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Title of Thesis

*“ Granger causality between money, interest rates and prices
in Armenia ”*

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PART I. GENERAL OVERVIEW

1.1 General overview of Armenian economy	<i>1</i>
1.2 Banking Sector	<i>5</i>
1.3 Macroeconomic and monetary policy	<i>6</i>
1.4 Foreign exchange policy	<i>12</i>

PART II. THEORETICAL FRAMEWORK

2.1 The relationship between money and prices	<i>18</i>
2.2 The relationship between money and interest rates	<i>19</i>
2.3 The relationship between interest rates and prices	<i>20</i>

PART III. EMPIRICAL INVESTIGATION

3.1 Causality, Time series analysis	<i>24</i>
3.2 Methodology	<i>27</i>
3.3 Data	<i>32</i>
3.4 Empirical analysis	<i>32</i>

CONCLUSIONS	<i>36</i>
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General Overview of the Armenian Economy

Under the old Soviet central planning system, Armenia had developed a highly sophisticated industrial sector, supplying to the USSR and foreign markets machine building equipment, defense electronics and optics, textiles, and other manufactured goods in exchange for raw materials and energy resources. Armenia today remains a large food importer. Its mineral deposits - copper, coal, molybdenum, and gold - appear so far to be relatively small.

Since declaring independence from the former Soviet Union in 1991, Armenia has vigorously pursued free market reforms within a democratic framework, facing the acute political and economic difficulties that have beset the country in recent years. Among the factors that have contributed to these difficulties are the devastating earthquake in 1988, the economic blockade imposed on Armenia as a result of armed conflict between the Republic of Azerbaijan and the enclave of Nagorno-Karabakh, the forcing of Armenia's major northern trade route due to civil conflict in neighboring Georgia, and the considerable economic dislocation associated with the disintegration of the Soviet Union. Economic decline has been reflected in sharp output reductions, falling incomes, reduced trade flows, severe energy shortages, and scarcity of consumer goods. At the same time, the conflict over Nagorno-Karabakh has forced the government to militarize a number of its operating machinery manufacturers, thus putting additional non-productive burden on the weak economy. Despite this adversity, the Government has persevered with the economic reform program, placing particular emphasis on liberalization, stabilization, and economic

restructuring. Most agricultural land was privatized shortly after independence, and privatization in other sectors is moving ahead. Price control applies only to a limited number of essential goods and services, and it is being phased out.

On the macroeconomics side, stabilization policy is a Government priority, given the challenge of the difficult budgetary position, combined with the need to contain inflationary pressures and maintain exchange rate stability. The Government has achieved some success in its stabilization efforts, bringing the monthly inflation rate down to single digits from the 1884% annual prevailing at the end of 1993. The Government is strongly committed to securing a sound and stable macroeconomic framework for future economic growth and development. Full integration into the world economy and continuing diversification of Armenia's economic relations with other countries are central tasks of the Government's reform efforts. The Government believes that these objectives can only be attained through open trade policies which emphasize specialization on the basis of international comparative advantages.

Armenia is a republic with a highly diversified spectrum of industrial production. Armenia's industrial policy aims to ensure more efficient use of domestic resources within a market-oriented framework. The central policy objective affecting industry is privatization. Pending completion of the privatization program, the Government is obliging state-owned enterprises to operate according to market principles. Since the beginning of 1995, no direct subsidies have been granted to the industry. This is in sharp contrast to previous years, when direct subsidies were provided on a fairly large scale via concessionary credits to firms. Armenian manufacturers are interested in developing constructive technical and trade cooperation in various areas of manufacturing with companies and entrepreneurs in foreign countries. For instance, operation in machine building and its non-metal consuming branches will include machine-tool building and instrument

building, electric engineering, electronics and radio engineering. Cooperation with foreign partners will also encompass industrial activity related to the production of consumer goods such as leather footwear and knitwear, rugs, kindred goods, textiles, fruit and vegetable canning, and the production of mineral water, wines, cognac, traditional branches of its economy. Various forms of cooperation can be used to develop and apply new technologies as well as to establish competitive goods manufacturing. This cooperation can also be extended into other intellectual and manufacturing areas. As of now, Armenia has privatized nearly ninety percent of its land. As far as inputs are concerned, two large state enterprises acted as dominant suppliers of agricultural services and inputs such as seed and fertilizer. These enterprises have recently been transformed into stock companies in preparation for privatization. The enterprises accept payment in kind on the basis of pre-negotiated contracts and should be required to be self-financing. Other suppliers are not prevented from entering the market in any way. Nevertheless, the predominance of these firms, along with the fact that they receive at least some of the payment for their services in kind, means that competition remains somewhat constrained in both input and output markets. The government regards this as a transient phenomenon since conditions supporting increased firm involvement are expected to develop.

The Armenian economy has contracted sharply over the last few years but with some signs of improvement in 1994 and 1995 and it continues up to the moment. Four main factors account for this deterioration. First, the sudden and dramatic disruption of traditional economic ties within the former Soviet Union severely undermined traditional production and exchange relations in a period of acute macroeconomic instability. Second, the economic blockade and civil conflicts in Georgia aggravated this disruption. Third, even without these external shocks, any country attempting to make the transition from a

centrally planned to a market-based economic system is bound to experience dislocation, and Armenia was no exception. Fourth, Armenia's dependence on external energy sources, and difficulty in the acquisition of fuel have contributed to the shrinkage of the economy. Armenia's trade relations within the former Soviet Union were strongly influenced by its small size, its mining sector and its relatively industrialized production base as well as by a heavy dependence on imported industrial raw materials and energy. These factors, too, resulted in the high degree of integration into the Soviet system experienced by Armenia and leading to its vulnerability to the system's collapse. During the Soviet Union the economy was constructed in a way that every single, final production process was in close connection with some dozens of other small productions as the supplementary parts of the later and the final product could not be produced if one of this chain fails to do so. In intermediary step losing one production connection it could mean break-down of the whole system, such the economy was designed in a way that one production process could not replace another because of strictness of former economic structure and absence of other choices. It was planned in a way that the interaction of those enterprises would yield to the maximum dependence from the others and never could be promoted of their own. And collapse or disruption of them because of economic blockade imposed by two neighbors (Turkey and Azerbaijan), which was not only shut up of the economic ties between them as neighbors, but also Azerbaijan was controlling strategically important railway passing into Armenia through its territory. providing with important transportation route with the other partners. led to interruption of the others by the rule of inertia and brought a very difficult situation. In this situation, it was essential in the first instance to find ways of maintaining some continuity in trade flows. During past years government proceeded with efforts to reduce the role of the public sector in Armenia's external trade, but, progression in this endeavor has been frustrated to a degree by

difficulties in transport, the existing economic blockade, shortcomings in the payments system and the need to guarantee a minimum level of energy security. However, it should be emphasized that as private sector producers and traders acquire adequate access to the means of transportation and properly functioning system of payments, the role of the state is correspondingly reduced and market leverages have been established. The Government maintains no policies aimed to discourage the development of the private sector.

Banking Sector

The Central Bank of Armenia is responsible for regulating the banking system in Armenia, as stated in the law on the Central Bank of Armenia. In its role as regulator, the Central Bank authorizes banks to perform banking services, and, the banks are subject to the law on the Banks and Banking Activities in the Republic of Armenia. Subject to satisfying criteria related to the satisfactory performance of banking services, the Central Bank maintains a liberal policy toward the provision of banking licenses. Among the preconditions for establishing a commercial bank is a minimum capital investment of \$1 mln. and certain reserve requirements. Some 30 commercial banks are currently licensed and successfully operate in Armenia.

