University of Economics, Prague

Faculty of Economics

Study program: Economics and Economic Administration

The Effect of Exchange Rate Fluctuations on a Trade Balance, the case of Russia.

Bachelor thesis

Author: Masliukova Tatiana
Thesis Supervisor: Ing. Helena Chytilová, Ph.D., M.A.
Year: 2015

I do declare that I have written this bachelor this by one's own, using reliable source I have referred to.

Tatiana Masliukova

15.05.2015, Prague

I would like to thank my advisor, Helena Chytilová for overwhelming support and valuable hints for my thesis.

Abstract

This thesis examines the impact of exchange rate fluctuation on trade balance. In order to examine the effect of depreciation of domestic currency on the trade balance, the data for Russian Federation was used. The time series analysis includes quarterly data since 2000 till 2014. With help of cointegration model it was concluded that there is a long-term dependence between exchange rate and trade balance. Regression results suggest that the impact of depreciation of national currency on trade balance of Russia is positive after one quarter, while response of exchange rate depreciation without time lag is deterioration of the balance of trade. This empirical evidence supports the pattern of movement described by the J-Curve.

Key Words: Exchange Rate, Trade Balance, J-curve

JEL: C32, F14, F31, F41

Table of Contents

Introduction

That work is topical due to the fact that the tremendous pace of globalization leads to an increase in the role of exchange rate in the world economy. Today exchange rate fluctuations affect all spheres of economic relations. The volume of transactions in the foreign exchange market exceeds $4 trillion per day (for 2010, in the middle of 1990s - $1.5 trillion).[1] The main impact of the exchange rate has on the world trade. The volume of world exports continues to increase every year.

The issue of depreciation of national currency is relevant for today's Russia, which faced great currency depreciation in 2014. The ruble depreciated by almost 16% in 2014. Because of this, it is interesting to see what will be the response of the trade balance of Russia to such depreciation of exchange rate.

The aim of this work is to investigate the relationship of macroeconomic parameters such as exchange rate and trade balance. The thesis has following objectives. Introduce the concept of the exchange rate and consider the main factors that affect the formation of exchange rate. Examine the basic economic models describing the relationship between the exchange rate and the trade balance. Find the empirical confirmation or refutation of the negative relationship between exchange rate and trade balance. Conduct a statistical analysis of the impact of the exchange rate on trade balance of Russia.

In order to estimate the effect of exchange rate fluctuations on trade balance, the regression analysis as well as cointegration model are used. Various other factors, GDP of Russia and GDP of major partner countries are included in regression analysis in order to make the model more complex. Data used for the purpose of this analysis cover 2000-2014 period in Russia.

This thesis is organized as follows. First part of the thesis outlines exchange rate determination, second part covers theories related to the impact of exchange rate on trade balance and third part includes the review of existent literature. Fourth part includes data collection, hypothesis and variables used in

[1] Data is taken from International Monetary Fund.

the model. Fifth part covers description of the models, significance of analysis and interpretation of results.

1. Exchange rate and determinants of exchange rate

1.1. Definition of exchange rate

Exchange rate plays a central role in international trade because if allows us to compare the prices of goods and services produced in different countries. It is also called the "nominal exchange rate". If we express the rate of the domestic currency as the amount per unit of the foreign, it is called the direct quotation.

The numerical value of the exchange rate varies from day to day. Exchange rate volatility is a normal phenomenon in a system of flexible or floating exchange rates. Exchange rates are not recorded officially, but are determined by supply and demand in the foreign exchange market. This system of floating exchange rates have became global after the adoption of the Jamaican currency system, according to which currency should have free convertibility and should not be secured by any precious metal. This monetary system exists since the late seventies of twentieth century to the present moment. As opposed to nominal exchange rate, real exchange rate tells us the rate at which we can trade the goods of one country for the goods of another. If the real exchange rate is high, foreign goods are relatively cheap, and domestic goods are relatively expensive.

The market in which international currency trades take place is called the foreign exchange market. Foreign exchange trading takes place in many financial centers, with the largest volumes of trade occurring in such major cities as London (the largest market), New York, Tokyo, Frankfurt, and Singapore. (Krugman P., 2012, p.324). The foreign exchange market spans the globe, with prices moving and currencies traded somewhere every hour of every business day. Consequently, the daily volume of trading in the foreign exchange market in 2012 was about $ 4 trillion. For the comparison, consider the GDP of Russian Federation. In 2013, according to RosStat (Russian Federation Federal State Statitics Service), GDP of Russia was 66.7 trillion of rubles, which is slightly more than $1.9 trillion. Thus, the amount of daily trading on the foreign exchange markets is more than two times bigger than the annual GDP of Russia. The integration of financial centers implies that there can be no significant difference between the exchange rate quoted in New York at 9 A.M. and the exchange rate

quoted in London at the same time (which corresponds to 2 P.M. London time). This is due to the fact that if at some point of time there is a difference in exchange rate, it leads to arbitrage, because economic agents buy the currency where it is cheaper and sell currency where it is more expensive. Finally, these operations continue as long as the exchange rates are unequal. Since modern technology allows making transactions in seconds, there is no difference in exchange rates. (Krugman, 2012).

Needless to say that significant amount of transactions are made in US dollar. US dollar is the world reserve currency and for banks it is more profitable and convenient to make transactions in US dollars. For example, if bank want to exchange Russian rubles to Czech korunas, it would likely exchange rubles to US dollars, and just then US dollars to Czech korunas. This is more beneficial for the banks than searching for the agent, which has Czech korunas and want to buy Russian rubles. (Ershov, 1992)

To minimize the foreign currency risk some financial instruments are traded in the foreign exchange market, such as futures and options. When you buy a futures contract, you are biding yourself to deliver a specified amount on a specified date in the future. In this case, the contract can be resold to third parties. But while one has no choice about fulfilling a forward deal, he can sell his futures contract on an organized futures exchange, realizing a profit or loss right away. The option also gives the right but not the obligation to holder to buy or sell a specific amount of foreign currency at a predetermined exchange rate at any time up to a specified expiration date. (Krugman 2012).

1.2. The formation of the exchange rate

Because of the importance of the exchange rate in the world economy, we are ought to examine the factors affecting its formation. As already mentioned, the exchange rate shows the ratio of two currencies. In other words, it represents the ratio of the prices of goods. Such understanding of the exchange rate is underlined by the theory of purchasing power parity (PPP). Which states that the exchange rate between two countries' currencies equals the ratio of the

countries' price levels. According to the theory, the exchange rate will vary because of different speed of inflation in countries. If the rise in prices abroad will be faster than in the domestic economy, it would lead to national currency appreciation.

Another well-known theory is interest rate parity, in which the exchange rate is determined by the ratio of interest rates in different countries. The theory also has two forms: covered interest rate parity and uncovered interest rate parity. In covered interest rate parity, it is assumed that investments in the national economy and abroad should bring the same profit. "Investing money for interest-bearing *i* in the period or investment money abroad (or in foreign assets) for the percentage *i** should have the same yield" (Chetvirikov S., 2005, p.9). Thus, investors should be indifferent whether to invest in domestic assets or to exchange money and invest in foreign assets, and then convert money by forward exchange rate to the domestic currency. Uncovered interest rate parity relates the expected change in the exchange rate with respect to interest rates. In other words, it predicts the future value of the exchange rate, based on the current interest rates within the country and abroad.

In the 1970s monetarists introduced more sophisticated theory of exchange rate formation. Over the past 35 years, the monetary approach to understanding exchange rates has become the dominant model of exchange rate determination. "Three fundamental concepts have influenced the current construction of the monetary model of exchange rate determination – the quantity theory of money, the Cambridge cash-balance approach, and Keynesian monetary theory."(Ian Wilson, 2009, P. 84). Monetary approach is based on the definition of exchange rate as the relative price of one currency in terms of another. At the same time, the relative price is determined from the relative supply and demand for the currency. From the point of view of the monetarists, the excess demand or excess supply will be compensated by the change in its exchange rate. There are following assumptions in the model: domestic and foreign capital are perfect substitutes. This means that investors are indifferent to which country invest their money. It is assumed that perfect capital mobility between countries exists. Monetary approach is based on the implementation of the purchasing power parity.

