HOW BANKING SYSTEM IN POST-SOVIET ECONOMIES ASSIST TO THEIR DEVELOPMENT. THE CASE STUDY OF ARMENIA

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Abstract

This paper aims to explain how the banking system is dependent on financial performance of banking system in Armenia. In analysis cointegration of series, system equation models, omission of insignificant variables as well as three-stage least squares methologies are used. Our empirical findings indicate that in fact the Central Bank through changing money supply and refinance rates affects macroeconomic indicators of the Armenian economy. It can be concluded that improvement of Armenian macroeconomic indicators can be explained due to prudent implementation of monetary policy.

Key words: Armenia, banking system, causality, cointegration, economic and financial indicators, monetary policy, three-stage least squares.

1 Introduction

Since independence from the Soviet Union in 1991 until the present day, Armenia has made good progress in her transition to a market economy in spite of its geographical location. In this period, the GDP of Armenia declined and this can be attributed to thee factors: the collapse of the COMECON, the collapse of the USSR, and the Armenian blockade. In the era of communism, Armenia (Armenian SSR) exported 95% of its production. After the end of the Cold War, there was no demand for Armenian exports because they had not been adjusted to the standards of western nations, as was the case with products of all post-communist nations.

The steady decrease of the GDP, with the dramatic crisis in 1992, stopped in 1993 and growth resumed in 1994, when economic and political stability was achieved[1]. After its lowest points in 1993 to 1997, the GDP increased by approximately 23% at an average annual rate of 5.3%. At the end of 2001, Armenian GDP per capita was $2800.

The abovementioned was achieved by implementation of tight monetary and fiscal policies. In 1998 news legislation on banking system was adopted. The intermediate target of monetary policy is money supply (M2) and money base is the operational target of the monetary policy. The band (+, - 2%) for money base fluctuations was introduced in the monetary policy program in 1999. This concept was aimed at avoiding sharp fluctuations in monetary base while ensuring adherence to the goals of monetary policy. This promotes achievement of the ultimate target of the monetary policy, i.e. the establishment and maintenance of price stability.

Armenia is considered to be the most economically and politically stable country among CIS nations[2]. Since the election of Robert Kocharyan as President of Armenia and his appointment of a new political government in March 1998, the country has enjoyed even greater political stability. The new government has emphasized its commitment to sound economic policies and structural reforms. It also actively encourages the participation of Armenia's Worldwide Diaspora in the economic development of the homeland.

2. ECONOMETRIC METHODOLOGIES

2.1 Unit root tests

In order to estimate time-series and obtain unbiased estimation, the time-series should be *stationary*; the behavior of the series does not change through time, the assumptions made in OLS are not violated and the series can be estimated. If the behavior of the series changes

[1] Source: "Armenian Economic Trends", Annual Report of the Ministry of Statistics of Armenia, 2001.
[2] Source: EBRD, "Armenian Development Report", 2001.

through time, the series is *non-stationary*, and the assumptions are violated. In order to test whether the series is stationary or not, a stationarity test *(or unit root test)* should be applied.

According to Engle and Granger (1987),[3] the most powerful technique is the Augmented Dickey-Fuller (ADF) Test. The model for the ADF test is:

$$\Delta s_t = \gamma_0 + \rho s_{t-1} + \sum_{t=1}^{k} \gamma_i \Delta s_{t-i} + u_t \qquad (2.1)$$

Where: Δ-difference operator,

$\Delta s_t = s_t - s_{t-1}$,

S_{t+1} – the values of S_t in the previous period,

u_t- error term,

i-time lag.

The null hypothesis is H_0: $\rho=1$, the unit-root exists, which means that the series is not stationary and the rationality does not exist. The alternative hypothesis is H_1: $\rho<1$, the unit-root does not exist, so the series $\Delta s_t = s_t - s_{t-1}$ is stationary. The null hypothesis is rejected when the ADF statistic exceeds the tabulated one, by its absolute value. The lag is chosen according to the Akaike criterion[4].

