income countries. The purpose of such a trade estimator is to develop exchange rate assessments. Using macroeconomic variables derived from general equilibrium model of international trade theory the author concluded that both import demand elasticities could be positive, while the export supply elasticity could be negative. This can be explained by the fact that if the price of imported goods rises, then the quantity will fall, leading to a negative elasticity. In the case of exports, if the prices change, then the quantity for imported goods could increase. The last part of the paper focuses on the impact of changes in exchange rates on its trade balance. He finds out that the devaluation of currency in small countries helps to improve the trade balance, but not for a rich country, because the "big tyranees" are able to influence the international prices of its exports and imports.

The authors from Princeton University, Hooper, Johnson, Marquez, (2000), however, based their research on the assumption that in order to decrease the external deficit of a country using the currency devaluation, the total price elasticities of imports and exports summed together must be bigger than 1[2]. They stressed out the

[2] This proposition is also known in economy as the Marshall-Lerner condition.

idea that prediction of price elasticities in the economy allows the policy makers to control for exchange rate changes and utilize them to redress the trade balance. The paper presents the estimation of income and price elasticities using conventional equations for the G-7 countries foreign trade data. A division between long-run and short-run movements is made, this being justified by the idea that the trade is influenced by a variety of key factors in different periods of time, such as: order or delivery lags, changes in trade policy. The main idea of the study relies on the proof of stability of elasticities over time along with price homogeneity. The authors also found evidence about the implication of price elasticities on exchange rate fluctuations, showing that there is direct relationship between the rates of depreciation and trade elasticities in developed countries. However, this effect is not so pronounced in order to help offset the trade position in the mentioned countries.

The research published by Asian Development Bank Institute, Horbecke, Komoto (2010) also sustains the idea that changes in exchange rates can help rebalance the transpacific trade. The analysis is based on the trade relationship between East Asian countries and the US, outlying that most of the trade imbalances were observed during the Global Financial Crisis from 2008. The main hypothesis suggests that the appreciation of yuan against the dollar would help rebalance the bilateral trade among the studied countries. The authors divide all the exports, imports and bilateral trade balance in 3 periods: Before Lehman Brothers Shock, The first Year after Lehman Brothers Shock and the second year. After examining the global trade data and observing how the predicted quantities of imports and exports fell during the first period of Lehman Brothers Shock, DOLS model is used for the estimation. Preliminary results indicate that estimated trade elasticities are at a relative small level, which leads to the conclusion that appreciations or depreciations of the currency might not be sufficient to reduce the total deficit of the U.S. Moreover, there was also found evidence about the asymmetry between the income elasticities of exports and imports, the income elasticity of imports being bigger than those for export in U.S., known for the name of The Houthakker-Magee effect.

Another study about trade balance effect on exchange rate was done by Ogbonna (2010), who tested the relationship about the bilateral exchange rate and the trade balance from Benin Republic covering the period from 1950 to 2008. Applying cointegration tests and VECM, the author found evidence about Marshall-Lerner condition and its involvement to improve the trade balance of Benin. However, the J-curve hypothesis was rejected, meaning that the obtained estimates are not sufficient to provide a verdict for the country's economy. In addition, it was found out that only

a small percent of the variation in trade balance is explained by the exchange rate. The paper concluded with the idea that if the depreciation of the currency is accompanied by inflation, it will cause a decrease in the aggregate demand, due to the erosion of purchasing power parity (Kamoto 2006).

The studies concerning the analysis of non-price competitiveness determinants have made into the scene last year (2013), therefore the importance of this concept has started to being discussed latterly. Algieri (2013) essayed to investigate the factors that influence the export demand in the GIIPS countries (Greece, Ireland, Italy, Portugal, and Spain) covering the period from 1980 to 2012, by underlying the idea that changes in trade export shares are not related to trade disturbances, but are influenced by a group of external factors, defined as "non-price competitiveness". Using Vector Autoregressive Error Correction Model based on the Johansen method, the study expanded the traditional substitutes model to incorporate the presence of product differentiation and product innovation through the use of capital stock variables. The empirical results support the idea that there is an eloquent relationship between export demand and investments. Moreover, world income, price fluctuations and non-price competitiveness are drivers of export demand in GIIPS economies in short-term and all of the variables have significant effects in long run also. The main conclusion supports the assumption that higher price elasticity will lead to increase in the competitiveness of international market for exports, and hence will result in the success of currency depreciation in encouraging export incomes.

The investigation in this field is enriched by European Central Bank's paper about non-price competitiveness of exports from emerging countries, Benkovskis and Wörz (2013). In order to capture non-price factors, such as variety of products and quality, the authors constructed an export price index, based on the methodology proposed by Feenstra (1994) and Broda and Weinstein (2006).).The index is as a function of unit noticeable values and volumes of exports plus unnoticeable elasticities of substitution among variables. The study uses the data for nine emerging countries between 1996-2011 and shows that there are major differences in non-price competitiveness across countries. The results indicate improvement in competitiveness as a result of non-price factors in the cases of all the countries, except for Argentina and Indonesia. Contrary to the effects of exchange rates and consumer prices, which have react fast to shifts in global demand, the results indicate that non-price components are pushed more by structural/long-term factors. Table 2.1 presents an outline of existing studies along with the applied methodology and variables.

Table 3.2: Comparison of literature sources

Authors	Target countries	Estimation period	Level of aggregation	Methodology	Variables used
Jaime Marquez and Caryl McNeilly, (1988)	5 non-OPEC developing countries	1973-1984	Food, raw, materials, manufacturing and no-oil goods	2SLS	Total volume of imports, real GNP, relative imports prices, bilateral exchange rate, domestic currency, dummy for on- time events;
Jean Imbsyand and Isabelle MÈjean, (2010)	33 exporting countries	1995-2004	5000 products	GMM	Value share of sectors in aggregated imports and exports, share of country's exports, share of sector in country's nominal consumption, share of domestically produced goods in sector consumption, share of sector consumption in country that is imported;
Stephen Tokarick, (2010)	24 developed and 63 developing countries	2001, 2004	Exportable, importable, and non-traded products	Standard general equilibrium model from international trade theory, without use of econometrics	Domestic prices of imports and exports, price of non-traded goods, labor, capital, wage rate, return to capital, exogenously given price of imported intermediate inputs.
Peter Hooper, Karen Johnson and Jaime Marquez, (2000)	G-7 countries	1990-1996	Total volumes of goods and services	ECM	Export and import price indices, GDP deflator, share of country's exports and imports;
Willem Thorbecke and Ginalyn Komoto, (2010)	7 East Asian Countries and US	1990-2008	Manufacturing goods	DOLS	Real exports and imports, bilateral real exchange rate, GDP, capital stock, consumer price index, time trend;
BigBen and Chukwuma Ogbonna, (2010)	Benin Republic	1950-2008	Total volume of goods and services	ECM	Trade balance ratio, real GDP, real bilateral exchange rate, money supply;
Konstantins Benkovskis and Julia Wörz, (2013)	9 emerging countries	1996-2011	>5000 products	GMM	Price of goods imported, unobservable quality parameter of a product, shares of exporting countries serving a particular market and the share of new or disappearing exporters;
Bernardina Algieri, (2013)	GIIPS countries	1980-2012	Total volume of goods and services in real terms	ECM	Exports of goods and services in real terms, the external demand/income, real effective exchange rate and real capital stock index;

Source: Own elaboration

As depicted from the mentioned literature, there are separate approaches to the estimation of trade and income elasticities, targeting different groups of countries. We contribute to the existing literature, by estimating the price elasticities of imports and exports in countries with different levels of competitiveness and development with a focus on recent period. Contrary to the existing studies, which focus mostly on price competitiveness determinants, our analysis includes both classical substitutes model and the model extended for non-price competitiveness factors, which allows to compare the results and provide more objective diagnosis on the competitive advantage of a country.

4 Empirical analysis

4.1 Theoretical model specification

As we are interested in the estimation of import and export price elasticities, the expression of demand equations is necessary. Therefore, our defined model will follow the procedure proposed by Goldstein and Kahn (1985) and Yellen Rose (1989), known as imperfect substitutes model. The central idea lying at the base of the model is that neither imports nor exports are perfect substitutes for the domestically produced goods, therefore one can clearly distinguish between the domestic and the imported merchandise, such that the trade elasticities can be estimated for most of the goods. In the equations below, we express the quantity of imports, domestically demanded IM_d, and the quantity of imports, demanded by the rest of the world $IM^*{}_d$:

$$IM_d = f_1(Y, P_{IM,} P) \tag{4.1}$$

$$IM^*{}_d = (Y^*{}_{e,} P^*{}_{EX,} P^*) \tag{4.2}$$

Where Y is the domestic income, Y_e^* is the foreign income, P is the overall domestic price level, P_{IM} is the domestic price expressed in national currency paid by domestic importers, e is the exchange rate, $P^*{}_{EX}$ is the foreign price paid by domestic importers and P^* is the foreign price.

The above equations imply that the imperfect substitutes model is a function of domestic price, landed price and money income (Brooks, 1999). However, the consumer is supposed not to suffer from money illusion, meaning that demand must not change with the increase in money or prices. This condition is imposed by homogeneity of degree zero, such that the imports demand is a function of relative prices and real income (Brooks, 199). In our case, the assumption about homogeneity is obtained by dividing the right hand side of our equations by P. We can rewrite the expressions as:

$$IM_d = f_1(Y,\ RP_{IM}) \tag{4.3}$$

$$IM^*{}_d = (Y^*\ RP^*{}_{IM}\ ) \tag{4.4}$$

Where RP_{IM} represents the real foreign currency price of exports, and RP^*_{IM} the overall price of exports, both multiplied by real exchange rate.

Continuing with the imperfect substitute model, we must define both supply and demand equations simultaneously. As it was already mentioned by Goldstein and Kahn (1985), specifying the supply side is often difficult. Therefore, incorporating in our model the Marshall – Lerner condition, which assumes that supply elasticities are finite combined with the assumption about the stability of demand, will guarantee the proper identification of our model.

The demand equations for trade on a bilateral basis are presented below:

$$IM = f(Y_{i,}\, REX_i) \tag{4.5}$$

$$EX = f(Y^*_{i,}\, REX_i) \tag{4.6}$$

Where, IM is the total imports in the economy, Y_i is the domestic income represented by real GDP, EX stands for total exports, Y^*_i represents the world income and REX_i is the bilateral exchange rate.

4.2 Formulation of empirical models

4.2.1 Price – competitiveness model

For our current research, we are going to define two empirical models, which are necessary to capture the devaluation of currency through price and non-price competitiveness on the trade balance. The identified models will be compared and a based on their results, a final conclusion will be made.

We begin with the first model and the first step into estimating the effect of devaluation through price competitiveness on the trade balances is to determine the import and export price elasticities, which implies the specification of demand equations. The imperfect substitutes model is relevant for the use, because it takes into account both the goods imported and domestically produced.[3]

[3] "Popular Model of Trade"; Rose (1991) and Rose and Yellen (1989).

Following the procedure adopted by many authors, we define the equations for imports as a function of imports, GDP and exchange rate:

$$LIM_{i,t} = \alpha + \beta LDI_{i,t} + \gamma LREX_t + \varepsilon_t, \quad (4.7)$$

Where:

$IM_{i,t}$ – total import volumes in country i

$DI_{i,t}$ – domestic income

REX_t – real effective exchange rate

ε_t – stochastic error term

Therefore, if the REX depreciates we would expect the decrease in imports, presented by $\gamma > 0$. As concerns the income elasticity, we expect it β to be positive meaning that with the increase in income in a country, the total imports will grow. In the case of exports, we would expect a devaluation of currency to augment the exports. Also, we will observe if there is some heterogeneity among the trade elasticities, which are the result of specific country position in international trade and possible political or major economic crisis.

The export demand equation is formulated in a similar way:

$$LEX_{i,t} = \alpha + \beta LWI_{i,t} + \gamma LREX_t + \varepsilon_t, \quad (4.8)$$

Where:

$EX_{i,t}$ – total exports volumes in country i

$WI_{i,t}$ – world income

REX_t – real effective exchange rate

ε_t – stochastic error term

It is expected in the second equation that an increase in world income and depreciation of exchange rate will lead to an increase in exports for the studied country. The price elasticity will be $\gamma < 0$. But, according to Bahmani-Oskooee and Kara (2003), an increase in world income can cause a decrease in exports. This could

be in the case when an increase in world income is attributed to an increase in import substitutes in the rest of the world.

The import and export elasticities will help to determine the Marshall – Lerner Condition. In particular, the price elasticity of imports plus the price elasticity of export must sum greater than 1. In our model, this will be represented by the following equation:

$$\gamma_{IM} + |\gamma_{EX}| > 1 \tag{4.9}$$

If the condition is met, a depreciation of currency will improve the trade balance in the long-run.

4.2.2 Non-price competitiveness model

The second empirical model relies also on the imperfect subsitute model, but in a more extensive version, which will include the non-price competitiveness factor. While estimating the long-run price elasticities of imports and exports, we try to add the product variety that changes over time and the quality parameter. Several authors Croix and Urban (1998), Senhadji and Montenegro (1998) used this extension in order to prove the impact of change in the product diversification on the trade balance, by mentioning that "consumers make their choice not only on the base of price and their disposable income, but also on the variety of products and quality", as postulated by the New Trade Theory. The recent theories emphasize the major role of product quality and horizontal differentiation on the intra-industry trade.

In this context, the second empirical model has the following form:

$$LTB_{i,t} = \alpha + \beta LDI_{i,t} + \gamma LREX_t + \delta LCS_{i,t}\, \varepsilon_t, \tag{4.10}$$

Where:

$TB_{i,t}$ – trade balance in country i

$DI_{i,t}$ – domestic income

$CS_{i,t}$ – capital stock

ε_t – stochastic error term

It is expected in this specification that depreciation of exchange rate and product variety will lead to amelioration in the trade balance for the studied country. The price and non-price elasticities will be $\gamma > 0$ and $\delta > 0$ respectively. Positive value of the coefficient of the exchange rate variable indicates high import/export elasticity, meaning that the trade balance would improve as a result of depreciation of domestic currency, whereas negative sign suggests low elasticity not exceeding one and deterioration of trade balance (Rokas and Petras, 2003), therefore in this specification Maeshall-Lerner holds if price elastictity has positive values. In addition, we expect the domestic income to have a positive impact on the trade balance.