Equilibrium in the domestic money market can be described by the equation:

$$m = p + ky - \lambda i \quad (1)$$

where m - logarithm of money supply, p - logarithm of price level, y - logarithm of income, *i* - logarithm of the interest rate, k and λ - constant parameters.

For foreign market formula remains the same, only the values of the variables will be different. Therefore, variables will be marked with *:

$$m^* = p^* + k^* y^* - \lambda^* i^* \quad (2)$$

Another variable, which we will need for the model is purchasing power parity:

$$s = p - p^* \quad (3)$$

where s - logarithm of nominal exchange rate, p - logarithm of price level, p * - logarithm of foreign price level.

The domestic price level is determined by domestic supply of money, so it is one of the factors that influence the exchange rate. So, from the equation (1) we express p and from (2) - p *. Further substitute them into (3) and it will give us the basic equation for the nominal exchange rate in the monetary model:

$$s = (m - m^*) - (ky - k^* y^*) + (\lambda i + \lambda^* i^*) \quad (4)$$

Equation (4) is the simplest form of the monetary approach to exchange rates. So, monetary theory proposes that exchange rates are a monetary phenomenon affected by the money supply, income level, and interest rates.

"The monetary approach continues to be one of the important tools used to explain the variation in exchange rates. In the early 1980s, it appeared certain that no research support for this approach was available. However, with improved statistical tools and a more precise specification of the model, recent research has established the long-term validity of the monetary approach to exchange rate determination" (Ian Wilson, 2009, p. 96).

Portfolio-balance model is another model, which describes the exchange rate formation. “The portfolio-balance model views the exchange rate and interest rates as determined simultaneously by the portfolio equilibrium conditions for wealthholders in each country. Residents of each country are assumed to allocate their net financial wealth among three assets: the domestic monetary base, domestic government bonds, and net foreign bonds denominated in foreign currency”. (Douglas K. Pearce, 1983, p. 25)

$$W = M + B + SF \tag{5}$$

where W - the well-being of residents, M – national currency, B - national assets, S - exchange rate, F - foreign bonds.

The demand for each type of asset is dependent on the national interest rate and foreign interest rates. Individuals placed their money in different assets to hedge the risks. For this, in particular, foreign securities are used, the demand for which is directly dependent on the exchange rate now and expectations associated with the value of the exchange rate in the future. The portfolio-balance model is not perfect one – “because it focuses only on disturbances to asset portfolios, it ignores the underlying determinants of trade as well as the role of purchasing power parity”. (Douglas K. Pearce, 1983, p. 26)

2. Theoretical aspects of effect of exchange rate fluctuations on a trade balance

Exchange rate plays an important role in country's foreign trade. After establishment in 1976 the system of floating exchange rate, the functioning of the entire monetary system had changed. The crucial place in new system was given to exchange rates, which were ought to bring into balance the trade balance, changing under various market factors. It was assumed that the interference of responsible authorities would take place only when it is a dire necessity; for serious failures of a mechanism that equalizes country's trade balance. As a consequence, thanks to the new regime, banks were able to reduce their reserves, which were needed to maintain exchange rate stability. (Ershov M.V., 1992)

Change in the exchange rate in one or another direction will affect the prices of domestic goods for foreigners. "The most important role in the formation of trade relations between two countries was played by the monetary sphere[2], because it is the infrastructure on the basis of which the trade exchange is exit." (Ershov M.V, 1992, p.7). Exchange rates can affect foreign trade, through the formation of expectations of economic agents associated with exchange rates fluctuations, which also will affect trade flows between countries. As a result, there are three ways in which exchange rates affect international trade: changes in foreign trade prices; impact on the economic situation in the country; and through expectations with respect to changes in exchange rates.

2.1 Elasticity approach to trade balance

Depreciation of the domestic currency makes export cheaper, increasing the competitiveness of exports. "This will cause an increase in demand from foreign buyers for the products of the country and led to the expansion of exports." (Ershov M.V., 1992, p.36) At the same time, cost of import (in national currency) will increase. Imported goods will become more expensive, so less attractive to

[2] Under the monetary sphere we understand the exchange rate regime and exchange rates.

consumers. As a result, the trade balance of the country should be improved by amelioration of the current account.

However, it is not so obvious as it may seem at the first glance. For example, some of imported goods may be necessity goods for the country. Accordingly, the price elasticity of demand is very low or even zero. As an example might be considered oil for those countries, which do not have own oil supply.

Depending on the price elasticity of export and import, the impact of exchange rate fluctuations on flows of import and export won't be straightforward. There is a formula that reflects the relationship between the change in the exchange rate and the trade balance, depending on the price elasticity of export and import.

$$\frac{\delta TB}{\delta ER} = -\frac{1}{ER} * \eta ed * \left(P_e * Q_e - P_m * Q_m\right) - \frac{1}{ER} * P_m * Q_m * \left(\eta ed + \eta md + 1\right) \quad (6)$$

where TB - trade balance, ER - exchange rate, P_e - export prices in the national currency, Q_e - volume of export, P_m - import prices in the national currency, Q_m - volume of import, ηed - price elasticity of export demand, ηmd - price elasticity of import demand.

From equation (6) follows that depreciation will lead to an improvement in the trade balance only if the equation is greater than zero. Thus, if we assume that originally the trade balance was in equilibrium $\left(P_e * Q_e - P_m * Q_m = 0\right)$, $-\frac{1}{ER} * \eta ed * (P_e * Q_e - P_m * Q_m)$ vanishes.

Also the following equations should be considered:

$$\eta ed = \frac{dQ_e}{dP_e} * \frac{P_e}{Q_e} \quad (7)$$

$$\eta md = \frac{dQ_m}{dP_m} * \frac{P_m}{Q_m} \quad (8)$$

where ηmd - price elasticity of import demand, ηed - price elasticity of export demand, P_e - export prices in the national currency, Q_e - volume of export, P_m - import prices in the national currency, Q_m - volume of import.

Formulas (7) and (8) is derived from definition of price elasticity of export and import.

In this case, improvement condition of trade balance could be written in the form of the following equation:

$$\eta ed + \eta md < -1 \tag{9}$$

From formula (9) we can see that trade balance would be improved after depreciation of exchange rate only if sum of price elasticities of export and import is less than -1.

However, this condition is not enough to improve trade balance. We should also take into consideration that not only demand determines the value of import and export, but also supply could limit them. For instance, as a result of depreciation of the national currency, demand of foreign economic agents might become so buoyant that the domestic exporters will not be ready to fulfill this demand. This may be due to the fact that the production capacity will be excessed by demand. Another reason could be that scarce or imported raw materials may be used in the production of exported goods. In this case, for the expansion of export also import has to be expanded, which has become more expensive after the depreciation of exchange rate. Therefore, output expansion could be unprofitable. (Ershov, 1992).

After inclusion of the supply into the formula, the impact of exchange rate on trade balance will be as follows:

$$\frac{\delta TB}{\delta ER} = \frac{TB}{ER} * \frac{\eta ed}{\eta ed - \eta es} * \left(1 + \eta es\right) + \frac{P_m D_m}{ER} *$$

$$\left(\frac{\eta md * \eta ed * \left(1 + \eta ms + \eta es\right) - \eta ms * \eta es * \left(1 + \eta md + \eta ed\right)}{\left(\eta ms - \eta md\right) * \left(\eta es - \eta ed\right)} \right) \tag{10}$$

where, ηes - the price elasticity of export supply, ηms - price elasticity of import supply, D_m - national import demand.

