The Effect of Global Financial Crisis on Trade Elasticities: Evidence from BRIICS Countries and Turkey

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Abstract: The effect of the global financial crisis on the international trade patterns of developed countries has been one of the main focuses of recent studies. However, the dependence level of world trade on emerging markets increases every day. Therefore, it is important to study the level of the negative effect of the crisis on emerging economies and the level of their recovery potential. This paper empirically studies the effects of the financial crisis on changes in the trade elasticities of BRIICS (Brazil, Russia, India, Indonesia, China and South Africa) countries and Turkey. The imperfect substitute model (Goldstein and Khan 1985) for the export and import demand functions is used. The autoregressive distributed lag (ARDL) approach to cointegration is applied to test the cointegration relationships between exports and imports and their determinants and in order to estimate the export and import elasticities in the countries under examination. The empirical results provide enough evidence to conclude that changes in the exchange rate did not play significant role in export and import demand functions before the global financial crisis and after. However, foreign and domestic incomes are found highly significant and elastic in export and import demand functions, respectively. It is found as well that the global financial crisis had increasing effect on export and import responsiveness to foreign and domestic incomes respectively, except for Turkey and Brazil in the export demand function and South Africa in the import demand function.

Keywords: financial markets; international trade; emerging markets.

JEL Classification Codes: F14, F41

1. Introduction

BRIC (Brazil, Russia, India and China) is a group of countries that are considered to be the biggest emerging economies with the highest growth rates. Due to their fast growth, it is believed that these countries may be among the most dominant countries in the world by 2050 (Goldman Sachs 2007). Indonesia and South Africa (BRIICS) were added to this group by the Organization for Economic Co-operation and Development (OECD) due to Indonesia's high level of population growth among middle income countries in South-East Asia, and due to South Africa's highest level of development compared to other African countries. Figure 1 and Figure 2 show trade patterns in the considered countries. All estimated countries have had tendencies of continuous growth in trade especially since 2000 with the extreme case of China. At the same time, it can be seen that all of the estimated countries have had sharp declines in exports as well as in imports in 2009 with the following recovering in 2010.

The development of the considered emerging countries was characterised by unsteady growth of GDP in the 1990s, and by significant declines in the cases of Russia and Indonesia. All

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BRIICS countries have followed accelerating positive growth since 2000, with the exception of Turkey, which had a decline in its real GDP in 2001 with subsequent recovery. However, it can be seen from Figure 3 that the growth of all BRIICS countries significantly slowed down in 2009, being affected by the global financial crisis with the extreme case of Russia, where a decline in real GDP was observed. In terms of the growth of real GDP, the countries that were least affected by the global financial crisis were China and Indonesia, while the country that was the most affected was India. After substantial slowdowns, all economies had substantial recovery in the following year, 2010.

A great deal of attention in the literature is spent on the contagion effect of the global crisis on the financial markets of emerging economies. Aloui et al. (2011) in their paper on the effect of the global financial crisis in BRIC countries employed a multivariate copula approach. They demonstrated that the financial markets of countries that are highly dependent on commodity prices, Brazil and Russia, are more heavily dependent on the United States compared to such countries as China and India, which are more dependent on the export prices of finished products. Dooley and Hutchison (2009) in their study using the decoupling-recoupling hypothesis evaluated the transmission of the U.S. crisis to emerging markets including the BRIICS and Turkey examples, except for India and Indonesia. They found that the equity markets of emerging economies appeared to have been isolated from the U.S. financial markets for the period starting from the date when the first signals of the crisis appeared in the U.S. until the summer of 2008. However, starting from the summer of 2008, the financial markets in emerging economies were found to be highly correlated to the deteriorating economic conditions of the U.S. Thus studies on the financial transmission of the crisis provide evidence of the moderate responsiveness of emerging financial markets to the signals of the crisis in the United States.

However, due to the short time span not enough studies have been completed on change in trade tendencies in response to the global crisis in the world, including emerging markets. For example, McKibbin and Stoeckel (2009) studied the potential impact of the financial global crisis on the world in 15 countries and regions including developed as well as developing countries by modelling the crisis as a combination of shocks to a set of changes in an economy. They found that financial crisis caused trade protectionism in terms of increased tariffs and support for domestic industries, which can lead to the deterioration of the domestic and trade partners GDPs. At the same time, the authors found that financial protectionism emerged as well, enforcing the decline in international trade flows. Chor and Manova (2010) in their study showed how credit conditions during the global financial crisis affected world trade flow. They found that high interbank rates and tight credit conditions were important channels of the transmission of financial crisis on trade flows.

This study seeks to clarify empirically the consequences of the global financial crisis in the trade sector of major developing countries. The focus of this study is on the trade patterns of the developing countries BRIICS and Turkey. This study estimates the effect of the financial crisis by measuring trade elasticities in export and import demand functions for two different periods on a quarterly basis, 1989Q1-2007Q2 and 1989Q1-2010Q4. It is known that first signs of the financial crisis took place in August 2007 in the U.S., followed by a global contagion effect that emerged in the second half of 2008 in many countries. To measure the trade elasticities of the developing countries two periods were chosen, the pre-crisis period and the full period including the global financial crisis and its contagion effect, to be able to capture the changes in trade elasticities that may have happened before and after the contagion effect started. The financial crisis that spread in the second half of 2008 generally may be defined as

a decline in foreign investments, changes in foreign debt servicing burdens, a reduction in trade credits and a global decline in total expenditures.

The paper is structured as follows. The next section highlights the main features of the pre- and post-crisis trade patterns of BRIICS countries and Turkey. Section 3 explains the methodology, applied export and import demand functions and outlines the testing strategy. Section 4 presents and discusses the main empirical results. Finally, Section 5 gives the concluding remarks for this study.