In the long-term, the Armenian Government wants to turn Armenia into the financial center of the region. Now, the financial services market in Armenia has advanced greatly in comparison of the other states. Establishment of foreign banks Mellat Bank (Iran), Midland-Armenia (UK) , Russian Credit Bank and Greek Commercial Bank lead the local banks to market competition and improvements of banking services . Some experts indicate that up to 15 million dollars in cash enter Armenia every month (a significant part of it is assistance to local residents by their relatives living in the United States or

Russia). Earlier the money was transferred through private hands (tourists) or illegal money transfer companies and never entered into banking system. However step by step the financial transfers through the banking system are starting to dominate due to improved, security and fast services. On the other hand, more credits and grants are being extended for various projects in Armenia by foreign governments, international organizations and various foreign agencies. USAID governmental organization assisted the Armenian banking sector with establishment of a modern inter-bank electronic transfer system which have brought access to international transfer networks. Some Armenian banks started to cash traveler's checks, and accept credit cards.

Macroeconomic and Monetary policy

From the macroeconomic point of view 1994 has been a year of progress and considerable achievement. The introduction of national currency "Dram" made possible formulation of an independent monetary policy that is the major part of the state economic program. The disintegration of the financial markets of the Former Soviet Union and particularly the withdrawal of Russia from ruble zone in 1993 reinforced the need for independent stance.

From the point of economic trends, the year 1994 was unusual. The program of economic development was aimed at halting economic decline reducing inflation and creating conditions for the revitalization of the economy. Although peculiar problems related to transition remained, the measures taken not only halted the recession but also provided a starting economic growth. The policy pursued by Armenian policy makers was influenced by the following factors reflecting the macroeconomic situation:

- the dynamic movement of indices arising from economic reform,
- the stabilization of macroeconomic indices,
- revitalization of production and turn off the recession,
- tight budgetary and fiscal policy.

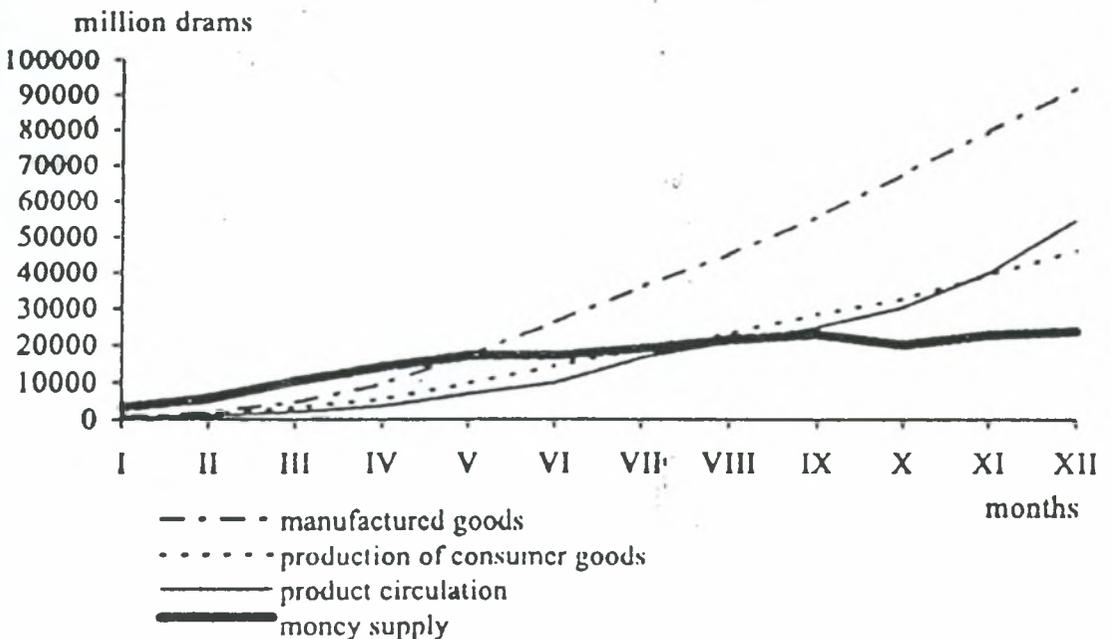
-encouraging exports and measures directed at reducing the balance of payments deficit,

By the results of 1994, although the produced national income grew by 3.3 % in comparison with the previous year and the quantity of manufacturing goods grew by 6.9 %, indices made substantial progress in comparison to previous year.

Although the tension in the consumer market has calmed down by the results of year under study, the production volume of the consumer goods made 100,8% of the previous year. The tense situation created in the economy especially the low level of the sale in comparison with the produced manufacturing products as well as continuing growth of overdue debts in mutual settlements or clearing between economic entities which made huge amount at the end of 1994, had an extremely negative effects on realization of the state budget incomes of Armenia.

The subsidization of the state budget deficit by loans from Central Bank during first half of 1994 made inevitable the increase of money mass in circulation which had a negative effect over a targeted level of the rate of inflation. Later it began the realization of hard budget policy as well as the results of measures directed to state budget income collection made possible to reduce the amount of additional money injected into circulation.

Graph1 ▲ Macroeconomic indices and the money supply



Besides the fact that 1994 was a year of both economic achievements and failures in macroeconomic policy the following year was a clearly year of macroeconomic stabilization and continuous economic growth. It was a transition year for market reforms which led to obvious stabilization in comparison of the previous ones. Certain reasons for this are:

- v The willingness of the policy-makers to follow market oriented decisions in their policy;
- v substantial changes in military situation over the enclave Nagorno-Karabagh and cease-fire;
- v backing IMF and World Bank assistance for implementation of new market-oriented policy with substantial financial and managerial assistance.

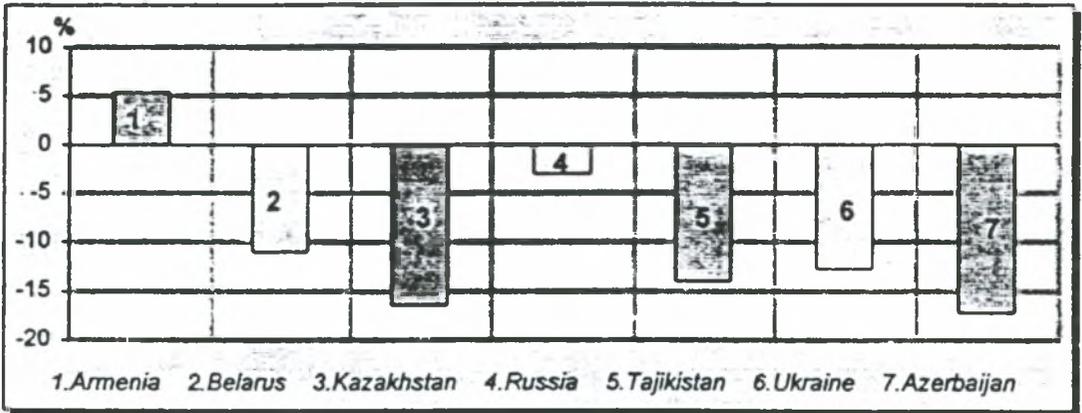
Moreover, 1995 was a year during which a market economy began to emerge in Armenia. Tight monetary and fiscal policies pursued by the Government and Central Bank of Armenia respectively became the main driving forces for economic and financial stabilization. Structural adjustments that included the development of administrative mechanisms of state enterprises and further liberalization of trade led to the following events:

- v Stabilization of production early in the year with continued stable growth.
- v Liberalization of prices,
- v A sharp decrease in inflation and less fluctuation in prices.
- v Growth in real income of the population,
- v More attractive conditions for private investments.