If we assume that at the time of the depreciation of national currency, the country's trade balance was in equilibrium, the whole formula (10) comes to $\left[\frac{\eta md * \eta ed * (1 + \eta ms + \eta es) - \eta ms * \eta es * (1 + \eta md + \eta ed)}{(\eta ms + \eta md) * (\eta es + \eta ed)}\right]$. Accordingly, for the positive effect of currency depreciation, expression in the last brackets has to be positive. The denominator is always greater than zero. The elasticity of demand is always negative, and elasticity of supply is positive, so $\eta ms - \eta md > 0$ and $\eta es - \eta ed > 0$ As for the numerator, for the same reasons - $\eta md * \eta ed * \left(1 + \eta ms + \eta es\right) > 0$. Thus, the rest $\eta ms * \eta es * \left(1 + \eta md + \eta ed\right)$ should be negative. Since the elasticity of supply is always bigger than zero, the equation comes to formula (9).

The equation (9) is called the Marshall-Lerner condition. As already stated, it describes the necessary condition under which the depreciation will have a positive impact on the trade balance. “If one assumes that trade is initially in balance, the Marshall-Lerner condition states that devaluation will improve the trade balance if the sum of the elasticities of demand (absolute values) for the country’s exports and imports exceeds unity” (Dennis R. Appleyard and Alfred J.Field, 1986, p. 52).

To analyze Marshall-Lerner condition following example can be used. Let’s assume that there has been the national currency depreciation. As a result of depreciation, export prices, which are denominated in foreign currencies, will be lower and export demand will increase. At the same time, export prices, denominated in national currency will not change, but the total value of exports will increase. However, there will be an increase in the total value of imports. In this case, the improvement of the trade balance will happen if the high elasticity of import demand lead to a slight increase in the cost of imports. A small increase in exports would be enough to neutralize these costs.

From the Marshall-Lerner condition we can conclude that if the price elasticity of import demand is greater or equal to one ($\eta md \geq 1$), then as a result of depreciation of the national currency, the value of imports will remain the same (in the case of equality of the elasticity to one) or will decrease. In such case, even if the elasticity of demand for exports is zero (export demand does not depend on

changes in prices) as a result of the devaluation, the trade balance will either remain unchanged or improved. This is also valid for the opposite situation, when the elasticity of import demand is zero and the elasticity of demand for exports is greater or equal to one. In this case, according to formula (9), after devaluation, trade balance should also improve because although the cost of imports will rise, it would be in smaller scale than the increase in value of exports.

However, Marshall-Lerner condition has a number of assumptions which are crucially important. First of all, it is assumed that initially trade balance is in equilibrium, otherwise, the first term of the formula (10) is not equal to zero, so condition (9) will not always be sufficient to improve trade balance. For instance, when there is large trade deficit, the depreciation of the national currency may be ineffective. Secondly, the model does not include an international movement of capital, defining trade balance as the difference between exports and imports. This assumption leads to the fact that supply and demand of foreign currency are determined from export and import. Thirdly, we assume flexibility of prices for exports and imports, in order to include the change of exchange rate in prices. In reality, prices change in a smaller proportion than the exchange rate. Fourthly, the Marshall-Lerner condition assumed that resident's demand for imported goods, as well as supply of goods for export depends just on the level of prices of these goods in the national currency. Lastly, we assume that the import and export prices are equally correlated with changes in exchange rate. For instance, export prices have not changed, but import prices have changed. (Ershov, 1992).

Assumptions of the Marshall-Lerner condition refer to elasticity too. There is a single elasticity for all the export volume of goods and total imports. This is possible, only if all traded goods are homogeneous. If products are heterogeneous, it is necessary to take into account the cross-elasticity, which reflects the change in demand for good A, due to the changes in price of good B. Also Marshall-Lerner condition assumes perfect competition, which does not exist in the real world.

In addition, there is a time lag between the change in the exchange rate and price adjustment, which is not included in the basic assumptions of described above condition. This phenomenon can be explained by the fact that in most cases, the agreement for delivery of goods abroad or import of goods from abroad does not signed for one day. These agreements are long-term, so exporters and

importers are forced to deliver the goods at the prices specified in the contract. Also, this gap in price adjustments could be explained by different elasticity of exports and imports in the long term and short term. Many products have low elasticity in the short term. "In short period of time (less than one year) import and export can be very inelastic." (Kireev A.P, 2001, p.72). The good example of this time lag was seen in Russia while ruble was in the beginning of depreciation. The price of the Apple products, expressed in the national currency remained unchanged, despite the fact that the nominal exchange rate of ruble against the euro depreciated from 44 rubles per 1 euro in the first half of November 2013 to 51,5 rubles per 1 euro on 15.10.2014 (Central Bank of Russia). Thus, it happened that Apple products, which were always more expensive in Russia than in Europe, for certain period of time were considerably cheaper in Russia than in European countries. As a result, time lags may lead to the fact that after the depreciation, the trade balance may deteriorate for some time, and only then start to improve. This phenomenon is called «J - Curve». (Bahmani-Oskooee, 1985)

"The J-curve describes the time lag with which a real currency depreciation improves the current account." (Krugman, 2012, p. 448). The J-Curve phenomenon has been explained by several factors. Krueger (1983) has argued that the phenomenon emanates from the fact that at the time an exchange rate change occurs, goods already in transit and under contract have been purchased, and the completion of those transactions dominates the short-term change in the trade balance. Therefore the trade balance deteriorates first, but after the passage of time (during which the elasticities have a chance to increase) it begins to improve. (Bahmani-Oskooee, 1985, p.502)

If some implications are to be derived, it takes time since the full adjustment of the economy to the new exchange rate is taking from a few months to almost a year. "Empirical evidence indicates for most industrial countries a J-curve is lasting more than six months but less than a year."(Krugman, 2012, p. 448). The existence of such an effect leads to the conclusion that in the short time period, the depreciation will likely result in deterioration of trade balance rather than improvement, taking into account all conditions described above.

2.2 Income – absorption approach to trade balance

When we are considering the effect of exchange rate on trade balance of the country, it is crucial to remember about the importance of real income. The higher it is the greater will be the demand for domestic goods and services. Increased demand will reduce the opportunities for export, because more goods (of the total production) will be consumed within the country, so there will be a fewer goods available for export.

As an income of the country rises, the domestic demand increases. Increased demand may cause a decline in exports and rise in imports, changes in which ought to neutralize all positive effects of exchange rate depreciation on trade balance. The appropriate question concerning the neutralizing effect of increased demand: what should be the conditions under which trade balance will improve after the depreciation of national currency?

The first systematic study of this question was reported by Sidney S. Alexander (1952). In particular, the income-absorption approach was build upon his article "Effects of a devaluation on a Trade Balance".

In his article, Sidney Alexander claimed that it is presumed that the depreciation initially tends to reduce the foreign prices of the country's exports in proportion to the devaluation. "At these reduced prices, foreign demand for the country's exports will be increased, thus tending to bid up the foreign prices of these exports partway back towards their pre-depreciated levels. How much the foreign currency proceeds of the country's exports will change then depends upon the elasticity of foreign demand for the country's exports and the elasticity of domestic supply of export goods. Similarly it hold on the import side." (Alexander, 1952, p.263).

In his article, Alexander tried to prove that, for a more detailed analysis of the impact of depreciation on trade balance we have to take into account the real expenditures and real income as well as their relationship with price level. According to Alexander, the trade balance of the country can be defined as the difference between the total goods and services produced in that country and the total goods and services taken off the market domestically. For brevity, the taking of goods and services off the market will be referred to here as absorption. Relying

on well-known Keynesian identity, all mentioned above can accordingly be expressed in a formula:

$$Y = C + I + G + NX \quad (11)$$

where Y - the national income, C - consumption, I - investments, G – government expenditures, NX - net exports, which is the difference between export and import of the country.

$$A = C + I + G \quad (12)$$

where A – absorption.

$$TB = Y - A \quad (13)$$

Depreciation may affect the trade balance only for two reasons: firstly, it can lead to a change in the volume of goods and services produced within the country. Such change would be connected with changes in absorption. Secondly, depreciation can change consumption, which would be connected with real income. In other words, depreciation may lead to changes in income and absorption. Because of these two indicators balance of trade can be changed. Changes in these quantities may be denoted by the corresponding small letters:

$$tb = y - a \quad (14)$$

Also, absorption depends on other factors, which are connected to depreciation. So, it is crucial to include the depreciation into formula :

$$a = cy - d \quad (15)$$

where d – depreciation.