2. Methodology

To examine to what extent movements in the balance of trade are explained by change in relative prices, income and exchange rate the imperfect substitute model (Goldstein and Khan 1985) was employed for the export and import demand functions, where it is assumed that foreign and domestic products are imperfect substitutes.

$$X_{it} = f(P_{xit}, P_t^*, Y_t^*) \quad (1)$$

Where t denotes the time period of estimation, X_{it} is the total export of ith country, P_{xit} is the export price of ith country in the national currency, P_t^* denotes the foreign price deflator in the national currency of the estimated country, and Y_t^* is foreign real GDP expressed in the national currency of the estimated country. The total export in the equation 1 can be measured as total nominal exports deflated by export price index. However there is the lack of data on export price index on bilateral basis. Therefore, as an alternative, export values (or inpayments) are used to determine the currency and income changes. If we divide the right-hand side of equation (1) by foreign prices P_t^*, due to the linearity of demand functions the export demand is not going to change (Goldstein and Khan 1985). Therefore, the logarithmic form of the export demand function may be expressed in the following form:

$$LnX_{it} = c_0 + c_1 Ln(P_{xit}/P_t^*) + c_2 Ln(Y_t^*) + \varepsilon_t \quad (2)$$

Where LnX_{it} is the natural logarithm of the total export value of ith country, $Ln(P_{xit}/P_t^*)$ is the natural log of relative export prices of the estimated country relatively to foreign country and $Ln(Y_t^*)$ is the natural logarithm of the foreign income. Finally ε_t is the error term.

Due to the difficulty in obtaining the import and export prices of the estimated countries, equation 2 has to be modified. The modified approach used in the literature is to specify relations between export and import values and the real exchange rate. Studies such as those by Bahmani-Oskooee and Economidou (2005), Bahmani-Oskooee and Ratha (2008), Irandoust et al. (2006), Hsing (2008), Kwack et al. (2007), Kumar (2008), Bahmani-Oskooee et al. (2013), Huchet-Bourdon and Bahmani-Oskooee (2013) and others used real exchange rates in their studies to calculate the exchange rate elasticity. Therefore, the alternative log-linear form of the export demand function can be written as follows:

$$LnX_{it} = \alpha_0 + \alpha_1 Ln(E_t) + \alpha_2 Ln(Y_t^*) + \varepsilon_t \quad (3)$$

Where E_t is the real exchange rate calculated by the following formula: $ER\left(\frac{P}{P_*}\right)$, where ER is the nominal exchange rate represented in foreign currency per unit of domestic currency. As a proxy for domestic and foreign prices a GDP deflator is used (for similar studies, see Irandoust et al. [2006] and Kwack et al. [2007]). Y_t* is the real GDP of the foreign trade partner. For every estimated country, a set of nine countries is chosen as a representative of the foreign trade partner. Countries in every set are selected according to the highest time-varying bilateral trade shares between the estimated country and its trade partners.[2] It is expected that the coefficient of relative export price α_1 in equation 3 being negatively related to export value as an increase in domestic prices will decrease the demand for export while foreign price increase will raise the demand for export. Income elasticity α_2 may get different signs. It will get a positive sign if an increase in the foreign income raises demand for home country export. However, if foreign goods and services are highly competitive with home country export foreign income in this case can have negative effect on the export value from the home country.

The standard form of the import demand function can be expressed by the following equation:

$$M_{it} = f(P_{mit}, P_t, Y_t) \tag{4}$$

Where M_{it} is the import of ith country, P_{mit} is the import price of ith country in the national currency, P_t denotes domestic price deflator and Y_t is the domestic real GDP. There is a lack of data on import price index on bilateral basis, similar to export demand equation. Therefore, import values (or outpayments) are used to determine the currency and income changes in equation 4. Following the extraction of export demand function the right-hand side of equation (4) can be divided by domestic prices P_t. As a result, the import demand function is taking the following form:

$$LnM_{it} = \gamma_0 + \gamma_1 Ln(P_{mit}/P_t) + \gamma_2 Ln(Y_t) + u_t \tag{5}$$

Where LnM_{it} is the natural logarithm of the total import value for ith country, $Ln(P_{mit}/P_t)$ is the natural logarithm of relative import prices, $Ln(Y_t)$ is the natural logarithm of the domestic income. Finally u_t is the error term. The log-linear form of the import demand function corrected for import prices will take the following form:

$$LnM_{it} = \beta_0 + \beta_1 Ln(E_t) + \beta_2 Ln(Y_t) + u_t \tag{6}$$

[2] The following countries were selected as proxy for foreign trade partner: Turkey – Germany, China, Russia, United States, Italy, France, Spain, the United Kingdom, the Netherlands; Brazil – the United States, China, Argentina, Germany, Japan, Italy, France, the United Kingdom, the Netherlands; Russia – China, Germany, the United States, France, Italy, Japan, the United Kingdom, the Netherlands, Turkey; India – China, the United Arab Emirates, the United States, Australia, Germany, Switzerland, Korea, Japan, the United Kingdom; Indonesia – Singapore, China, Japan, United States, Malaysia, Korea, Thailand, Australia, Germany; China – Japan, Korea, the United States, Hong Kong, Germany, Australia, Malaysia, Russia, Thailand: South Africa – China, Germany, the United States, Japan, the United Kingdom, India, France, Italy, Netherlands.

Where E_t is the real exchange rate calculated by the following formula: $ER\left(\frac{P^*}{P}\right)$, where *ER* is the nominal exchange rate represented in domestic currency per foreign currency. *Y* is the domestic output. It is assumed that the relative import prices coefficient β_1 will be related negatively to the import quantity as according to the demand theory increase in the import price will reduce the import demand while increase in domestic prices will raise demand for import. However, income elasticity β_2 can have different signs as in the case of the export demand function. If there are no alternatives for imported goods in the domestic production, income will have a positive effect on the import volume. However, if there are a lot of import substitutes in the domestic production, an increase in the domestic income can lead to a decrease in the import demand.