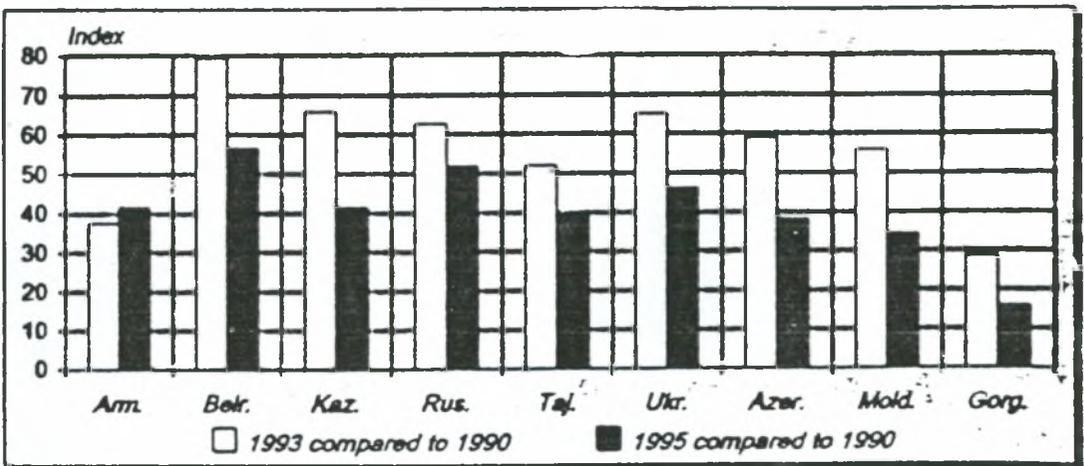
As it is concerned GDP growth, started in 1995, the Armenian economy had already passed painful economic decline. In addition, in terms of macroeconomic stabilization and economic growth, Armenia substantially differed from other FSU countries. Among the FSU republics she was the first to have such a achievement, which is successful start for revitalizing economy for Armenian policy-makers and to go ahead economic development making

attractive field for foreign investments. In terms of GDP growth as well as real GDP Armenia was first showing positive results.

Graph 2 . GDP growth in CIS countries



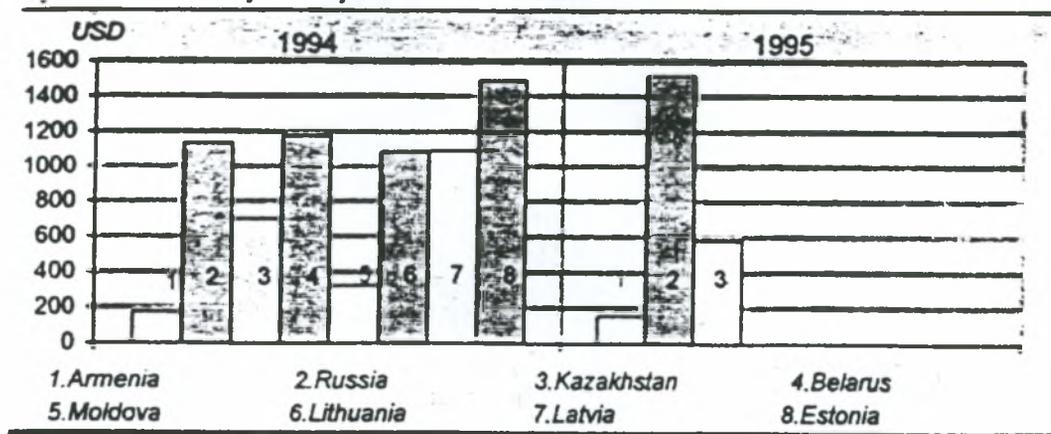
Graph 3 Real GDP in CIS countries (1990=100)



Inflation shut down was also the great achievement and appeared to be again the first among the other FSU countries. Although such substantial achievements in 1995, Armenia remained far below of indication on GDP per capita account.

Graph 4

GDP per capita in FSU countries



Despite the increase in real income the majority of population continued to face extremely difficult living and social conditions and unemployment continued to rise.

Economic analysis indicates that during the 1995 the real income of population grew 10-12 times substantially exceeding the growth rate of GDP. This was due to an increase of 294% in the state budget expenditures decrease of 214% in the current account deficit, a 14,1 fold decrease in inflation , a 4,6 fold decline in money supply and an increase in net transfers from abroad.

The two main factors contributing to macroeconomic stabilization and economic growth were the effectiveness of government expenditure and tight monetary policy.

However further regulation of both aggregate money and inflation restraint, without development of the basic factors necessary for economic growth, could lead to serious obstacles for the future development of financial and economic system. Economic growth could be encouraged by:

- v enlargement of the private sector through privatization;
- v strengthening the financial sector and development of primary and secondary financial markets;
- v development and implementation of public sector and governmental investment programs.

The monetary policy is characterized by its increasing influence on general trends of macroeconomic parameters. In the reviving phase of economic reforms, the Central Bank continued to implement tight monetary policy, the

main goal of which still remained continuing the low rate of inflation and stability of the dram. Policy was coordinated with the Governments' program aimed to strengthen the financial system and provide stable economic growth. The efforts by Government and Central Bank were to achieve goals such are:

- √ a 5% growth of GDP per year in real terms,
- √ to reduce the rate of inflation to 12% per year,
- √ acceleration of the privatization process to strengthen private sector,
- √ reduction of the state budget deficit to 10% of GDP.

Commenting on goals above it is worth mentioning that Armenia irreversibly took course of establishment of market-oriented economy and stimulation of essential economic and business activity.

In this transition period substantial steps have been taken for financial markets stabilization and establishment of low inflation. During the period, CPI was substantially less in contrast with past. As a result of speculative demand for money, as well as an absence of secondary stock market in the country, the monetary indicators have been improved mostly under the influence of monetary factors creating essential basis for further development and macroeconomic stability. However, if it is observed that economic growth was ordinary task of policy makers, the stabilization policy was a obligatory step towards the forthcoming growth. As it is typical for any other transition economy, Armenian economy also faced severe problems and particularly succeeded to come over relative to others.

It is also worth mentioning that the Armenian economy was not able to cope against the global problems without assistance of international organizations like the IMF and the World Bank. The key to the success was laid upon the efforts of these organizations which in addition to the tremendous financial assistance, promoted various training courses for senior and junior governmental officials. From this point, Armenia has received a large amount of credits and for the moment it is near to 700 mln. US dollar. The repayment of this debt is dependent upon the future economic development

that now is under way and deviation from economic course designed for reforms will yield a serious economic consequences for the state and further improvements could be doubtful.

The ability of the Central Bank to implement monetary policy was strengthened by further developments of interbank credit, foreign exchange and stock markets as new infrastructures. It was introduced a new approach covering interbank credit auctions and existing foreign exchange legislation also took place. Unlike in the past, by implementing credit policy and removal of credit restrictions, the interest rate have been liberalized and began to be determined through market mechanisms. Direct control of interest rate has been eliminated ultimately and indirect controls took place. As a result of this interest rate moved from a high 210% per annum to 84,1% at the end of 1995. Despite nominal interest rates falling 2.5 times compared with the previous year, the real interest rate increased five times. This was due to reduced inflation which brought real and nominal interest rates close to each other. As a result of those measures, some foreign investors appeared in the market and showed a willingness to invest in various fields of the Armenian economy. Besides the fact investment opportunities began to grow, the following years did not boost satisfactory investment activities such as Armenia was and still remains high risk country due to its geopolitical and military problems.