2.2 VAR Models and Theory

The structural approach to simultaneous equations modeling uses economic theory to describe the relationships between several variables of interest. The resulting model is then estimated and used to test the empirical relevance of the theory. Unfortunately, economic theory is often not rich enough to provide a tight specification of the dynamic relationship among variables. Furthermore, estimation and inference are complicated by the fact that endogenous variables may appear on both the left and right sides of the equations.

These problems lead to alternative, non-structural, approaches to modeling the relationship between several variables. Here, the estimation and analysis of vector autoregression (VAR) models are described.

The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables.

The VAR approach sidesteps the need for structural modeling by modeling every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The mathematical form of a VAR is:

[3] Maddala G.S. (1994).

[4] The lower the criterion is, the better the results are.

$$Y_t=C_1+\Sigma\alpha_{1i}Y_{t-I}+\Sigma\beta_{1i}X_{t-I}+E+\varepsilon_{1t} \quad (2.2.1)$$
$$X_t=C_2+\Sigma\alpha_{2i}Y_{t-I}+\Sigma\beta_{2i}X_{t-I}+E_2+\varepsilon_{2t}$$

-Where: i=1,..,n is the time lag, E vector of exogenous variables, A,B and C are matrices of coefficients to be estimated.

Since only lagged values of the endogenous variables appear on the right-hand side of each equation, there is no issue of simultaneity, and OLS is the appropriate estimation technique. It should be noted that the assumption that the disturbances are not serially correlated is not restrictive because adding more lagged Y's could absorb any serial correlation. The length of time lag is chosen according to information criteria, the smaller the value of the information criteria, the "better" the model.

The information criteria are computed by the residual covariance:

$$\left|\hat{\Omega}\right| = \det\left(\sum_t \tilde{\varepsilon}_t \tilde{\varepsilon}_t' / T\right) \quad (2.2.2)$$

ε_t is k-th vector of residuals.

The loglikelihood value is computed, assuming Gaussian Normal Distribution:

$$\ell = -\tfrac{Tk}{2}\left(1+\log\ 2\pi\right) - \tfrac{T}{2}\log\left|\hat{\Omega}\right| \quad (2.2.3)$$

Akaike (AIC) and Scwartz (SC) information criteria are computed the following way:

$$AIC=-2\ell/T+2n/T; \qquad SC=-2\ell/T+n\log T/T \quad (2.2.4)$$

In empirical applications, the main uses of the VAR are the impulse response analysis, variance decomposition, and Granger causality tests.

2.3 Granger Causality

Correlation does not necessarily imply causation in any meaningful sense of the word. The econometric graveyard is full of correlations, which are simply spurious or meaningless. Interesting examples include a positive correlation between teachers' salaries and the consumption of alcohol and a superb positive correlation between the death rate in the UK and the proportion of marriages solemnized in the Church of England. Economists debate correlations that are less obviously meaningless.

The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant. Note that two-way causation is frequently the case; x Granger causes y and y Granger causes x.

It is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

In general, it is better to use more rather than fewer lags, since the theory is couched in terms of the relevance of all past information. Lag length should be picked "i", that corresponds to reasonable beliefs about the longest time over which one of the variables could help predict the other.

The null hypothesis is therefore that "x does not Granger-cause y" in the first regression and that "y does not Granger-cause x" in the second regression. The null hypothesis is checked by F-statistics. If empirical F* exceeds the theoretical F, the null hypothesis is rejected and it is accepted that one of the series causes the other.

2.4 Testing for Cointegration

Given a group of non-stationary series, we may be interested in determining whether the series are cointegrated, and if they are, in identifying the cointegrating (long-run equilibrium) relationships. One of the VAR-based cointegration tests that are implemented, is the methodology developed by Johansen (1991, 1995)[5]. Johansen's method is to test the restrictions imposed by cointegration on the unrestricted VAR involving the series.

For cointegration test *λMAX* and *Trace* statistics are used. The null hypothesis for Trace statistics is that the maximum r cointegrated vectors exist. In the case of λMAX statistics (r+1) cointegrated vectors exist. Vectors are estimated for cointegration e.g. r=0 (no cointegration), r=1, r=2 etc. In both cases, the null hypothesis is checked by LR statistics. From the tables of $\chi 2$ distribution, the critical values are obtained for λMAX and Trace statistics, with the degrees of freedom (p-r, p-number of observations, r-degree of root). If (λMAX*>λMAX) and (Trace*>Trace), in this case, the null hypothesis is rejected. Thus, the series are coiintegrated (integrated of order s, and the residuals of order d, s>d). In this case, the vectors can be estimated, without taking differences, despite the fact that the series are not stationary.