The focus of the analysis is to study the long-run relationship and dynamic interactions among the variables in the export and import demand functions. To incorporate the short-run dynamics, the autoregressive distributed lag (ARDL) approach to cointegration is applied. The ARDL approach involves two steps for estimating the long-run relationship (Pesaran et al. 2001). The first step is to examine the existence of long-run relationship among all variables in an equation and the second step is to estimate the long-run and short-run coefficients of the same equation. The second step determines the appropriate lag lengths for the independent variables and is applied only in the case if cointegration relationships are found in the first step. In error-correction models, the long-run multipliers and short-run dynamic coefficients improve the export demand function as follows:

$$\Delta \log X_t = \lambda_0 + \sum_{i=1}^{p} \lambda_1 \Delta \log X_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta \log E_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta \log Y^*_{t-i} +$$

$$+ \phi_1 \log X_{t-1} + \phi_2 \log E_{t-1} + \phi_3 \log Y^*_{t-1} + \varepsilon_t . \qquad (7)$$

The error correction model for the import demand function is as follows:

$$\Delta \log M_t = \mu_0 + \sum_{i=1}^{p} \mu_1 \Delta \log M_{t-i} + \sum_{i=0}^{p} \mu_2 \Delta \log E_{t-i} + \sum_{i=0}^{p} \mu_3 \Delta \log Y_{t-i} +$$

$$+ \varphi_1 \log M_{t-1} + \varphi_2 \log E_{t-1} + \varphi_3 \log Y_{t-1} + u_t .$$

(8)

Equations (7) and (8) may be transformed to following equations in order to accommodate the one lagged error correction term:

$$\Delta \log X_t = \lambda_0 + \sum_{i=1}^{p} \lambda_1 \Delta \log X_{t-i} + \sum_{i=0}^{p} \lambda_2 \Delta \log E_{t-i} + \sum_{i=0}^{p} \lambda_3 \Delta \log Y^*_{t-i} +$$

$$+\delta_1 EC_{t-1} + \varepsilon_t$$

(9)

$$\Delta \log M_t = \mu_0 + \sum_{i=1}^{p} \mu_1 \Delta \log M_{t-i} + \sum_{i=0}^{p} \mu_2 \Delta \log E_{t-i} + \sum_{i=0}^{p} \mu_3 \Delta \log Y_{t-i} +$$

$$+\nu_1 EC_{t-1} + u_t$$

(10)

The ARDL approach is used to establish whether the dependent and independent variables in each model are cointegrated. The null of no cointegration $H_0 : \phi_1 = \phi_2 = \phi_3 = 0$ in the export demand model is tested against the alternative hypothesis of $H_1 : \phi_1 \neq \phi_2 \neq \phi_3 \neq 0$. In the import demand function the null of no cointegration $H_0 : \varphi_1 = \varphi_2 = \varphi_3 = 0$ is tested against the alternative hypothesis of $H_1 : \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq 0$.

The Walt-type (F-test) coefficient restriction test is conducted, which entails testing the above null hypotheses H_0 and H_1. Pesaran et al. (2001) computed two sets of asymptotic critical values for testing cointegration relationships existence. The first set assumes variables to be I(0), the lower bound critical value (LCB) and the other I(1), upper bound critical value (UCB). If the F-statistic is above the UCB, the null hypothesis of no cointegration can be rejected irrespective of the orders of integration for the time series. Conversely, if the test falls below the LCB, the null hypothesis cannot be rejected. Finally, if the statistic falls between these two sets of critical values, the result is inconclusive.

Since the results of the F-test are sensitive to lag lengths, we apply various lag lengths in the model. However, as Pesaran and Pesaran (1997, 305) argue that variables in regression that are "in first differences are of no direct interest" to the bounds cointegration test. Thus, a result that supports cointegration at least at one lag structure provides evidence for the existence of a long-run relationship. Alternatively, Kremers et al. (1992) and Banerjee et al. (1998) have demonstrated that in an ECM, significant lagged error-correction term is a relatively more efficient way of establishing cointegration. So, the error correction term can be used when the F-test is inconclusive.

3. Empirical Results

3.1 Cointegration Test

In order to ascertain whether the tested variables are stationary, the ARDL cointegration test was employed. Based on the cointegration test results represented in Table 1, the strong evidence of the cointegrating relationship was found in export demand functions in all countries except India and South Africa. On the other hand, weak evidence for cointegration was found for the cases of Russia and Indonesia with a 10% significance level. Testing Import demand functions, the existence of cointegration can be confirmed with 1 and 5% significance levels in all cases except Brazil, where cointegration was confirmed with a 10% significance level, while

in the case of China the hypothesis of no cointegration was accepted. Therefore, continuing with further estimations, India and South Africa in export demand function and China in import demand function cannot be included.

3.2 Cointegration Coefficient Estimates

The stationarity of the linear combination of a group of non-stationary series is defined by the cointegration test. In order to find the long-run equilibrium relationship among variables, the linear combination of the non-stationary time series has to be stationary. The long-run cointegrating coefficients are estimated by using ARDL procedure, where the appropriate autoregressive order was chosen by using the Schwarz criterion (SC), and presented in Table 2. The coefficients α_1 and β_1 represent long-run elasticities of real exchange rate for export and import demand functions on the basis of equations 3 and 6, respectively. The coefficients α_2 represent the long-run elasticities of foreign income for the export demand function (equation 3), while the coefficients β_2 illustrate the long run elasticities of domestic income for the import demand function (equation 6).

It is assumed in the paper that the real exchange rate coefficients of export and import, respectively, are related negatively to trade flows. An increase in relative foreign prices may lead to an increase in export demand. On the other hand, an increase in export prices leads to a decline in export demand (see equation 2). Whereas in the case of import demand function a raise in foreign prices leads to a decline in import demand, while an increase in domestic prices leads to an increase in import demand (see equation 5). The results of long-run coefficient estimations are presented in Table 2, where India and South Africa are not included due to the lack of cointegration relationships in the export demand function. From Table 2 it can be seen that in the export demand function exchange rate elasticities of Turkey, Brazil, Indonesia and China produced the expected negative sign and only in the case of Russia was the real exchange rate elasticity estimated with positive sign for the considered periods. In all cases of the export, demand function exchange rate elasticities appeared to be inelastic in addition to being very close to zero. However, the majority of exchange rate estimates did not show significance, which illustrates that the real exchange rate does not influence the export demand in the considered developing countries in the long run.