Foreign Exchange policy

From a time when a new currency “dram” was introduced into circulation, Armenia began to implement its own foreign exchange policy. The installation of the new currency created big fluctuations on the exchange rate with respect to USD and it was an unstable factor in the economy. Exchange rate fluctuations were severe in the initial period and a black market of foreign

currency began to operate in Armenia. The presence of a black market was fueled by the existence of strict controls in the foreign exchange market by the needs of the importers to obtain foreign exchange. The presence of foreign exchange controls contributed to excess demand for foreign exchange and a strong incentive for a black market to emerge. The functional and very mobile black market created problems for foreign exchange regulation and prevented implementing transactions through the banking system, thus affecting legal levers of the economy to function. The black market was a factor of instability in the economy in a sense that hardly available foreign currency was circulating mainly in private hands and was affecting legal rules in the economy. All the measures have been taken to eliminate black market phenomena, which was also the place where the dealers were making untaxed huge incomes playing on unstable exchange rates and trading the currency.

During the time of its operation, the Armenian foreign exchange market has been characterized by three important sub-periods: the first, from November 1993 to April 1994, is characterized by the low size of foreign reserves held by the Central Bank and the low credibility of the Central Bank to effectively control foreign exchange transactions. Potential traders were prohibited from obtaining foreign exchange, since the amount of foreign reserves was very limited. As a result, excess demand for foreign exchange occurred, while such an excess demand drove black market rates far above efficient rates.

In May 1994, the Armenian Central Bank removed certain foreign exchange controls that characterized the foreign exchange market by giving internal and general licenses to commercial banks to make auctions in the foreign exchange market on the basis of comprehensive evaluations of bank activities, while at the same time it limited black market activities. These commercial banks became more independent in pursuing their own commercial policies, including foreign exchange transactions, than the

former public banks. Since then, the Central Bank has been responsible to audit the commercial bank's activities in the foreign exchange market. The second sub-period (from May 1994 to October 1994) is characterized as a transition period in which the Central Bank was striving to stabilize the entire banking system and to further increase its capability to accumulate more foreign reserves aiming at managing more effectively the behavior of the official exchange rate.

In November 1994 further deregulation actions were undertaken which contributed to a stabilized foreign exchange market. Such deregulation actions involved the establishment by the Central Bank of an inter bank credit market which encouraged efficiency in the private banking sector, the establishment of the legislative framework to facilitate currency transactions (e.g., minimum size of the foreign exchange reserve requirements), expansion of the arrays of transactions fulfilled by banks in foreign currencies, the freedom of authorized banks to open and operate correspondent accounts in foreign banks rather than in the Central Bank, the freedom of residents and non-residents to convert amounts in Drams into foreign currency without any documentation and amount limits, the freedom of the foreign banks to participate in foreign exchange transactions, the elimination of all restrictions on capital flows, and the abolishment of all restrictions on the inflow to Armenia of foreign currency and import of securities reflected in foreign currency. The consequences of such deregulated actions characterized the beginning of the third sub-period (November 1994 to January 1997) and they were, first, the enhanced ability of the Central Bank to implement an efficient exchange rate policy through the creation of large foreign exchange reserves which generated more than enough foreign currency for stabilization purposes. Second, the development of an official foreign exchange market to provide for internal convertibility of the Dram, and liberalization of the terms of conducting transactions in foreign exchange through the creation of a vast network of foreign currency exchange

offices. Third, the foreign exchange became an investment medium, considering that a well-functioning stock market does not exist in Armenia.

The implemented exchange rate policy allowed maintenance of a relatively stable price level for imported goods. Exchange rate stabilization became the key factor to ensure interest rate and price stability in the country such as consumer markets were dominated by imported goods. Having unsatisfactory level of domestic production of consumer goods and pressure of imported inflation on the consumer price index has declined and confidence in currency grew. Along with stabilization of exchange rate the margin between official and market exchange rates declined significantly yielding to 1-2% difference.

Participation in adjustment of the exchange rate in domestic foreign exchange market took place mainly via an indirect intervention policy. Along with stabilization of exchange rate, authorities made significant steps towards liberalization of capital movements, which affected also the cut off balance of payments deficit and consequently boosting the export operations and promoted the domestic production system. The stable exchange rate played an essential role on in the production and export promotion process. Along with stable interest rate, with minor fluctuations, it also became possible to promote borrowing for producers in credit market which had also great effect on the stabilization of domestic producer prices. As of that basic necessary conditions had been created for effective start to vitalize and develop domestic production activity.

Theoretical framework

The role of money, the interest rate, prices and output has been the central point of a discussion among leading economic circles and various explanations have been given to their role and importance for the economy as well as to interrelationships among them. The ruling Keynesian approach to

macroeconomics has been strongly challenged by a number of economists who have emphasized the great importance of changes in the stock of money. By arguing that changes in money income are dominated by changes in the money stock, they have revived the conclusions of the mainstream of monetary theory scratching from David Hume through Irving Fisher and Alfred Marshal to the early work of Lord Keynes.

Monetarism includes more than just the emphasis on the importance of changes in the quantity of money. Monetarists generally agree on a number of allied propositions, though not every monetarist necessarily has to accept all of them, since relationship between them is not one of a logical implication. Instead, their interrelationship is probabilistic in the sense that if one of them is valid, then this raises the probability that the others are valid too, without requiring this necessary be the case. The one of the most basic proposition of monetarism is the validity of the results reached by the quantity theory of money, that is, first, that a change in the quantity of money has a powerful effect on money income, and second, that most of the past changes in money income can be explained by changes in the stock of money. However these two hypothesis are not the same thing. It is possible for a given change in the money stock to have a powerful effect on money income and yet, if money stock fluctuates little, relative to other factors that determine money income, it may explain little of the variations actually observed in money income.

The next proposition is a particular approach to the transmission process that explains how money affects income. Here there is a substantial disagreement between monetarists on some aspects, but there are two common traits that distinguish the monetarist view of the transmission process from the Keynesian one. The first is that, while Keynesians think of increases in the money stock as being spent on the first instance on buying securities, monetarists stress the purchase of goods rather than securities. The second common trait is that monetarists de-emphasize the role of the rate of interest in the transmission process. Of course, they do not deny that in a formal sense, it

is changes in interest rates and yields that cause portfolio shifts as the quantity of money is increased, but they believed that empirically it is difficult to measure “the rate of interest”, so that it is better to use as relevant measure the quantity of money.

Monetarists assert that price changes can best be understood by looking at the price level as a whole rather than by looking at the prices of individual goods. This involves the view that the price level is fairly flexible and determined by demand factors rather than by cost push effects. One of the strongest criticism of monetarism is that it relies on essentially unexplained correlations between money and income. Keynesians frequently accuse monetarists of relying on a black box and argue that the true explanation of correlation between money and income is that changes in income induce changes in the money stock.

One of the most important problems of the above topics is whether the central bank should use the money stock or the interest rate as its intermediate target. Sometimes a money stock target reveals that the central bank should be more expansionary while an interest rate target suggests a more restrictive policy. There has been much discussion concerning the interrelationships that may or may not exist between the three variables, money interest rates, and prices. However, the vast majority of studies have only probed into relationships that exist between any two of the variables.

These relationships include:

1. The influence of money on prices, e.g., the quantity theory of money.
2. The influence of prices on money, e.g., the accommodation hypothesis.
3. The influence of money on the interest rate: e.g., the income effect, the liquidity effect, etc.
4. The influence of interest rate on money, e.g., the new view of the money supply theory, and Keynes' money demand theory.
5. The influence of prices on the interest rate : e.g., The Fisher effect, the Mundel effect, etc.