4.3 Data discussion

For the employed study, quarterly data is used covering the period from 1991 to 2012, since we are interested in the recent period of time, with a special focus after the economic crisis. The sample period may vary across the countries as a result of unavailability of data. Therefore, for certain economies, the sample starts in the first quarter of 1995 and ends on last quarter of 2011.

The dataset contains 8 countries that were randomly chosen in our study according to the data available. All of them have been ranked according to the Global Competitiveness Index, such that we have different level of productivity and development. On one hand, we are interested in the behavior of the trade balance in more developed countries, that produce high-technology products of very good quality and for which, the depreciation of currency might not cause a decrease in imports of domestic goods. These countries are: Belgium, Canada, Finland, Italy, USA. On another hand, the effect of devaluation on TB was tested for less competitive countries, which economies rely on the export of commodities in order to maintain a positive trade balance, such as Australia, Chile, Korea.

The primary 5 variables in our first model are: Imports (IM), Exports (EX), Real Exchange Rate (REX), Domestic Income (DI) and World Income (WI). All the variables used are real, in natural logarithms and in quarterly format.

1. Total **Imports** (*lIM*) stands for total volume of imports of each country. All the data for imports are converted to index and have base 2005=100.

2. Total **Exports** (*lEX*) denotes country's total volume of exports in real terms. The data for exports are converted to index and have base 2005=100.

3. Real exchange rate (*lREX)* used in the study is the real effective exchange rate which measures the real value of the development of a country's currency against the basket of currencies of its trading partners and, according to the literature, it is relevant for the use in estimation of price competitiveness. The log of exchange rate has already been accounted for inflation, it was divided by the consumer price index quotient.

4. Following the literature, the variable for **Domestic Income** (*lDI*) is approximated by the volume of real GDP. It represents the economic activity and development in the economy.

5. In the case of **World Income** (*lWI*), the Industrial Production Index of Industrialized countries has been taken as indirect measure (Gupta-Kapoor and Ramakrishnan, 1999). This proxy is based on many studies from the relevant literature.

Consequently, we estimate the second empirical model using the following explanatory variables:

1. The **trade balance** (*lTB*) is obtained by dividing country's total volume of exports by the nominal value of imports. The choice of the mentioned ratio as a proxy for Trade Balance is necessary for construction of the model in a logarithmic form and therefore is able to estimate the Marshall-Lerner condition as an exact value, rather than approximation (Boyd, et al, 2001, Salasevicius and Vaicius, 2003).

2. The variable for **Domestic Income** (*lDI*) is approximated by the volume of real GDP, as in the previous model.

3. The **real exchange rate** (*lREX*) used in the study is the real effective exchange rate which measures the real value of the development of a country's currency against the basket of currencies of its trading partners and it is the same as in the first model.

4. The **capital stock** variable (*lCS*) is used as a proxy for indirect measuring of the variety of products, which accurately reflects the non-price competitiveness feature of international trade. We chose real capital stock mostly because of its availability, while some other variables which might have been relevant, such as

R&D expenditures, patents, educational attainment are not available during the time period. Moreover, some previous studies done by Owen and Wren-Lewis (1993), Muscatelli *et al.* (1995) and Madden *et al.* (1999), have proved that capital stock is the most adequate proxy and it mirrors product innovation and improvement in quality, having a big influence on imports and exports. Since the data for capital stock are available only at annual basis, we have applied quadratic interpolation method in order to obtain our quarterly series.[4] For this purpose, a VBA tool was used, namely Cubic Spline Interpolation Method, which has been designed especially for these type of interpolations: from annual basis to quarterly or from quarterly basis to annual.

All the data come from publicly available sources: International Financial Statistics, OECD database and countries' Statistical Offices. More detailed information about the dataset, including sources of variables, can be found in the Appendix A, Table A1.

4.4 Estimation procedure

4.4.1 Unit Roots

The justification laying behind the importance of knowing whether the variables are stationary or not comes from the inefficiency of OLS in estimating correctly a time-series model. The results can show significant t-statistic or R-square pretty high, thus Granger and Newbold (1974) showed that linear models are spurious in facing the non-stationary variables. It has become more and more popular in the analysis of time-series the identification of the stationarity of variables, which was later proved by Nelson and Plosser (1982). Therefore, in order to show the existence of unit root in autoregressive models, we begin with the general framework using the polynomials in the lag operator, $A(L)$ and $B(L)$:

$$A(L)y_t = B(L)\varepsilon_t \tag{4.11}$$

In the case then the roots of $A(L) = 0$ are situated outside the unit circle, we conclude that y_t is a stationary ARMA process, but if there is at least a unit root on the unit circle, then the process has a unit-root and we say that it is not stationary. We can also conclude that the time-series are integrated of order I(1).

[4] Athanasoglou and Bardaka, (2008) have also linearly interpolated from annual to quarterly frequencies the variable for capital stock.

In order to determine the stochastic trend of our variables and stationarity, we must use some rigorous tests. We will use 3 different tests in the study, starting with Augmented Dickey-Fuller Test[5], which enjoys a big popularity among time-series analysts. The ADF Test involves the following OLS regression[6]:

$$\Delta X_t = \alpha + \rho_t + \beta X_{t-1} + \sum_{i=z}^{p} \lambda X_{t-1} + \varepsilon_t \quad (4.12)$$

Where X is the tested variable, Δ is the first difference of the variable, t is the time trend and ε is the stochastic error term. The null hypothesis is $H_0: \beta = 0$ and being rejected means that the tested variable does not contain a unit root and it is stationary $H_A: \beta < 0$.

The second test used for determination of non-stationarity of variables is the one developed by Phillips and Perron (1988) and it is also largely used in financial time-series. Phillips and Perron's test statistics can be considered the same as Dickey–Fuller statistics with the advantage that PP is robust to serial correlation because it is using the Newey–West (1987) consistent covariance matrix estimator in order account for heteroskedasticity and autocorrelation.

The regression for PP Test is presented below:

$$\Delta Y_t = \beta' D_t + \pi y_{t-1} + \mu_t \quad (4.13)$$

Under the null hypothesis, the PP, both t-statistics have equal asymptotic distributions as the ADF t-statistic and normalized bias statistics. However, an advantage of the PP tests over the ADF tests is that the PP tests are robust to general forms of heteroskedasticity in the error terms and corrects for serial correlation.

Since it is wide known that the above tests suffer from low power, especially the ADF test, the KPSS test will be used to verify the stationarity of our variables. The KPSS test, developed by Kwiatkowski, Phillips, Schmidt, and Shin (1992) is quite contemporary, therefore we don't find its use in many empirical papers. It uses the Lagrange Multiplier (LM) test, where the null hypothesis implies the trend stationarity. The KPSS then tests for the amount of the variance of random walk component[7], where the null hypothesis denotes the residual with zero variance.

[5] Dickey and Fuller, 1981; Phillips and Perron, 1988

[6] For a thorough explanation of the procedure see Bahmani-Oskooee (1991) and Chueng and Chinn (1994).

[7] $r_t = r_{t-1} + \mu_t$

The KPSS Test is constructed in the following way:

$$LM = \sum_{t=1}^{T} S_t^2 / \sigma_l^2, \quad (4.14)$$

Where the residuals are: $S_t = \sum_{i=1}^{t} e_i$ for $t = 1,2, \dots, T$

A consistent estimator for σ^2, $s(l)^2$ can be constructed from the residuals:

$$s(l)^2 = T^{-1} \sum_{t=1}^{T} e_t^2 + 2T^{-1} \sum_{s=1}^{l} w(s,l) \sum_{t=s+l}^{T} e_t e_{t-s} \quad [8] \quad (4.15)$$

In addition, Bartlett Window is used in order to guarantee the non-negativity of $s(l)^2$:

$$w(s,l) = 1 - s/(l+1) \quad (4.16)$$

The null hypothesis in the KPSS test, $\sigma_\mu^2 = 0$ implies the trend stationarity of the variable, while the alternative hypotheses confirms the non-stationarity, and describes the series as having a unit root.

As concerns the results of ADF test and KPSS, a 2x2 matrix can be developed (Cheung and Chinn, 1994), where the second cell accepts the null hypothesis for both tests and the last cell rejects H_0. The remaining cells of the matrix provide contradictory results, and therefore are considered as weak or nonsensical results. For our purpose, we will use all the three tests: ADF, PP and KPSS.

Table 4.1: Comparison between ADF and KPSS tests

	KPSS: Rejection of I(0)	**KPSS: Non-rejection of I(0)**
ADF: Rejection of I(0)	?	I(0)
ADF: Non-rejection of I(0)	I(1)	?

Source: Nielsen, 2005

[8] Kwiatkowski, Phillips, Schmidt Shin, (1992)

4.4.2 VAR and VECM. Cointegration approach

Based on the unit root tests, we determine the order of integration. In the case when variables are not stationary in levels, we say that they are integrated of order one *I(1)* and we need to differentiate them in order to obtain the stationary series.

$$\Delta lnIM = \alpha + \beta \Delta lnDI + \gamma \Delta lnREX + \varepsilon_t \quad (4.17)$$

$$\Delta lnEX = \alpha + \beta \Delta lnWI + \gamma \Delta lnREX + \varepsilon_t \quad (4.18)$$

$$\Delta lnTB_{i,t} = \alpha + \beta \Delta lnDI_{i,t} + \gamma \Delta lnREX_t + \delta \Delta lnCS_{i,t}\, \varepsilon_t \quad (4.19)$$

Generally, a linear combination of two series, which are integrated of order one is also a *I(1)* series. Furthermore, if the linear combination of two or more *I(1)* series are integrated of order zero *I(0),* then we conclude that the series are cointegrated or in long-term equilibrium. Since we are interested in our thesis in the long-run relationship between the variables, especially in the estimation of lung-run elasticities, testing for the cointegration among the variables is the most adequate methodology to employ. Cointegration roughly captures the long-run stationary relationship between two or more non-stationary variables (Brooks, 1999). In this context, we chose Johansen – Juselius' Maximum Likelihood estimation technique (1990). Johansen's methodology starts its point in the Vector Autoregressive model of order p which can be represented as follows:

$$y_t = \mu_t + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t, \quad (4.20)$$

Where y_t is an $(n * 1)$ vector of variables that are integrated of order I(1), represented by equations below. A_i is a $(n * n)$ vector of parameters and $(\varepsilon * 1)$ – vector of innovations.

$$y_{t1} = \begin{bmatrix} lnIM_t \\ lnDI_t \\ lnREX_t \end{bmatrix} \quad (4.21)$$

$$y_{t2} = \begin{bmatrix} lnEX_t \\ lnWI_t \\ lnREX_t \end{bmatrix} \quad (4.22)$$

$$y_{t3} = \begin{bmatrix} lnTB_t \\ lnDI_t \\ lnREX_t \\ ln\, CS_t \end{bmatrix} \quad (4.23)$$

As was already mentioned by Harrys (1995), the VAR equation can be rewritten as:

$$\Delta y_t = \mu + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_i, \quad (4.24)$$

Where $\prod = \sum_{i=1}^{p} A_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

According to Harris (1995), if we construct the equation using this methodology, most likely we will receive information through $\prod_i$ and Γ_i about short and long-run adjustment to changes in y_t. In VECM analysis however, proposed by Johansen and Juselius (1990), the long-run matrix $\prod$ can be decomposed as the product of α and β, two (*k x r*) matrices each of rank *r*, such that the long run coefficients are defined by $\prod = \alpha\beta'$ and $\beta' y_t$, where r is the number of cointegrating relationships, the elements of α are known as the adjustment parameters in the vector error correction model and each column of β is a cointegrating vector. If $\prod$ has zero rank, it means that there aren't any cointegration relationship between y_t, and viceversa, if *rank Π = 1*, there is a cointegrating vector; for other cases in which *1<rank Π<k* there are multiple cointegrating vectors (Algieri, 2013)

Johansen elaborated two different likelihood ratio tests of the significance of these cointegrating relationships and thereby the reduced rank of the Π matrix: the trace test and maximum eigenvalue test, shown below:

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad (4.25)$$

$$J_{max} = -T ln(1 - \lambda_{r+1}) \quad (4.26)$$

Using Johansen's test for cointegration on both our models, we determine whether our specified variables are cointegrated and according to the results, we would be able to proceed to the proper estimation. For the equations that present traces of cointegration , we will employ a VECM, because it is robust to estimate cointegrated vectors. VECM is constructed in the way that can restrict the long run behavior of endogenous variables to converge to their cointegrated relationships, allowing at the same time for short-term adjustment.

$$\Delta lnIM = \alpha + \sum_{i=1}^{n} \beta_i \Delta lnDI + \sum_{i=0}^{n} \gamma_i \Delta lnREX + \theta EC_{t-1} + \varepsilon_t \quad (4.27)$$

$$\Delta lnEX = \alpha + \sum_{i=1}^{n} \beta_i \Delta lnWI + \sum_{i=0}^{n} \gamma_i \Delta lnREX + \theta EC_{t-1} + \varepsilon_t \quad (4.28)$$

$$\Delta lnTB = \alpha + \sum_{i=1}^{n} \beta_i \Delta lnDI + \sum_{i=0}^{n} \gamma_i \Delta lnREX + \sum_{i=0}^{n} \delta_i \Delta lnCS + \theta EC_{t-1} + \varepsilon_t \quad (4.29)$$

Where, EC_{t-1} is the error-correction term lagged one period.

5 Results and Interpretation

5.1 Empirical results

We begin our empirical analysis with the transformation of our series into logarithms and proceed to the choice of the optimal lag length. The software presented different results for information criteria, the optimal lags being examined up to 8. Additionally, we run both of the models using different lags, than those offered by a specific criterion, and chose the lags that best capture the information available in the residuals and that best fits the stability test of our series. Moreover, we pay attention not to choose too small number of lags, as this can lead to the underparametrization of our models and to the over rejection of null hypothesis of the cointegration tests. Alternatively, a too big lag length can lead to the over parametrization of the models, and resulting in a less efficient cointegration tests. The output of results from information criteria and the lag length chosen in each case, are presented in Tables 5.1 and 5.2.