Insignificant change in the values of the exchange rate elasticities can be observed when different estimation periods are compared. Thus in the cases of Brazil, Russia and Indonesia exchange rate elasticities almost did not show any changes in the period of the global financial crisis compared to the pre-crisis period 1989-2007. In the case of Turkey, the exchange rate elasticity of exports declined and appeared to be significant in the period covering the crisis, thus illustrating the decline of the export responsiveness to prices. In the case of China, however, the exchange rate elasticity increased in the full period; nevertheless, the elasticity value is so small and insignificant that it is still illustrates the low responsiveness of exports to the real exchange changes in the long run.

The results of the estimations are consistent with some results in the literature. For example, in the case of Turkey, Ozkale and Karaman (2006) concluded that price is inelastic and the sign of the real exchange rate is negative for the export demand function for goods trade. While Aydin et al. (2004), on the other hand, found that the exchange rate is inelastic for goods but a positive in sign in Turkey. Hossain (2009) found as well that the long-run relative price elasticity of the demand for exports is significantly lower than that in Indonesia.

Vieira and Haddad (2011) found in the case of Brazil that the trade weighted real exchange rate elasticity of manufactured export is inelastic with expected negative sign. Algieri (2004) found

that in case of Russia the relative prices elasticity of exports is significant and elastic with expected negative sign, contrary to the results of the present study. However, the exports of Russia in Algieri (2004) did not include oil, gas or its product. The inclusion of oil and energy products in exports produced the inelasticity of exports to relative prices, indicating that the demand for energy products are inelastic to change in prices. On the other hand, the real exchange rate elasticity in the Chinese export demand function in Cheung et al. (2009) was found with significant and highly elastic with negative sign. However, Cheung et al. (2009) in their study use the CPI-deflated exchange rate, which may be a weaker measure compare to the GDP deflator, and may produce different results.

Thus the export estimation results show that changes in the real exchange rates do not affect exports in the long run considering the pre-crisis periods and the period that saw the global financial crisis.

The long-run income elasticities α_2 and β_2 of export and import, respectively, are expected to have a positive sign demonstrating increase in export value as a result of growing foreign incomes. Respectively, an increase in domestic incomes is expected to increase the demand for imports, giving positive sign to elasticity. Estimations of the export demand function provide enough evidence to assume a positive relationship between income and export demand in all of the considered countries with high significance levels in the majority of cases. In the cases of Turkey and Brazil, the long-run income elasticities of export demand function are elastic and significant with positive sign. The results illustrate that the income elasticities are higher in pre-crisis periods than in the period that experienced the financial crisis. Thus it can be concluded that the general trend of high export responsiveness to income slightly declined as a result of the global financial crisis. However, in the cases of Russia, Indonesia and China, the long-run export responsiveness to foreign incomes increased in the period which experienced the financial crisis with a high significance level only in the case of Indonesia.

The statistical data show that Indonesia was one of the first to recover from the global crisis countries out of the considered countries. Indonesia has the highest growth rate of exports value in 2010 compare to 2008. If in 2009, all of the considered countries had significant declines in export trade, in 2010 the exports values of Turkey and Russia were lower compare to 2008, while in Indonesia the exports value were 15% higher than in 2010. In second and third place were India and China, where the growth rate was 11 and 10%, respectively.

The results of the estimations are consistent with those of the literature. For example, Algieri (2004) found that the world income long-run elasticity of exports is elastic in the case of Russia. Hossain (2009) in its study found evidence that long-run income elasticity for Indonesia's exports is significantly greater than one, which is consistent with the present study. These results are similar to the outcomes of Cheung et al. (2009) that produce high and statistically significant income elasticity of exports. The results illustrate that growing incomes of trading partners proportionally increase export demands for Russian, Indonesian and Chinese goods.

Accordingly, we have enough evidence to conclude that it is primarily the foreign income that affects the export demand in the long run in BRIICS countries and Turkey. It is found that while the tendency of export responsiveness to foreign income decreased in the cases of Turkey and Brazil in the period when the financial crisis is included, in the cases of Russia, Indonesia and China there was an increasing tendency in export responsiveness to foreign income. The trading partners of Turkey and Brazil had slight changes for import substituted goods, while in the cases of Russia, Indonesia and China trade partners that had a tendency to increase imports from these countries after the financial crises was included. The tendency of increased imports may illustrate the comparative advantage of trading goods compare to local ones, while the global

crisis has a negative effect on the competitiveness level of local production. However, the results illustrate that the trading partners of Turkey and Brazil prefer an import substitution policy during crises, which significantly decreased the value of the exports of these countries. These results are supported by statistical data[3] demonstrating a 12% decline in export values in 2010 compared to 2008, while in Brazil export values increased in 2010 only by 2% compared to 2008.

The estimations of the import demand function do not include the case of China due to the absence of cointegration relationships between variables. The estimates of the long-run exchange rate coefficients produced an expected negative sign only in the case of Russia, while in all other cases the long-run exchange rate elasticity appeared to be positive. In all of the estimated countries the long-run exchange rate elasticity was found inelastic. In the cases of Brazil, India and Indonesia, the exchange rate elasticities were found inelastic, nearly close to zero, and they were not found to be significant in the import demand function. Estimates of the long-run exchange rate elasticities of Turkey and South Africa were found to be significant and inelastic with positive sign.