6. The influence of the interest rate on prices, e.g., the Fama effect, the make-up effect, etc.

Furthermore, there is still a great deal of controversy surrounding these theories.

The relationship of between money and prices

The relationship between the quantity of money and prices has frequently been a central issue of debate among a number of scholars. Some authors attach importance to the influence of quantity theory on prices, while there are others who attach it to the impact of the quantity of money. The different theories may be briefly described as follows.

The influence of quantity of money on prices. The quantity theory of classical school regards the quantity of money as being the main reason for price increases. It states that the rate of increase in the quantity of money is equal to the rate of increase in prices. Later, Friedman put forward the view that changes in the quantity of money will result in asset substitution, leading to changes in both the velocity of circulation and income, resulting prices that do not change proportionately. The rational expectations School has gone even further to propound the view that prices will completely react to anticipated adjustments in the quantity of money, without having a real effect. This kind of view is associated with the theory of demand-pull inflation.

Nevertheless, Friedman believes that changes in the stock of money influence nominal income after a time lag averaging six to nine months. Tanner (1979) in a later study obtained empirical results that led him to the conclusion, that in period of sluggishness, in order for expansionary monetary policy to be effective, there needs to be a lag of at least eight quarters.

The influence of prices on money: Humprey (1982) in his real bill doctrine in 1982 believes that if commercial banks supply finance according to the value of

firms output, then the system would become unstable, with good possibility of there being continual inflation or deflation. The recent accommodation hypothesis adopted this point of view, believing that if in times of inflation, the money supply did not change, real income would be reduced, with the result being that money supply would have to be increased in order to accommodate the needs of trade and thus avoiding an economic recession. Accordingly, after there has been price inflation, the supply of money should be subsequently increased. However, if after an increase in prices occurs, the government decides to reduce the growth rate of the money supply in order to lower the prices, it would cause the quantity of money to respond to a change in prices.

In addition, Hume of the classical school referred to the price-specie-flow mechanism pointing out that when the price level of a country is higher than that of foreign countries, under a system of fixed exchange rates this will lead to an international balance of payments deficit, a fall in foreign reserves and a reduction in the domestic money supply of that country. Based on these considerations, it is extremely difficult to determine the causality that exists between prices and the quantity of money.

The relationship between money and interest rates

Some studies view money as a 'cause' and the change in the interest rate as the 'effect'. Certain other studies hold the opposite view. These conflicting opinions are outlined below.

The influence of money on the interest rate: According to the liquidity preference theory of the Keynesian school, a change in the quantity of money will cause the interest rate to change in the opposite direction. Stokes and Neuberger (1979) believe that the influence of money on the interest rate could be divided into short-term and long-term effect. With regard to the short-term, following an increase in the supply of money, funds are comparatively slack, causing the price of those funds -the interest rate- to fall, resulting in a liquidity

effect. As for the long-term, after the firms have got the funds they asked for and have increased both their production and trading activity, the increased demand for funds will result in an increase in the interest rate, the so-called income effect. Gibson (1968) believes that when nominal interest rates go up, if the central bank wants to maintain the former low rate of interest, it will be forced to increase quantity of money, but this again will lead to a price expectation effect, causing the nominal interest rate to increase at an even faster rate, this being the so called Gibson paradox, which means the long-term tendency for prices and interest rate to move the same direction. Burger (1971) also provided evidence from the Bank Credit Market in support of the Gibson paradox. Friedman (1968) pointed out that it is impossible to try to exert pressure to lower the long term interest rate by increasing the quantity of money.

The influence of the interest rate on the quantity of money. According to the New View Theory of money supply, different changes in the interest rates will result in different combinations of financial assets being held by individuals (Cagan (1969) and Chen (1973)). According to the money demand theory, proposed by Keynes, a rise in the interest rate will result in a decrease of money demand. The data on the quantity of money reflect both the influences of the demand and supply sides. Whether the demand or supply side has a stronger influence is open to question.

The relationship between interest rates and prices

The influence of the interest rate on prices. Deleeuw and Gramilich (1969) analysing the influence of interest rate changes on prices, believe that the interest rate belongs to firms production costs and where conditions of monopolistic competition prevail in the industrial structure, firms will adapt the make-up method and drive up prices. Therefore, the high interest rate will cause the price level to increase. This is the so called cost-push inflation. In

addition, Fama (1975) also believes that when the real interest rate is stable and the market is extremely efficient, the level of nominal interest rate will already be able to summarize all available information regarding prices, and thus will be able to predict inflation. This implies that the two variables are positively correlated.

However, if we perform our analysis from demand side, it is quite possible that the interest rate will have the opposite effect on prices. Jorgenson (1963) viewed the interest rate as a cost of funds, which has a negative effect on investment. As a result, demand and prices will decrease when interest rates rise.

The influence of prices on the interest rate. Fisher (1930) believes that price changes lead to price expectations, which fully respond to adjustments in the nominal interest rate. Mundell (1963) thinks that price expectations only partly respond to nominal interest rate adjustments and that the real interest rate will fall slightly this being the so called Mundell effect. In a country that has rigid interest rates which are hard to adjust, after adjustments in prices have brought about changes in price expectations, one will not see a corresponding adjustment in the nominal interest rate. The change being completely absorbed by a fall in the real interest rate.

Woodford (Mankiw 1994) considers the use of “non-standard indicators,” such as commodity price indexes or interest rate spreads, in monetary reaction functions. He briefly reviews the empirical evidence on these indicators, but his main concern is to show that using atheoretical forecasting regressions to design a monetary feedback rule can be highly misleading, a point relevant to both standard and non-standard indicators. Taylor and Bennett McCallum (1983) express the same position in their comments on the Feldstein-Sock paper. In view of controversies about how the economy operates, we should be seeking a feedback rule that produces desirable outcomes in a variety of structural models, as McCallum (1994 Mankiw)

suggests. An interest rate rule may be superior to a money supply rule if velocity is unstable.

Walsh (1991) finds that monetary signals affect real and nominal interest rate, an argument which is consistent with the empirical results reported by Roley(1984) and Walsh,(1985) and Hardouvelis, who show that there is a causative relationship between announcement of money supply and interest rate. In addition, Siegel (1985) shows that money announcements provide information about real economy even if money is neutral. Also, the works by Rush (1985) and Hardouvelis (1987) show that innovations in the base and innovations in the money multiplier have different correlations with output and interest rates.

In their paper Rotemberg, Driscoll, Poterba (1995) state that money can be used to examine the effects of monetary shocks on the price level. In the long run, if output is not affected by monetary shocks and velocity is stable, prices should rise one-for- one with increases in the money stock. They have tested Granger causality between monetary aggregates and found that in long run prices rise in proportion to the rise in money. According to them, some indicators of monetary policy based on nominal interest rates can forecast output as well as aggregate money; they also suggest long-run nonneutrality of output with respect to money. According to money view, monetary contractions initially reduce money balances and interest rates must rise to make people to hold new constellation of assets and this increases interest rates.

On their part Atesoglu and Dutkowsky (1992) investigate the role of money supply and interest rates in predicting real output using VAR over several selected subperiods for the US. They emphasize structural change as an important factor affecting the relationship of money, interest rate and output. Investigation of two post-war subperiods reveals substantially different findings. The first sample (1947-69) strongly indicates a non-trivial effect of the interest rate in determining output with little role for money supply, which supports Sims (1980) and points to the effectiveness of Federal Reserve interest

rate targeting taking place during that period. In contrast, examination of the period 1970-1988 indicates a non-trivial effect of money supply in output determination, with interest rate effects becoming negligible. Estimated standard errors uniformly suggest significant effects of the interest rate during 1947-1969 and money during the post-1970 period in all orderings. They also argue that in general the role of interest rate in relevant period remains uncertain.