Table 5.1: Lag length selection criteria for price-competitiveness model

	Country		AIC	FPE	HQIC	SBIC	Lag length chosen for VECM
1	Australia	Imports	2	2	1	1	3
		Exports	6	6	5	2	2
2	Belgium	Imports	7	7	1	1	5
		Exports	6	6	6	1	6
3.	Canada	Imports	3	3	3	2	2
		Exports	6	6	5	5	5
4.	Chile	Imports	5	5	5	5	3
		Exports	6	6	6	1	5
5.	Finland	Imports	5	5	5	5	5
		Exports	6	6	6	2	5
6.	Italy	Imports	5	6	5	5	5
		Exports	6	6	6	1	4
7.	Korea	Imports	5	5	5	5	3
		Exports	6	6	5	1	2
8.	USA	Imports	3	3	1	1	2
		Exports	6	6	6	1	1

Table 5.2: Lag length selection criteria for non-price competitiveness model

	Country	AIC	FPE	HQIC	SBIC	Lag length chosen for VECM
1	Australia	6	6	5	4	4
2	Belgium	6	6	6	4	3
3	Canada	4	4	4	4	4
4	Chile	5	6	4	4	6
5	Finland	5	5	5	5	5
6	Italy	5	5	5	5	5
7	Korea	5	5	5	4	4
8	USA	5	5	5	4	4

Further in our analysis, the unit roots tests were performed on each of our variables: the Augmented Dickey Fuller, the Phillips-Perron, and the KPSS. Based on the results presented in Annex A, Tables A2 and A3, we can observe that in each of our equations we have at least two I(1) variables. With the unit root test conducted that clearly indicate the presence of integration of order one, in some cases even of order two of our variables, we apply the Johansen cointegration test procedure (1988, 1991) and Johansen and Juselius (1990, 1992, 1994). The first row of the trace statistic tests the hypothesis of no cointegration against the alternative of one or more cointegrating vectors (r>0); the second row tests the null hypothesis of a maximum of one cointegrating relation (r≤1) against the alternative of r>1 cointegrating vectors, and so on (Algieri, 2013). In the tables below, the results of the tests are presented, with the trace and maximal eigenvalues reported.

Table 5.3: Johansen's Lambda-Trace Cointegration Test Results of model I

		$\lambda\ trace$		
	Null	$r = 0$	$r \leq 1$	$r \leq 2$
	Alternative	$r > 0$	$r > 1$	$r > 2$
95% Critical Value		29.68	15.41	3.76
Australia	Imports(3)	30.1144*	6.9295	0.5928
	Exports(2)	31.2906*	4.3367	0.0008
Belgium	Imports(5)	45.0587*	14.9928	1.8925
	Exports(6)	36.7544*	6.1132	1.3849
Canada	Imports(2)	32.2301	17.0851*	3.3383

	Exports(5)	30.5809*	9.4386	0.0101
Chile	Imports (3)	32.2853*	11.2925	3.1983
	Exports(5)	36.4819*	13.9388	0.3175
Finland	Imports(5)	37.4273*	6.3635	1.8369
	Exports(5)	43.5406*	9.7073	4.7350
Italy	Imports(5)	38.9602*	8.7742	0.6406
	Exports(4)	35.9525*	11.7141	1.0795
Korea	Imports(3)	33.5163*	13.8880	4.9019
	Exports(2)	30.8586*	8.6445	2.7278
USA	Imports(2)	34.8692*	13.0306	2.5505
	Exports(1)	38.6085	3.3716	0.3670

Note: r = number of cointegrating vectors; * denotes rejection of the hypothesis at 5 percent level. The lag order for the each VECM appears in parenthesis

Table 5.4: Johansen's Lambda-Max Cointegration Test Results of model I

		$\lambda\, max$		
	Null	$r = 0$	$r = 1$	$r = 2$
	Alternative	$r = 1$	$r = 2$	$r = 3$
95% Critical Value		20.97	14.07	3.76
Australia	Imports(3)	23.1849*	6.3367	0.5928
	Exports(2)	26.9539*	4.3359	0.0008
Belgium	Imports(5)	30.0659*	13.1003	1.8925
	Exports(6)	30.6412*	4.7283	1.3849
Canada	Imports(2)	15.1450*	13.7468	3.3383
	Exports(5)	21.1422*	9.4285	0.0101
Chile	Imports (3)	20.9928*	8.0942	3.1983
	Exports(5)	22.5431*	13.6212	0.3175
Finland	Imports(5)	31.0637*	4.5267	1.8369
	Exports(5)	33.8333*	4.9723	4.7350
Italy	Imports(5)	30.1861*	8.1335	0.6406
	Exports(4)	24.2384*	10.6346	1.0795
Korea	Imports(3)	19.6283*	8.9861	4.9019
	Exports(2)	22.2141*	5.9166	2.7278
USA	Imports(2)	21.8386*	10.4801	2.5505
	Exports(1)	35.2369*	3.0046	0.3670

Note: r = number of cointegrating vectors; * denotes rejection of the hypothesis at 5 percent level. The lag order for the each VECM appears in parenthesis

Table 5.5: Johansen's Lambda-Trace Cointegration Test Results of model II

$\lambda\, trace$			
Null	$r = 0$	$r \leq 1$	$r \leq 2$
Alternative	$r > 0$	$r > 1$	$r > 2$
95% Critical Value	47.21	29.68	15.41
Australia (4)	65.7771*	27.4341	9.2234
Belgium (3)	55.2012*	19.6768	6.9149
Canada (4)	64.5281	34.4126*	12.4088
Chile (6)	48.4059*	20.5980	4.8051
Finland (5)	70.9893	33.8684*	8.6374
Italy (5)	68.5284*	27.4865	5.5368
Korea (4)	90.2193	32.8326*	12.5973
USA (4)	55.1334*	25.6982	8.9888

Note: r= number of cointegrating vectors; * denotes rejection of the hypothesis at 5 percent level. The lag order for the each VECM appears in parenthesis

Table 5.6: Johansen's Lambda-Max Cointegration Test Results of model II

$\lambda\, max$			
Null	$r = 0$	$r = 1$	$r = 2$
Alternative	$r = 1$	$r = 2$	$r = 3$
95% Critical Value	27.07	20.97	14.07
Australia (4)	38.3431*	18.2107	7.7387
Belgium (3)	35.5244*	12.7619	6.3650
Canada (4)	30.1155	22.0038*	7.5269
Chile (6)	27.8079*	15.7929	4.7948
Finland (5)	37.1209	25.2310*	8.1590
Italy (5)	41.0419*	21.9497	5.5366
Korea (4)	57.3867*	20.2353	9.9479
USA (4)	29.4353*	16.7093	16.7093

Note: r= number of cointegrating vectors; * denotes rejection of the hypothesis at 5 percent level. The lag order for the each VECM appears in parenthesis

As the λ-trace and λ-max statistic values are bigger that 5 percent critical values, we are able to reject the null hypothesis of no cointegration vectors and accept the alternative of one or more cointegrating vectors. The results from Johansen's cointegration tests show that for most of the countries we have one cointegrating vector, except for Canada, Finland and Korea from second model, where we have cointegration of order two. Once we have determined the number of cointegrated vectors, we can proceed to the estimation of lung-run relationships among our variables of interest, using Vector Error Correction Model, using intercept and no trend as determininstic elements. The estimated values of all the cointegrating vectors can be found in TableS 5.7-5.10.

Table 5.7: Estimates of the Import Demand Elasticities (Model I)

Import Demand	**Australia**	**Belgium**	**Canada**	**Chile**	**Finland**	**Italy**	**Korea**	**USA**
lnDI	0.44	-0.85	0	-1.78	-2.35	1.96	45.60	-0.69
	(3.85)	(-6.48)	-	(-11.38)	(-5.15)	(1.26)	(3.67)	(-12.76)
lnREX	-1.54	-4.25	-1.74	-2.85	-12.77	-10.06	-30.37	1.24
	(-8.30)	(-7.45)	(-5.18)	(-4.85)	(-6.25)	(-5.28)	(-0.78)	(11.09)
constant	0.46	18.75	3.42	16.85	65.08	32.63	-86.09	-7.18

Dependent variable: ln real imports of goods and services. T-statistics appears in brackets

Table 5.8: Estimates of the Export Demand Elasticities (Model I)

Export Demand	**Australia**	**Belgium**	**Canada**	**Chile**	**Finland**	**Italy**	**Korea**	**USA**
lnWI	0.30	3.29	-0.85	-1.72	-3.20	2.19	3.12	-1.34
	(0.74)	(1.58)	(-2.37)	(-2.67)	(-3.88)	(1.36)	(7.59)	(-6.50)
lnREX	-2.67	-19.98	-1.76	-3.85	-11.26	-11.55	0.13	1.69
	(-10.52)	(-6.16)	(-8.72)	(-5.00)	(-6.76)	(-4.94)	(0.34)	(7.36)
constant	6.26	72.07	7.36	21.23	61.96	38.57	-19.48	-6.26

Dependent variable: ln real exports of goods and services. T-statistics appears in brackets

Table 5.9: M-L Condition Estimates (Model I)

Country	Australia	Belgium	Canada	Chile	Finland	Italy	Korea	USA
M-L condition	**1.13**	**15.73**	**0.02**	**1.00**	**-1.51**	**1.49**	**-30.24**	**2.93**

Table 5.10: Vector Error Correction Estimates of Model II

Cointegrating vector β	Australia	Belgium	Canada	Chile	Finland	Italy	Korea	USA
lnDI	- 1.38	-0.87	0	-4.43	0	0.18	0	4.01
	(1.89)	(-5.79)		(-1.14)		(3.55)		(1.23)
lnREX	0.32	-0.74	0.25	3.97	3.38	-0.04	0.14	1.22
	(1.62)	(-4.96)	(3.67)	(3.13)	(6.49)	(-0.39)	(0.56)	(4.47)
lnCS	-1.80	1.80	0.36	4.38	1.57	0.84	-0.13	-4.08
	(-2.16)	(6.34)	(4.92)	(1.20)	(4.70)	(10.68)	(-1.65)	(-2.86)
constant	0.34	-0.90	-2.80	-19.69	-23.07	-4.50		-4.40
Speed of adjustment, α								
dlnTB	-0.42	-0.09	-0.38	-0.09	-0.71	-0.92	-0.86	-0.23
	(-4.66)	(-0.65)	(-2.28)	(-1.88)	(-3.99)	(-3.30)	(-6.48)	(-4.72)

Dependent variable: trade balance ratio. T-statistics appears in brackets

5.2 Discussion of results of Price Competitiveness Model

We have estimated the coefficients of the error-correction model using Johansen's method. The final estimates are presented in Table 5.7 and 5.8 and are interpreted as the long-run equilibrium relationship between the variables. As specified in the theoretical part, the depreciation of a country's national currency should lead to a decrease in imports, $\gamma > 0$. In our case some of the results have contradictory effects. Therefore, if the national currency depreciates by 1%, the imports will decrease by 1.24 %, but only in the case of USA, meaning that our first hypothesis is not satisfied for rest of the countries. As concerns the sign of domestic income, we expected it to be positive, such that with the increase an income, the imports will augment also. The

assumption is satisfied only for the 3 countries: Australia and Korea, however for Belgium, Canada, Chile, Finland and USA the sign of income elasticity is not in line with the theory. This suggests that an increase in domestic income, will lead to a decrease in a country's imports. In particular, with the depreciation of currency, the imports will be expensive in terms of national currencies, once the relative prices change and as a reaction, the residents will tend to purchase domestic products and goods.

On another hand, as shown in table 5.8, the results for export elasticities are negative, as it was expected, in the cases of Australia, Belgium, Canada, Chile, Finland and Italy, thus a depreciation of currency will lead to a growth of exports in these countries. Although Korea and USA have been classified by GCI as the most innovative countries, with permanent technological adaptation and business sophistication, according to our results, these features are not sufficient to keep the exports at high levels. Thus, in order to register increase in exports, they should produce and export enough quantities during the time when the economies are close to achieve their peak, such that they are able to meet the additional demand. In addition, the income elasticity has different effects on our economies. In Australia, Belgium, Italy and Korea it carries the expected positive sign, implying that an increase in foreign income augments the foreign demand for exports.

An interesting fact to remark is that the price elasticities of imports and exports are found to be considerably heterogeneous across countries, varying from -30.37 (Korea) to 1.24 (USA) in the case of imports and from -19.98 (Belgium) to 1.69 (USA) for exports, respectively. The export elasticities dispersion among countries can be justified by the sectoral specialization of exports and are not influenced by the level of development or competitiveness in a certain county, as supposed initially. Exports tend to react to big changes in the composition of international trade and so do export elasticities. The pattern of variation of import elastiticies lies behind heterogeneous sectoral elastiticites of subsitituion among traded goods (Imbs and Méjean, 2010)

On overall, the results of the trade elasticities suggest that from all the 8 countries that we have chosen in our study, Marshall-Lerner condition is satisfied in most of the cases, except for Canada, Finland and Korea. The M-L condition estimates are reported in table 5.9. According to the theory, the sum of import and export price elasticities should be bigger than one, in order satisfy the Marshall – Lerner condition. We have obtained large enough elasticities for Australia (1.13),

Belgium (15.73), Chile (1.00), Italy (1.49) and USA (2.93), such that our main hypothesis is satisfied. The results clearly indicate that the depreciation of the national currency will improve their trade balances in the long-run. The coefficients of the real exchange rate variables in these countries are significantly different from zero at 5 percent significance level. In addition, we notice that M-L condition holds in advanced economies, such as USA and in less competitive ones, like Italy or Chile.