Johansen estimates the following model: let's say X_t is Nx1 vector of I(1) variables, and the vector is k-th degree VAR with Gauss error ε_t:

$$\mathbf{X_t=\Pi_1X_{t-1}+\Pi_2X_{t-2}+\ldots+\Pi_KX_{t-K}+\varepsilon_t \qquad t=1,2,\ldots,k.} \qquad (2.4.1)$$

Π is matrix of long-run coefficients and defined as follows:

[5] Johansen & Soren (1995).

$$\mathbf{I-\Pi_1-\Pi_2-...-\Pi_K=\Pi} \qquad (2.4.2)$$

Π is matrix NxN, that defines the number of cointegrated vectors that exist among variables X. 2 matrices Nxr are defined, α and β, such that $\Pi=\alpha\beta'$. The lines of β' stand for r cointegrated vectors, such that β_i' is i-th line of β', $\beta_t'X_t \sim I(0)$.

Johansen shows that the likelihood function that is determined is correlated with:

$$L=\left(\prod_{t=1}^{N}(1-\hat{\lambda}_i)\right)^{-T/2} \qquad (2.4.3)$$

where, $\lambda_1^{\wedge}$,..., $\lambda_v^{\wedge}$ are N quadratic normal correlations among the series X_{t-2} and ΔX_t (adjusted with the descending order, such that $\lambda_i > \lambda_j$ i<j).

Thus, the likelihood function on cointegrating vectors for the null hypothesis of the Trace statistics is determined as follows:

$$Trace = T\sum_{i=r+1}^{N}\ln(1-\hat{\lambda}_i) \qquad (2.4.4)$$

The LR of λMAX statistics for r cointegrated vectors against (r+1) vectors, is determined as follows:

$$\mathbf{\lambda MAX=T\ln(1-\lambda_{r+1})} \qquad (2.4.5)$$

If the test shows r of r cointegrated vectors that means that the specification error persists. In this case, the VAR model is not proper, and the VEC (Vector Error Correction) model should be applied.

2.5 System Estimation Methods[6]

While the discussion to follow is expressed in terms of a balanced system of linear equations, the analysis carries forward in a straightforward way to unbalanced systems containing non-linear equations. Denote a system of m equations, in stacked form, as

$$\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_m \end{bmatrix} = \begin{bmatrix} X_1 & 0 & \dots & 0 \\ 0 & X_2 & \dots & 0 \\ \dots & \dots & & \\ 0 & \dots & 0 & X_m \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_m \end{bmatrix} \qquad (2.5.1)$$

[6] Pindyck & Rubinfeld (1991).

where y_t is T vector, X_i is a Txk matrix, k_j and β_j is a vector of coefficients. The error terms ε have an mTxmT covariance matrix V. We can compactly denote this system as:

$$\mathbf{y=X\beta+\varepsilon} \qquad (2.5.2)$$

Under the assumptions of least squares, the residual variance matrix from this stacked system is given by:

$$\mathbf{V=E(\varepsilon\varepsilon')=\sigma^2 I_m \otimes I_T} . \qquad (2.5.3)$$

Other residual structures are of interest. First, the errors may be heteroskedastic across the m equations. Second, they may be heteroskedastic and contemporaneously correlated. We can characterize both of these cases by defining the mxm matrix of contemporaneous correlations Σ, where the (i,j)-th element of Σ is given by $\sigma_{ij}=E(\varepsilon_{it}\varepsilon_{jt})$ for all t. If the errors are contemporaneously uncorrelated, then $\sigma_{ij}=0$ for $i\neq j$, and we can write:

$$\mathbf{V=diag(\sigma_{11}, \sigma_{22,\ldots,}\ \sigma_{mm}) \otimes I_T} \qquad (2.5.4)$$