A combination of the functional relationship (15) with the fundamental identity (14) yields

$$tb = (1 - c)y + d \quad (16)$$

“This formulation rises to three basic questions: How does the devaluation affect income? How does a change in the level of income affect absorption, i.e., how large is c? How does the depreciation directly affect absorption at any given level

of income, i.e., how large is d? In order to analyze these questions in precise terms, the entire economic structure of the devaluing country and of the rest of the world would have to be considered." (Sidney Alexander, 1952, p. 266).

The effect of devaluation on income is associated with the increased exports of the devaluing country and the induced stimulation of domestic demand through the familiar multiplier relationship (Sidney Alexander, 1959, p. 26).

The net effect of the increase in income and production will be equal to the difference between the increase in production and an increase in absorption. This difference between real income and real expenditures is called savings. Alexander (1952) has written that the foreign balance is, by the fundamental identity, equal to the aggregate real hoarding of the economy as a whole. The income-induced change in the balance is accordingly equal to the income-induced change in real hoarding, i.e., the change in income, multiplied by the propensity to hoard, 1-c. The existence of the business cycle makes it plausible that c may be greater than unity, that an increase in income may stimulate an even greater increment in the absorption of goods and services into consumption and investment. If c is equal to or greater than unity, the foreign balance will not be improved as a result of the increased output. Under such circumstances, the devaluation might be effective in stimulating recovery but not in improving the foreign balance except possibly through direct effects (Alexander Sidney, 1952)

Based on these findings, the following conclusion for the country's macroeconomic policy could be drawn: for any value of the marginal propensity to consume, the availability of resources and unemployment, the depreciation will lead to an increase in real national income and economic reflating. However, if the country wants by depreciation achieve an improvement of trade balance, it is necessary to have available resources, as well as the value of c less then unity. "If the country is at full employment, this potentiality does not exist and the effects of a devaluation must depend on the more tenuous and less attractive direct effects on absorption." (Sidney Alexander, 1959, p. 33).

Another income effect, which influences the foreign balance, is the terms of trade. "It is usually presumed, frequently with justification, that a devaluation will result in a decline of export prices in foreign currency greater than the decline of import prices in foreign currency." (Sidney Alexander, 1952, p. 268). This belief is

based on the fact that most of the country's exports have greater specialization than imports. For example, the biggest share of Russian export is natural resources, but it is difficult to distinguish the dominant import products, because Russia imports everything from food to machinery. As a result, the value of the fraction (18) will decrease.

$$\frac{P_e * ER}{P_{mf}} \tag{17}$$

where P_{mf} - import prices in foreign currency, ER - exchange rate, P_e - export prices in national currency.

There is an erroneous belief that the deterioration of the terms of trade caused by the depreciation of the national currency will improve the country's trade balance, as it reduced real income and, as a consequence, the demand for imported goods. Of course the fact that the demand for domestic and imported goods will fall is true, but a decrease in income for some value will lead to a reduction in the value of absorption for these value. The decrease in national income, which is caused by the deterioration of the terms of trade, in fact, will lead to deterioration in the trade balance.

$$(1-c)x \tag{18}$$

This expression is part of the formula (18). As real income declines, the value of x is negative. In this case, to improve the balance of trade, the marginal propensity to consume has to be greater than one; otherwise there will be deterioration in the balance of trade. "If $0<c<1$ trade balance deteriorates and if $c>1$ it improves" (Ershov, 1992, p. 49).

The question arises, what should be the marginal propensity to consume for the improvement of trade balance? Earlier in the paper it was found that *c* should be less than one. Income effect can be expressed as (1 - c) multiplied by the change in income. The decline in export prices increases the competitiveness of domestic products in the world market and leads to an increase in exports and real national income (assuming the availability of resources). Thus, a decrease in income connected with deterioration of the terms of trade will be neutralized by the increase of income caused by the growth of competitiveness of the goods. Thus, the

condition for improving the trade balance will be the availability of resources and the value of the marginal propensity to consume less than unity. (Alexander, 1952).

Another income effect, which influences the foreign balance, is the income redistribution. The increase in wages usually lags behind rising prices. Thus, economic agents with fixed incomes lose part of their profit in favour of persons whose incomes depend on market conditions. Economic agents whose income depends on market conditions could be, for example, entrepreneurs with a relatively high income and relatively low marginal propensity to absorb. People with fixed income may belong to the group of persons with low incomes and higher marginal propensity to consume. This redistribution of resources will lead to an improvement in trade balance. If income is redistributed in favor of those, whose marginal propensity to consume is high, trade balance will deteriorate. (Ershov, 1992)

There is another channel through which depreciation has direct impact on the absorption. This is expectation associated with the development of market conditions. For instance, if economic agents believe that present level of prices is very high and in the near future it could fall, they will begin to consume less, so the absorption will temporary decrease and it will help to improve trade balance (Ershov, 1992, p. 51).

In later versions of the theory, the role of elasticities was included into the model[3], because in some cases, even at a low level of marginal propensity to consume income growth does not lead to an improvement in the trade balance. In order to improve the trade balance as a result of depreciation of the national currency, the product of demand elasticities of export and import was bigger than the product of supply elasticities of export and import (Yeger, 1986, p. 162).

2.3. Monetary approach to trade balance

The main difference between the monetary approach to the trade balance from the previous two approaches is that as part of this approach, a key role in

[3] For instance, Yeager L. B, International monetary relations: theory, history and policy, 1986.

changing the balance of payments plays the money factor. “International monetarists argue that devaluation reduces the real value of cash balances and/or changes the relative price of traded and non-traded goods, thus improving both the trade balance and the balance of payments” (Bahmani-Oskooee, 1985, p. 500).

The first serious discussions and analyses of monetary approach to trade balance emerged during the 1970s with help of Rudiger Dornbusch (1973). In his article in “The American Economic Review” he tried to describe the effect of depreciation to trade balance. “The role of the real balance effect is emphasized and a distinction is drawn between the relative prices of goods, the exchange rate and the price of money in terms of goods. Furthermore, money is treated as a capital asset so that the expenditure effects induced by a monetary change are spread out over time and depend on the preferred rate of adjustment of real balances. The latter aspect gives rise to the analytical distinction between impact and long-run effects of a devaluation.” (Dornbusch, 1973, p. 871).

$$L = kP\overline{y} \tag{19}$$

where L - demand for money, k – the desired ratio of money to income, P - price level, y- real output, which is fixed in the model.

To simplify the analysis we assume that the exchange rate is formed according to the purchasing power parity, which implies the fulfillment of the equation:

$$ER = \frac{P}{P^*} \tag{20}$$

where ER - exchange rate, P - national price level, P * - foreign price level.

Depreciation leads to a change in the equilibrium of price levels in two countries, so it will lead to change in the exchange rate according to the theory of purchasing power parity. As in the model it is assumed that there are only two countries involved in a trade, the increase in hoarding in the country will be a corresponding decrease in hoarding abroad.

$$H = -ER_0 H^* \tag{21}$$

where H - domestic rate of hoarding, H * - foreign rate of hoarding.

The volume of hoardings depends on price level (P) and nominal quantity of money in the country (M). “An increase in the price level creates a stock excess demand for money and causes expenditure to decline relative to income as the community attempts to restore the real value of cash balances” (Dornbusch, 1973, p. 872).

As a result of depreciation of the national currency, the foreign price level will remain unchanged, but the domestic price level will rise in proportion equal to the change in the exchange rate (according to (20)). Also, according to the formula (21) depreciation will lead to a reduction of foreign hoardings. The reduction of foreign hoardings is due to the fact that as a result of the changed exchange rate, revenues of foreign country from export to the country with depreciated currency will fall and it will have to spend hoardings to support the economy. Changes in the price level will lead to the fact that foreign cash balances will grow, and national will decline.

