

“Theory of Communicating Vessels”: The Problem of Currency Regulation¹

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Abstract One of the key dilemmas of modern monetary policy is the issue of currency regulation. In the center of controversy about the optimal approach to monetary policy is the problem of intervention or non-intervention by the central banks in the currency markets and in the process of formation of the exchange rate.

On the one hand most developed countries there is no any significant relationship between exchange rate and inflation, which in terms of monetary regulation defeats the purpose of intervention by central banks in the currency markets. However, in emerging markets, along with a significant relationship between exchange rate and inflation processes and the lack of effective tools of central banks appears necessity to intervene in the formation of exchange rates of national currencies. This in turn deepens the institutional failure and distortion of market mechanisms in economy. Thus, the problem of currency regulation is most acute in developing economies, including in Armenia. Analysis conducted in this research show significant distortions and inefficiencies currency regulation in Armenia including impact on inflationary processes in the real economy.

On the other hand, against the backdrop of global world financial and currency markets, as well as the instability of world currencies and related consequences, there are supporters of fixed exchange rates. The main argument for fixed exchange rates is primarily a high degree of influence of fluctuations in international exchange rates on monetary systems of the world, and the lack of acceptable diversification of the world currency markets.

All these assign the task of finding the optimum in currency regulation to authors and determine relevance extended research topic.

The basic hypothesis of this study is the idea that the maximum non-interference in the formation of the exchange rate by central banks is the most favorable for stable inflation in the economy.

Keywords Exchange rate - Inflation - Currency regulation - Monetary policy

JEL classification E42

¹ “**Theory of communicating vessels**”: The physical act of communicating vessels is put on the basis of the theory. The economic content of the theory is in close relation to exchange rate fluctuations and inflation caused by the inability to fix the exchange rate and the achievement of market indicators of inflation in the economy.

Methodology

In the frameworks of this study there was carried out triangulation, i.e. used both qualitative and quantitative methods. Here we will apply quantitative methods of comparative and contrastive analysis of the main variables considered, in which identified causal link between the exchange rate and inflation. Given the theme of the study, which is not necessary to go beyond the narrow scope of linguistic and seek a double meaning or implication technique under study is a qualitative method of content analysis. To identify the relationship between the exchange rate and inflation in Armenia in this research we use the technique within a quantitative method with the help of which we can determine the model and conduct a regression analysis with which this relationship is obtained.

In the model, as the dependent variable, we use CPI, and the independent variables are real effective exchange rate, nominal effective exchange rate, foreign trade-weighted average of CPI, output gap and lagged inflation. The considered model is a more general version of the standard model of the Phillips curve in an open economy and estimation of the relationship is conducted through OLS.

This methodology will focus on the synthesis and evaluation of the main results, which are derived from an analysis of the various studies of the issue. Conclusions of the research are based on the results obtained from the model, considering the conclusions of the studies on the subject.

Theoretical overview

The problem of mutual impact of exchange rate and inflation should be viewed in the context of two basic postulates. The first examines aspects of the impact of the exchange rate on domestic inflation, based on the internal factors of the economy. The second one also includes the impact of foreign markets through import prices. However, review of the literature leads to ambiguous conclusions.

The problem of relationship between exchange rate and inflation

Thus, inflation can be conceptually divided into two parts: demand-pull inflation and cost-push inflation.

The first approach to the study of inflation (known as the monetarist approach) focuses on the growth of the money supply. Taking into account a stable velocity of money and exogenous level of production, the expansion of the money supply can be controlled only by changing prices. For example, the theoretical explanation of the phenomenon of inflation in Cagan (1956) is largely developed with traditional monetarist perspective, represented by Milton Friedman, who claims that inflation is formed as a result of excess money supply over the potential market-driven production capacity or demand. As an example of the monetary doctrine of inflation there is fiscal and monetary approach, which emphasizes the impact of rising government deficits as a reason for the expected growth of the money supply, which in turn feeds the inflationary process (Sargent and Wallace, 1973). This scenario is especially true in countries with fiscal policy, free and dependent central bank, which automatically monetize budget deficit.

The argument of monetary expansion, however, is not entirely satisfactory, since the stability of inflation (the rate at which inflation converges to equilibrium after the shock) often ex-

ceeds the growth of the money supply. Therefore, the literature is based on cost-push inflation as the main alternative monetary point of view. This view explains the role of the exchange rate in the inflationary process and creating a vicious circle of increasing prices. In the context of developing countries, where the share of imported intermediate goods is high, large depreciation of the national currency, is likely to lead to an increase in import prices, which then affect the cost increase and ultimately to higher prices for the products in the economy. In addition, the structural dependence of import of capital along with a lack of foreign exchange reserves suggests that developing countries have a recurrent problem with the balance of payments and the depreciation of the national currency is endemic. It should be also noted that not only inflation, but also the fiscal crisis is considered as a result of balance of payments crisis.

Given the above, we can say that the impact of the exchange rate in relation to inflation itself depends on the choice of exchange rate regime in the country.

Exchange rate regime plays an important role in reducing or minimizing the risk of exchange rate fluctuations, which will have an impact on the economy. Any changes in the exchange rate will have a significant impact on the economy. As an example, consider the financial crisis in Thailand, when the government decided to introduce the floating exchange rate regime in mid-1997, which became part of the so-called Asian financial crisis.

Many studies have been carried out on the topic of the advantages and disadvantages of various exchange rate regimes (e.g., Aghevli, 1991; Obstfeld, 1995). From all of the actual studies we can note the empirical study of the impact of different exchange rate regimes on inflation and output. Alogoskoufis (1992) argues that under a floating exchange rate, inflation will be more persistent and the level of dependence on monetary policy will be higher than under a fixed exchange rate.² He proves this theory, based on research data from the US and the UK, since 1880, as well as 21 OECD countries in the postwar period. Obstfeld (1995) in his work confirms this result, except for the case with the US. He explains that the United States is attributed to the role of backup center in the Bretton Woods system. Collins (1996) in his work sought to explain the problem of choosing the exchange rate regime, using data from 24 countries in the Western Hemisphere during the period 1978-1992. She concluded that countries with small and relatively less open economies are less prone to choosing a flexible exchange rate, and countries with a current account deficit or the ones which were involved in the IMF program, by contrast, are more prone to choosing a flexible exchange rate. Ghosh et al. (1995) classify exchange rate regimes of 136 countries for the period from 1960 to 1989 on nine types (which are further classified into different categories) using the annual reports of the IMF measures of currency regulation and currency restrictions. Using deviation of the values from the annual global average, they found that inflation is significantly lower when the exchange rate pegs, particularly if binding is occasionally adjusted. They also concluded that the increase in production is slightly different under the actions of various exchange rate regimes.