More generally, if the errors are heteroskedastic and contemporaneously correlated:

$$\mathbf{V=\Sigma \otimes I_T} \qquad (2.5.5)$$

Lastly, at the most general level, there may be heteroskedasticity, contemporaneous correlation, and autocorrelation of the residuals. The general variance matrix of the residuals may be written:

$$V=\begin{bmatrix} \sigma_{11}\Omega_{11} & \ldots & \sigma_{1m}\Omega_{1m} \\ \ldots & \ldots & \ldots \\ \sigma_{m1}\Omega_{m1} & \ldots & \sigma_{m}\Omega_{mm} \end{bmatrix} \qquad (2.5.5)$$

Where Ωij is an autocorrelation matrix for the i-th and j-th equations.

2.5.1 Ordinary Least Squares (OLS).

This technique minimizes the sum-of-squared residuals for each equation, accounting for any cross-equation restrictions on the parameters of the system. If there are no such restrictions, this method is identical to estimating each equation using single-equation ordinary least squares.

The OLS estimator of the estimated variance matrix of the parameters is valid under the assumption that

$$\mathbf{V= \sigma^2 I_m \otimes I_T} . \qquad (2.5.6)$$

The estimator b is given by:

$$\mathbf{b_{OLS}=(X'X)^{-1}X'y} \qquad (2.5.7)$$

and the variance estimator is given by

$$\mathbf{var(b_{OLS}) = s^2(X'X)^{-1}}, \tag{2.5.8}$$

Where s^2 is the residual variance estimate for the stacked system.

2.5.2 Seemingly Unrelated Regression (SUR)

The seemingly unrelated regression (SUR) method, also known as the multivariate regression, or Zellner's method, estimates the parameters of the system, accounting for heteroskedasticity, and contemporaneous correlation in the errors across equations. The estimates of the cross-equation covariance matrix are based upon parameter estimates of the unweighted system.

Note that EViews estimates a more general form of SUR than is typically described in the literature, since SUR is appropriate when all the right-hand side regressors X_t are assumed to be exogenous, and the error variance matrix is given by

$$\mathbf{V = \Sigma \otimes I_T}. \tag{2.5.9}$$

Zellner's SUR estimator of β is given by

$$\mathbf{b_{GLS} = (X' (\Sigma^{\wedge-1} \otimes I) X)^{-1} X' (\Sigma^{\wedge-1} \otimes I) y} \tag{2.5.10}$$

Where $\Sigma^{\wedge}$ is a consistent estimate of Σ with typical element

$$\mathbf{s_{ij} = (y_i - X_i b_{OLS})' (y_j - X_j b_{OLS}) / \max(T_i, T_j)} \tag{2.5.11}$$

The max function is designed to handle the case of unbalanced data by down-weighting the covariance terms. Provided the missing values are asymptotically negligible, this yields a consistent estimator of Σ.

2.5.3 Two stage least squares (TSLS)

TSLS is a single equation estimation method that is appropriate when some of the variables in X are endogenous. Write the j-th equation of the system as

$$\mathbf{Y \Gamma_j + X B_j + \varepsilon_j = 0} \tag{2.5.12}$$

or, equivalently,

$$\mathbf{y_i = Y_j \gamma_j + X_j \beta_j + \varepsilon_j} \tag{2.5.13}$$

$$\mathbf{= Z_j \delta_j + \varepsilon_j}$$

Where

$$\Gamma_j = \begin{bmatrix} -1 \\ \gamma_j \\ 0 \end{bmatrix}, \ldots B_j = \begin{bmatrix} \beta_j \\ 0 \end{bmatrix}, \ldots \delta_j = \begin{bmatrix} \gamma_j \\ \beta_j \end{bmatrix} \tag{2.5.14}$$

Y is the matrix of endogenous variables and X is the matrix of exogenous variables.