However, not all products are involved in world trade. There are so-called non-traded goods, goods that are produced and consumed within the same country. Non-traded goods, because they do not depend on the exchange rate and foreign prices, have their own price level. The relative price of these goods is determined by the ratio of their prices to the price of the goods involved in global trade.

$$q = \frac{P''}{P'} \tag{22}$$

where q - the relative price of non-traded goods, P"- the price of non-traded goods in the national currency, P'- the price of traded goods in the national currency.

Now, the real rate of hoarding will not depend on price level and nominal quantity of money in the country, but on relative price and real quantity of money measured in terms of traded goods $\left(\frac{M}{P'}\right)$.

However, inclusion of non-tradable goods into analysis will not have impact on the effect of the depreciation. As a result of the depreciation, the price level of traded goods will rise, as imports would become more expensive. Prices of non-traded goods will not change, since there is no influence of exchange rate on them.

As a result of the growth of prices for traded goods, there will be a reduction in their consumption and an increase in the trade balance. Also, by reducing the absorption within the country, the relative price of non-traded goods will decrease, while abroad, as a result of the growth of absorption; there will be an increase in the relative price of non-traded goods.

However, the rise in prices for traded goods as a result of the depreciation will not be a proportional to an increase in exchange rate. Accordingly, changes in trade balance will not be proportional to the increase in exchange rate.

$$dTB_t \equiv \hat{e} \qquad dTB_{t\&n} \equiv \alpha\hat{e} \tag{23}$$

where dTB_t - changes in trade balance, if only traded goods are considered, $dTB_{t\&n}$ - changes in trade balance, if traded and non-traded goods are considered, $\hat{e}$ - changes of exchange rate, α - the coefficient, $0<\alpha<1$.

Basic monetary model described by Rudiger Dornbusch is quite simple and straightforward. It describes the change in trade balance as a result of changes in prices of traded and non-traded goods. More sophisticated model is developed for small fully employed economy which trades in commodities, securities and money. Consumption is assumed to depend on the real value of assets. Population (the labor force) is assumed constant and all quantities are measured in per capita terms. (Frenkel Jacob, 1975).

$$c = f(a); \qquad f'(a) > 0 \tag{24}$$

where a – real value of assets, c – consumption.

The real value of assets in terms of consumptions is defined as

$$a \equiv p_k k + m \tag{25}$$

where k – the stock of capital, m – the real value of cash balances, p_k - the relative price of capital in terms of consumption.

Production of the country is a function of the amount of capital and the value of investment depends on the relative price of capital. Mathematically, this can be described by the following expressions:

$$Q = f(k); \qquad I = f(p_k) \tag{26}$$

where Q – total output, I – investment.

At the same time, the entire output of the country in a closed economy can be used either for consumption or for investments. If this condition is satisfied, the economy is in equilibrium. The first equilibrium condition is:

$$f\left(k\right) = c\left(a\right) + f\left(p_k\right) \tag{27}$$

The second equilibrium condition involves the composition of the portfolio of assets. The desired ratio (*l)* of real cash balances to the real value of capital is assumed to depend on the nominal interest rate (*p*) (Frenkel Jacob, 1975, p. 676)

$$m = l\left(p\right)p_k k \qquad\qquad l'\left(p\right) < 0 \tag{28}$$

Suppose now that the economy is in a steady state and opens to international trade. As the country is relatively small compared to the rest of the world, it faces the global level of prices and world interest rate[4]. Assume also that the formation of the exchange rate is in accordance with the purchasing power parity, so the equation (20) is true.

Moreover, the home country's ownership of capital is denoted by k_D and stock capital that is located in the home country is denoted by k. If k differs from $\frac{dm_0}{1+l}$, foreign ownership (or debt) makes up for the difference. For example, if k were to exceed k_D, foreigners own k_F units of domestically located capital (Frenkel Jacob, 1975, p. 677).

$$k_F \equiv k - k_D \tag{29}$$

[4] Without loss of generality it is assumed that world interest rate is lower that national.

The result of opening the trade with other countries will be an increase in the price of capital within the country as a result of excessive demand for domestic securities. Excess demand for domestic securities will be caused by the difference between the domestic and foreign interest rates. Since this difference is positive, invest in the national economy is more profitable.

Monetarists also considered the impact of changes in the monetary stock to trade balance. Suppose that at time t_0 the real stock of cash balances is raised by dm_0. The impact effect of this change is to raise the value of assets from a^* to $a^* + dm_0$ and thus to induce an excess demand for equities that is equal to $\frac{dm_0}{1+l}$. Accordingly, instantaneous portfolio adjustment results in an immediate exchange of part of the increased monetary stock for equities resulting therefore in larger holdings of both real cash balances and equities (Frenkel Jacob, 1975, p. 680).

These changes will also affect various items of balance of payments. Since the change of monetary stock does not affect the capital stock, the level of output is fixed and consumption rises, there will be a decrease in trade balance (as exports will remain unchanged, while imports increase). However, changes in the portfolio of assets will lead to an increase in the monetary stock, which is spent on securities. Such a change would lead to an increase in the balance of services. The amount of changes in the trade balance and the balance of services reflects the impact of increasing monetary base on the current account.

As the deterioration of the trade balance will be divisible by dm_0, and improvement in balance of services - $\frac{dm_0}{1+l}$, the overall effect on balance of payments will be negative, so it will deteriorate. As a result of increasing monetary stock, there is a change in the portfolio of assets caused by the fact that part of the increased monetary stock was immediately exchanged for securities. The result is deterioration in trade balance of the country.

2.4 Summarization of theory approaches to trade balance

Within the theory of elasticity it is assumed that, depending on different price elasticities of demand and supply of both imports and exports, the impact of exchange rate fluctuation on balance of trade may be different. In the case of low price elasticity of export, the exchange rate change will not affect the volume of exports, but at a high price elasticity of demand, the growth of the exchange rate will lead to an increase in demand for exports. Therefore, the theory of elasticity formulates the Marshall-Lerner condition that describes a necessary condition for improving the country's trade balance as a result of depreciation of the national currency. Its' main point is that for the positive impact of the depreciation on the trade balance, it is necessary that the sum of the absolute values of price elasticities of export and import demand has been greater than one. In the context of this theory, J-curve effect is formulated, which states that there is a time lag between the depreciation of exchange rate and the improvement of trade balance.

Income-absorption approach differs from the elasticity approach because it includes income and absorption into analysis. Proponents of the absorption approach (e.g., Alexander, 1952) describe how depreciation may change the terms of trade, increase production, and switch expenditures from foreign to domestic goods, thus improving the trade balance. In later versions of the theory, the role of elasticities was included into the model.

Proponents of monetary approach to trade balance consider the money factor as the main source of influence on trade balance. Basic monetary model was described by Rudiger Dornbusch (1973). It describes the change in the trade balance as a result of changes in prices of traded and non-traded goods. In the later stages of development of the theory, it has been proven that the growth of monetary stock in the country leads to a change in the portfolio of assets and to deterioration of trade balance, due to the fact that imports increase.

3. Literature review

One of the papers in which author tries to make an analysis of the macroeconomic impact of exchange rate on foreign trade of the country, is the book of Ershov (1992) "Currencies in world trade". In this book, the economy of the United States of America is analyzed, as one of the dominant countries in the international trade. Furthermore, most of the external payments and revenue of the country is in the national currency, which certainly makes it easier to build a model. Ershov built his model on the basis of functions of import and export, as well as import and export prices. Data were taken for the United States for the period 1975-88 period.

The empirical model of Ershov proves that the exchange rate plays an important role in the world trade, along with other economic parameters. By the example of United States it can be claimed that as a result of the depreciation trade balance will improve. This will be due to the fact that the depreciated exchange rate will increase the demand for exports, but also increase import prices. The growth of the import prices will reduce the demand for imports. The aggregate effect of such changes, ceteris paribus, will be improved trade balance (Ershov, 1998, p.82).