Turning back to the cases of Canada, Finland and Korea, it seems that the model is misspecified somehow. In Canada, one of the main reasons might be the trade agreement between Canada, USA and Mexico, known as "North American Free Trade Agreement (NAFTA), which was enabled in 1994. A possible structural change in import and export demand relationships might have been induced after the implementation of this accord, and which is not completely reflected by the real exchange rate. As concerns Korea, all the symptoms of a financial crisis were registered in in 1997-1998, where the consequences have been very painful and IMF intervention was needed. The industrial firms had big challenges from their main competitors (China, Thailand, Indonesia) leading to an increase to labor cost, which made Korean products more expensive in the world market. In Finland, despite the hihest level of competitiveness and innovation, the depreciation of currency would not improve the trade balance deficit in the long-run. Contrarily to our estimations, Finland has already successfully used this tool to fight its great recession in 1990. A devaluation of 40 pc from the value of Finish currency led to unbelievable improvements in competitiveness. Our results however are justified by the statement of Jaakko Kiander, director of the Labor Institute for Economic Research, Helsinki, who declared that "currency devaluation which solved the Finish Crisis in '90s is not available to Eurozone members. For countries within the Eurozone, deflation appears to be the only viable alternative". Thus, nowadays, depreciation might not have helped Finish economy recover, as it is a member of Eurozone since 1999.

Although we are interested in the long-run relationship among our variables, we provide brief comments on the short-run estimated coefficients. The results from Appendix A, Tables A4 and A5 are the values of short-run coefficients for each country. The obtained values clearly indicate that in short period of time the exchange rate does not have any statistical influence on changes in imports and exports. The only statistical significant results are present in the case of USA (exports equation) and carries the expected sign, meaning that depreciation will increase the exports of USA shortly after its implementation. The reaction of imports and exports to changes in income are not significant in short-run, meaning that it will take longer time to

affect the trade balance performance. Hence, in short-run, our countries are not dominated by shifts in income and price-competitiveness, it will request more time to respond. Tables contain also the speed of adjustment coefficients. For all countries in our sample, the speed of adjustment carries the expected sign and is statistically different from zero for Belgium, Canada and USA in the equation for import demand. In the case of Chile, the coefficient has the expected sign, but it is not statistically significant. The export equation presents only one country with correct speed of adjustment – Korea. The other countries are not line with the theory, even though the speed of adjustment has very low values. Negative value of speed of adjustment suggest that current deviation of imports from long-run equilibrium is removed through the short-run dynamics. Moreover, the values of the coefficients indicates the speed of convergence towards the equilibrium. In presence of a shock to imports demand equations, the disequilibrium in USA is eliminated faster than in Canada and Belgium. It will take approximately 3.5 quarters (1/0.29) for USA, 5.9 quarters for Belgium and about tripled time interval of 14.3 quarters for Canada to bring back the equilibrium after shock. As concerns the export equations, it will take 14.3 quarters for Korea to restore to its equilibrium.

After estimating the income and price elasticities, we may inquire about their stability and properties of residuals. The importance of stable long-run cointegrating vectors is necessary for further policy predictions. Hence, we apply the dynamic stability tests (Appendix A, Figure A1), by plotting Inverse Roots of AR Characteristic Polynomial. The graphs of the Eingen values indicate that none of the remaining values are situated close to the unit circle and stability of our VEC models is confirmed. In addition, we perform Lagrange-Multiplier test for autocorrelation (Appendix A, Table A7-A8) up to lag 8 and the results show that at overall level residuals do not show autocorrelation issues.

5.3 Discussion of results of Non – Price Competitiveness Model

The results of non-price competitiveness model are presented in Table 5.10, where β coefficients represent the long-run equilibrium relationships among our variables and matrix α illustrates the speed of adjustment approaching this equilibrium. The cointegration analysis shows that trade balance is cointegrated with domestic income, real exchange rate and real capital stock. The second model estimates emphasize the behavior of trade balance caused by changes in both real exchange rates and real

capital stock. In particular, the positive values of real exchange rates coefficients in most of the studied countries indicate high export-import elasticity, which is in line with the prediction of the imperfect substitutes model. The assumption is met in the cases of Australia, Canada, Chile, Finland, and USA, with long-run price elasticities laying from 0.25 in Canada to 3.97 in Chile. According to Boyd, *et al*, 2001, Salasevicius and Vaicius, 2003, Marshall-Lerner condition in the equation where trade balance is expressed as ratio of exports to imports requires price elasticity coefficients to be positive in order to improve the trade balance, thus 1 percent depreciation in the real exchange rate will improve the trade balance with about 3.97 percent in Chile, 3.38 percent in Finland, 1.22 percent in USA, 0.32 percent in Australia and 0.25 percent in Belgium. At general levels, the results confirm the influence of real exchange rate on current account and might be used by the mentioned above countries in order to redress their trade balance. A high level of price elasticities leads to an increase in the competitiveness on the international market of imports and exports. As concerns Korea, the results of price elasticities are not statistically significant, therefore we cannot provide any reliable conclusions. On another hand, contrarily to the results from our first model, negative price elasticities in Belgium and Italy clearly indicate that the trade balance would not ameliorate as a result of currency devaluation and therefore exchange rate policies might not be so efficient in promoting international trade. The above mentioned negative effects might lead to wrong government intervention, which will fail to solve the existing deficit with devaluation. This idea support the assumptions presented in Chaper 2.3, where we attempted to explain the failures of policy makers while implementing restrictive measures. In this context, non-price competitiveness factor could be applied in order to attain the desired trade balance equilibrium.

Our main interest however is in the behavior of real capital stock variable, which is also presented in Table 5.10. One of the most important findings is that real capital stock is statistically significant in all the cases, except for Chile and registers positive values in most of our countries. These results confirm that there is an important relationship between import/export demand and cumulative investments, which supports the new theories on trade and growth by Krugman (1989), Helpman and Krugman (1989), and Grossman and Helpman (1993). Their theory articulates the importance of product differentiation and innovation. Relating it to our case, the results show that non-price competitiveness factors has notable influence on trade balance, with most prominent effects on the economies of Finland (1.57), Belgium (1.80) and Italy (0.84). In Canada the values of capital stock have a value of 0.36,

which also sustain our hypothesis. Based on the obtained results, there a 1 percent change in the capital stock would lead to an improvement in the trade balance, supporting the idea that differentiation in the resource base and product innovation has positive impacts on the trade balance and helps the country broaden its exports on the world market. Connecting the obtained results to the initial classification of countries, we do not notice improvement in products quality to have positive effects only in any specific group of countries. Both innovative economies (Finland, Canada) and less competitive one (Italy) exert significant influence from product differentiation on the structure of their bilateral trade development.

Our results also show evidence about the influence of domestic income on the trade balance. The income elasticities vary between -1.38 in Australia to 0.18 in Italy and indicate that changes in domestic income could lead to an improvement or deterioration of the trade balance in the long-run.

On overall, domestic income, real exchange rate and capital stock cause significant impacts on the trade balance. In some cases, only the price competitiveness factors are not so valuable in redressing the trade balance. This idea has been discussed also by Amable and Verspagen (1995), by emphasizing that the trade balance of a country cannot register long run improvement only because there is a permanent devaluation of currency. Therefore, policy makers should take into account other factors, such as product variety and quality, which capture the non-price competitiveness effect as a solution to repair current accounts. By including in the trade equation the quality variable we are able suppress the pure price effect and provide more complex approach to the depreciation of currency as a Government trade policy instrument. Moreover, the reform of economic mechanism should rather create the preconditions to the stimulation of export performance by the allocation of resources to the efficient producers, for whom efficient innovation and quality change is an endogenous variable within the framework of long-term development (Mejstrik, 1989).

As concerns the results of short-run relationships among our variables of interest, they can be found in Appendix A, tables A6. In the short period of time, the fluctuations in the real effective exchange rate do not have any significant impact on changes in trade balance. This is justified by J-effect that supposes that a devaluation of currency is not instantly reflected in trade balance amelioration. In particular, changes in domestic income and real depreciation of currency do not immediately improve the trade balance, since none of the coefficients are statistically significant.

Real capital stock elasticities are significant only for Australia and Korea, although they do not carry the expected sign. Hence, in the short run, the trade balance of our countries does not show any strong influences by changes in domestic income, real exchange rate and capital stock.

Table 5.10 presents the estimated speed of adjustment of our coefficients. They are statistically significant (exception – Belgium) and carry the expected sign, meaning that if there is a shock in the system, our co-integrating vectors converge to their long-run equilibrium. The disequilibrium in is eliminated faster in Finland, Italy, and Korea than in Chile, USA, Australia and Canada. It will take about 1.1 and 1.2 quarters for Italy and Korea respectively to restore after shock, 1.4 quarters to Finland, compared to Chile, which will need about 11 quarters to achieve the equilibrium and USA, which will restore after 4.3 quarters. The coefficients of speed of adjustment that we received from the error-correction model fulfills at the same time the role of cointegration test. The negative sign of our α coefficients and statistically significant values serves as a proof for cointegration among the variables and therefore confirms our findings in previous section.

After estimating the model, Lagrange Multiplier test has been employed on the residuals up to 8 lags. Altogether, the results (Table A9, Appendix A) do not show presence of first order autocorrelation at 5% significance level. Once the price and non-price elasticities have been estimated, we proceed to testing their stability over time. We plotted the eingen values of the companion matrix in order to show that our estimated model is "dynamically stable". The stability is confirmed in the Appendix A, Figure A2, showing that none of the remaining eigenvalues appears close to the unit circle. The stability check does not indicate that our model is misspecified.

- Impulse response functions

The short-run dynamics of the price and non-price effect of devaluation together with the adjustment period are better evidenced in the combined IRF graphs. Figure A3 from Appendix A shows the impulse response functions of Trade Balance to Real Capital Stock shock and real exchange rate shock. The plots indicate that a one unit orthogonalized shock to the real capital stock has a permanent improving effect on the trade balance of Belgium, increasing the trade balance by 0.0038 percentage points (p.p.) in the first period and it continues to register surplus in long period also. Contrarily to the positive impact mentioned above, a one unit shock to the capital

stock has a permanent negative effect of about 0.007 p.p. in Italy in the first 4 periods and trade balance continues to deteriorate at smaller levels in long run. For the rest of countries 1 unit shock to the capital stock has only transitory effects. On average, one standard deviation shock to the real capital stock increases the trade balance of Australia with about 0.008 p.p.. The effect will last about 2 quarters, and after that it will deteriorate the trade balance up to 0.016 percentage points the next 18 periods. Similar response is present in Finland, where we have a short-term positive impact of about 0.003 p.p., lasting up to 3 quarters and after it will have a deterioration effect which will be deepening more in time.

As concerns Canada, Korea and USA, we have an initial deterioration of trade balance as a response to a one unit standard deviation shock with values up to 0.003 p.p. in Canada and after 5 periods TB starts to set in. In Korea and USA there is about 0.02 and 0.002 p.p. of decrease in trade balance which last about 6 periods, 4 periods, respectively, after which trade balance starts to register positive values. An orthogonalized shock in capital stock of about 1 unit in Chile turns out to be accompanied by a cyclical behavior of trade balance. It improves by 0.038 p.p. in the first periods and registers a slow decline after 4^{th} period. Trade balance shows short periods of amelioration, which is followed by a decline in the next time interval. Thus, we can notice different effect of non-price competitiveness factor on the trade balance, which deteriorates the trade balance in some of the countries and improves it in others. Due to this contradictory short-term and long-term effect, we cannot provide an objective conclusion about the impact of product differentiation on trade balance and its lasting effect.

Next, we provide the trade balance response functions to real exchange rate shocks (Figure A4, Appendix A). The IRF graph in Belgium suggests that initial downturn of the trade balance to a one unit depreciation of real exchange rate is around 0.02 percent. The short-run effect, as shown in the plot, lasts for about 2 quarters, which corresponds to 6 months. The results are not consistent with the traditional theory that short-term adjustments should persist for one year (Krugman, 1991). The effect begins to set in from 3^{rd} period and continues up to 0.006 percentage points. Similar impact is present in Korea, where a unit shock to the real exchange rate depreciates the trade balance by 0.05 percent in the initial 3 periods, after which it gradually increases and reaches positive values. After approximately 1 year, the trade balance attains a long-run static condition at a surplus of 0.13%. Theoretically, such a short-term adjustment is viable, however more detailed analysis of the composition of imports and exports sectors is needed. In addition, the IRFs in

these countries clearly indicate the presence of J-Curve phenomenon, by showing a restore eventually of trade balance to more than it was before devaluation. After long-term the exchange rate has the desired effect of improving the trade balance and there is a pass-through of exchange rate changes to import prices.

Concerning the cases of Canada and Korea, the trade balance initially has already a positive effect to a unit depreciation in the exchange rate, up to 0.0013 p.p. in Canada and 0.0058 p.p. in Korea, respectively. Nonetheless, the effect does not last longer than 2 and 4 quarters, after which it dies out. For the rest of the countries, the graphs show a persistent effect of trade balance deterioration as a result of a unit standard deviation to real exchange rate. The shock decreases the trade balance in Australia by 2 % and in Chile up to 5 % with no signs of recovery. Finland shows a negative effect of about 0.012 p.p. with an attempt of reaching positive values after 15^{th} period, which turn out unsuccessful. When it comes to USA, the trade balance practically does not generate any positive response of trade balance, except for a small insignificant increase in the initial period. Afterwards, a decreasing trend can be noticed and it is permanent.

6 Conclusion

In this thesis, we have examined the role exchange rate deviations can play in rebalancing the current account deficit. The main purpose was to provide reliable estimates of income, price and non-price elasticities of imports and exports demand, so that we can obtain an appropriate recommendation for policy makers. In particular, we have estimated these elasticities on a bilateral basis between eight countries and the world. While in the existing literature similar studies have been employed for a single country or a group of countries with similar characteristics (G8 Group, Baltic countries or GIIPS) we attempt to improve the findings by examining countries with different level of development. In addition, we conducted our analysis on recent period of time, from 1991-2012, as we wanted to check our hypothesis also during the economic crisis. In order to obtain the trade elasticities and test whether Marshall-Lerner condition holds, we have used the traditional Imperfect Substitutes model. Specifically, we formulated two empirical models, for price and non-price competitiveness. First model aimed to illustrate the Marshall-Lerner condition and price elasticities, using import and export demand equations and classical bilateral approach, while in the second model, we have extended the Imperfect Substitutes model to incorporate a non-price competitiveness factor. For this purpose, we used the capital stock variable as a proxy for product differentiation and quality, which according to Madden *et al.* (1999), has a big influence on a country's competitiveness and promotion of exports.