With regard to other studies on the analysis of the impact of the exchange rate pass-through and fluctuations of price of imported goods, the most important one is the study of Feinberg (1986, 1989) and Woo (1984). More recent studies continue further research of the influence of the exchange rate on import prices and domestic inflation. Kim (1998) in his work used vector error correction model, and came to the conclusion that in the United States, the exchange rate has a negative long-term effect on the producer price index (PPI). Nevertheless, his work does not discuss the relationship in the short term, which is more important for the conduct

² Alogoskoufis GS (1992) Monetary accommodation, exchange rate regimes and inflation persistence, *Economic Journal* 102: 461-80.

of monetary policy. In this regard, Dellmo (1996) exploring the impact of changes in import prices on consumer price index (CPI) for Sweden, found that here this influence is relatively weak, despite the fact that Sweden is a small open economy.³ In the case of large US economy, the results of the impact of exchange rate pass-through relative to domestic prices are mixed. Koenig (1998) and Boldin (1998) concluded that the inclusion of import prices in a simple model for forecasting CPI improved forecasts for 1990.

Choudhri and Hakura (2006) investigated the extent of impact of exchange rate pass-through for 71 countries, including the crisis-hit countries in Latin America and Southeast Asia, using quarterly data from 1979 to 2000, to test the hypothesis Taylor (2000), that in countries with low inflation exchange rate pass-through on domestic prices is weaker.⁴ Mihaljek and Klau (2001) assessed the degree exchange rate pass-through on domestic prices for thirteen countries with developing economies, using quarterly data from 1980 to 2001.⁵ But these studies have one major drawback, which is that they do not take into account possible changes in the exchange rate regime between the pre-and post-crisis period.

Another approach to the study of the influence of the exchange rate pass-through is the study of nonlinearity in the Phillips curve with inclusion of the function curve of the exchange rate pass-through coefficient. Let's consider this method in more detail.

The presence of nonlinearity in the Phillips curve has corresponding implications for monetary policy. The slope of the Phillips curve, measuring the response of inflation to decline in production, shows directly the cost of disinflation. Schaling (2004) showed that when the Phillips curve is convex, i.e. when the sensitivity of inflation to the economic activity increases with the level of production, the optimal reaction function of monetary policy is asymmetric. Nonlinearity may also be present in the exchange rate pass-through into import prices. If the exchange rate pass-through, for example, stronger when the economy is in the stage of recovery, we can assume that the central bank's reaction to depreciation of the national currency in this context would be appropriate. In fact, the study of the presence of nonlinear mechanisms in the Phillips curve is an important topic in modern economic literature. Most research on nonlinear Phillips curve for advanced economies was focused on the slope of the Phillips curve and the effect of exchange rate. In the first case, Laxton, Rose and Tambakis (1999) and Bean (2000) proved that the Phillips curve is convex and Stiglitz (1997) and Eisner (1997) argue that the Phillips curve is concave.⁶ In the literature on the exchange rate pass-through effect, in turn, contain multiple sources of nonlinearity, which indicate that the degree of the exchange rate pass-through may be associated with some macroeconomic variables, including the exchange rate. Mann (1986), Goldberg (1995), Gil-Pareja (2000), Mahdavi (2002) and Olivei (2002) found that the asymmetry of the exchange rate pass-through is associated with the direction of changes in the exchange rate, while Ohno (1989), Pollard and Coughlin (2004) indicated the presence of asymmetry associated with the magnitude of exchange rate changes.

The business cycle is also noted as the source of nonlinearity of the exchange rate pass-through into import prices. Transfer of exchange rate devaluation on domestic prices will be

³ Dellmo H (1996) Relationships between Swedish Producer Prices and Import Prices and the CPI. Working Paper No. 29, Sveriges Riksbank.

⁴ Choudhri EU, Hakura DS (2006) Exchange Rate Pass-Through to Domestic Prices: Does the Inflationary Environment Matter? *Journal of International Money and Finance*, 25: 614-639

⁵ Mihaljek D, Klau M (2001) A Note on the Pass-Through from Exchange Rate and 28 Foreign Price Changes to Inflation in Selected Emerging Market Economies, *BIS Papers*, No.8: 69-81.

⁶ Filardo AJ (1998), New evidence on the output cost of fighting inflation, *Economic Review*, 83(3): 33-61, 3rd Quarter.

lower during the recession. Goldfajn and Werlang (2000) estimated the group consisting of 71 countries and found that depreciation of the national currency is transferred to the prices when the economy is in the stage of recovery. In the case of Brazil, Carneiro, Monteiro and Wu (2002), for example, obtained similar results, showing a reverse view of the Phillips curve, with the pass-through coefficient of the exchange rate as a function of the level of unemployment and the real exchange rate.⁷ In these works, the value of the exchange rate pass-through coefficient is a function of several variables.

Aigbokhan showed that the real exchange rate is the main factor determining the rate of inflation in Mexico during the 1980s and 1990s.⁸ Chhibber developed detailed econometric model that takes into account both monetary and structural factors in the study of the causes of inflation in Zimbabwe. This study shows that the monetary growth, world prices, exchange rate and interest rate are the main determinants of inflation in this country.⁹

Such a macroeconomic model of inflation has been used in work of Ghana Chhibber and Shafik.¹⁰ This study, which covers the period 1965-1988, suggests that monetary growth is one of the key variables that explain inflation in Ghana. Variables such as the official exchange rate and real wages have failed to have a significant impact on inflation. However, a significant positive correlation was found between the parallels of the exchange rate and the general price level. On the issue of inflation, Chhibber suggested that there is only one link between the exchange rate and price inflation. He is basing his argument on empirical studies in some African countries and one of his main conclusions is that devaluation may have increased pressure on the general price level by increasing the cost of production in short term. Chhibber believed that on the extent to which the devaluation of the local currency will cause inflation to a large extent depends on the influence of policy measures, income and expenses (budget) of the Government, together with monetary policy.¹¹

The basic idea of the PPP theory - it is the law of one price. According to it in competitive markets in the absence of transportation costs and official trade barriers (such as tariffs) the same goods in different countries should be sold for the same price, if we express this price in the same currency. If this law does not take place, then there is a possibility of currency arbitrage, which involves adjusting the exchange rate as long as the law of one price will not be restored. Thus, the PPP connects exchange rate and the prices of goods denominated in different currencies. PPP also plays an important role in understanding the exchange rate fluctuations. For example, PPP is used to predict the equilibrium bilateral exchange rate between currencies, which is based on the analysis of trends in the consumer price index or other key indicators of price level.

Limitations of law of one price in stimulating of effective currency arbitrage in international markets, even for homogeneous goods, may be one of the reasons why the use of PPP based on price indices gives disappointing results on the correctness and validity of the PPP theory.

⁷ Muinhos MK (2001) Inflation targeting in an open financially integrated emerging economy: The case of Brazil, Banco Central do Brasil Working Paper Series no. 26, Aug.