The outstanding result of analysis of the impact of exchange rate on trade balance was obtained by Irina Tochitskaya (2006) in her paper "Effect of changes in exchange rate on the trade balance of Belarus". The author of this work used a model that combines the elasticity and income-absorption approach. To perform the regression analysis data for 1995-2005 period was taken. Tochitskaya had constructed two separate equations for import and export.

$$\ln X = \underset{(-2,71)}{-67,572} + \underset{(2,96)}{18,149}\ln YW - \underset{(-3,37)}{2,055}\ln EX - \underset{(2,61)}{0,166}trend \tag{30}$$

$$\ln M = \underset{(-2,23)}{-5,153} + \underset{(4,58)}{1,952}\ln Y + \underset{(0,23)}{0,057}\ln EX \tag{31}$$

Based on the regression results, she has also confirmed the relationship between exchange rate and trade. However, in her model impact of exchange rate on import was insignificant, so changes in trade balance is just depend on export of Belarus. The explanation might be that import of Belarus is relatively inelastic because the main importer is Russia and amount of suppliers is also limited. (Tochitskaya, 2006, p.671).

Another research paper on the topic of exchange rate effects on the balance of trade was written by Boyd (2001). He had denied the popular opinion among economists of the end of twentieth century about the extremely small elasticity of export and import of developed countries. If the elasticity of export and import were extremely small, Marshall-Lerner condition would not hold. For analysis he had considered the data for 8 OECD countries (Canada, France, Germany, Italy, Japan, Netherlands, UK, USA) for the period since 1975 till 1994. To test the hypothesis that exchange rate affects trade balance and that the Marshall-Lerner condition is fulfilled in reality, D. Boyd used the vector autoregressive distributed lag (VARDL). Boyd came to the conclusion that depreciation of real exchange rate will lead to an improvement in the trade balance.

The problem of the effect of exchange rate on the trade balance was comprehensively explored by Mohsen Bahmani-Oskooee (1985). In his article devoted to the depreciation and J-curve, he was trying to prove the existence of a time lag between the depreciation of the national currency and the improvement of the trade balance. For his analysis he took a data for four countries (Greece, South Korea, India, Thailand) in the period since 1973 till 1980. The results of empirical research in this thesis are quite similar to those in article of Bahmani-Oskooee. Trade balances of the countries have deteriorated at first and improvement comes after some amount of quarterly lags. These statistical results support the existence of such phenomena as the J-curve.

Rahman M. and Mustafa M. (1997) in their paper devoted to the US - Japan real trade balance tries to prove that there is no correlation between the exchange rate and trade balance. For the analysis data for 1973 - 1993 period were taken. Rahman and Mustafa (1997) had concluded that even if the exchange rate has an impact on the trade balance, it is not implied by the theory.

So, the depreciation of dollar against yen leads to deterioration of trade balance, although in theory, it should be exactly the opposite. Thus, based on this analysis, it can be argued that during the period since 1973 till 1993, when the depreciation of the US dollar against the yen occurred, there was deterioration in the US trade balance (Rahman M., Mustafa M., 2010, p. 664).

Another author who has tried to prove the absence of effect of exchange rate on trade balance was Buluswar (1996). His empirical research proved that exchange rate affects trade balance of India just in short-term period. However, even this could be called into question, because t-statistics of coefficients are sufficiently small.

Empirical attempts to verify the existence of the relationship between exchange rates and trade balance does not provide a clear answer. For example, such economists as M. Ershov (1992), I. Tochitskaya (2006), D. Boyd, M. Bahmani-Oskooee (1985), were able to confirm a theoretical concept about the improvement in the trade balance of the country after the depreciation of the national currency. Some of these authors were also able to confirm the existence of the J-curve. However, for example, economists M. Rahman and M. Mustapha (1997), M. Buluswar (1996) concluded that the impact of the exchange rate on the trade balance even in the short time period cannot be called into question because of the statistically insignificance of regression equations.

4. Data

We base our analysis on the development of trade balance of Russia. The quarterly data since 2000(I) till 2014(IV) was used. This time interval was taken because development of the Russian trade before 1999 does not make sense, due to the fact that in this period the economy of Russia was regenerating after the collapse of Soviet Union. In 1998, Russia suffered the economic crisis. As a result, depreciation of ruble for more than 4 times (from 6 rubles per US dollar before the crisis to 28 rubles per US dollar in early 1999)[5] was the case. Therefore, inclusion of this period into the model could have negative effect and distort the results. The trade balance of Russia was taken in US dollars. Database of Central Bank of Russia serves as the main source of data.

We readily admit that the topic requires further analysis, when more data will be available in response to currency depreciation happened in 2014 in Russia.

4.1 Explanatory variables

As one of our main explanatory variable the exchange rate (ER) was chosen. We have used exchange rate between Russian ruble and US dollar. The direct quotation was considered. So, the depreciation of domestic currency (in our case of ruble) means that now more units of domestic currency are given per unit of foreign currency. Data was collected from the statistics of Central Bank of Russia.

Second variable that was used is GDP of Russia (Y). It is assumed that GDP adequately represents the situation in economy of the country. It was also considered in world reserve currency – US dollars. The data was collected from Federal Statistics Service of Russia.

Another independent variable in the model is GDP of main trade partners of Russia (YW). 13 countries were chosen as the main Russian trade partners. Turnover with them for 2014 year was 61,6% from the whole (China – 10,5%,

[5] The data is collected from Central Bank of Russia.

Netherlands – 9,9%, Germany – 8,8%, Italy – 5,5%, Ukraine – 5,4%, Belarus – 4,3%, Turkey – 4,1%, Japan – 3,7%, USA – 3,4%, Poland – 3,3%, Kazakhstan – 2,7%). Data was captured from World Bank and OECD Statistics. All values were taken in US dollars.

4.2 Hypothesis

This thesis, using regression analysis and cointegration model aims to confirm hypothesis about the impact of exchange rate on trade balance. The absence of proper investigations about the effect of exchange rate on trade balance of Russia motivated author to test empirically the effect of ruble exchange rate on the trade balance of Russia.

To sum up, we hypothesize that, exchange rate and trade balance have short-term as well as long-term dependence. (Tochitskaya, 2006).

4.3 Expected signs

Based on the studies of Tochitskaya (2006), Ershov (1992), Bahmani-Oskooee (1985) we present the following model:

$$TB = f(\overset{+}{EX}, \overset{-}{Y}, \overset{+}{YW})$$

Based on the theory, we expect that growth of GDP (Y) will lead to an increase in imports, as national agents will be bound to buy more expensive imported goods. So, it will be a negative effect on trade balance. On the other hand, increase in income of traded partners (YW) will lead to an expansion of exports from Russia, so there is a positive effect on trade balance. From the theoretical point of view, depreciation of exchange rate should lead to improvement of trade balance, because import becomes more expensive and export for internal partners – cheaper. As we use direct quotation, the coefficient before exchange rate has to be positive. (Tochitskaya, 2006, p.661).

5. The basic models

First of all, the basic OLS will be used for the analysis of the data. This model is built with first differences of logarithms of variables.

$$ld\_TB = \beta_1 + \beta_2 ld\_ER + \beta_3 ld\_Y + \beta_4 ld\_YW \tag{32}$$

To test the long-term dependence between trade balance and exchange rate the cointegration model was used. Since for cointegration model the variables should have the same order of integration, we will use the logarithm of variables (ln_TB and ln_ER).[6]

5.1 Testing significance of the model

We opted for cointegration model and tested the existence of cointegration by Engle Grager test. Results confirmed that there is cointegration between variables. Additionaly, we tested stationarity of time series with help of ADF (Augmented Dicky-Fuller test). Since the test has confirmed non-stationarity, we resolved this problem by first difference of variables.

$$\ln TB = \alpha + \beta \ln ER + \varepsilon \tag{33}$$
$$b = \left(1; -\beta\right)$$

5.2 Stationarity

Before the regression, it is critical to test stationarity of time series. "A stationary time series process is one whose probability distributions are stable over time in the following sense: if we take any collection of random variables in the sequence and then shift that sequence ahead h time periods, the joint

[6] Variable ER has second order of integration and TB has first order of integration.

probability distribution must remain unchanged" (Wooldridge, 2008, p. 378). We have to use Augmented Dickey–Fuller test for unit root.