On the other hand there have been numerous empirical studies which have tried to clarify the causality structure between money, prices and interest rate by using so-called non-structural models. On their turn Pikkarainen and Viren (1986) insist that if results of these studies are scrutinized, one can no longer be optimistic. Perhaps, the main reason for this disappointment is the sensitiveness of results in various studies, particularly in terms of the conditionalization of variables.

In their work Fisher and Fackler and Orden (1995) investigated dynamic interactions among money, prices and output for New Zealand. They find evidence of cointegrating relationship and stochastic trends among them. Under their assumption that a monetary stock has no effect on output in the long run, a productivity shock for which there is partial monetary accommodation explains most of the variability of output at all forecast horizons, whereas the monetary shock is the most important determinant of levels of money and prices.

Much interesting work has been done by Ya-Hwei Yang, where the author tests causality between money, interest rates and prices in Taiwan. The multivariate time-series model for testing causality, adopted in his paper, on the one hand makes the method of determination relatively simple, and on the other hand leads to more accurate results. The analysis carried out tests for the existence of causality between the monetary aggregates, wholesale prices and money market interest rates, which leads to the conclusion, that a rising interest rate has the effect of decreasing money demand and the level of the interest rate is not

clearly influenced by money and prices. Moreover, he finds differences between models of M_1 and M_2 monetary aggregates and states that these are not completely the same. Although M_1 's model shows that rising interest rates result in higher prices, it does not robustly support cost-push inflation theory (Yang, 1990).

Causality, Time series analysis

Before examining whether any of the monetary indicators Granger-causes (or more accurately, provides incremental explanatory power in forecasting) various measures of real activity, one must examine the long-run relationships between those variables. If, in fact, a monetary aggregate is cointegrated with a measure of real activity, then there must be a Granger-causal ordering between those two variables. Cointegration would also imply that our bivariate systems are misspecified: They should, in fact, be respecified as error-correction models.

After Granger (1969) proposed the two-variable method for identifying causality, Sims (1972), Pierce (1977), Hiaso (1981, 1982) and others have successfully advanced new methods for testing causality. The econometric verification technique has been extended from a general regression model into a Box-Jenkins time series one referred to as the ARIMA model. Granger (1969) and Sims (1972) adopted the regression approach to identify causality. Regardless of which of the approaches is adopted, Granger's or Sim's, the following difficulties are encountered:

1. The choice of the lag period is a little arbitrary, and trying every kind of lag period is sometimes time-consuming.
2. When there is residual of autocorrelation, the variance of the estimated coefficient will be overestimated.
3. The problem of multicollinearity usually exists among the independent variables.

4. Choosing an appropriate filter to transform the original series into a stationary series is time-consuming.
5. There is no way of determining multivariate causality by Grangers or Sims approach.

Hsiao (1982) then transformed each variable into a autoregressive model, and used Akaike's (1969) final prediction error (FPE) to determine the lag period.

Hsiao's prediction method has two shortcomings:

1. It does not deal with residual correlation.
2. Selecting the model and the lag involves a considerable amount of effort.

Pierce (1977) used a time series model, detrended the individual series into the residual term, and tested for autocorrelation among the error terms. His approach had a disadvantage in that he ignored the possibility that interdependence may exist between changes in the trends of variables.

In order that the causality in the series itself and also among the residuals could be studied, the multivariate time-series model was adopted to determine the residuals and causality. This approach is applicable in circumstances where there are three or more variables.

Multivariate time series analysis and regression analysis have certain similarities. Regression equations can be transformed into a vector ARIMA model. Usually, regression analysis is a special case of the ARIMA model. Therefore, the ARIMA model can be used to test for causality evade some of the shortcomings that accompany other econometric methods.

Granger (1969) has introduced a concept of causality that, under conditions to be discussed, can be analyzed in the framework of bivariate VAR processes.

Broadly speaking, a variable y_{1t} is said to be Granger caused by a variable y_{2t} , if the information in past and in present y_{2t} helps to improve the forecasts of the y_1 variable. To formalize, suppose Ω_t contains all the relevant

information in the universe up to period t and define $\sigma^2 [y_{1t}(1) | \Omega_t]$ to be the conditional MSE of the optimal forecast $y_{1t}(1)$ given the information in Ω_t . The variable y_1 is Granger-caused by the variable y_2 if for some t

$$\sigma^2(y_{1t}(1) | \Omega_t) < \sigma^2(y_{1t}(1) | \Omega_t \setminus \{y_{2s} | s \leq t\})$$

where $\Omega_t \setminus \{y_{2s} | s \leq t\}$ denotes all information in Ω_t that is not in $\{y_{2s} | s \leq t\}$. In other words, y_1 is Granger caused by y_2 if it can be predicted more efficiently when the information in past and present y_2 is taken into account in addition to all other information in the universe. Granger causality from y_1 to y_2 is defined analogously. A bivariate system where y_1 is caused by y_2 and y_2 is caused by y_1 is called a *feedback system*.

Assuming that $y_t = (y_{1t}, y_{2t})'$ is generated by a stationary, normally distributed, bivariate VAR(p) process,

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} v_{1t} \\ v_{2t} \end{bmatrix} + \begin{bmatrix} \theta_{11,1} & \theta_{12,1} \\ \theta_{21,1} & \theta_{22,1} \end{bmatrix} \begin{bmatrix} y_{1,t-1} \\ y_{2,t-1} \end{bmatrix} + \dots + \begin{bmatrix} \theta_{11,p} & \theta_{12,p} \\ \theta_{21,p} & \theta_{22,p} \end{bmatrix} \begin{bmatrix} y_{1,t-p} \\ y_{2,t-p} \end{bmatrix} + \begin{bmatrix} v_{1t} \\ v_{2t} \end{bmatrix}$$

(1)
and assuming in addition that y_t contains all relevant information in the universe so that

$$\Omega_t = \{y_s | s \leq t\}$$

it can be shown that y_2 does not Granger-cause y_1 if and only if

$$\theta_{12,1} = \theta_{12,2} = \dots = \theta_{12,p} = 0$$

In turn, y_1 does not cause y_2 if and only if

$$\theta_{21,1} = \theta_{21,2} = \dots = \theta_{21,p} = 0$$

In other words y_2 does not Granger cause y_1 if y_2 does not appear in the first (y_1) equation of (1) and y_1 does not cause y_2 if the first variable does not appear in the second equation of the system (1).

In order to make Granger's concept of causality operational, some quite restrictive assumptions should be made. First, information set Ω_t must be reduced to the information in the past and present of the involved variables y_1 and y_2 , which is short of some information in the universe. Second, we have to assume that data-generation process is normally distributed stationary VAR process with known order p . The violation of any these assumptions may invalidate the test. It is possible however, to develop causality tests for more general situation.

Methodology

The central theme of the Granger test procedure is that X causes Y (given an information set Ω_t , which includes both X and Y) if Y_t can be predicted better by using the past and the present values of X over and above the past values of Y than by not using them. In order to draw a meaningful causal link between X and Y , one must consider as many factors as possible in the information set.