In the first stage, we regress the right-hand side endogenous variables Y_j on all exogenous variables X and get the fitted values

$$\mathbf{Y^{\wedge}_j = X (X' X)^{-1} X' Y_j}. \tag{2.5.15}$$

In the second stage, we regress y_j on $Y^{\wedge}_j$ and X_j to get

$$\boldsymbol{\delta_{2SLS} = (\hat{Z}'_j \hat{Z}_j)^{-1} \hat{Z}_j \, y_j} \qquad (2.5.16)$$

-Where $\hat{\mathbf{Z}}_j = [\hat{\mathbf{Y}}_j \, \mathbf{X}_j]$.

2.5.4 Three-Stage Least Squares (3SLS)

Three-stage least squares (3SLS) is the two-stage least squares version of the SUR method. It is an appropriate technique when right-hand side variables are correlated with the error terms, and there is both heteroskedasticity, and contemporaneous correlation in the residuals.

These estimates are used to form an estimate of the full cross-equation covariance matrix, which, in turn, is used to transform the equations to eliminate the cross-equation correlation. TSLS is applied to the transformed model. Since TSLS is a single equation estimator that does not take account of the covariances between residuals, it is not, in general, fully efficient. 3SLS is a system method that estimates all of the coefficients of the model, then forms weights and reestimates the model using the estimated weighting matrix. It should be viewed as the endogenous variable analogue to the SUR estimator described above.

The first two stages of 3SLS are the same as in TSLS. In the third stage, we apply feasible generalized least squares (FGLS) to the equations in the system in a manner analogous to the SUR estimator.

SUR uses the OLS residuals to obtain a consistent estimate of the cross-equation covariance matrix . This covariance estimator is not, however, consistent if any of the right-hand side variables are endogenous. 3SLS uses the TSLS residuals to obtain a consistent estimate of Σ.

$$\boldsymbol{\delta_{3SLS} = \{Z' [\hat{\Sigma}^{-1} \otimes X (X' X)^{-1} X'] Z\}^{-1} Z'(\hat{\Sigma}^{-1} \otimes X (X' X)^{-1} X') y.} \qquad (2.5.17)$$

$$\boldsymbol{s_{ij}=(y_i - Z_i \delta_{2SLS})' (y_j - Z_j \delta_{2SLS}) / \max (T_i T_j).} \qquad (2.5.18)$$

If you choose to iterate the weights, the current coefficients and residuals will be used to estimate Σ.

2.6 Testing Overidentified Models[7]

The system of equations can be *exactly identified, overidentified, or underidentified*. An exactly identified model is equal to the number of parameters to be estimated; hence a unique solution for each parameter is obtained. An underidentified model contains an insufficient number of observations for parameter estimation. An overidentified model consists of more equations than necessary for parameter estimation. When the number of observations is not large, and the equations in the system are many, neither the equations can be omitted, because of the problem of endogeneity, nor the number of estimators in the equations in the model be increased, because of high correlation among variables. There are two possibilities in the case of the multicollinearity: either to enlarge the sample, in the case of limited observations it is

[7] William R.Dillon & Matthew Goldstein (1984)

not possible, or to take the differences, but in this case the observations will be less. The solution is to omit some variables. According to Specht (1975), the overidentified system can be solved if some conditions are satisfied. The method is based on the ratio of the explained variance and the variance to be explained. Specht shows that for the exactly identified model:

$$\mathbf{R^2_m = 1 - (1 - R^2_1)(1 - R^2_2) \ldots (1 - R^2_p)} \qquad (2.6.1)$$

-Where R^2_m is the squared ordinary multiple correlation coefficient of the i-th equation, obviously, $0 \leq R^2_m \leq 1$. The next step in testing an overidentified model is to calculate the analogous to R^2_m. The measure M is defined

$$\mathbf{M = 1 - (1 - R^2_1)(1 - R^2_2) \ldots (1 - R^2_p)} \qquad (2.6.2)$$

It should be noted that M differs from R^2_m**,** because R^2-s of equations with omitted variables are less than those of original ones, thus $0 \leq M \leq R^2_m$. Letting

$$Q = \frac{1 - R_m^2}{1 - M} \qquad (2.6.3)$$

we can test the significance of fit of overidentified model by forming

$$\mathbf{W = -(N - d) \ln Q} \qquad (2.6.4)$$

Where N is the sample size and d is the number of overidentifying restrictions. W follows χ^2 distribution with d degrees of freedom. The null hypothesis is that the overidentified model fits the original one. If $W > \chi^2_{(\alpha, d)}$ that means the overidentified model does not fit the original one.