We modeled the price and non-price competitiveness elasticities for our sample, using an Vector Autoregressive Error Correction framework based on Johansen's methodology and in the end, an Impulse Response Function was constructed in order to examine the short-run trade dynamics. Although previous studies that estimated trade elasticities have employed various other econometric techniques, we opted for a model which is able to capture the long-run relationship among our variables of interest and which at the same time is able to test for more than one co-integrating vectors. Moreover, Johansen and Juselius' (1990) maximum likelihood estimator corrects for autocorrelation and endogeneity, by using vector error correction mechanism specification (Algieri, 2013) and performs better than other estimators when some assumptions are violated, i.e. normally distributed errors or over-parameterization (Gonzalo, 1994).

In the first regression model, which mirrors price-competitiveness factors and classical trade model, the results indicate that Marshall-Lerner condition is satisfied in Australia, Belgium, Chile, Italy and USA. Thus, a devaluation of national currency should redress the trade balance deficit within these countries. A devaluation of about 100 basis points in the real exchange rate would lead to an improvement of about 1% in Chile, 1.13% in Australia, 1.49% in Italy, 2.93% in USA and around 16% in Belgium. The bigger the price elasticity is, the more competitive is the international market for a certain country and depreciation of currency will help to increase export revenues. Our findings contradict, however the assumption of IMF, which proposed devaluation of currency as a growth strategy in developing countries. We have found evidence about improvement of trade balance as a result of currency depreciation, both in developed and developing countries, therefore this economic tool could be successfully applied in all types of economies. Even though Chile and Italy are classified at the end of our countries' ranking according to Global Competitiveness Index, they both show large enough price elasticities in order to satisfy M-L condition. For Canada, Finland and Korea – technologically advanced economies, however, a depreciation of domestic currency will not rebalance their current account deficit. The results might be justified by the entrance of Finland in Eurozone in 1999 or other crisis shortcomings, the adoption of "North American Free Trade Agreement" between Mexico, Canada and USA in 1994 or the painful economic consequences in Korea after the 1997-1998 financial crisis.

The outcomes of the first model, also confirm the disparity in income elasticities, as mentioned by Sawyer and Sprinkle (1996). Specifically, this means that income elasticity of import demand is bigger than the income elasticity of export demand. This idea is supported by our findings in Australia, Finland, Korea and USA, which can be actually a plausible justification for the failure of the currency depreciation to improve the trade balances in Finland or Korea. On overall, the results of price-competitiveness model, particularly in the countries where M-L condition does not hold, suggest for other economic measures to be taken into account by policy makers, such as fiscal consolidation or improvements in product quality and innovation-promoting activities (Algieri, 2013)

The second regression model was constructed using both price and non-price competitiveness factors, for the same group of countries. The results obtained for income, price and non-price elasticities are significant and carry the expected signs in the majority of the studied economies. Long-run price elasticities differ considerably from the previous model and range from 0.25 to 3.97, which indicate a quite large

response of trade balance to fluctuations in domestic currency. In detail, one percent depreciation in the real exchange rate will improve the trade balance with about 3.97 percent in Chile, 3.38 percent in Finland, 1.22 percent in USA, 0.32 percent in Australia and 0.25 percent in Canada, indicating that Marshall-Lerner condition holds for these countries. The results for Finland and Canada contradict those from the previous model, however for Korea we still have an insignificant effect. Thus, for the rest of the countries, a real devaluation of currency is not sufficient to improve their trade balances, therefore using non-price competitiveness factors to adjust the trade imbalances might serve as an alternative.

By witnessing some losses in price competitiveness in several countries from our sample, we confirm our initial hypothesis mentioned in Chapter 2, that forced devaluation of national currency does not solve entirely the trade deficit. However, as soon as we added non-price competitiveness factors (quality of exported products), we obtained more pronounced trends in both, advanced and less developed economies. We proxied the quality variable with capital stock index and we found that it has positive and significant values in Belgium, Canada, Finland and Italy. These results articulate the role of non-price competitiveness factors in ameliorating the trade balance, and therefore omitting this variable, as in the majority of existing studies about trade elasticities, could lead to model misspecification. Our findings also indicate the existence of the J-curve pattern, as reflected by the short-run coefficients. The effects of our explanatory variables are limited in short-term, meaning that it will take longer for the price and non-price factors to have an impact on trade balance.

In synthesis, our results illustrate a major influence which relative prices, and, most of all, non-price competitiveness factors have in influencing country's successful trade performance. Furthermore, the results that we obtained have two ponderous implications. One of the most straight-forward implication for policy makers is that imports and exports traded volumes tend to significantly react to changes in real exchange rates, thus policies associated with depreciation of domestic currencies would profitably contribute to rebalance the current trade deficits. However, for the entire resolution, policy makers should pay attention to non-price competitiveness factors also. For this purpose, the measures to be undertaken should also focus on innovation of products, permanently developing of marketing strategies, product variety and diversification, amelioration of product quality along with a raise in investments and R&D expenditures. Besides this conclusion, we proved that the traditional framework of demand substitution, without allowing for innovation or

quality of products, provides non-reliable government policies, which are using exchange rates as the main instrument in improving the trade deficit.

While our thesis has advanced the existing literature at various aspects and contributed to the development of a different approach to the current account deficit, reflected by non-price competitiveness factors, further research is necessary. Although the "New-Trade" theory has been recently mentioned by some authors, there is a lack of studies in this field. In addition, the implication of non-price competitiveness factors in the traditional trade model proved to have significant effects and therefore discovery of more relevant variable for its measurement, apart from capital stock would be efficient. Also, in order to provide a more-detailed analysis on the impact of depreciation on individual sectors of the economy, elasticities could be estimated for specific commodity groups.

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Appendix A: Tests performed and additional empirical results

Table A1: Variables description

Imports Index, 2005 = 100	Total volume of imports of goods and services, in real terms, reference year 2005, US dollars, (quarterly data) Source: *Directions of Trade, International Financial Statistics CD-ROM*
Export Index, 2005=100	Total volume of exports of goods and services, in real terms, reference year 2005, US dollars, (quarterly data) Source: *Directions of Trade, International Financial Statistics CD-ROM*
Domestic Income, 2005=100	The real GDP volume, converted to Index, (quarterly data) Source: *International Financial Statistics CD-ROM*
World Income, 2005=100	Industrial Production Index of Advanced Economies, (quarterly data) Source: *International Financial Statistics CD-ROM*
Real Effective Exchange Rates Index - CPI Based 2005=100	REER based on consumer price index, seasonally adjusted, (quarterly data) Source: *International Financial Statistics CD-ROM*
Trade Balance	The merchandise trade balance is defined as the ratio of total exports to imports, both expressed in Billions of US Dollars Source: *Directions of Trade, International Financial Statistics CD-ROM,*
Capital Stock, 2005=100	Net Capital stock, volume, (yearly data) Source: *OECD Database* *Chile: National Institute of Statistics (INE)*
Time variable	a) Model I 1991-2012: Australia, Canada, Chile, Finland, Italy, Korea, USA 1995-2012: Belgium b) Model II 1995-2011: Belgium, Italy, Korea 1991-2011: Australia, Canada, Chile, Finland, USA

Table A2: Unit root test results of Model I

Country	Variable tested	Augmented DF (p-value)	Phillips-Perron (p-value)	KPSS (LM-statistic)	Decision
Australia	$lnIM$	0.9730	0.9714	1.3244	I(1)
	$\Delta lnIM$	0.0000	0.0000	0.335741	
	$lnEX$	0.9658	0.9840	2.28456	I(1)
	$\Delta lnEX$	0.0013	0.0000	0.432748	
	$lnREX$	0.8740	0.8695	1.39376	I(1)
	$\Delta lnREX$	0.0000	0.0000	0.2266	
	$lnDI$	0.1006	0.5509	2.28637	I(1)
	$\Delta lnDI$	0.0000	0.0000	0.312399	
	$lnWI$	0.2808	0.3936	2.02421	I(1)
	$\Delta lnWI$	0.0000	0.0000	0.058959	
Belgium	$lnIM$	0.7911	0.7933	0.620981	I(1)
	$\Delta lnIM$	0.0504	0.0000	0.236565	
	$lnEX$	0.6943	0.8069	0.5991	I(1)
	$\Delta lnEX$	0.1136	0.0000	0.234965	
	$lnREX$	0.3419	0.3108	0.277732	I(1)
	$\Delta lnREX$	0.1272	0.0000	0.235021	
	$lnDI$	0.1890	0.2695	1.09142	I(1)
	$\Delta lnDI$	0.0354	0.0000	0.289159	
	$lnWI$	0.0922	0.1241	0.538695	I(1)
	$\Delta lnWI$	0.0122	0.0000	0.117056	
Canada	$lnIM$	0.9726	0.9687	2.37084	I(1)
	$\Delta lnIM$	0.0001	0.0000	0.252811	
	$lnEX$	0.9623	0.9558	1.3383	I(1)
	$\Delta lnEX$	0.0013	0.0000	0.19438	
	$lnREX$	0.5503	0.6301	0.966303	I(1)
	$\Delta lnREX$	0.0002	0.0000	0.464702	
	$lnDI$	0.4931	0.5293	2.97483	I(1)
	$\Delta lnDI$	0.0012	0.0001	0.365411	
	$lnWI$	0.5467	0.4145	1.08466	I(1)
	$\Delta lnWI$	0.0002	0.0000	0.0702829	
Chile	$lnIM$	0.6686	0.7954	1.85427	I(1)
	$\Delta lnIM$	0.0008	0.0000	0.0737242	
	$lnEX$	0.9414	0.6480	1.26074	I(1)

	$\Delta lnEX$	0.0040	0.0000	0.0725455	
	$lnREX$	0.2900	0.1006	0.271557	I(1)
	$\Delta lnREX$	0.0000	0.0000	0.14469	
	$lnDI$	0.0211	0.7350	2.24384	I(1)
	$\Delta lnDI$	0.0041	0.0000	0.174528	
	$lnWI$	0.5467	0.4145	1.08466	I(1)
	$\Delta lnWI$	0.0002	0.0000	0.0702829	
Finland	$lnIM$	0.7775	0.7931	0.913606	I(1)
	$\Delta lnIM$	0.0434	0.0000	0.210039	
	$lnEX$	0.1458	0.1478	0.221528	I(1)
	$\Delta lnEX$	0.0376	0.0000	0.115926	
	$lnREX$	0.0000	0.0010	0.570355	I(0)
	$\Delta lnREX$	0.0096	0.0000	0.201496	
	$lnDI$	0.4118	0.7389	0.210039	I(1)
	$\Delta lnDI$	0.0044	0.0000	0.0965675	
	$lnWI$	0.5467	0.4145	1.08466	I(1)
	$\Delta lnWI$	0.0002	0.0000	0.0702829	
Italy	$lnIM$	0.8781	0.8815	1.20955	I(1)
	$\Delta lnIM$	0.0413	0.0000	0.212709	
	$lnEX$	0.8468	0.8703	1.47754	I(1)
	$\Delta lnEX$	0.0036	0.0000	0.184341	
	$lnREX$	0.0022	0.0546	0.183765	I(0)
	$\Delta lnREX$	0.0083	0.0000	0.215466	
	$lnDI$	0.6718	0.0000	0.31168	I(0)
	$\Delta lnDI$	0.0000	0.0000	0.100696	
	$lnWI$	0.1918	0.3965	1.27222	I(1)
	$\Delta lnWI$	0.0000	0.0000	0.0636412	
Korea	$lnIM$	0.6418	0.6755	0.985726	I(1)
	$\Delta lnIM$	0.0000	0.0000	0.171133	
	$lnEX$	0.4064	0.4313	2.08228	I(1)
	$\Delta lnEX$	0.0003	0.0000	0.25317	
	$lnREX$	0.6466	0.4802	1.03174	I(1)
	$\Delta lnREX$	0.0000	0.0000	0.0839128	
	$lnDI$	0.1564	0.3939	2.27204	I(1)
	$\Delta lnDI$	0.0386	0.0000	0.302028	
	$lnWI$	0.2808	0.3936	2.02421	I(1)
	$\Delta lnWI$	0.0000	0.0000	0.058959	

USA	$lnIM$	0.9601	0.9258	2.30853	I(1)
	$\Delta lnIM$	0.0000	0.0000	0.143408	
	$lnEX$	0.9611	0.9919	3.38032	I(1)
	$\Delta lnEX$	0.0000	0.000	0.361433	
	$lnREX$	0.6876	0.5737	0.668538	I(1)
	$\Delta lnREX$	0.0000	0.0000	0.212039	
	$lnDI$	0.2273	0.0797	2.93051	I(1)
	$\Delta lnDI$	0.0056	0.0000	0.731842	
	$lnWI$	0.4963	0.4247	2.96433	I(1)
	$\Delta lnWI$	0.0000	0.000	0.0633438	