Granger causality test is based on the following regressions.

$$Y_t = a_0 + \sum_{i=1}^n a_{1i} Y_{t-i} + \sum_{j=0}^m a_{2j} X_{t-j} + \sum_{k=0}^p a_{3k} Z_{t-k} + u_{1t} \quad (1)$$

$$X_t = b_0 + \sum_{i=1}^n b_{1i} X_{t-i} + \sum_{j=0}^m b_{2j} Y_{t-j} + \sum_{k=0}^p b_{3k} Z_{t-k} + u_{2t} \quad (2)$$

$$Z_t = c_0 + \sum_{i=1}^n c_{1i} Z_{t-i} + \sum_{j=0}^m c_{2j} Y_{t-j} + \sum_{k=0}^p c_{3k} Z_{t-k} + u_{3t} \quad (3)$$

$$t=1,2,3,\dots,N$$

where u_{1t} , u_{2t} and u_{3t} are serially uncorrelated zero mean stochastic error terms, capturing error all short-run deviation from, say, money-prices nexus, and Z is

an important third variable affecting the money-prices relationships (e.g. imports, investments, government expenditures, etc.).

The Granger test requires that X , Y and Z should be stationary, but many economic time series are likely to be non-stationary, i.e., they have to be differenced once in order to become stationary. A stationary series fluctuates around a mean value with a tendency to converge to the mean but a non-stationary series wanders widely without any tendency to converge; it is relatively smooth. The null hypothesis that X does not Granger cause Y , given Z , is rejected if a_{2j} s are jointly-significantly different from zero., based on standard **F-tests**. If b_{2j} s are jointly significant, X does not Granger cause Y , given Z . The causal influence of Z on Y and X can be examined by testing the significance of the coefficients a_{3k} and b_{3k} , respectively. Alternatively, the influence of Y and X on Z can be examined by testing the significance of the coefficients c_{2j} and c_{3k} .

There are some difficulties with this set procedure. First, although the Granger's causality test seems to have a greater appeal than most other alternative techniques, the issue concerning the optimal lag length still remains illusive. The distribution of a test statistic is sensitive to the order of lags used. If the lag order used is less than the true lag, the regression estimates will be biased and residuals will be serially correlated. If the order of lags used exceeds the true order, the power of the test is likely to be reduced. To overcome this problem, we adopt the minimum final prediction error (FPE) criterion, proposed by Akaike (1969). The FPE can be computed as $(SER)^2 (N+k)/N$, where SER =the standard error of regression and K = the lag length used in regression. The optimal lag length corresponds to the minimum FPE.

The issue of FPE for the determination of optimal lag length is still controversial. Jones (1989) performed a simulation study to select the appropriate technique for this purpose. He used three alternative statistical search procedures (FPE, Bayesian estimation criterion and Pagano-Hartley t-test) and two *ad hoc* methods (arbitrary and rule of thumb lag lengths) to

identify a causal link between money supply growth and inflation for the USA over the period 1959Q₁ to 1986Q₂. The arbitrary ad hoc procedure performed marginally better than FPE, when a long lag length is used.

Given the arbitrary nature of the ad hoc procedure and requirement of a long lag length, the choice of this procedure over FPE does not seem to be well-established. The FPE performed very well in examining the causal nature of money-income relationship for postwar USA. The advantage of using FPE is that it balances the risk of an increased variance when a higher order is chosen. Furthermore, it does not constrain the lag to be the same and is equivalent to applying an F-test with varying significance levels.

Second, the test procedure only examines whether or not past (and present) changes in a variable (e.g., money) explain the current changes in another variables (e.g., prices). It does not allow one to test for Granger causality in the presence of a stochastic trend common to all the variables in question. As it is plausible that two variables share a common stochastic trend, the current changes in one variable may be due to partly to its movement with the trend value of the other variable. This type of alignment between two variables is beyond the short-run dynamic adjustment, captured by the error terms in the standard Granger model.

The following procedure is therefore developed in order to allow the causality stemming from such alignments (also Miller and Russek 1990). Consider equation (1) and take the lag with $k=1$ for simplicity. Thus, the equation becomes:

$$Y_t = \alpha_0 + \alpha_{11}Y_{t-1} + \alpha_{20}X_t + \alpha_{21}X_{t-1} + \alpha_{30}Z_t + \alpha_{31}Z_{t-1} + u_{1t} \quad (4)$$

Now, if we subtract Y_{t-1} from both sides, add and subtract $\alpha_{20}X_{t-1}$ and $\alpha_{30}X_{t-1}$ from the right hand side of equation (4) we get:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \Delta Z_t + \alpha_3 (Y_{t-1} - \beta_1 X_{t-1} - \beta_2 Z_{t-1}) + u_{1t} \quad (5)$$

where $\alpha_0 = a_0$, $\alpha_1 = a_{20}$, $\alpha_2 = a_{30}$, $\alpha_3 = (a_{11} - 1) < 0$ for dynamic stability, $\beta_1 = (a_{20} + a_{31}) / (1 - a_{11})$, $\beta_2 = (a_{30} + a_{31}) / (1 - a_{11})$ and Δ is the first difference operator.

A long-run static solution to the difference Equation (5) is given by:

$$Y_t = \beta_1 X_t + \beta_2 Z_t$$

Thus, the non-stationary series X_t , Y_t , and Z_t can be considered as connected by the relation (6) with stationary error term; v_t , that is, by the following cointegration equation

$$Y_t - \beta_1 X_t - \beta_2 Z_t = v_t \quad v_t \sim IN(0, \sigma^2) \tag{7}$$

A non-zero value of v_t indicates that X_t , Y_t , and Z_t are displaced from their long-run equilibrium. Such a displacement may arise from errors in agents past decisions (see Ericsson 1990). When the profit maximizing agents realize their errors in past decisions, they attempt to correct such errors, as reflected by the third term in Equation (5). Thus equation (5) can be interpreted as an error correction model.

In this set-up, the current change in Y can arise from (a) the contemporaneous change in X and Z , and (b) Y_{t-1} having been out of line with $\beta_1 X_{t-1} + \beta_2 Z_{t-1}$. This latter source of change provides an additional channel through which X may Granger cause Y , given Z , and this is not detected by standard Granger causality test. Substitute Equation (7) in Equation (5) to get:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \Delta Z_t + \alpha_3 v_{t-1} + u_{1t} \tag{8}$$

where the null hypothesis that \mathbf{X} does not Granger cause \mathbf{Y} , given \mathbf{Z} , is a $H_0(\alpha_0 = \alpha_3 = 0)$. The null hypothesis may be rejected if either one or more of these parameters is different from zero. It can be tested by using standard F-test. Introducing the optimal lag lengths i, j, k for \mathbf{X}, \mathbf{Y} , and \mathbf{Z} , Equation (8) can be written as:

$$\Delta \mathbf{Y}_t = \alpha_0 + \sum_i \alpha_{1i} \Delta \mathbf{X}_{t-i} + \sum_k \alpha_{2k} \Delta \mathbf{Z}_{t-k} + \alpha_3 \mathbf{v}_{t-1} + \mathbf{u}_{1t} \quad (9)$$

One can similarly write

$$\Delta \mathbf{X}_t = \gamma_0 + \sum_i \gamma_{1i} \Delta \mathbf{Y}_{t-i} + \sum_k \gamma_{2k} \Delta \mathbf{Z}_{t-k} + \gamma_3 \mathbf{v}_{t-1} + \mathbf{u}_{2t} \quad (10)$$

$$\Delta \mathbf{Z}_t = \delta_0 + \sum_i \delta_{1i} \Delta \mathbf{X}_{t-i} + \sum_j \delta_{2j} \Delta \mathbf{Y}_{t-j} + \delta_3 \mathbf{v}_{t-1} + \mathbf{u}_{3t} \quad (11)$$

under the null hypothesis of non-causality between \mathbf{X} and \mathbf{Y} , given \mathbf{Z} , $H_0(\alpha_{1i} = \alpha_{2k} = \alpha_3 = 0, \gamma_{1j} = \gamma_{2k} = \gamma_3 = 0, \text{ and } \delta_{1i} = \delta_{2j} = \delta_3 = 0)$

The null hypothesis now implies that:

- (i) all past values of \mathbf{X} have zero coefficients in Equation (9);
- (ii) all past values of \mathbf{Y} have zero coefficients in both Equations (9) and (10);
- (iii) all past values of \mathbf{Z} have zero in both equations (9) and (10); and
- (iv) the conditions are satisfied for Equation (11). A straightforward F-test can be used to test H_0 . A feedback relationship between money (\mathbf{X}) and prices (\mathbf{Y}) in the presence of other factors (\mathbf{Z}) requires that the coefficients α and γ are jointly significant. If one or more of the α -coefficients are significant but not the γ -coefficients, then \mathbf{X} will Granger cause \mathbf{Y} , and vice versa.