⁸ Aigbokhan BE (1991) The Naira Exchange Rate Depreciation and Domestic Inflation. *The Indian Journal of Economics*, 71: 507-517.

⁹ Canetti E, Greene J (1991) Monetary Growth and Exchange Rate Depreciations as Causes of Inflation in African Countries: An Empirical Analysis. Mimeo, IMF, Washington.

¹⁰ Chhibber A, Shafik NS (1990) Exchange Rate Reform, Parallel Markets and Inflation in Africa: The Case of Ghana. World Bank Working Papers, WPS 427, May.

¹¹ Canetti E, Greene J (1991) Monetary Growth and Exchange Rate Depreciations as Causes of Inflation in African Countries: An Empirical Analysis. Mimeo, IMF, Washington.

For example, Huizinga (1987) and Meese, and Rogoff (1988) could not prove the hypothesis that exchange rates follow a random walk process. Frankel (1990) argues that if the deviation of exchange rate from PPP is slow, it will be difficult statistically or otherwise observe the convergence of exchange rates, based on PPP. Using a data set of dollar/pound exchange rate, spanning from 1869-1984, he was able to reject the random walk hypothesis of exchange rate. In the 1990s, there have been many studies (Diebold et al. (1991) and Glen (1992)), covering longer periods of time, which also refute this hypothesis. However, the disadvantage of these studies is that there are mixed operating until 1973 fixed exchange rates and operating since 1973 floating exchange rates.

Despite the theoretical validity of the law of one price and PPP, there are different results of empirical research concerning the theory of PPP. The results of the empirical analysis can be divided into studies of the 1990s and, respectively, research relating to the 2000s. Several studies conducted in the 1990s, support the theory of PPP in relation to such actively traded commodities like gold and oil (Froot and Rogoff (1996), Hakkio (1992), Frankel and Rose (1995), Mac Donald and Taylor (1992)).

Other studies have attempted to test the hypothesis of random walk of exchange rate and compare it with respect to the mean reversion based on PPP, using cross-sectional data. For example, Wei and Parsley (1995) tested the annual data for fourteen OECD countries traded goods. Just as in previous studies, they find that bringing the exchange rate to equilibrium according to the theory of PPP, at the exchange rate deviation from PPP, takes an average of 4 to 5 years. Thus, in the long run, at the exchange rate deviation from purchasing power parity, usually reversion relative to the mean is achieved, albeit at a slow pace.

More recent studies have used cointegration analysis regarding PPP. For example, Hong and Phillips (2005) used a modified cointegration analysis for the study of linear regression with respect to PPP, using monthly data on US, Japan and Canada, after the Bretton Woods agreement. While commonly used tests of cointegration ADF and PP gave different results on cointegration, modified cointegration analysis disproves null hypothesis of cointegration. Similarly, Bahmani-Oskooee and Goswami (2005), using monthly data from eight developing countries in Asia during 31 years, analyzed the theory of PPP on the black market. The results showed that while the variables in the model are cointegrated within Johansen cointegration analysis, internal and external prices are not exogenous factors in many countries, and because of that direct analysis gives a refutation of the PPP hypothesis.

Koekijk, Tims and van Dijk (2004) analyzed the hypothesis of purchasing power parity for the Eurozone countries for the period 1973-2003. The empirical results of their work support the hypothesis of PPP for a list of real exchange rates. They concluded that the process of economic integration in Europe has accelerated convergence of exchange rate to the PPP in the Eurozone.

Baum, Caglayan and Barkoulas (1998) made a model of the dynamics of adjustment to long-term purchasing power parity in the post-Bretton Woods agreement in the framework of nonlinear analysis. With help of the ESTAR model, they estimated variables deviations from PPP using both the CPI and values based on the wholesale price index for a wide range of US trading partners. The results of their study indicate reversion relative to the mean, which supports the hypothesis of PPP.

Canetti and Greene (1991) used the vector auto regression analysis in order to separate the impact of monetary growth from the effects of exchange rate changes on inflation projection in Africa and concluded that fluctuations of exchange rate and increase in money supply affect the changes in consumer prices in many sub-Saharan Africa. In particular, the authors find a significant causal effect of the exchange rate on prices in Sierra Leone, Tanzania and Congo.

Studies on the relationship between inflation and exchange rate were conducted over several decades. Ndungu (1997), using Granger causality analysis, based on the data from 1970 to 1993 in Kenya showed the mutual influence of the level of domestic inflation and exchange rate changes.¹² Ndungu made the following conclusions:

- The level of inflation and exchange rate changes affect each other;
- Domestic debt affects inflation unilaterally;
- The level of domestic inflation and changes in foreign exchange reserves affect each other;
- Changes in foreign reserves and exchange rate also interrelated.

Rana (1983) showed that changes in exchange rates do not affect the level of inflation in the ASEAN countries, except for Thailand.¹³ On the other hand, Kamin and Klau (2003) found empirical relationship between inflation and real exchange rate in many countries in Asia and Latin America. In addition, they also found that the effect of exchange rate changes on inflation in Latin America was much higher than in Asia and industrialized countries.

Noer, Arie and Piter (2010) conducted a comparative study on the relationship between inflation and real exchange rate. Using Granger causality test, they found a strong correlation between changes in the level of inflation and the real exchange rate in most of the countries surveyed.¹⁴

Exchange rate pass-through

Traditional economics considers that the goal of devaluation is to make import more expensive and export cheaper, devaluation is effective if domestic prices must remain unchanged. In the situation where currency devaluations affect domestic prices and the relationship with any other country, such a measure would certainly be exacerbated, as each subsequent devaluation do not create its own wage-price spiral, while the initial effect is neutralized. However, in this case, the domestic production does not increase enough to meet the additional demand caused by devaluation.

Oyejide noted that devaluation of exchange rate often leads to increased costs of imported inputs in local currency (raw materials and intermediate capital goods) and final goods through cost-push inflation. He noted that the non-traded goods can't be imported because the excess of demand for them will lead to an increase in domestic prices in the short term.¹⁵

Omotor considered the impact of prices on the exchange rate changes in Nigeria, using annual data for the period 1970-2003. Evidence suggests that exchange rate policy plays a significant role in determining inflation in Nigeria.¹⁶ There are also other studies that have reached similar conclusions (Odedokun, Odusola and Akinlo, Nnanna, and Zhang Lu). Hav-

¹² Ndungu NS (1997) Price and Exchange Rate Dynamics in Kenya: an Empirical Investigation (1970-1993). AERC research Paper, 58.

¹³ Rana PB(1983) The Impact of The Current Exchange Rate System on Trade and Inflation of Selected Developing Member Countries”. Asian Development Bank Economic Staff Paper, No. 18.

¹⁴ Noer AA, Arie JF, Piter A (2010) The relationship between inflation and real exchange rate: Comparative study between ASEAN+3, the EU and North America. European Journal of Economics, Finance and Administrative Sciences. 18

¹⁵ Oyejide TA (1989) Thoughts on Stability of Nigeria's Exchange Rate. The Nigerian Banker, September –December.