Table A3: Unit root test results of Model II

Country	Variable tested	Augmented DF (p-value)	Phillips-Perron (p-value)	KPSS (LM-statistic)	Decision
Australia	$lnTB$	0.0916	0.0915	0.241913	I(0)
	$\Delta lnTB$	0.0001	0.0000	0.118942	
	$lnREX$	0.0544	0.5743	1.7725	I(1)
	$\Delta lnREX$	0.0059	0.0000	0.302834	
	$lnDI$	0.9066	0.8253	0.994053	I(1)
	$\Delta lnDI$	0.0005	0.0000	0.225789	
	$lnCS$	0.6006	0.8910	1.77832	
	$\Delta lnCS$	0.2385	0.2435	0.221938	I(2)
	$\Delta\Delta lnCS$	0.0283	0.0134	0.0958336	
Belgium	$lnTB$	0.4523	0.0289	1.18459	I(1)
	$\Delta lnTB$	0.0005	0.0000	0.0597601	
	$lnDI$	0.6092	0.5117	1.64927	I(1)
	$\Delta lnDI$	0.0049	0.0000	0.207126	
	$lnREX$	0.5477	0.5726	0.359079	I(1)
	$\Delta lnREX$	0.0099	0.0000	0.262782	
	$lnCS$	0.4398	0.4048	1.77398	
	$\Delta lnCS$	0.1991	0.0958	0.338548	I(2)
	$\Delta\Delta lnCS$	0.0126	0.0091	0.0393282	
Canada	$lnTB$	0.2803	0.0154	0.347312	I(1)
	$\Delta lnTB$	0.0001	0.0000	0.0998165	
	$lnDI$	0.3500	0.6684	1.75282	I(1)
	$\Delta lnDI$	0.0104	0.0002	0.251111	
	$lnREX$	0.5850	0.5464	0.512961	I(1)
	$\Delta lnREX$	0.0006	0.0000	0.420907	
	$lnCS$	0.6219	0.9850	1.76124	
	$\Delta lnCS$	0.3579	0.5756	0.317027	I(2)
	$\Delta\Delta lnCS$	0.1184	0.0418	0.17053	
Chile	$lnTB$	0.5145	0.0126	0.709229	I(1)
	$\Delta lnTB$	0.0001	0.0000	0.093817	
	$lnDI$	0.6189	0.7300	1.28448	I(1)
	$\Delta lnDI$	0.0040	0.0000	0.113619	
	$lnREX$	0.2566	0.0577	0.139677	I(0)
	$\Delta lnREX$	0.0309	0.0000	0.194652	
	$lnCS$	0.2659	0.0403	1.27332	I(2)

	$\Delta lnCS$	0.9868	0.8452	0.658833	
	$\Delta\Delta lnCS$	0.0981	0.0899	0.194566	
Finland	$lnTB$	0.9527	0.4168	0.825743	I(1)
	$\Delta lnTB$	0.0090	0.0000	0.620063	
	$lnDI$	0.5428	0.8042	1.43544	I(1)
	$\Delta lnDI$	0.0042	0.0000	0.0741704	
	$lnREX$	0.0000	0.0009	0.511442	I(0)
	$\Delta lnREX$	0.0116	0.0000	0.218314	
	$lnCS$	0.9310	0.9988	1.45012	
	$\Delta lnCS$	0.0884	0.4973	0.773501	I(2)
	$\Delta\Delta lnCS$	0.0001	0.0352	0.123022	
Italy	$lnTB$	0.2162	0.2306	1.0429	I(1)
	$\Delta lnTB$	0.0000	0.0000	0.0583183	
	$lnDI$	0.7378	0.0000	0.354552	I(1)
	$\Delta lnDI$	0.0005	0.0000	0.0782408	
	$lnREX$	0.5667	0.1495	0.80362	I(1)
	$\Delta lnREX$	0.0033	0.0000	0.117879	
	$lnCS$	0.8143	0.0000	1.21597	I(1)
	$\Delta lnCS$	0.0056	0.0339	0.695235	
Korea	$lnTB$	0.0064	0.0162	0.128777	I(1)
	$\Delta lnTB$	0.0006	0.0000	0.0802103	
	$lnDI$	0.8686	0.5805	1.45976	I(1)
	$\Delta lnDI$	0.0011	0.0000	0.0474897	
	$lnREX$	0.6356	0.3790	0.461562	I(1)
	$\Delta lnREX$	0.0530	0.0000	0.153493	
	$lnCS$	0.0995	0.3598	1.45535	
	$\Delta lnCS$	0.8301	0.0954	0.447854	I(1)
	$\Delta\Delta lnCS$	0.0377	0.0291	0.0607157	
USA	$lnTB$	0.2291	0.3405	1.21028	I(1)
	$\Delta lnTB$	0.0360	0.0000	0.317067	
	$lnDI$	0.3681	0.1417	1.72983	I(1)
	$\Delta lnDI$	0.0370	0.0000	0.542079	
	$lnREX$	0.7037	0.5780	0.378235	I(1)
	$\Delta lnREX$	0.0007	0.0000	0.243071	
	$lnCS$	0.2290	0.2069	1.77605	
	$\Delta lnCS$	0.3369	0.4896	0.683788	I(2)
	$\Delta\Delta lnCS$	0.1759	0.0263	0.198143	

Table A4: VECM System short-run coefficients, model I (Imports)

Variables	Australia	Belgium	Canada	Chile	Finland	Italy	Korea	USA
$\Delta \ln IM_{t-1}$	0.27	-0.19	0.49	0.23	0.39	0.31	0.50	0.36
	(1.69)	(-1.09)	(3.14)	(-1.77)	(2.14)	(2.13)	(4.28)	(3.05)
$\Delta \ln IM_{t-2}$	-0.33	0.14	-0.42	-0.01	-0.16	-0.27	-0.44	-0.43
	(-2.05)	(1.01)	(-2.79)	(-0.08)	(-0.79)	(-1.76)	(-3.43)	(-3.84)
$\Delta \ln IM_{t-3}$	-0.04	0.09		-0.00	0.01	0.077	0.14	
	(-0.23)	(0.68)		(-0.04)	(0.01)	(0.51)	(1.22)	
$\Delta \ln IM_{t-4}$		0.03			-0.15	0.05		
		(0.24)			(-0.72)	(0.28)		
$\Delta \ln IM_{t-5}$		0.32			0.08	0.02		
		(2.27)			(0.47)	(0.12)		
$\Delta \ln IM_{t-6}$								
$\Delta \ln DI_{t-1}$	-0.62	-0.13	0.34	0.47	-0.13	0.26	0.03	0.10
	(-0.95)	(-0.68)	(0.74)	(1.31)	(-0.38)	(1.31)	(0.32)	(0.21)
$\Delta \ln DI_{t-2}$	-0.10	0.28	0.24	0.11	-0.00	-0.01	0.02	0.19
	(-0.15)	(1.45)	(0.52)	(0.27)	(-0.01)	(-0.08)	(0.20)	(0.43)
$\Delta \ln DI_{t-3}$	-0.21	0.12		-0.06	0.02	-0.03	0.09	
	(-0.35)	(0.64)		(-0.17)	(0.10)	(-0.29)	(1.15)	
$\Delta \ln DI_{t-4}$		-0.89			0.02	-0.04		
		(-4.83)			(0.10)	(-0.33)		
$\Delta \ln DI_{t-5}$		-0.85			0.07	-0.23		
		(-3.54)			(0.21)	(-1.22)		
$\Delta \ln DI_{t-6}$								
$\Delta \ln REER_{t-1}$	0.11	1.34	-0.08	0.24	0.00	0.03	-0.17	0.01
	(0.90)	(1.79)	(-0.71)	(0.63)	(0.01)	(0.10)	(-1.40)	(0.06)
$\Delta \ln REER_{t-2}$	0.06	-1.00	0.05	0.31	0.02	0.06	-0.14	-0.09
	(0.43)	(-1.50)	(0.49)	(0.86)	(0.04)	(0.21)	(-1.21)	(-0.62)
$\Delta \ln REER_{t-3}$	0.11	-1.56		0.18	0.37	0.12	-0.14	
	(1.90)	(-2.32)		(0.50)	(0.77)	(0.42)	(-1.20)	
$\Delta \ln REER_{t-4}$		-1.33			0.35	-0.13		
		(-1.86)			(0.75)	(-0.45)		
$\Delta \ln REER_{t-5}$		-0.91			0.09	0.10		
		(-1.38)			(0.22)	(0.37)		
Speed of adjustment, α								
dlnIM	0.01	-0.17	-0.07	-0.04	0.03	0.02	0.00	-0.29
	(0.26)	(-2.88)	(-2.50)	(-0.69)	(1.69)	(1.51)	(1.67)	(-3.86)

Notes: The symbol Δ is the difference operator. Figures in brackets are t-statistics.

Table A5: VECM System short-run coefficients, model I (Export)

Variables	Australia	Belgium	Canada	Chile	Finland	Italy	Korea	USA
$\Delta\, ln\, EX_{t-1}$	0.39	0.20	0.31	-0.84	0.41	0.31	0.39	0.34
	(3.27)	(0.83)	(2.09)	(-5.65)	(2.17)	(2.00)	(3.62)	(2.76)
$\Delta\, ln\, EX_{t-2}$	-0.18	0.01	-0.48	-0.50	-0.09	-0.16	-0.17	
	(-1.53)	(0.03)	(-3.09)	(-2.77)	(-0.44)	(-0.96)	(-147)	
$\Delta\, ln\, EX_{t-3}$		0.23	-0.17	-0.34	0.13	0.21		
		(0.94)	(-1.01)	(-1.92)	(0.63)	(1.25)		
$\Delta\, ln\, EX_{t-4}$		0.17	-0.27	-0.16	-0.29	-0.11		
		(0.66)	(-1.77)	(-0.97)	(-1.45)	(-0.72)		
$\Delta\, ln\, EX_{t-5}$		0.28	0.29	-0.15	0.04			
		(1.14)	(1.8)	(-1.26)	(0.20)			
$\Delta\, ln\, EX_{t-6}$		0.13						
		(0.50)						
$\Delta\, ln\, WI_{t-1}$	0.36	-0.16	0.22	0.83	-0.15	0.09	0.12	0.07
	(2.46)	(-0.35)	(0.12)	(1.59)	(0.53)	(0.45)	(0.78)	(1.63)
$\Delta\, ln\, WI_{t-2}$	0.34	-0.28	0.31	1.49	0.20	-0.29	0.25	
	(2.27)	(-0.63)	(2.20)	(3.09)	(0.90)	(-1.54)	(1.65)	
$\Delta\, ln\, WI_{t-3}$		-0.32	0.18	0.95	-0.05	0.07		
		(-0.80)	(1.29)	(2.08)	(-0.25)	(0.36)		
$\Delta\, ln\, WI_{t-4}$		-0.29	0.06	1.05	0.00	-0.24		
		(-0.76)	(0.44)	(2.33)	(-0.02)	(-1.33)		
$\Delta\, ln\, WI_{t-5}$		-0.32	0.05	0.06	0.17			
		(-0.72)	(0.29)	(0.11)	(0.61)			
$\Delta\, ln\, WI_{t-6}$		-0.31						
		(-0.64)						
$\Delta\, ln\, REER_{t-1}$	0.07	0.78	0.22	0.37	0.08	-0.02	-0.04	-0.12
	(0.64)	(0.70)	(1.39)	(1.22)	(0.18)	(-0.06)	(-0.43)	(-2.11)
$\Delta\, ln\, REER_{t-2}$	0.32	-0.43	0.12	0.46	-0.08	-0.11	-0.06	
	(2.76)	(-0.39)	(0.72)	(1.45)	(-0.17)	(-0.38)	(-0.59)	
$\Delta\, ln\, REER_{t-3}$		-0.97	0.55	0.03	0.18	0.02		
		(-0.98)	(3.09)	(0.08)	(0.40)	(0.06)		
$\Delta\, ln\, REER_{t-4}$		-0.90	0.10	0.00	0.63	0.08		
		(-1.00)	(0.53)	(0.00)	(1.36)	(0.29)		
$\Delta\, ln\, REER_{t-5}$		0.40	-0.35	-0.05	0.22			
		(0.46)	(-1.97)	(-0.18)	(0.50)			
Speed of adjustment, α								
dlnIM	0.03	0.02	-0.05	0.12	0.04	0.02	-0.07	0.00
	(1.01)	(1.39)	(-1.40)	(2.44)	(2.39)	(1.99)	(-2.52)	(0.04)

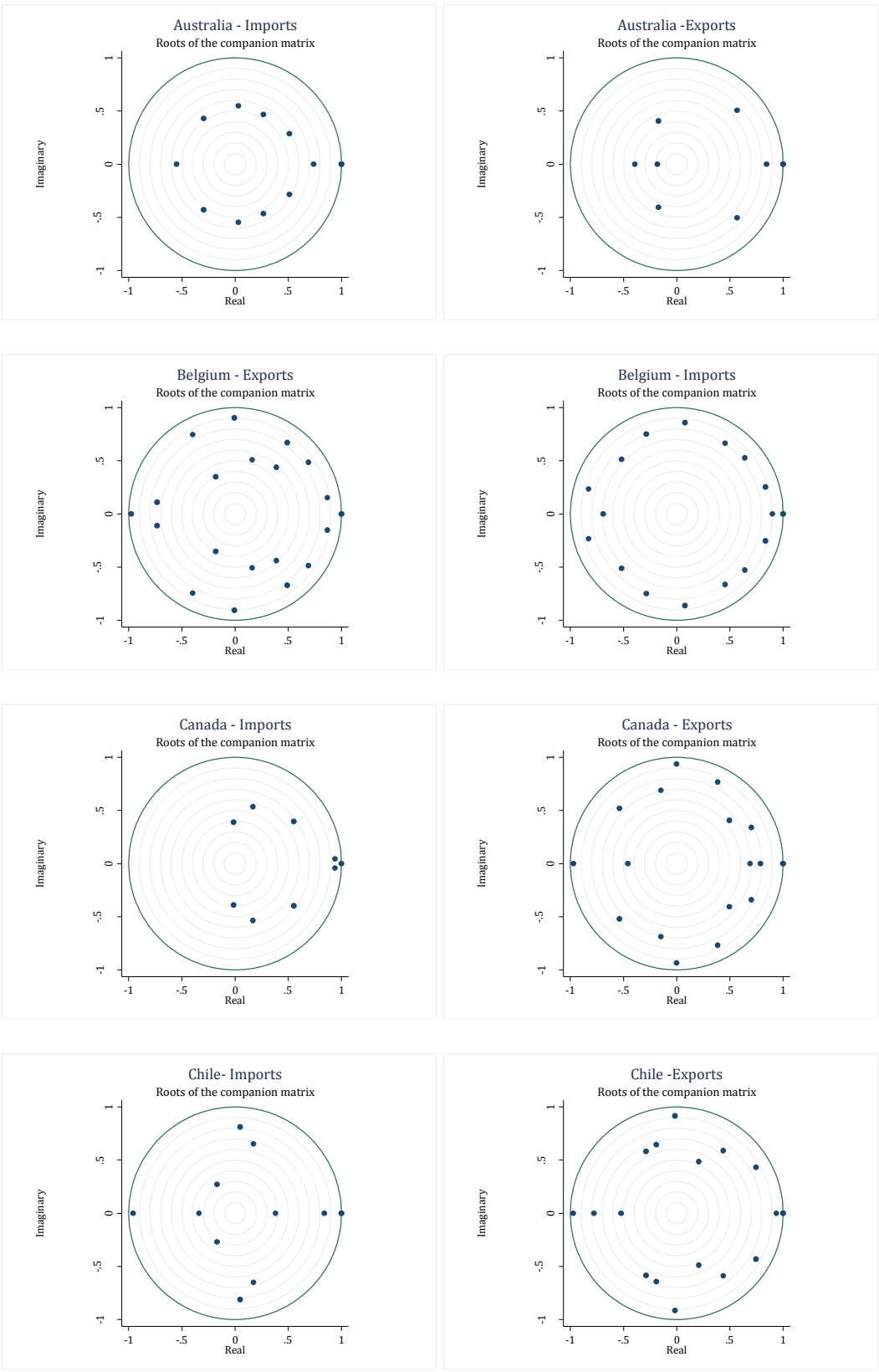
Notes: The symbol Δ is the difference operator. Figures in brackets are t-statistics.