The stationarity is tested by using augmented Dickey-Fuller (ADF) test based on the regression:

$$\Delta Y_t = d_0 + d_1 Y_{t-1} + \sum_j d_{j+1} \Delta Y_{t-j} + e_t \quad (13)$$

where Δ is the first-difference operator and e_t is a stationary random error. The null hypothesis of non-stationary of ΔY (or Y in the case of level) is rejected when d_1 is significantly negative. The results (not reported here to conserve space) indicate that each of the series for all variables are non-stationary, when the variables are defined in levels. But when the first differences of variables are used, the null hypothesis of non-stationarity is rejected.

Data

In our empirical work we have used monthly data from 09.95 to 12.97 period. The data have been provided upon the request from Central Bank of Armenia. For the interest rate component 91-day Treasury bills rates are taken as the interest rate, the money (M) component is the base money expressed in mln drams and for prices (P) we used CPI for the same period Dec 1994=100. All together it counts to 28 observations.

Empirical analysis

We begin the empirical analysis by carrying out an analysis in terms of Granger causality (step one) and then using the method of variance decomposition tests (step two). The variables' first letters notate respectively, i.e. Money-M, Prices-P, Interest Rate-R, where the LM, LP, LR are the logarithms of corresponding variables. RATS software has been used for research analysis.

Before testing for causality, we test for unit root stationary through Dickey-Fuller test (1981). The results are reported in Table 1.

Table 1
ADF Unit Root test in levels

Variable	without trend	with trend
L M	- 0,76 (6)	- 2,10 (6)
L P	0,63 (5)	-2, 6 8 (7)
L R	-1,77 (6)	- 2,35 (5)

The results for the first differences are

Variable	Without Trend	With trend
DM	- 3,76 (5)	- 3,62 (6)
DP	-3,81 (4)	- 3,79 (4)
DR	- 6,20 (1)	- 6, 12 (2)

The Granger causality test yields the results represented in Table 2:

Table 2: Causality tests

Causality Direction	F-test	p-value
from M to P	5.32	0.01
from P to M	0.007	0,99
from M to R	5.73	0,002
from R to M	0.01	0.98

from R to P	0.37	0.69
from P to R	6.20	0.00

The results represented in Table 2 provide no basis for strongly in favor of overall causality structure. The p-value is actual or marginal probability of making type 1 error, that is rejecting the true null hypothesis. In this table, causality direction is from M to P where the p-value=0.01 means that non-causality hypothesis can be rejected at all levels of significance above 0.01. Whenever the p-value is lower than the chosen level of significance, the null hypothesis must be rejected. By the results of the test, there is a causation between money and prices and that causation runs typically from money to prices. The quantity theory of classical school regards the quantity of money as being the main reason for price increases. It states that the rate of increase in the quantity of money is equal to the rate of increase in prices. Friedman put forward the view that changes in the quantity of money will result in asset substitution, leading to changes in both the velocity of circulation and income, resulting in prices that do not change proportionately. But the inverse structure, i.e., causation from prices to money, is not present. By the results in the table, prices do not cause money. If the relationship of money and interest rate is concerned, there is a positive causation from money to interest rates. According to the liquidity preference theory of the Keynesian school, a change in the quantity of money will cause the interest rate to change in the opposite direction. Stokes and Neuberger (1979) believe that the influence of money on the interest rate could be divided into a short-term and a long-term effect. With regard to the short-term, following an increase in the supply of money, funds are comparatively slack, causing the price of those funds -the interest rate- to fall, resulting in a liquidity effect. As for the long-term, after the firms have got the funds they asked for and have increased both their production and trading activity, the increased demand for funds will result in an increase in the interest

rate, the so-called income effect. But in fact, it can be pointed out that interest rates do not help to explain the movements of money and prices. There is no causality relationship from interest rates to money and prices. Finally prices do cause interest rates. However, Fisher believes that price changes lead to price expectations, which fully respond to adjustment in nominal interest rate. For Mundel, price expectations only partly respond to nominal interest rate adjustments and that the real interest rate will fall slightly this being the so called Mundel effect.

As we can see here, most theories are not empirically supported in the present analysis (in fact some of them do). Several possible reasons might be taken as explanations for this phenomenon:

- Those theories are probably not suitable during the empirical period in Armenia;
- It might be that several theories need for more complicated research to examine the hypothesis under investigation.

So very fair question raises here that how robust the results are. Coming out of this purposes we have carried out additional empirical analysis. For that purpose, variance decomposition tests are pursued with the results to remain practically unchanged.

**Table 3. Variance Decomposition Tests
For R**

Steps	R	P	M
1	100	0	0
6	86.4	2.3	11.3
12	86.3	2.35	11.3
60	86.3	2.35	11.3

For P

Steps	R	P	M
1	0	100	0
6	3.4	85.3	11.3
12	3.4	85.2	11.3
60	3.4	85.2	11.3

For M

Steps	R	P	M
1	0	0	100
6	4.9	11.3	83.8
12	5	11.3	83.8
60	5	11.3	83.8

There is a minor disadvantage in our research, that is monthly data are no doubt sensitive, but short term data always contain too many unexpected shocks which can not be assimilated into our research framework. The fact that we use monthly data as well as the short period of investigation does not allow investigation of the role of long-term effects.

Conclusions

Granger, Sims, Hsiao, Pierce and Stokes have developed different econometric verification techniques for testing causality, but all those

approaches have their disadvantages. The technique adopted here in our empirical work for testing causality, on the one hand, makes relatively simplicity, and on the other hand leads to more accurate results. The analysis carried out tests for the presence of causality between money, consumer prices indexes and 91-days Treasury bills interest rates, using monthly data covering from September 1995 to December 1997, leads to the following conclusions:

1. The results provide strong basis for arguing that money is the most important causal element in explaining movements in economic activity.
2. The level of interest rate is clearly influenced by money and prices.
3. There is neither any causal relationship from prices to money nor from interest rate to prices.

The abovementioned conclusions are drawn from our empirical and theoretical analysis. For the time investigated here, the Armenian economy has shown its movements towards the monetary economy. The fact that there is an influence of the quantity of money on prices and not any from interest rates to money; in other words, the quantity theory of money (supported by Friedman) holds in the Armenian economy and the influence of the interest rate on the quantity of money, (Keynes) does not. Those results mean that developments and approaches to the economy have been dominated by monetary tools and factors. However, for the period considered in our work the central bank has been involved in economic activity in a more intensive way than the governmental structures. If our results are interpreted in the light of the discussion on the ultimate reasons for business cycles, they do support the monetary business cycle view with monetary impulses as the major cause for those real fluctuations.

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