¹⁶ Omotor GD (2008) Exchange Rate Reform and its Inflationary Consequences: The Case of Nigeria. *Economics* Pregled, 59 (11): 688-716

ing considered the evidence, we were able to establish the main effect of the exchange rate on inflation in the country, although there are other variables such as money supply, government spending, and others.

There are other indicators for linking the exchange rate and price dynamics. These are so-called real exchange rate, the real effective exchange rate, as well as the exchange rate by purchasing power parity (PPP). Real exchange rate characterizes the change in the level of prices in one country compared with the price level to another, measured through the nominal exchange rate. Inflation is one of the irremovable characteristics of fatal capitalist economy. It can be more or less, take open or depressed form, but it is present in all economies for decades.

Over the past twenty years there has been a decline in the number of countries which use the fixed exchange rate as a formal anchor of monetary policy. In 1979, 68% of IMF member countries have used a fixed exchange rate policy, while their number in 1997 reduced to 36%. Including countries with limited floating exchange rate, the corresponding numbers fell from 76% to 44% (IMF, 1999). However, the official regimes tell us only the part of the story. The actual monetary policy may be changed without reflecting changes in the organization of monetary policy. Given the number of countries applying *de facto* fixed exchange rates as an anchor of its monetary policy, it appears that fixed exchange rates in one form or another are still important anchor of monetary policy around the world. Almost 60% of countries have fixed regime, although only 45% of them use a fixed exchange rate as a formal objective of monetary policy.¹⁷ Nevertheless, the number of countries using the fixed exchange rate decreased. In 1991, 76% had a fixed exchange rate as their primary tool of monetary policy, but this number has decreased to 60% (IMF, 1999 and International Financial Statistics, August 1999).

Under the new conditions of free capital flows there appeared questions about the suitability of the policy of a fixed exchange rate as a nominal anchor of monetary policy. In recent years, in different countries often use “strict” fixed exchange rate regime or a more flexible exchange rate policy. Consequently, the question arises, what can replace the fixed exchange rate as an anchor of monetary policy. Economists, central bank governors and large number of countries are increasingly set the policy of the establishment as a formal regime of inflation monetary policy. Almost all the authors have studied the relationship between inflation and exchange rate in the postwar period have come to the conclusion that exchange rate movements do not correspond exactly to the relative purchasing power parity, and that the introduction of floating exchange rates have increased dramatically the absolute size of the deviations from PPP rates. However, the concept of PPP is widely used in the practice of state regulation of the economy of developed countries. All authors who adhere to the concept of relative PPP emphasize that it is the basis of the quantity theory of money. English economist Gregory T. shows the connection of exchange rates to the quantity theory of money, “Exchange rates are determined by the ratio of the amount of money issued by the various countries.”

For the PPP theory as the basis of exchange rates formation, as a whole, is characterized by the exchange theory, which means exaggeration of the role of the circulation. Similar concept of exchange rate formation based on the quantity theory of money, which is denying labor theory of value, asserts that the value of money and the level of commodity prices are determined exclusively by the amount of money in circulation.

It should be noted that currency as the category enables connection and interaction of national and world economy.¹⁸ With a strong inflation in the country national currency is dis-

¹⁷ Thórarinn G. Pétursson “Exchange rate or inflation targeting in monetary policy”, Monetary Bulletin 2000/1

¹⁸ Krasavina LA, Alibegov TI (2006) International monetary and financial relations, p. 34 - Finance and Statistics

placed by more stable foreign currency, i.e. dollarization of the economy going. Therefore, in many developing countries, including the CIS countries, there is a dollarization of the country, which leads to high, and sometimes to excessive demand for foreign currency. The main reason of dollarization is the emergence of the difference between the current exchange rate and the real purchasing power of the national currency. To resolve this difference it is necessary to carry out devaluation of the national currency, but, as experience shows, in some CIS countries, the government and the Central Bank actively intervene in the formation of the current exchange rate of the national currency. In these conditions it is impossible to determine its market value, and therefore it is practically impossible to establish the real difference between the current exchange rate and objective purchasing power of the national currency.

In developed countries, the transition to convertibility of national currencies began as a rule, with its simultaneous devaluation and the subsequent introduction of a fixed exchange rate. The “floating” regime of the national currency exchange rate occurred when inflation reached a small size while revitalizing all sectors of the economy. For example, Austria, the UK was FRG France and Japan. In the CIS countries the transition to convertibility began and continues to this day in the deepening crisis of national production.

With regard to the literature on the dynamics of inflation and exchange rate Agenor and Montiel (1999), when considering purchasing power parity (PPP),¹⁹ noticed that the consumer price level is determined by the exchange rate. Therefore, the stabilization of inflation apparently requires that the rate of depreciation of the national currency is slowed to a rate of change of the exchange rate, thus giving it the task of ensuring price stability, and external balance would be achieved due to the policy of limiting the aggregate demand.

According to Goldberg and Knetter (1997) exchange rate pass-through is defined as “the degree of sensitivity of the imported goods prices to one percent change in the national currency exchange rate called the exchange rate pass-through to prices.” However, the change in import prices in some extent also affects the production and consumer prices. For this reason, in this work exchange rate pass-through is considered in a wider sense, as the consumer price changes can be related to previous changes in the nominal exchange rate.

The literature distinguishes between two channels of the exchange rate pass-through: the direct and indirect channels. The importance of each of them becomes more noticeable, depending on the degree of openness of the economy.

Direct transfer channel works through the external sector of the country, i.e. through import prices. If we denote exchange rate by E (the number of national currency per unit of foreign currency), and the price of imported goods in foreign currency by P^* , the $E \cdot P^*$ will represent the price of imported goods in the national currency. If P^* remains unchanged, and E is depreciated (stronger), then the price of imported goods in the national currency will grow proportionately. The result of this process is called the exchange rate pass-through to import prices. Nevertheless, the pass-through effect is complete, if the margins on products and marginal costs remain constant. Changes in import prices are also moving to production and consumer prices, if producers raise prices in line with the increase in import prices.

Indirect channel of the exchange rate pass-through refers to the competitiveness of products in the international markets. Depreciation of the domestic currency makes domestic goods relatively cheaper for foreign buyers, and as a result, aggregate demand and exports begin to grow and cause a rise in domestic prices. As the contracts for nominal wages remain unchanged in the short term, real wages fall, and production increases. However, when eventu-

¹⁹ Agenor P, Montiel P (1999) Development Macroeconomics, 2nd ed., Princeton University Press, Princeton, NJ.

ally the real wage increase and return to its former level, production costs will increase, the general price level will increase and volume of production will decrease. Thus, in the end, the depreciation of the national currency leads to a permanent increase in the price level with a temporary increase in production volume.