The depreciation of domestic currency leads to a slight increase in imports indicating signs of the possible presence of a J curve. The assumption of existence of the J curve effect in the cases of Turkey and South Africa are verified by results obtained on the exchange rate elasticities of exports. The depreciation of a currency making exports cheaper to foreign buyers therefore exports increase and imports decrease. However, in the short run, such reasons as existing contracts, the inelasticity of exports or imports, the absence of alternative, do not allow exports or imports to change significantly. In these cases depreciation is followed by an increase in import values and decrease in export values. In this study, increases in imports and decreases in exports following depreciation in the cases of Turkey and South Africa are reflected by long-run coefficients as well, without the indication of balance of trade improvement in the long run. However, it is important to note that the current study is carried out on the basis of quarterly data, where the long-run term still may be short enough to illustrate the balance of trade improvement.

Similar results are found in the literature as well. Ogus and Sohrabji (2009) found that the exchange rate has a negative effect on Turkish exports; however, they found that the exchange rate has negative effects on imports as well. Aydın et al. (2004) found that real depreciation will not increase exports significantly; however, in their study they found that depreciation will decrease the volume of imports significantly. Narayan and Narayan (2003) found relative prices of elasticity of demand in South Africa inelastic as well; however, with negative sign. The values of the long-run exchange rate elasticities in the cases of Turkey and South Africa were found to be similar in the estimated pre and post crisis periods, providing additional evidence of the exchange rate insignificance in the long run for the considered countries. In the case of Russia, long-run exchange rate coefficients were found significant with expected negative sign indicating that the depreciation or appreciation of the Russian ruble leads to a decrease or increase in imports, respectively. However, the inelasticity of the exchange rate indicates that changes in imports that take place due to the real exchange rate fluctuations are not major. On the other hand, it can be seen that the real exchange rate appeared to be more inelastic and insignificant in the period which covered the global financial crisis.

All coefficient estimates of income for import demand function were found to be elastic with positive sign. In most of the estimated countries long-run income elasticities were found statistically significant. The positive sign of income elasticity shows that with an increase in

[3] OECD statistics.

income, the estimated countries have higher preferences for imported goods than for domestic ones. In all of the estimated countries, except South Africa, the values of long-run income elasticities demonstrate increase in the period which covered the global financial crisis. This indicates that the global crisis did not deteriorate demand for imports in the considered developing countries; conversely it shows an increasing tendency in demand growth for import in response to growing domestic incomes. The period 1989-2010, which demonstrates an increase in long-run income elasticities, was characterised by sharp declines in domestic incomes in all of the considered countries at the end of 2008 and at the beginning of 2009 (see Figure 3). Therefore, increased income elasticities may be interpreted as a rising tendency in import decline in response to declining domestic real incomes during the global financial crisis. Estimates of the long-run income elasticities of South Africa reveal a decline in the period covering the crisis indicating a slight decline in the import demand response to income changes.

In general, there is enough evidence to conclude that the real exchange rate does not significantly affect the export and import demands in the long run in the estimated developing countries. On another hand, export demand is highly dependent on foreign income. In Turkey and Brazil, the export demand response to foreign income changes declined in the period covering the global crisis. This indicates that the global financial crisis slightly directed the trading partners of Turkey and Brazil towards import substituting policies, or towards cheaper producers; however, these changes were not major. In Indonesia, the response of export demand to changes in the foreign incomes increased, indicating that as a result of an effect of the financial crisis, an increase or decrease in foreign income led to a higher increase or decrease in export demand, respectively. The estimations provide enough evidence of high dependence on the import demand function on the domestic income in the long run. The estimations illustrate that the import demand became more sensitive to changes in domestic income after the effect of the global crisis in Turkey, Brazil, Russia, India and Indonesia, while the level of dependence of imports on domestic incomes slightly declined in South Africa.

3.3 Error Correction Model

The vector error correction model is designed for cointegrated series. The vector error correction model specifies the short-run adjustment dynamics for long-run equilibrium deviations. The results of the short-run coefficient estimates associated with the long-run relationships obtained from the ECM version of the ARDL model are presented in Table 3. The ECM coefficient is supposed to be significant with negative sign indicating the speed of the adjustment of variables to the long-run equilibrium. Error correction terms δ_1 for the export and ν_1 for the import demand functions, respectively, were found negative and statistically significant in the case of Indonesia in the first period of the export demand function and in Turkey, Brazil and Indonesia in the second period. Estimating the import demand function error correction terms were found negative and statistically significant in the cases of Turkey, Russia and South Africa in the first period and in Turkey, India, Indonesia and South Africa in the second period. These results ensure once more that stable long-run relationships among the variables in the model of current account balances exist in all considered countries, as noted by Kremers et al. (1992) and Bannerjee et al. (1998).

The magnitude of the error correction term in the export demand function is between -0.019 and -0.108, depending on the estimated country in the first period, and between -0.021 and -0.115 in the second period. Therefore, it implies that disequilibria in the export demand function was corrected by approximately 2-11% every quarter (respective to country) before the global financial crisis. This means that a steady state equilibrium in the export demand function can be reached between 2 and 13 years, respective to country in the pre crisis period. However, in

the period covering the crisis, the general tendency of the disequilibria correction almost did not change, the steady state equilibrium was reached in the period between 2 and 12 years, respective to country. Only some slight changes were observed on the individual country level. Thus, in Turkey, the steady state equilibrium was reached in approximately 6 years in the pre crisis period, while under the effect of the global crisis this period declined to 2 years.

In the import demand function the equilibrium adjustment speed is higher compare to export functions. Thus the magnitude of the error correction term is between -0.055 and -0.296 in the pre crisis period and between -0.055 and -0.294 in the full period. Therefore the steady state equilibrium can be reached in the period between less than a year and four and half years. Particularly in Turkey the steady state equilibrium was reached in less than a year with no effect from the global crisis, while in South Africa the adjustment process declined from year and a half before the crisis to three years and a half under the effect of the crisis.