Table 1

TB	ER	Y	YW	lnTB	lnEr	lnY	lnYW
I (1)	I (2)	I (2)	I (1)	I (1)	I (1)	I (1)	I (1)

The data set encounters typical problem of macroeconomic time series, all time series was non-stationary. This would cause the estimates of the regression to be irrelevant. Author resolves non-stationary by using first differences of logarithms of variables.

5.3 Regression analysis

First econometric model presents the combination of income-absorption approach and elasticity approach (Tochitskaya, 2006, p.662). As a result of regression analysis of data for the Russian economy for the period since 2000 to 2014, the following multiple regression equation was obtained:

$$ld\_TB = \underset{(3,224)}{0,037} - \underset{(2,545)}{1,611} ld\_ER - \underset{(3,231)}{0,056} ld\_Y - \underset{(0,194)}{0,195} ld\_YW \quad [7] \qquad (34)$$

$$R^2 = 0,67 \qquad F = 5,63 \qquad p = 0,001 \qquad DW = 2,119$$

Value of coefficient of determination is quite high, which means that model explains over 65% of the variation. The value of the F-test and p-level denote that we can reject the null hypothesis that the regression equation is statistically insignificant. Residuals in the model do not have autocorrelation and have normal distribution. Thus, it can be argued that the exchange rate as well as other variables in the model affect the trade balance.

[7] In the parentheses below coefficients values of t-statistics are written.

Equation (34) shows that the increase in value of the exchange rate for 1% (depreciation of the currency) would lead to a deterioration of the trade balance by 1.61%. As it was mentioned before, according to the theory, the result should be the opposite: the depreciation of exchange rate should cause improvement in the trade balance. However, in equation (34) there is no lag, which causes a gap in improvement of the trade balance in response to depreciated currency. Accordingly, this equation reflects the prompt response of trade balance to changes in the explanatory variables. The reason for this result could be the fact that the market and economic agents cannot immediately adjust to new conditions, which are caused by changes in exchange rates, due to the fact that there are long-term contracts. Moreover, it could be a drawback of the model.

As for the relationship between national income and exchange rate, increase in national income for 1% leads to decrease in trade balance by 0,056%. This can be explained by the fact that growth of national economy expands import of the country as it was mentioned before. However, it is not possible to derive anything about the impact of income of traded partners on trade balance because the variable is insignificant in the regression.

The analysis would not be accurate enough just with instant response of trade balance to change in exchange rate, as there are a lot of empirical proofs concerning existence of the effect of J-curve. Author have followed Bahmani-Oskooee (1985), who had tried to prove the existence of J-curve by estimating the trade balance equation for four developing countries, using quarterly data for the 1973-80 period. So, regression was made, taking into account the quarterly lags. The number in brackets before the equation indicates the number of quarters, which characterize the time interval between the change in the exchange rate and trade balance.

$$(1)\, ld\_TB = \underset{(2,334)}{0,026} - \underset{(3,042)}{0,151} ld\_ER - \underset{(2,202)}{0,209} ld\_Y + \underset{(1,996)}{0,196} ld\_YW \qquad (35)$$

$$R^2 = 0,75 \quad F = 3,104 \quad p = 0,034 \quad DW = 1,89$$

$$(2) ld\_TB = \underset{(1,76)}{0,089} + \underset{(2,752)}{1,169} ld\_ER + \underset{(0,802)}{0,183} ld\_Y - \underset{(-0,996)}{0,319} ld\_YW \quad (36)$$

$$R^2 = 0,77 \quad F = 2,555 \quad p = 0,065 \quad DW = 1,96$$

$$(3) ld\_TB = \underset{(1,76)}{0,066} + \underset{(2,04)}{0,463} ld\_ER + \underset{(0,299)}{0,081} ld\_Y + \underset{(1,947)}{0,332} ld\_YW \quad (37)$$

$$R^2 = 0,55 \quad F = 5,26 \quad p = 0,003 \quad DW = 1,64$$

$$(4) ld\_TB = \underset{(0,98)}{0,028} + \underset{(0,631)}{0,438} ld\_ER - \underset{(-0,83)}{0,228} ld\_Y - \underset{(-0,575)}{0,135} ld\_YW \quad (38)$$

$$R^2 = 0,46 \quad F = 2,16 \quad p = 0,037 \quad DW = 1,85$$

Residuals in the all models do not have autocorrelation and have normal distribution. In the equation (38) all of variable are not significant. The Wald test was used to test joint insignificance. In the first equation, depreciation of the exchange rate will lead to deterioration in the trade balance. However, in the equations (36) and (37) while increasing value of the time lag, negative impact of the exchange rate on the trade balance disappears. This pattern is similar to the idea of the J-curve. According to the results of the regression analysis, it can be argued that depreciation of the currency will lead to improvement in the trade balance of Russia after one quarter.

The coefficient of the national income is significant only in the first equation (35), where with increase in national income by 1% the trade balance will decrease by 0,2%. If income in the country increases, the import demand will rise, so the trade balance will deteriorate. As for equations (36) – (38) the variable is insignificant, so it is not possible to argue that there is a link between changes in the income of Russia and its trade balance.

As for coefficients of foreign income, from equations (35) and (37) we can argue that there is an effect of foreign income on the trade balance. Thus, on average, an increase in income of non-residents of the country by 1% will lead to the improvement of the trade balance of Russia by 0,25%.

5.4 Cointegration model

Based on the obtained regression equations, it is not possible to claim anything in a long-term relationship between these two variables. For this purpose cointegration model was used.

$$\ln TB = 0{,}36 \ln ER + E_t \qquad (39)$$

$$b = (1; -0{,}36)_8$$

From given model we should test the stationarity of residuals with help of ADF test.

H_0: residuals are non-stationary

H_1: residuals are stationary

LM-test indicates the absence of autocorrelation in the model. So, we should compare obtained value of t-statistic with critical values for Dickey-Fuller and Augmented Dickey-Fuller cointegration tests. Since obtained value is less then lower critical (at 10% significance level: -3,45<-3,26), then null hypothesis about non-stationarity is rejected. Therefore, there is a cointegration between exchange rate and trade balance.

5.5 Interpretation of the results and drawbacks of the model

It is important to remember about the assumptions that were made to simplify the calculations. For example, not all the external partners of the Russian Federation were included in the model, only the main amount of 61.6% of total trade, which may distort the analysis results. Also the price elasticity of export and import is not used in the model due to the fact that it would be highly difficult to count them. That could be a reason why not all results of the regression analysis match the theory. Nevertheless, if we try to seek for the explanation in current economic situation in Russia, we can find following answers. First of all, export of

[8] Cointegrating vector.

Russian Federation in statistical databases is presented in US dollars and in that currency it was taken for analysis. Depreciation of domestic currency leads to price reduction of national goods. Since there are long-term contracts, economic partners pay the same amount of money in rubles. When this amount is converted to US dollars at depreciated exchange rate - the result is a lower value in US dollars. As a consequence, the total cost of export decrease, despite the depreciated exchange rate. Secondly, a large part of Russian export is natural gas, oil and oil products, the price of which is usually expressed in dollars. Thus, in 2013, from 523 billions of US dollars of export, 349 billion of US dollars (67%) were natural gas, crude oil and oil products. These products have very small price elasticity, because in the modern world, they can be considered as necessity goods. Therefore, in short-term period the export will remain unchanged. While, in the long-term period, when national agents will be renegotiating the contracts, they will reduce the dollar price of these goods, but anyway it will remain profitable for them in terms of revenue in national currency. However, with reduction in dollar price of export, profit from export in US dollars will decline. Concerning the import to Russian Federation, as it was mentioned before in the paper, it is very various, because almost nothing is produced within the country. As a consequence, there are no substitutes of imported goods in domestic market. Taking into account the fact that some of imported goods can be considered as necessity goods, the quantity demanding would not fall even with rise in prices as a response to depreciation of domestic currency.