In reality, however, exchange rate pass-through can't be complete. Goldberg and Knetter (1997) argue that U.S. import prices represent only 50% of foreign exchange rate changes (despite the fact that the price reaction is different depending on the industry). Perhaps the most common explanation for this phenomenon is the so-called strategy of pricing based on the market, used by exporting companies. Instead of adjusting their prices to exchange rate changes, exporting companies leave prices for their goods unchanged and simply increase the premium. This behavior is called market-oriented pricing. This means that exporting firms are taking temporary loss of their income in order to avoid long-term losses (in the case of national currency appreciation) their market share. Many studies show that the expansion of market-oriented pricing is positively correlated with the concentration in the market. Market-oriented pricing is largely present in the competitive sectors.

Monetary policy of the CBA: Overview

Armenia has committed itself, as a country that implements inflation targeting²⁰ and implementing a policy of floating exchange rate policies. According to the official position of the CBA, as well as the IMF classification, Armenia belongs to the countries which implement the "managed float" policy as a part of their monetary policy.

From the very beginning of the inflation targeting the CBA has faced serious issues. The main difficulty lies in the fact that the central bank doesn't have sufficient tools to control inflationary pressures up to this day, which in its turn is caused by virtually not developed financial market.

Furthermore, the overall macroeconomic instability inherent in Armenian economy does not allow building effective prediction models, which is also a serious obstacle for the implementation of the inflation targeting.

As we can see in Figure 1, starting in 2006, the Central Bank failed to reach the target in more than a half of the periods. On the other hand, in the annual cut of five periods observed in two cases Central Bank failed to reach the target value (see Table 1). Moreover, we note that in 2008 the deviation from the target has reached 61%, and in 2011 - 40%. Deviations, though small, is also observed in 2013.

The official position of the monetary authorities about missing the target is based on the serious impact of the global financial crisis on the whole Armenian economy, which is reflected in the money market. Of course, some effects of the crisis can't be taken into consideration. It should be also noted that taking into consideration isolation of the economy, weak export, and in particular the problems in financial sector of Armenia, position of the monetary authorities is doubtful for this cases.

On the other hand, the financial crisis to some extent had to have positive impact on the economy of Armenia. Reduction in disposable income in the world has led to a decrease in a level of cash transfers in Armenian economy. This in its turn has contributed to the decline of the dollar supply in the country, which certainly could not affect the exchange rate of the

²⁰ Note: Armenia adopted inflation targeting in 2006

national currency. Indeed, private transfers in 2009 amounted to 1124 million dollars²¹ against 1635 million dollars in 2008. This reduction in the inflow of foreign currency has led to instability in money market and caused another round of inflationary pressure, which was exacerbated by negative inflation expectations from the real sector.

Figure 1 CPI and target, quarterly.

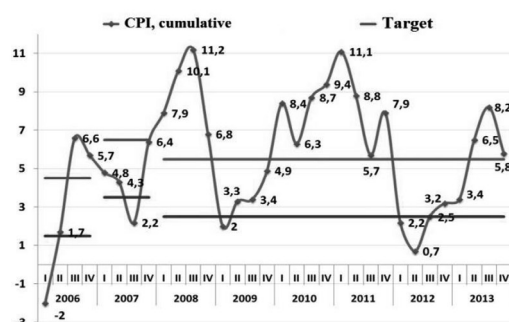


Table 1 CPI and targets annually.

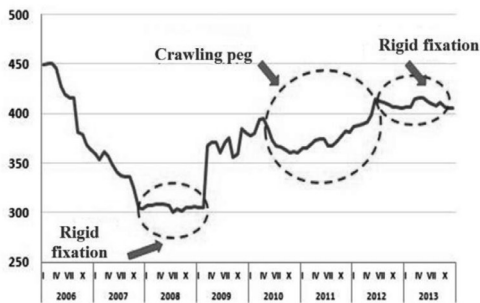
	2006	2007	2008	2009	2010	2011	2012	2013
Target (bottom limit)	1,5	2,5	2,5	2,5	2,5	2,5	2,5	2,5
Target (high limit)	4,5	5,5	5,5	5,5	5,5	5,5	5,5	5,5
The actual level of inflation	2,9	4,4	8,9	3,4	8,2	7,7	3,2	5,8
The deviation from the target	0%	0%	61%	0%	49%	40%	0%	5,5%

Source: Used data from the official website of the CB of RA-www.cba.am.

The response of “monetary authorities” to this situation was a tightening of monetary policy. A question arises. Is it possible to implement tight monetary policy under inflation targeting? As the experience shows and the inflation targeting regime requires, the combination of this model of monetary regulation in the framework with hard currency control reduces the effectiveness of monetary policy in General. Researchers have shown that none of inflation-targeting countries allows major intervention on the foreign exchange market by the Central Bank. Along with this, the situation in Armenia is absolutely opposite. Since the start of implementation of inflation targeting the CBA started active interventions in the currency market. According to the official position the main tool of the Central Bank in monetary policy in Armenia is the refinancing rate. However, research shows that over the past five or more years, all attempts to reduce inflationary pressures in the economy through a policy of “expensive money” have not led to any positive results. As a rule, a tightening of interest rate policy is followed by huge increase of the inflationary pressures. By the end of 2008, the refinancing rate has reached to 7.75%, while the inflation rate was at the same period 11.2%. After a certain lag of one or two quarters inflation rate declined slightly, but it was not due to so much the actions of the Central Bank in interest rate policy. This reduction was due to the General decline in business activity in the economy. The GDP growth rate for that period amounted to 6.8% against 13.7% in 2007. The next year was marked by an unprecedented drop in economic growth rates: - 14.4%!

So, what is the cause of insolvency of the interest rate as a monetary regulation instrument for the Central Bank of Armenia? The main problem in this case is very negligible correlation between financial system and the real sector of the economy. The reason for this is low level of development of the financial system. This inharmonious, unbalanced structure of the financial system (the share of the banking sector is more than 90% of total assets) makes the attempts of Central Bank to influence aggregate demand through the refinancing rate to vain.

²¹ Source: The data of the official website of the National Statistical Service of the Republic of Armenia. www.armstat.am

Figure 2 The exchange rate AMD/USD.

Source: Used data from the official website of the CB of RA-www.cba.am.

Noted problem deprives the Central Bank the effect of other instruments -especially open market operations securities. As of 2010 the level of capitalization of the market amounted to 1.49%. Such a small share of the financial market in the economy of Armenia does not allow the monetary authorities to use open market transactions of securities in order to impact the aggregate demand. However, taking into account the structure of transactions on the stock exchange, it is obvious that the Central Bank of Armenia has no other instruments of monetary regulation except foreign exchange policy.