Signs of the short-run elasticities are consistent with those of the long-run elasticities signs from Table 2. Strong support was found for concluding that the short-run exchange rates do not play a very important role in the long-run behaviour of import and export demands. In contrast to studies on export and import demand functions for services, where for example Ketenci and Uz (2010) in the example of Turkey found that short-run exchange rate elasticities of export and the import of services are highly elastic compared to inelastic long-run exchange rate elasticities. In all countries, the short run exchange rate elasticities in export as well as in import demand functions were found highly inelastic, nearly close to zero. Thus, only 0.1% of the disequilibrium of import in Turkey is corrected by exchange rate, and only 0.01 % of the disequilibrium of export in China is corrected by exchange rate. In contrast to studies on export and import demand functions for services, where, for example, Ketenci and Uz (2010) in the example of Turkey found that short-run exchange rate elasticities of export and import of services are highly elastic compare to inelastic long-run exchange rate elasticities.

Signs of the short-run income elasticities are consistent with signs of the long-run income elasticities in export as well as in import demand functions, except for the case of Turkey, where the short-run foreign income elasticity appeared with negative sign indicating that with an increase of income, foreign countries follow import substitution policies. However, the short-run income elasticity in the case of Turkey was not found significant; therefore, the conclusion cannot be certain. Estimations of the export demand function illustrate that in all countries except China the short-run foreign income is inelastic, demonstrating that on average about 20% of the disequilibrium in the export was adjusted by foreign income in the pre crisis period in the considered developing countries. On the other hand, the global financial crisis increased the importance of foreign income for export demand. Thus as a result of the crisis effect between 25 and 40% of the disequilibrium in export, respectively to a country, was adjusted by foreign income. In the case of China, foreign income was found to be highly important for export demand with increasing tendency after the crisis. Thus more than 300% disequilibrium in export was adjusted by foreign incomes in the pre-crisis period, while under the effect of the global crisis foreign income was responsible for adjustment of 400% of disequilibrium in export.

Estimations of the short-run income elasticities in the import demand function provided highly statistically significant results in all countries. In all countries, the global crisis increased the importance level of domestic incomes in the import demand function by increasing the value of the short-run income elasticities. The extreme case is South Africa, where before the crisis about 70% of the disequilibrium in imports was adjusted by domestic income, while with the effect of the crisis domestic income became responsible for more than 500% of the disequilibrium in imports, illustrating the steep increase in the import demand sensitivity level

to domestic incomes in South Africa. In other words, when deviations from the long-run equilibrium occur in the export and import demand functions of selected countries, it is primarily the foreign and domestic incomes that adjust to restore long-run equilibrium each quarter in the export and import demand functions, respectively, rather than the real exchange rate.

4. Conclusion

This paper empirically examined the effects of financial crisis on changes in the trade elasticities of BRIICS (Brazil, Russia, India, Indonesia, China and South Africa) countries and Turkey. The effect of the financial crisis was estimated by measuring trade elasticities in export and import demand functions for two different periods on the quarterly basis: 1989Q1-2007Q2 and 1989Q1-2010Q4. The first period was the pre-crisis period and second was the full period that covered the global financial crisis and its contagion effect. These two periods were studied in order to capture the changes in trade elasticities happened before and after the contagion effect started.

The empirical results provide strong support for concluding that short-run exchange rates do not play a very important role in the long-run behaviour of import and export demands. In all of the estimated countries, except China, the short-run foreign income was found inelastic with increasing tendency under the effect of the global crisis. The short-run income elasticities in the import demand function were found highly statistically significant and elastic in all countries. The results indicate that in all estimated countries the global crisis increased the importance level of domestic incomes in import demand.

The empirical results of long-run coefficients provide enough evidence to conclude that changes in the real exchange rate do not significantly affect the export and import demands in the long run. On another hand, foreign and domestic incomes were found highly significant and elastic in export and import demand functions. In Turkey and in Brazil, the responsiveness of export demand to foreign income declined after the global crisis. This indicates that the global financial crisis slightly directed the trading partners of Turkey and Brazil towards import substituting policies or towards cheaper producers. In Indonesia, the global financial crisis increased the sensitivity of export demand to changes in foreign incomes. Indonesia is one of a few countries that did not negatively affected by the financial crisis. Indonesia increased its global market share and domestic sales as well. This increase in exports is mainly attributable to resource based commodities, while there is still limited progress in exports of manufactured products[4].

The empirical results illustrate the high dependence level of the import demand function on the domestic income in the long run. Thus the import demand became more sensitive to changes in the domestic income as a result of the global crisis effect in Turkey, Brazil, Russia, India and Indonesia, while the level of the dependence on imports on domestic incomes slightly declined in South Africa.

In general, the responsiveness of exports and imports to the exchange rate in the considered emerging markets was very low and in many cases insignificant, where the global crisis did not have any effect on these relationships. On the other hand, the crisis in most of countries increased the already high responsiveness of exports and imports to foreign and domestic incomes, respectively. Taking into account that the incomes in the world improved after the crisis and started to increase in 2009 and 2010, it can be concluded that recovering from the crisis's negative effects emerging countries and their partners did not close their countries, but followed the tendency of international trade increase. Therefore, the trade policies of emerging countries should be based mainly on foreign and domestic incomes. The further research has to include extended dataset that will be helpful in estimation of the effect of new slowdown in the world's growth.