3.Empirical Part

In order to make some explanation of economic indicators by financial ones and vice versa and construct the model of economy; it should be examined whether it is possible to test the variables and avoid having spurious regression that leads to abnormal results and explanations of the variables. For this purpose, the test for the cointegration existence among variables should be applied. All variables were in logarithms, except rates of inflation and unemployment[8]. Nine endogenous and three exogenous variables were applied (one is the dummy variable and the other two stand for money supply and refinance rate that are employed as policy instruments by the Central Bank of Armenia, and in the model are applied as exogenous variables). The results of the cointegration test are presented below:

[8] In order to have explanation in percentages.

Table 3.3.1: Cointegration test results

Sample: 1997:12 2001:12
Included observations: 47
Test assumption: Linear deterministic trend in the data
Series: LGDP LASSETS LCA INF LLINVEST LTB LGSRO LCORACC UNEMP
Exogenous series: DUM1 LMONEY REFRATE
Lags interval: 1 to 3

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.988481	476.5449	192.89	205.95	None **
0.906880	320.3145	156.00	168.36	At most 1 **
0.857570	237.2293	124.24	133.57	At most 2 **
0.766476	169.0177	94.15	103.18	At most 3 **
0.725101	118.1112	68.52	76.07	At most 4 **
0.628479	72.91387	47.21	54.46	At most 5 **
0.548244	38.25862	29.68	35.65	At most 6 **
0.235716	10.44713	15.41	20.04	At most 7
0.029238	1.038588	3.76	6.65	At most 8

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 7 cointegrating equation(s) at 5% significance level

The test indicates 7 out of 9 cointegrated vectors. This means that despite the fact that the series are I(1), they are cointegrated or long-run converged, thus the series can be estimated without taking the first differences.

In the estimation, monthly data were used from 1997:12 till 2001:12. According to Table 3.3.2, there is a significant correlation among some variables. This means that if all variables are included in the system of equations, the multicollinearity problem arises. In order to avoid having boosted results of estimation, and taking into account that it is not possible to enlarge the sample size because of non-availability of data, the stepwise backward method of excluding variables was applied. If all variables in the system of equations that are present in VAR models are included, this system of equations cannot be solved because the rank and order conditions are not satisfied[9].

Table 3.3.2: Correlations of financial and Macroeconomic Indicators.

	LGDP	LASSETS	LCA	INF	LLINVEST	LTB	LGSRO	LCORACC	UNEMP
LGDP	1	0.941*	0.089	0.031	0.909*	0.900*	0.952*	0.843*	0.632*
LASSETS	0.941*	1	-0.083	0.188	0.990*	0.894*	0.982*	0.958*	0.657*
LCA	0.089	-0.083	1	0.045	-0.142	-0.247	-0.116	-0.305	0.441
INF	0.031	0.188	0.045	1	0.139	-0.194	0.072	0.194	0.065
LLINVEST	0.909*	0.990*	-0.142	0.139	1	0.900*	0.973*	0.971*	0.667*
LTB	0.900*	0.894*	-0.247	-0.194	0.900*	1	0.945*	0.867*	0.449
LGSRO	0.952*	0.982*	-0.116	0.072	0.973*	0.945*	1	0.929*	0.596*
LCORACC	0.843*	0.958*	-0.305	0.194	0.971*	0.867*	0.929*	1	0.586*
UNEMP	0.632*	0.657*	0.441	0.065	0.667*	0.449	0.596*	0.586*	1

[9] Dillon & Goldstein (1984).

* Stands for high significant correlation.

Where: **LGDP**: logarithm of GDP.
LASSETS: logarithm of the assets of banks.
LCA: logarithm of the Capital Account.
INF: inflation.
LLINVEST: logarithm of the loan investments.
LTB: logarithm of the Trade Balance.
LGSRO: logarithm of the investments in T-Bills.
LCORACC: logarithm of the corresponding accounts.
UNEMP: unemployment.