As a result, almost from the beginning of implementation of inflation targeting the CBA uses a single instrument of influence on the real sector that is the hard currency regulation. Since late 2005 and the beginning of 2006 the basic policy of “monetary authorities” was strengthening the exchange rate of the national currency. The activity of the Central Bank on the foreign exchange market in this period is unprecedented! The level of sales amounted to 105,6 million dollars in 2005 reached 799 million in 2009. Such action on the foreign exchange market by the Central Bank of Armenia has led to significant appreciation of the exchange rate of the national currency. Since 2003 the strengthening of the dram against the USA dollar amounted to 52%. Since the end of 2007 to the beginning of 2009 the Central Bank de facto implements a policy of rigid fixation of the exchange rate. By March 2009 the Central Bank of Armenia faced a serious lack of international reserves which amounted to 1331,4 million dollars and almost reached critical minimum. This situation forced the Central Bank of Armenia to weaken its position of on the currency market, which led to a depreciation of the exchange rate of the national currency by about 21%. This situation has led to significant volatility, but also to the decrease of trust to “monetary authorities”, financial and macroeconomic imbalances, increasing inflationary expectations, and finally to significant negative consequences in the whole economy.

How effective and justified was the currency policy of the CBA? As we can see in figure 3, the strengthening of the exchange rate was accompanied by continuous strengthening of inflationary pressure in the economy. In the result of the strict containment of money supply with the help of foreign currency interventions have not led to tangible results in the monetary regulation.

It should be noted that the official position of the CBA denies the above formulated thesis. According to the report of “monetary authorities” strengthening of course has been caused by the large inflow of remittances, changes in the dynamics of the exchange rate of the dollar against other currencies, the recession in the U.S. economy, and increasing confidence in the national currency in the economy of Armenia.

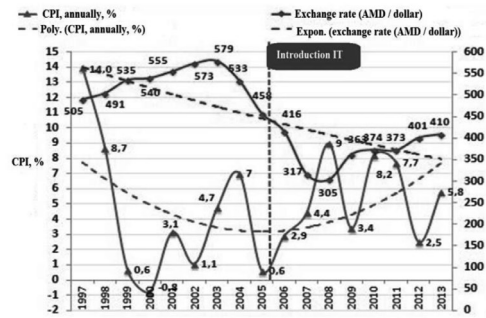
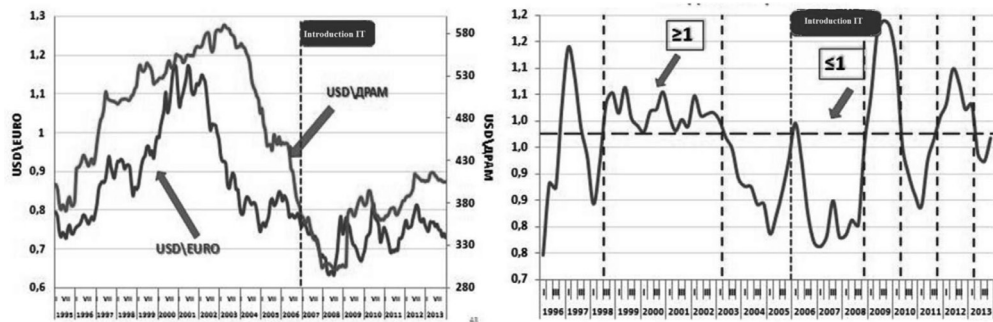
Figure 4.**Figure 3** The CPI and the exchange rate, annually.**Figure 5.** The index's advance.

Figure 4 Dynamics of exchange rate of USD\EURO and USD\AMD monthly). **Figure 5** The index's advance



Source: Used data from the official website of the CBoF RA -www.cba.am.

However, the author can't agree with this position. Studies clearly indicate artificial appreciation of the dram against the USA dollar.

First of all, it should be looked at the dynamics of the exchange rate of dram against the Euro.

As we can see in figure 4, changes in the exchange rate of the dollar against the Euro and dram till 2004 had similar trends. But then, the exchange rate of the dollar in Armenia acquired a completely reverse trend character to the world one.

Confirmation putting forward the thesis about the artificial strengthening of the exchange rate of the national currency, can be considered by indicators of the Index advance (see figure 5). The calculations showed that from 2004 till 2009 (during the period of strengthening of the exchange rate of the national currency) Index timing was constantly below 1, which indicates a higher rate of inflation than of exchange rate changes, and this in turn proves artificial nature of the changes on the currency market at that period.

A stable level of purchasing power parities is experienced for the whole period of strengthening the exchange rate of the dram in Armenia. At the same time the appreciation of the exchange rate of the national currency, as a rule, is accompanied by the increased purchasing power of the national currency. It should also be noted that the strengthening of the national currency, of course, is a result of a significant growth in the whole economy. However, the reviewed period such a jump in the rate of economic growth was not observed.

It is impossible to say that the strengthening of the dram is associated with the increasing confidence of the national currency. For the whole period of dollarization level of dram evaluation of economy in General and the banking system in particular, remained at a high level. A significant reduction in dollarization level is observed only at the end of 2008 and the beginning of 2009. Thus, in the third quarter of 2008, the level of dollarization of total deposits reached its minimum and amounted to 35, 5%. However, the events in March 2009 on the currency market have drastically undermined the credibility of the national currency and by the end of the first quarter of 2009, the level of dollarization of total deposits amounted to almost 70%.

What was the result? Monetary policy of the Central Bank of Armenia finally undermined the credibility of the “monetary authorities” from the real sector, intensified inflationary expectations, which in the shortest terms grew at quite high rates of inflation in the first place on the consumer market. Hard monetary policy for 5-6 years has led to the minimization of competitive advantages of Armenian goods in foreign markets, which had brought all attempts export-oriented manufacturers to expand the market. The latter has further weakened the position of

Armenia's economy on the world stage. In turn, strengthened exchange rate has worsened the situation with imports. Already dominating over the exports imports, which are characterized by a high degree of concentration, finally strengthened its position in the consumer market of the country.

Another negative effect of the artificial strengthening of dram's exchange rate can be considered as a significant decrease in real incomes. It is not a secret that the main share of income of the Armenian population is formed by the inflow of remittances. The latter, as a rule, proceed to the population in foreign currency, in most cases is in dollars. The depreciation of the dollar in Armenia resulted the decrease in AMD equivalent of incoming transfers. And if we add to this the growing level of consumer prices in Armenia in the last five or six years, it is obvious that the current RA Central Bank monetary policy has left a negative impact on the General welfare of the population.

And with all mentioned above, monetary policy of the Central Bank of Armenia has not led to significant results from the point of view of reducing inflationary pressures. Thus, carried out to the detriment of many macroeconomic indicators monetary policy turned out to be meaningless.

Model Specification

Let's imagine a small open economy, which produces, consumes and exports of domestic goods (H), as well as imports and consumes foreign products (F). The price of foreign goods P_F is determined by the exchange rate E (the ratio of the local currency to the US dollar) and the price of foreign goods in foreign currency P^*F (exogenous factors). The price of domestic goods P_H is determined by the equilibrium in the domestic market of goods.