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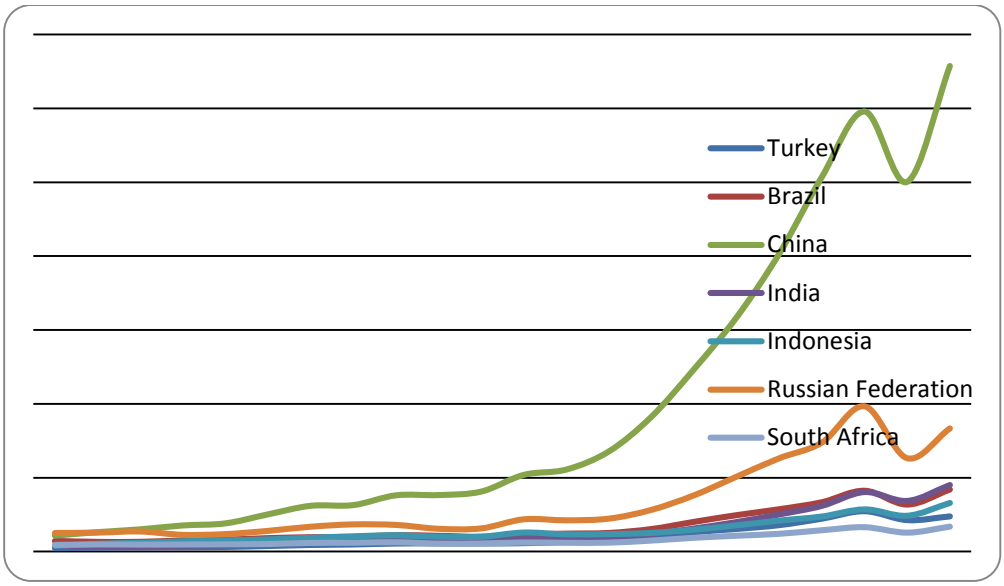
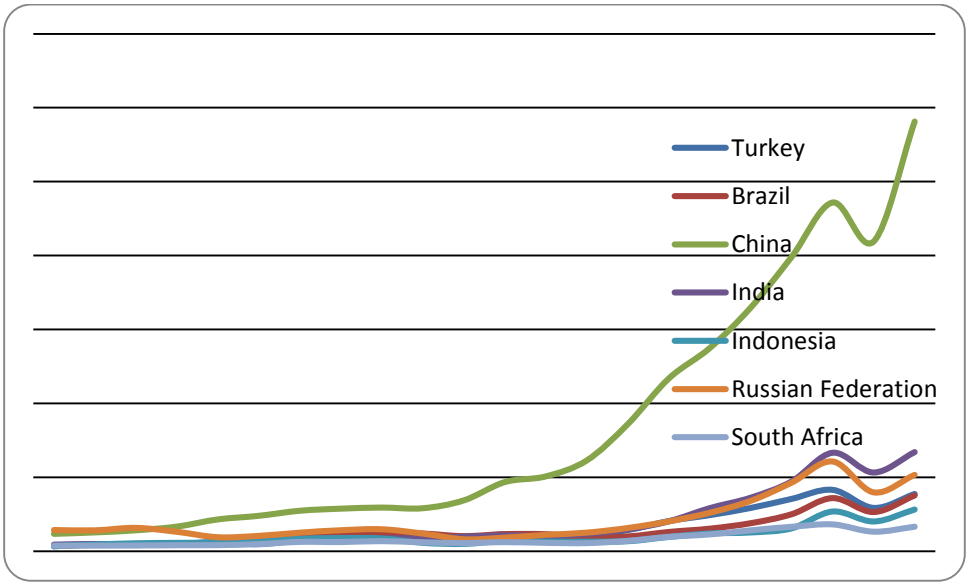
Figure 1. Exports in billions of US dollars



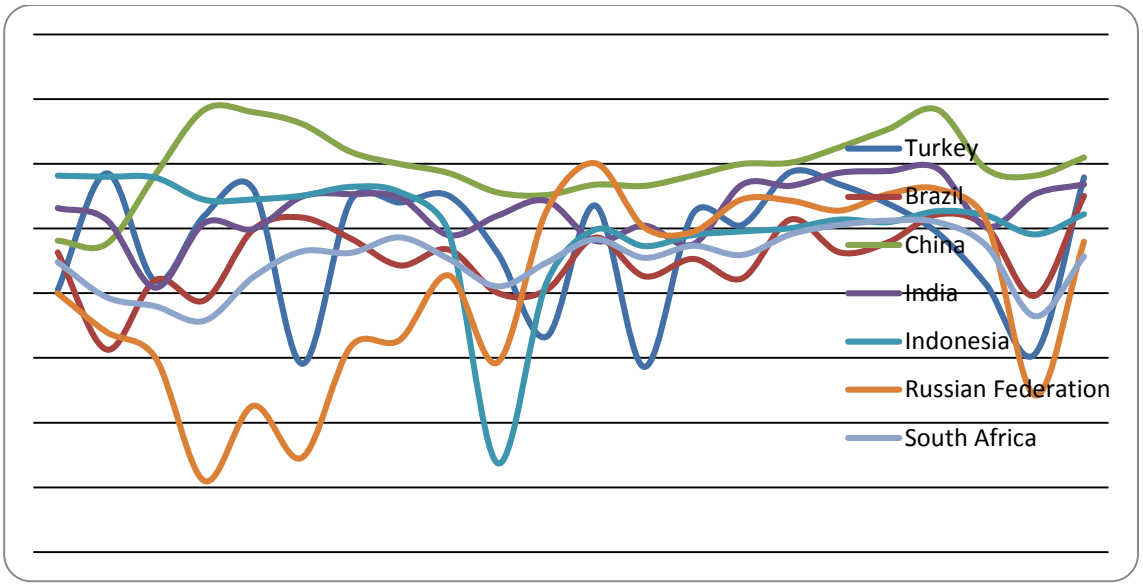
Source: Calculations are made on the basis of OECD statistics

Figure 2. Imports in billions of US dollars



Source: Calculations are made on the basis of OECD statistics

Figure 3. Real GDP, Growth Rate



Source: Calculations are made on the basis of OECD statistics

Table 1. F-statistics for testing cointegration relationship

		EXPORT			**IMPORT**	
Country	**Lags**	**F-statistic**	**Probability**	**Lags**	**F-statistic**	**Probability**
Turkey	6	F(3,57)= 2.887*	0.043	6	F(3, 57)= 4.005**	0.012
Brazil	4	F(3, 65)= 3.356**	0.024	6	F(3, 57)= 2.534	0.066
Russia	1	F(3, 77)= 2.261	0.088	5	F(3, 61)= 3.268**	0.027
India	4	F(3, 65)= 1.313	0.278	1	F(3, 77)= 3.703**	0.015
Indonesia	1	F(3, 77)= 2.684	0.052	3	F(3, 69)= 4.026**	0.011
China	6	F(3, 57)= 4.551**	0.006	6	F(3, 57)= 0.208	0.890
South Africa	6	F(3, 57)= 1.004	0.398	6	F(3, 57)= 8.359*	0.000

Notes: Asymptotic critical value bounds are obtained from Table "Critical values for the bounds test" case III: unrestricted intercept and no trend for k=3 from Narayan (2005). *, ** indicate significance at 10 and 5 percent levels, respectively.