Table A6: VECM System short-run coefficients, model II

Variables	Australia	Belgium	Canada	Chile	Finland	Italy	Korea	USA
$\Delta \ln TB_{t-1}$	0.18	-0.36	-0.07	-0.20	-0.30	0.36	0.16	-0.17
	(1.41)	(-1.88)	(-0.35)	(-1.44)	(-1.86)	(1.74)	(1.24)	(-1.97)
$\Delta \ln TB_{t-2}$	0.08	-0.32	-0.14	-0.42	-0.01	0.21	0.29	-0.29
	(0.76)	(-1.89)	(-0.67)	(-2.88)	(-0.05)	(1.07)	(2.26)	(-3.19)
$\Delta \ln TB_{t-3}$	-0.12	-0.21	0.17	-0.17	0.02	0.02	0.17	-0.19
	(-1.15)	(-1.30)	(0.91)	(-1.04)	(0.13)	(0.11)	(1.40)	(-2.01)
$\Delta \ln TB_{t-4}$	0.40		-0.08	0.16	0.10	0.54	0.12	-0.49
	(3.58)		(-0.53)	(0.95)	(0.16)	(3.49)	(1.14)	(5.31)
$\Delta \ln TB_{t-5}$				0.01	0.11	0.41		
				(0.07)	(0.93)	(0.24)		
$\Delta \ln TB_{t-6}$				-0.25				
				(-1.79)				
$\Delta \ln DI_{t-1}$	0.83	-0.02	-0.03	-2.25	-1.33	-0.20	-0.38	-1.12
	(0.73)	(-0.23)	(-0.02)	(-2.68)	(-3.31)	(-1.86)	(-0.98)	(-1.78)
$\Delta \ln DI_{t-2}$	1.41	-0.03	0.12	-2.22	-1.00	0.03	-0.21	-0.06
	(1.38)	(-0.42)	(0.09)	(-2.53)	(-3.96)	(0.39)	(-0.66)	(-0.09)
$\Delta \ln DI_{t-3}$	-1.38	-0.09	-1.37	-2.67	-1.02	-0.03	0.09	0.15
	(-1.38)	(-1.16)	(-0.94)	(-3.20)	(-4.01)	(-0.32)	(0.35)	(0.24)
$\Delta \ln DI_{t-4}$	0.65		0.78	-2.58	-0.78	-0.15	0.27	-0.96
	(0.61)		(0.71)	(-3.19)	(-3.19)	(-1.74)	(1.18)	(-1.59)
$\Delta \ln DI_{t-5}$				0.69	0.25	0.17		
				(-0.90)	(0.69)	(1.61)		
$\Delta \ln DI_{t-6}$				-0.73				
				(-1.03)				
$\Delta \ln REER_{t-1}$	-0.42	0.08	0.02	0.08	0.40	-0.01	0.06	0.31
	(-2.60)	(0.32)	(0.11)	(0.19)	(1.37)	(-0.04)	(0.20)	(2.16)
$\Delta \ln REER_{t-2}$	-0.08	0.14	0.28	0.98	-0.06	0.12	0.41	0.15
	(-0.44)	(0.60)	(1.37)	(2.35)	(-0.21)	(0.42)	(1.19)	(1.04)
$\Delta \ln REER_{t-3}$	0.22	-0.14	0.24	0.27	0.33	0.19	0.52	0.15
	(1.41)	(-0.63)	(1.23)	(0.60)	(1.09)	(0.69)	(1.57)	(0.24)
$\Delta \ln REER_{t-4}$	0.04		0.27	0.89	0.01	-0.10	1.14	0.14
	(0.25)		(1.37)	(1.93)	(0.03)	(-0.40)	(3.40)	(1.06)
$\Delta \ln REER_{t-5}$				0.32	0.30	0.08		
				(0.81)	(1.06)	(0.32)		
$\Delta \ln REER_{t-6}$				0.58				
				(1.45)				
$\Delta \ln CS_{t-1}$	49.43	14.97	-33.99	3.97	40.14	-40.46	-57.40	-0.36
	(1.56)	(1.78)	(-0.64)	(0.19)	(0.67)	(-2.11)	(-3.41)	(-0.01)
$\Delta \ln CS_{t-2}$	-204.05	-26.29	86.89	26.91	-75.08	74.087	151.31	39.98
	(-2.35)	(-1.33)	(0.61)	(0.50)	(-0.43)	(1.71)	(3.48)	(0.36)
$\Delta \ln CS_{t-3}$	270.91	14.83	-81.54	-16.88	-36.72	-38.39	-176.13	-93.14
	(2.98)	(1.52)	(-0.55)	(-0.24)	(-0.15)	(-0.75)	(-3.94)	(-0.83)
$\Delta \ln CS_{t-4}$	-129.70		31.05	-86.86	214.18	-13.519	85.91	68.67
	(-3.54)		(0.54)	(1.20)	(1.10)	(-0.34)	(4.66)	(1.58)
$\Delta \ln CS_{t-5}$				138.87	-135.36	18.04		
				(2.44)	(-1.86)	(1.16)		
$\Delta \ln CS_{t-6}$				-64.89				
				(-2.83)				

Notes: The symbol Δ is the difference operator. Figures in brackets are t-statistics.

Figure A1: Inverse Roots of AR Characteristic Polynomial, model I



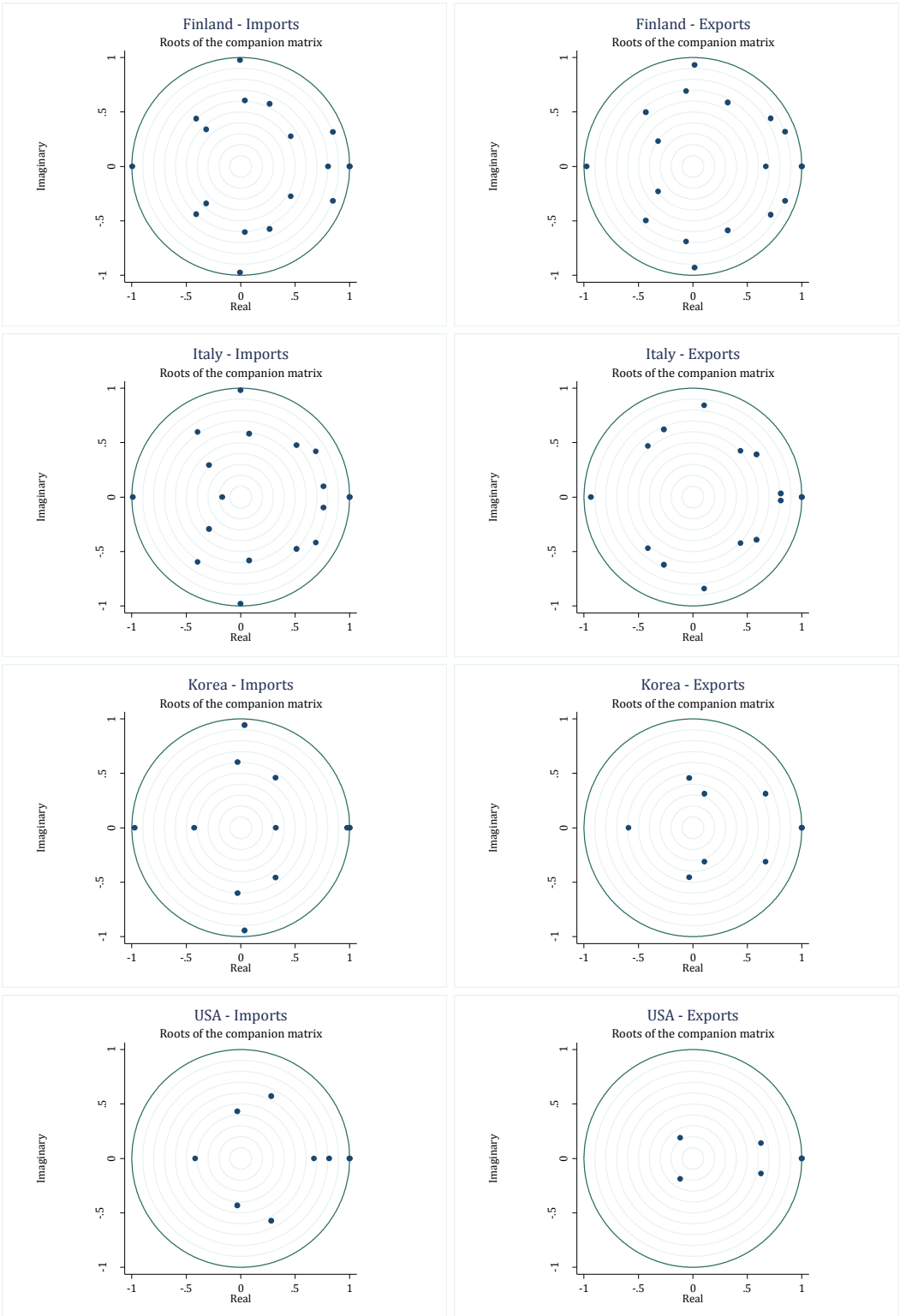

Finland - Imports
Roots of the companion matrix
Finland - Exports
Roots of the companion matrix
Italy - Imports
Roots of the companion matrix
Italy - Exports
Roots of the companion matrix
Korea - Imports
Roots of the companion matrix
Korea - Exports
Roots of the companion matrix
USA - Imports
Roots of the companion matrix
USA - Exports
Roots of the companion matrix
Imaginary
Real
-1
-.5
0
.5
1

Figure A2: Inverse Roots of AR Characteristic Polynomial, model II

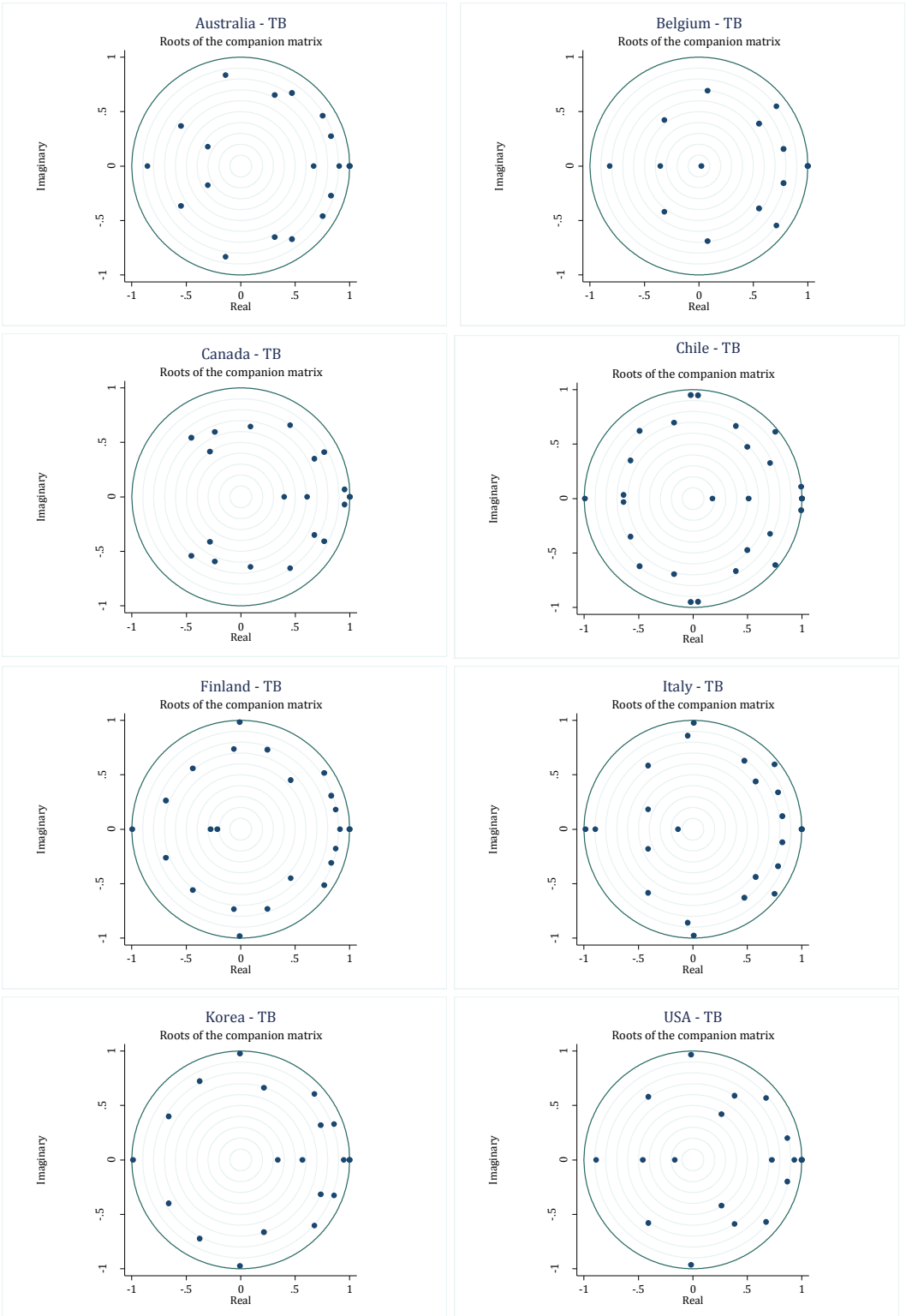


Figure A3: VECM impulse response functions of trade balance to real exchange rate shocks, model II