To determine the equilibrium price of domestic goods, we begin with a review of the manufacturers that maximize their profits, choose L , as used of labor, and accordingly Q_H , as the level of production. With the decline of the marginal product of labor for a given level of power or potential $\bar{Q}_H$ respectively, the demand for labor decreases with the increase in real wages W/P , where consumer price level P is the weighted average of the prices of domestic goods P_H and prices of foreign goods P_F .

Based on assumptions, we can get the supply curve for domestic products as a function of relative prices, or equivalent real exchange rate P_F/P_H ($\eta_{a,b}$ represents the elasticity of a against b .) The increase in the foreign prices leads to the increase of the subsistence minimum P , and therefore wage W , thereby increasing the real wages in the domestic market (W/P_H). The result is a reduction of supply on the domestic market.

$$\begin{aligned} S_H &= S_H(P_F/P_H; \bar{Q}_H) \\ \eta_{S_H, P_F/P_H} &< 0 \text{ и } \eta_{S_H, \bar{Q}_H} < 0 \end{aligned} \quad (1)$$

The demand of the residents of DH and foreigners D_H^* for domestic goods, it is assumed that depend on relative prices and aggregate demand absorption A and A^* . For simplicity, assume that the external and internal demand for domestic goods have the same flexibility in accordance with the relative prices, and that their elasticity with respect to the absorption of a single in both cases.

$$\begin{aligned}
 D_H^* &= D_H(P_F/P_H; A^*) \\
 \eta_{D_H, P_F/P_H} &= \eta_{D_H^*, P_F/P_H} > 0 \\
 \eta_{D_H, A} &= \eta_{D_H^*, A^*} = 1
 \end{aligned}
 \tag{2}$$

equilibrium condition for domestic goods require the offer to be equal to the sum of internal and external demand:

$$S_H = D_H + D_H^* \tag{3}$$

We differentiate this equation by the method of logarithmic differentiation, allowing changes in the level of potential output $\bar{Q}_H$. Differential in the domestic and foreign commodity prices - equivalent, changes in the real exchange rate can be expressed as normal inverse function of the weighted average growth of internal and external absorption on potential internal volume of the issue. In other words, the increase in absorbance in relation to internal potential output increases the price of domestic goods relative to foreign, thereby strengthening the real exchange rate.

$$\begin{aligned}
 (\hat{P}_F - \hat{P}_H) &= -\varepsilon \left[(\delta \hat{A} + (1 - \delta) \hat{A}^*) - \hat{\bar{Q}}_H \right] = \varepsilon \left[\hat{A}' - \hat{\bar{Q}}_H \right] \\
 \delta &= \frac{D_H}{(D_H + D_H^*)} \\
 \varepsilon &= \frac{1}{\eta_{D_H, P_F/P_H} - \eta_{S_H, P_F/P_H}}
 \end{aligned}
 \tag{4}$$

The relationship between logarithmically real exchange rate and the gap between absorption and the potential volume of the issue is presented below; $(\bar{P}_F/\bar{P}_H)$ represents the value of the real exchange rate in accordance with the balance in the internal market:

$$\log(\bar{P}_F/\bar{P}_H) = \Psi - \varepsilon \log(A'/\bar{Q}_H),$$

Where Ψ – constant variable

Note that equation (5) does not define which of the variables - the prices of domestic goods, the nominal exchange rate or the domestic absorption - adjusted in case of rejection of the market of domestic goods from the equilibrium state. Our hypothesis is that the nominal exchange rate and removals are determined first of all expectations, as well as fiscal and monetary policies, while domestic prices change in response to deviations between the actual and the equilibrium ratio of foreign commodity prices to domestic prices. Equation (7) shows the partial adjustment process, based on this reasoning, in which changes in internal prices proportional to the gap between the actual ratio between the foreign prices of the goods to the domestic and equilibrium ratio, $(\bar{P}_F/\bar{P}_H)$.²²

²² Adams C, Gros D (1986) The Consequences of Real Exchange Rate Rules for Inflation: Some Illustrative Examples. IMF Staff Papers, Vol. 33: 439-76.

$$\Delta \log(P_H)_t = \lambda \left(\log(P_F/P_H)_{t-1} - \log(\bar{P}_F/\bar{P}_H)_{t-1} \right), \lambda > 0 \quad (6)$$

If we substitute equation (5) into equation (6), we get the inflation rate for domestic goods as a function of the ratio of the absorption potential output and the level of the ratio of the foreign price of the goods to the domestic.

$$\Delta \log(P_H)_t = \lambda \log(P_F/P_H)_{t-1} - \lambda \Psi + \lambda \varepsilon \log(A'/\bar{Q}_H)_{t-1} \quad (7)$$

Equation (8) is a fundamental rationale for the relationship between inflation and the real exchange rate. Intuitively, we can assume that the depreciation of the real exchange rate in relation to the level that clears a market for Ukrainian goods, increasing the prices of foreign goods relative to domestic peer, switching the demand for domestic goods, while the increase in wages and, consequently, production costs - both these forces lead to rise in prices of domestic goods until such time as the real exchange rate will not return to the original level.

It should also be noted that equation (7) as a normal Phillips curve, doesn't include such traditional determinants of inflation as a monetary and fiscal policy. While monetary and fiscal policy can be fundamental causes of inflation, they are treated as in the standard textbook analysis as causing inflation through their impact on proximate determinants of inflation, exchange rate and absorption. For example, the easing of monetary policy may lead to higher inflation by increasing aggregate demand (the rise of A') and will devalue the exchange rate (thus, growth PF).

Therefore, while itself monetary policy is not covered in equation (8), some of its important effects are still included. In this sense, the equation (8) is a narrow description of the inflation process, focusing only on its immediate determinants. However, this can provide important information about the behavior of inflation in open economies, as well as based on the expectations augmented Phillips curve remains an important tool of analysis and forecasting in a more closed economy.

Before econometric calculation the equation (7), it is necessary to make a number of changes to the formula. First, our data for CPI inflation is the weighted average inflation of domestic and foreign goods, so it is not inflation only for domestic goods. Use lowercase letters for the determination of logarithms:

$$\Delta p = \alpha \Delta p_H + (1 - \alpha) \Delta p_F \quad (8)$$

Thus, substituting the expression for the inflation of domestic goods from equation (7) in equation (8):

$$\Delta p_t = -\alpha \lambda \Psi + \alpha \lambda (p_F - p_H)_{t-1} + \alpha \lambda \varepsilon (a' - \bar{q}_H)_{t-1} + (1 - \alpha) \Delta p_{Ft}^* + (1 - \alpha) \Delta e_t \quad (9)$$

Furthermore, multicurrency real effective exchange rate, which is used logarithm (RER) in our study is a function of the logarithmic ratio between the prices of foreign goods to domestic specified in the theoretical model:

$$RER = \frac{P^* \cdot E}{P} = \frac{P_F}{P_H^\alpha P_F^{1-\alpha}} = \left(\frac{P_F}{P_H} \right)^\alpha \quad (10)$$

The replacement ratio of prices of foreign goods to domestic factor RER:

$$\Delta p_t = -\alpha\lambda\Psi + \lambda rer_{t-1} + \alpha\lambda\varepsilon(a' - \bar{q}_H)_{t-1} + (1 - \alpha)\Delta p_{F_t}^* + (1 - \alpha)\Delta e_t \quad (11)$$

For many countries in our sample, we used real GDP as a variable, replacing the weighted average absorbance values (A'), because of the unavailability of accurate data on domestic absorption, covering a sufficiently long time period. So the ratio of the absorption potential GDP is replaced by the rupture of GDP. The comparison between the absorption of GDP in countries where there is both indicators confirm that these variables are highly correlated among themselves.