The cointegration analysis has proven that there is a long-term dependence between exchange rate and trade balance. This result contradicts the result of Mustafa and Rahman (2010), who failed to affirm any long-run association between the yen-dollar real exchange rate and the US - Japan real trade balance.

The existence of contradictions in the world practice concerning the dependence of these two macroeconomic indicators on each other makes the topic very challenging. Based on the obtained regression equations, it can be concluded that the effect of changes in the ruble exchange rate on the trade balance exists, but it does not fully comply with the theory. Thus, in Russia, the depreciation of the national currency should lead to deterioration in the trade balance, but with quarterly lag. This result corresponds with the empirical result achieved by

Bahmani-Oskooee (1985), who provides the evidence supports the pattern of movement described by the J-Curve. Therefore, it can be conclude that J-curve effect can be observed in the relationship of trade balance of Russia and the exchange rate of ruble.

Conclusion

This thesis investigates the effect of exchange rate fluctuations on balance of trade. For that purpose, the quarterly data of trade balance is estimated. Data set examined here covers period since 2000 till 2014. The aim of the thesis was to show the short-term and long-term dependence of exchange rate and trade balance. With help of cointegration analysis it was proved that there is a long-term dependence between exchange rate and trade balance. As for short-term relationship of these variables, the regression analysis was used. Among others, the following explanatory variables were selected: GDP of Russia and GDP of major partner countries. For analysis we used time-series model, where we solved for non-stationarity by using first differences of logarithms of variables.

First two chapters of the thesis deal with theoretical aspects of exchange rate and trade balance. They provide basic information about approaches to trade balance and explain how exchange rate can influence it. The following chapter describes the overview of adequate literature. It shows that the conclusions of some of scientific papers are rather controversial. As authors of empirical researches for different countries have proved that the dependence of trade balance and exchange rate not always can be observed thought analysis of available data.

This thesis tries to prove that existence of negative relationship of exchange rate and trade balance with help of available data for Russia. Russia faced irregular fluctuation of national currency in 2014. By means of econometrics author tries to see whatever the trade balance of Russia have negative dependence on exchange rate. The first result of empirical analysis of this thesis is the existence of long-term dependence of exchange rate and trade balance. This result was obtained with help of cointegration model. As for result of analysis of short-term dependence of these variables, it is not so clear. Base on conducted regression analysis, it can be concluded that the depreciation of Russian national currency leads to a deterioration in the balance of trade, but if the time lag is included in the

model, the deterioration come to improvement of the balance of trade after one quarter lag.

This study provides evidence on the effect of exchange rate on trade balance. However, the results are not conclusive, because the obtained regression results do not fully comply with the theory. The topic requires further examination with larger database available as well as deeper investigation of Russian economy.

References

Alexander Sidney S. Effects of Devaluation on a Trade Balance// Staff Papers – International Monetary Fund. Vol. 2, No. 2 (Apr., 1952), pp. 263-278.

Alexander Sidney S. Effects of Devaluation: A simplified Synthesis of Elasticities and Absorption Approaches// The American Economic Review. Vol. 49, No. 1 (Mar., 1959), pp. 22-42.

Bahmani-Oskooee M. Devaluation and the J-curve: Some Evidence from LDCs// The review of Economics and Statistics. Vol. 67, No. 3 (Aug., 1985), pp. 500-504.

Bahmani-Oskooee M., Ardalani Z. Exchange Rate sensitivity of U.S. Trade Flows: Evidence from Industry Data// Southern Economic Journal. Vol. 72, No. 3 (Jan., 2006), pp. 542-559.

Bahmani-Oskooee M., Harvey H. The J-curve: Indonesia vs. Her Major Trading Partners// Journal of economic Integration. Vol. 24, No. 4 (Dec., 2009), pp. 765-777.

Bahmani-Oskooee M., Kovyryalova M. The J-curve: Evidence from Industry trade Data between U.S. and U.K.// Economic Issues. Vol. 13, Part 1, 2008, pp. 25-44.

Bickerdike C. F. The Instability of Foreign Exchange// The Economic Journal. Vol. 30, No. 117 (Mar., 1920), pp. 118-122.

Boyd D., Caporale G. M. Real Exchange Rate Effects on the Balance of Trade: Cointegration and the Marshall-Lerner Condition// University of East London. June 13, 2001, pp. 1-21.

Brahmasrene T., Jiranyakul K. Exploring real Exchange Rate Effects on Trade Balances in Thailand// Managerial Finance. Volume 28, Number 11, 2002, pp. 16 -27.

Buluswar Murli D., Thompson H., Upadhyaya Kamal P. Devaluation and the trade balance in India: stationary an cointegration// Applied Economics. 1996, 28:4, pp. 429-432.

Central bank of Russia. URL: http://www.cbr.ru

Chetverikov C., Karasev G. Structural models of exchange rate of ruble. 2005. - 123 p.

Della Corte P., Sarno L., Tsiakas I. An Economic Evaluation of Empirical Exchange Rate Models// the Review of Financial Studies, Vol. 22, No. 9 (Sep. 2009), pp. 3491-3530.

Dornbusch Rudiger. Devaluation, Money, and Nontraded Goods// The American Economic Review. Vol. 65, No. 5 (Dec., 1973), pp. 871-880.

Dornbusch Rudiger. Exchange Rates and Fiscal Policy in a Popular Model of International trade//The American Economic Review. Vol. 65, No. 5 (Dec., 1975), pp. 859-871.

Ershov M. Currencies in the world trade. - 1992. 144 p.

Frenkel Jacob A., Rodriguez Carlos A. Portfolio Equilibrium and the Balance of Payments: A Monetary Approach// The American Economic Review. Vol. 65, No. 4 (Sep., 1975), pp. 674-688.

Greenwood Jeremy. Non-Traded Goods, the Trade Balance, and the Balance of Payments// The Canadian Journal of Economics/ Revue canadienne d'Economique. Vol.17, No. 4 (Nov., 1984), pp. 806-823.

International Monetary Fund. URL: http://www.imf.org

Kandil M. Exchange rate Fluctuations and the Balance of Payments: Channels of Interaction on Developing and Developed Countries// Journal of Economic Integration, Vol. 24, No. 1 (March 2009), pp. 151-174.

Kouri Pentti J. K. The Exchange Rate and the Balance of payments in the Short Run and in the Long Run: A Monetary Approach// The Scandinavian Journal of Economics, Proceedings of a Conference on Flexible Exchange Rates and Stabilization Policy. Vol. 78, No. 2(Jun., 1976), pp. 280-304.

Krugman P., Obstfeld M., Melitz M. International economics: theory and policy, 9-th edition. — 2012. — 735 p.

Pearce D.K. Alternative Views Of Exchange-Rate Determination // Economic Review, 1983, pp 16-31

Rahman M., Mustafa M., Burckel Daryl V. Dynamics of the yen-dollar real exchange rate and the US-Japan real trade balance// Applied Economics. 1997, 29:5, pp. 661-664.

Sek S. K., Har W. M. Testing the Marshall-Lerner Condition: Bilateral Trades Between Malaysia and Trading Partners// Journal of Advanced Management Science. Vol. 2, No. 1, March 2014, pp. 23-28.

Tochitskaya I. Effect of changes in exchange rate on the trade balance of Belarus. 2006, pp. 1-14.

Yeager L. B. International monetary relations: theory, history and policy, N.Y., 1966

Wilson I. The Monetary Approach to Exchange Rates: A Brief Review and Empirical Investigation of Debt, Deficit, and Debt Management: Evidence from the United States // The Journal of Business Inquiry 2009, pp. 83-99

World Bank. URL: http://www.worldbank.org