Table 2. Cointegration Coefficient Estimates (long run) 1989-2010

Export	**Coefficients**	**lag**	**1989-2007**	**lag**	**1989-2010**
Turkey	α1	(3,0,1)	-0.038 (0.041)	(1,0,1)	-0.014** (0.006)
	α2		6.128* (3.685)		3.979*** (0.403)
Brazil	α1	(1,0,0)	-0.002 (0.002)	(1,0,0)	-0.002 (0.0009)
	α2		5.478* (2.957)		4.852*** (1.087)
Russia	α1	(1,1,0)	0.008 (0.018)	(1,1,0)	0.003 (0.010)
	α2		2.673 (2.859)		3.158 (1.957)
India	α1		-		-
	α2		-		-
Indonesia	α1	(1,0,0)	-0.002 (0.003)	(1,0,0)	-0.003 (0.003)
	α2		1.909*** (.3656)		2.250*** (0.311)
China	α1	(1,0,1)	-0.0001** (0.00006)	(1,0,2)	-0.008 (0.008)
	α2		3.429** (1.475)		14.570 (9.706)
South Africa	α1		-		-
	α2		-		-
Import					
Turkey	β1	(1,0,2)	0.004** (0.002)	(1,1,1)	0.005**(0.002)
	β2		2.995*** (0.141)		3.192*** (0.111)
Brazil	β1	(2,0,3)	-0.00001 (0.002)	(2,0,4)	0.00043 (0.001)
	β2		2.134 (2.062)		2.428** (1.198)
Russia	β1	(1,0,0)	-0.019*** (0.007)	(1,0,2)	-0.001 (0.013)
	β2		1.327** (0.543)		2.927 (2.184)
India	β1	(1,0,0)	0.0002 (0.0004)	(1,0,0)	0.003 (0.003)
	β2		0.184** (0.079)		2.161*** (0.249)
Indonesia	β1	(3,0,1)	0.00003 (0.004)	(3,0,1)	0.001 (0.004)
	β2		1.481*** (0.465)		2.133*** (0.412)
China	β1		-		-
	β2		-	-	-
South Africa	β1	(1,0,0)	0.055** (0.023)	(1,0,1)	0.056** (0.025)
	β2		4.508*** (0.914)		3.109*** (0.643)

Notes : *, **, *** indicate significance at 10%, 5% and 1% levels, respectively; standard errors for the coefficient estimate are given in parenthesis. α1 and β1 are the elasticities of exchange rates for export and import from equations 3 and 6, respectively.
α2 and β2 are elasticities of income for export and import from equations 3 and 6, respectively. Standard errors are given in brackets.

Table 3. Vector Error Correction

	δ_1	λ_2	λ_3	δ_1	λ_2	λ_3
Export	***1989-2007***			***1989-2010***		
Turkey	-0.039 (0.048)	-0.002 *** (0.0006)	-0.279 (0.262)	-0.115*** (0.043)	-0.002** (0.0007)	-0.039 (0.227)
Brazil	-0.052 (0.047)	-0.0001 (0.0001)	0.283* (0.172)	-0.082** (0.039)	-0.0001 (0.0001)	0.398 ** (0.165)
Russia	-0.066 (0.071)	0.005** (0.002)	0.176 (0.118)	-0.099 (0.069)	0.005** (0.002)	0.313** (0.124)
India	-	-	-	-	-	-
Indonesia	-0.108** (0.053)	-0.0002 (0.0003)	0.207*** (0.119)	-0.115** (0.047)	-0.0003 (0.0003)	0.259** (0.118)
China	-0.019 (0.032)	-0.0001 ** (0.0001)	3.429** (1.475)	-0.021 (0.023)	-0.0002*** (0.0001)	3.989*** (1.021)
South Africa	-	-	-	-	-	-
Import	V_1	μ_2	μ_3	V_1	μ_2	μ_3
Turkey	-0.296*** (0.079)	0.001** (0.0006)	3.079 *** (0.300)	-0.294*** (0.072)	-0.003* (0.002)	2.902 *** (0.267)
Brazil	-0.055 (0.058)	-0.000 (0.0001)	2.838*** (0.535)	-0.055 (0.044)	0.000 (0.0001)	3.223*** (0.459)
Russia	-0.127** (0.054)	-0.002*** (0.001)	0.168*** (0.088)	-0.065 (0.055)	-0.0001 (0.001)	0.942** (0.468)
India	-0.068 (0.043)	0.0002 (0.0004)	0.184** (0.079)	-0.135*** (0.039)	0.0004 (0.0004)	0.292*** (0.084)
Indonesia	-0.115 (0.072)	0.000003 (0.0004)	1.738*** (0.548)	-0.106* (0.056)	0.0001 (0.001)	1.771*** (0.591)
China	-	-	-	-	-	-
South Africa	-0.155** (0.061)	0.008** (0.004)	0.696*** (0.228)	-0.069*** (0.023)	0.004* (0.002)	5.738*** (0.044)

Notes: *, **, *** indicate significance at 10, 5, and 1 percent levels, respectively. Standard errors are in parentheses.
λ1 , λ2 , λ3 - measure the speed of adjustment of the export of selected service categories, exchange rate and foreign income, respectively, towards the equilibrium, μ1 , μ2 , μ3 - measure the speed of adjustment of the import of selected service categories, exchange rate and domestic income, respectively, towards the equilibrium.