Finally, we assume that inflation may be resistance, therefore, included in our equation logarithmically dependent variable. Thus the final rule will have the following form:

$$\Delta p_t = -\alpha\lambda\Psi + \lambda rer_{t-1} + \alpha\lambda\varepsilon(a' - \bar{q}_H)_{t-1} + (1 - \alpha)\Delta p_{F_t}^* + (1 - \alpha)\Delta e_t + \beta\Delta p_{t-1} \quad (11)$$

It is necessary to pay attention to the fact that this equation is more general and is a standard Phillips curve for an open economy. In cases when the factors Δe , Δp^* and rer model converges to the Phillips curve. Also, similar to the Phillips curve with adaptive expectations can be shown that the sum of coefficients providing Δp_{-1} and ΔeE unit, in the long term will not be a compromise between the level of the real exchange rate and inflation. As attempts to keep the unemployment rate below its natural level may cause continuous growth of inflation in conventional models of the Phillips curve, and attempts to keep the real exchange rate more impaired than its level of market equilibrium for a given break GDP lead to increasing inflation in these larger framework.²³

SurveyResults

The technique used above in the work carried out a regression analysis was conducted based on the model of the Phillips curve, the proposed Kamin (1996).

Table 6 Regression results for Armenia
Dependent variable: $\Delta \log(P)$

	OLS	
$\Delta \log(P)-1$	0,26 (2,42)	
$\Delta \log(P^*)$	0,89 (27,82)	
$\Delta \log(E)$	0,51 (9,78)	
$\log(RER)-1$	0,46 (32,96)	
YGAP-1	0,3 (3,31)	
Adjusted R squared	0,64	Note: t-statistics in parentheses. P = end-year CPI; P*= foreign weighted P; E= multilateral nominal effective exchange rate; RER= multilateral real effective exchange rate; YGAP= log (real (GDP) - log (potential real GDP).
Regression standart error	0,02	
Darbin-Watson statistic	1,86	

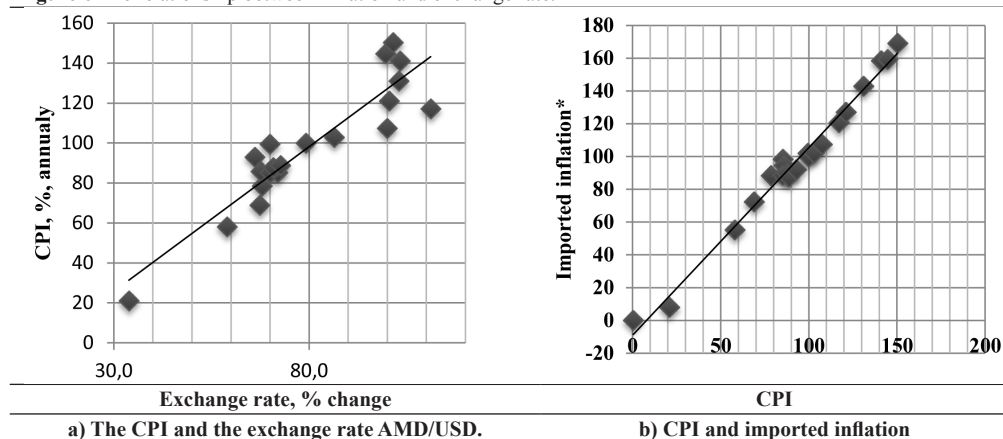
²³ Adams C, Gros D (1986) The Consequences of Real Exchange Rate Rules for Inflation: Some Illustrative Examples. IMF Staff Papers, Vol. 33: 439-76.

The study proved that Armenia to treat countries with a tendency towards fixing the exchange rate, where the relationship between changes in the nominal and real exchange rates and inflation is higher than in countries using other exchange rate regimes. As we can see in figure 6-a, there is a positive correlation between changes in the price level and real exchange rate. Also note that when calculating the regression we got R squared equal to 0.64, which further emphasizes the relationship.

Figure 2 The exchange rate AMD/USD.

Figure 3 The CPI and the exchange rate, annually.

Figure 6 The relationship between inflation and exchange rate.



Source: calculated by the authors.

In addition, the regression analysis shows high dependence of inflation from changes in import prices. It is obvious that Armenia, being an import-dependent country, will differ a great dependence of the General consumer price index from import prices (see figure 6-b). Taking into account all the above we can say that in Armenia there is quite a significant Association between changes in the nominal and real effective exchange rates and price levels, was also identified the relationship between foreign commodity prices and domestic inflation.

Conclusion and recommendations

What to do in this situation? Many mistakes had been committed. First of all, it should be noted that it was premature switching to inflation targeting. Armenia's economy, given the underdevelopment of the financial sector, a low level of trust to "monetary authorities", the overall macroeconomic instability of the economy, weak fiscal instruments and many other factors, was not ready to implement such a model of monetary regulation. However, for the sake of fairness, it should be noted that some countries, that have decided to implement inflation targeting, didn't achieve goals from the first try. A number of countries, owing to failures in the money market, declared unwillingness "monetary authorities" to move and chose to install some kind of transition (preparatory) the period before the next attempt of transition to inflation targeting.

On the other hand, the situation on the money market, itself compels "monetary authorities" to seriously reconsider its stance of monetary policy implementation. Reduced to a critical minimum international reserves do not constitute any choice but to let the exchange rate of the

national currency float freely. It is obvious that there are not any other alternatives today. What kind of risks are there? Of course, the weakening positions of the Central Bank in the money market, most likely, will lead to higher prices. However, there is a positive side of the possible consequences. The weakening of the course will lead to the strengthening of the positions of export of Armenian goods in foreign markets. Of course, these positive effects will manifest themselves immediately. However, gradual and competent macroeconomic policy will allow mitigating the negative effects of the freely floating exchange rate at the initial stage to some extent. In any case, the floating rate will allow using the market mechanisms of self-regulation at their maximum. Thus, for today any other scenario might ultimately undermine macroeconomic stability in Armenia.

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