As has already been mentioned above, only significant variables were included, and because of simultaneous causality, the system of equations was estimated using the 3SLS method. The money supply (M2) and the refinance rate were taken as instruments. This does indeed match the real economy. The CB of Armenia intervenes in the economy by changing the money supply and refinance rate (the CBA changes other rates as well). The tests rejected the endogeneity of the money supply and refinance rate, so these variables were taken as exogenous. In the estimation, one dummy variable was used, which stood for the post-crisis period[10]. The estimation results are shown overleaf:

Table 3.3.3: Simultaneous Estimation of the system with Financial and Economic Indicators.

Estimation Method 3SLS; Sample: 1997:12-2001:12+ ;
Instruments: lmoney, dum1, refrate .

Dependent Variable	LGDP	LCA	INF	LLIN VEST	LTB	UNEMP
Intercept	-6.4998* (-1.96)	8.98 (1.66)	-1.37 (-1.48)	-42.17* (-3.82)	-33.7* (-3.93)	-477.5* (-3.49)
Lgdp(t-1)_	1.025* (49.17)	0.448* (9.8)		-0.2* (-4.14)		
Lassets (t-1)	-0.112 (-1.89)		0.09* (2.98)	0.38* (2.02)		-6.35 (-1.91)
Lca (t-1)						5.62* (3.33)
Inf (t-1)	-0.534* (-4.38)		0.74* (13.82)			-15.46* (-5.11)
Llinvest (t-1)	0.259* (4.7)			0.295* (2.16)		
Ltb (t-1)		0.817* (3.01)			0.46* (2.54)	-9.39* (-2.1)
Lgsro (t-1)		-0.79* (-9.13)		0.27* (5.31)	0.06 (1.75)	
Lcoracc (t-1)	0.217 (1.82)	0.4* (2.1)			0.34* (2.01)	
Unemp (t-1)			0.01* (5.02)	-0.02* (-3.33)	-0.02* (-3.07)	0.34* (3.86)
R^2	**0.995**	**0.97**	**0.97**	**0.997**	**0.98**	**0.97**
Adj.R^2	**0.993**	**0.96**	**0.96**	**0.996**	**0.97**	**0.96**

[10] Terrorist act in Armenian parliament that took place on 27.10.99.

Dependent Variable	LGDP	LCA	INF	LLIN VEST	LTB	UNEMP
D.W.	**1.96**	**1.9**	**2.11**	**1.88**	**2.01**	**2.06**

+ Because of 48 observations, only time lag 1 was used for the causality.

In order to test whether the model with omitted variables fits the original one, the W statistic was calculated (Specht's, method that is described above).

$W=7{,}29 < \chi^2_{0{,}05;9}=15{,}21$.

The results of W statistics test indicate that null hypothesis is not rejected, thus the model with omitted variables fits the original one, and thus our model can be used for further estimation, without any violation of hypotheses.

4. CONCLUSIONS

The results indicate that the banking system in Armenia is important in the economic development. Armenia's development via her banking system matches the theory that suggests that the commercial banks, via their services, assist in the development of the country.

The Central Bank of the Republic of Armenia, via changing money supply and interest rates, implements the monetary policy.

The Armenian economy can be characterized as very sensitive to political and economic shocks.

The tendencies of financial and macroeconomic indicators showed that there was long-run convergence and stability, if there were no exogenous factors that might cause instability in the economy and the financial system. The analysis of the model of economy showed that there was mutual causality among financial and economic indicators. The CB might choose a target e.g. an increase in GDP growth, a reduction in the interest rate, that would cause an increase in loans because of the low cost of money maintenance, and this in turn would lead to an increase in consumption and GDP growth. Or the CB could increase the money supply in the market, reducing the monetary base that would raise the amount of money in the market, which would increase the funds for firms, allowing them to hire more workers, leading to a reduction in unemployment. The CBA would reduce the reserve ratio of the acquired means of commercial banks, the banks would invest the money in T-Bills and the government could pay wages and pensions. The chosen target would depend on the cooperation of the Ministry of Finance and Economy and the CBA.

Time is needed to achieve this, but first of all the Armenian economy requires stability and the elimination of blockade imposed by the "neighborhood states".

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