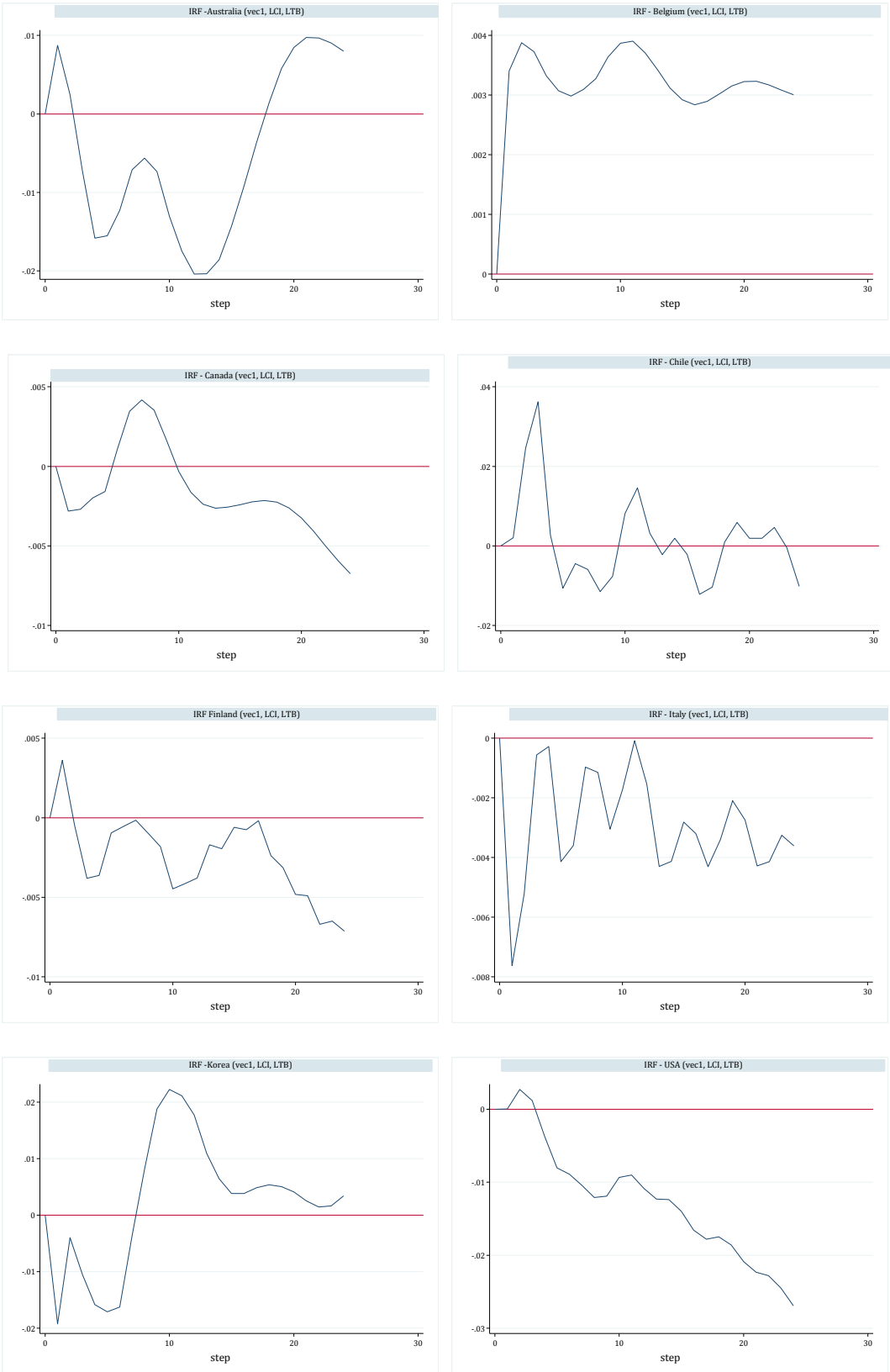


Figure A4: VECM impulse response functions of trade balance to capital stock index shocks, model II

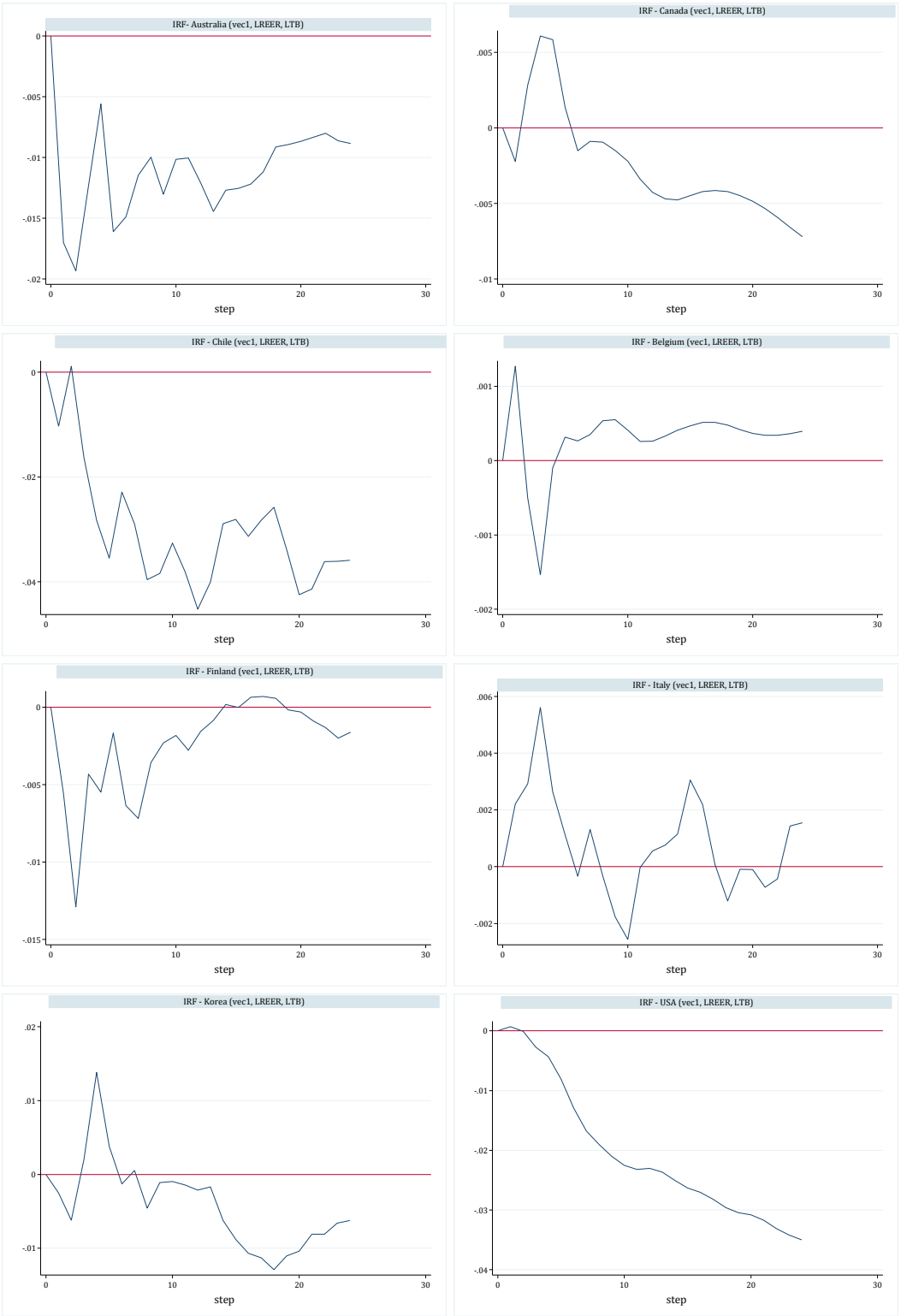


Table A7: VEC Residual Serial Correlation LM Test, model I – Imports

	Australia		Belgium		Canada		Chile		Finland		Italy		Korea		USA	
	LM-stat	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**
1	6.1670	0.72310	13.3923	0.14565	12.0598	0.20996	37.9294	0.00002	16.6939	0.05373	20.4894	0.01512	61.0042	0.00005	11.7494	0.22781
2	4.7838	0.85273	3.8842	0.91887	4.9907	0.83511	11.7115	0.23007	10.0237	0.34857	11.3990	0.24935	14.1803	0.11606	5.4683	0.79173
3	12.5556	0.18377	7.4197	0.59351	13.6418	0.13565	11.7533	0.22758	14.4359	0.10764	24.6012	0.00345	3.8674	0.91992	9.3566	0.40503
4	5.0048	0.83389	19.0462	0.02480	8.3881	0.49556	6.7249	0.66574	10.7601	0.29251	3.6246	0.93434	10.3013	0.32665	10.2167	0.33323
5	8.6936	0.46603	23.1792	0.00581	10.5339	0.30902	15.1040	0.08812	8.1425	0.51985	6.9460	0.64274	12.1318	0.20598	6.4371	0.69550
6	6.6552	0.67297	12.1723	0.20377	8.2740	0.50678	6.5949	0.67922	8.8455	0.45165	4.8665	0.84579	15.7729	0.07178	5.0912	0.82628
7	23.3092	0.00554	10.2929	0.32730	4.9244	0.84085	12.4516	0.18903	4.5091	0.87483	8.4546	0.48906	7.6451	0.57026	24.8620	0.00313
8	7.8185	0.55253	6.9656	0.64070	10.8845	0.28371	4.7519	0.85537	10.5241	0.30974	5.5214	0.78670	4.4603	0.87859	12.9215	0.16619

Table A8: VEC Residual Serial Correlation LM Test, model I – Exports

	Australia		Belgium		Canada		Chile		Finland		Italy		Korea		USA	
	LM-stat	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**
1	10.1999	0.33455	5.2257	0.81421	3.5828	0.93667	5.2862	0.80868	18.2697	0.03217	30.6683	0.00034	20.5637	0.01474	13.3353	0.14801
2	28.4056	0.00082	8.8651	0.44982	4.0643	0.90713	8.4491	0.48960	7.7621	0.55828	12.5769	0.18270	20.6974	0.01406	15.2545	0.08418
3	13.7460	0.13165	10.4423	0.31588	8.9006	0.44650	18.4372	0.03043	19.0514	0.02476	13.7273	0.13236	12.1373	0.20568	16.3720	0.05951
4	6.2949	0.67122	11.4401	0.24674	17.7353	0.03837	22.5238	0.00736	14.3433	0.11063	10.7763	0.29136	18.1882	0.032847	39.7559	0.00001
5	8.1361	0.52050	12.3973	0.19183	3.0681	0.96154	6.3656	0.70284	4.6224	0.86591	12.1701	0.20389	7.9191	0.54232	18.0472	0.03463
6	17.4747	0.04178	4.7421	0.85619	12.2717	0.19842	4.2534	0.89396	10.6601	0.29973	10.3556	0.32247	11.9466	0.21633	6.5461	0.68426
7	14.5969	0.10262	3.7369	0.92786	10.7800	0.29109	11.7034	0.23055	5.8712	0.75273	9.7971	0.36716	6.6583	0.67265	24.8620	0.00313
8	37.7359	0.00002	12.5042	0.18636	6.4461	0.69457	4.9084	0.84222	3.0906	0.96060	8.8255	0.45354	34.2841	0.00008	11.3210	0.21428

Table A8. VEC Residual Serial Correlation LM Test, model II

	Australia		Belgium		Canada		Chile		Finland		Italy		Korea		USA	
	LM-stat	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**	**LM-stat**	**prob**
1	26.8051	0.04370	35.0651	0.00389	20.8926	0.18268	37.3179	0.00189	27.2374	0.03892	18.8991	0.27393	32.2195	0.00936	12.0515	0.74043
2	21.2385	0.16952	21.9336	0.14535	11.4006	0.78411	27.3781	0.03747	24.5633	0.07790	16.0793	0.44744	16.3534	0.42858	18.7308	0.28287
3	29.8973	0.01854	15.2453	0.50675	23.7439	0.09525	13.9372	0.60339	17.3140	0.36557	16.2560	0.43524	26.0963	0.05269	19.3749	0.24970
4	39.4214	0.00095	32.7171	0.00805	31.2388	0.01254	50.5826	0.00002	48.6176	0.00004	38.3022	0.00137	25.7408	0.05779	56.7405	0.00000
5	18.0323	0.32201	26.6052	0.04608	12.5947	0.70213	29.7450	0.01937	13.2221	0.65645	12.2455	0.72691	17.8132	0.33495	22.7731	0.11994
6	12.7440	0.69137	8.8936	0.42603	9.2787	0.90149	15.0187	0.52327	18.2623	0.30876	15.9747	0.45472	20.2532	0.20903	11.3826	0.78528
7	22.1736	0.13767	11.7879	0.75845	11.1829	0.79806	13.5209	0.63436	18.0942	0.31841	13.1571	0.66124	13.2046	0.65774	13.8591	0.60921
8	14.2204	0.58230	27.5375	0.03588	19.0355	0.26683	14.5116	0.56066	12.0856	0.73807	14.9672	0.52704	14.8457	0.53597	30.5466	0.01537