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Halkos, George

University of Thessaly, Department of Economics

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George E. Halkos* **and Marianna K. Trigoni**
Department of Economics, University of Thessaly
Korai 43 St, 38333 Volos, Greece

ABSTRACT

In this study we try to detect the relationship between financial and real sector employing in the estimation procedure the recent time-series techniques of co-integration, vector error-correction modelling and Granger multivariate causality. We contribute to the existing literature by using for the first time a number of financial and economic variables for the case of Greece for the time period 1960-2005. Our empirical results reveal that the linkage between financial and real development is relatively weak in Greece and real sector plays the major role in the evolution of the financial system. The latter seems to promote growth only by increasing its competitiveness.

Keywords: Financial sector; real sector; Greek banks.

JEL Classification Codes: E5, G0

Address for correspondence

George Emm. Halkos
Director of Postgraduate Studies
Associate Editor in Environment and Development Economics
Director of the Operations Research Laboratory
Deputy Head
Department of Economics
University of Thessaly
Korai 43
Volos 38333, Greece
Tel.   0030 24210 74920
FAX   0030 24210 74772
email: halkos@uth.gr
http://www.halkos.gr/

1. INTRODUCTION

It is generally accepted that in Greece, banks have played a significant role in the accumulation of savings and its allocation to productive activities, in contrast with the capital market, which was till recently limited, due to low supply of small family oriented Greek enterprises.

Until 1980 financial restrictions were imposed, so as the problem of inflation to be encountered, caused mainly by large fiscal expenses. These restrictions concerned the amount of credit directed to the private sector so as the needs for credit to the public sector to be covered. The main characteristic of this period was also high interest rates necessary to cope with inflation as well as fiscal deficits taking into consideration the liberalization of capital flows.

But after the entrance of Greece in the Monetary European Union and the adoption of Euro, there was a need for a monetary as well as a real convergence. Consequently it became compulsory for interest rates to fall and there was liberalization in the allocation of credit. This was followed by the entrance of new financial enterprises, gradual mergers and acquisitions, a reduction in the portion of public banks in the financial market and a consequent increase in the portion of private ones. It is remarkable that from 1998 to 2003, the asset of Greek banks nearly doubled and in 2000 it exceeded GDP.

Taking the above conditions into consideration we try to define the interactions between the Greek financial and real sector, by capturing macroeconomic policies associated with economic growth. Our paper contributes to the existing literature by using for the first time a number of financial and economic variables for the case of Greece and by employing in the estimation procedure the recent time-series techniques of co-integration, vector error-correction modeling and Granger multivariate causality.

The structure of this study is the following. Section 2 presents a theoretical review regarding finance and growth. Section 3 describes the data used and the proxy measures of financial and real sector. Section 4 presents the empirical results and discusses the methodology proposed. Finally, the conclusions and their associated policy implications are presented in the last section.

2. THEORETICAL REVIEW

During the last decades there has been a controversy of opinions, regarding the relationship between financial development and economic growth. From one hand and according to Robinson (1952), Gupta (1984) and Demetriades and Hussein (1996), there is the *«demand leading hypothesis»* (Patrick 1996), which supports that growth induces financial development. Conversely, the *«supply leading hypothesis»,* which is consistent with Gerschenkron's view (1962), considers financial system to be the generating factor, trying to analyse the mechanisms through which finance affects growth (Levine, 1997). Bercivenga and Smith (1991) develop a model in which financial intermediaries influence growth rates, while de Rin and Hellmann (2002) introduce banks into a 'big push model', showing that they may act as catalysts for industrialization. King and Levine (1993) and Levine *et al.* (2000) among others give empirical supporting evidence, using cross country analysis. However, there are researchers, who support a two-way relationship between finance and growth (Thornton, 1996), little relationship (Atindehou *et al.*2005; Mouawiya Al-Awad and Narsi Harb 2005) or no relationship at all (Chang, 2002).

Moreover, the supporters of the «*supply leading hypothesis»* have alternative views regarding the impact of financial liberalization on economic growth. According to the *"structuralism view"* proposed by Taylor (1983), *Wi*jnbergen (1983) and Buffie (1984) financial deepening reduces the total real supply of credit available and hinders economic growth. On the contrary, McKinnon (1973, 1991), Shaw (1973) and Fry (1978) claim that liberalization of the financial system leads to the replacement of unproductive tangible assets with productive ones, positively influencing the quality and quantity of investment.

In this study, we explore which of these theories apply in the case of Greece. Specifically, as shown next, there is an application of a two-way relationship between finance and growth (Thornton, 1996), indicating that although real sector acts as a determining factor in the development of the financial market, finance is able to intrigue real sector, through increasing its liberalization and competitiveness.

3. PROXY MEASURES OF FINANCIAL AND REAL SECTOR

In an effort to analyze the interactions between real and financial sector in Greece, we use bivariate models between financial variables on one hand and real sector variables on the other, as well as an augmented VAR model, using annual data from 1960 to 2005. The financial variables which are indicative of the depth of the financial system are total credit of banking institutions to GDP (TOTCREGDP)-Levine et al. (2000), total deposits of banking institutions to GDP (TOTDEPGDP)- Thornton (1996) and liquid liabilities to asset banks (LIQTOASE)-Beck *et al.* (2000).

The efficiency of the financial system is expressed by the ratio of total credit to the private sector to GDP (CPSGDP)-King and Levine (1993), total credit to the private sector to credit to the public sector (PRICREPUBCRE), short to long term loans which represents loans that have a year duration to loans of a longer duration (SHOLON), asset of monetary authorities to GDP (AMGDP), total credit of monetary authorities to total credit of banking institutions (MABAN)-King and Levine (1993) and spread which is the difference between lending and deposit rate (SPREAD)-Eschenbach *et al.*(2000). AMGDP and MABAN are used as measures of the degree of financial liberalisation and SPREAD of competitiveness (the lower the values, the more efficient the indicators).

Real sector is characterised by a certain monetary policy, which is expressed by lending rate (LR) or deposit rate (DR) and a fiscal policy which is weighed by the ratio of public consumption to GDP (PUBCONGDP) and fiscal deficit to GDP (DEFGDP). Proxies of real sector growth are Gross Domestic Product (GDP), real gross capital formation (GFCF), total investments to GDP (INVGDP) and saving rate (S). S is defined as the ratio of net disposable income minus consumption to net disposable income.

SHOLON, TOTDEPGDP, TOTCREGDP, MABAN and PRICREPUBCRE are derived from the “Long term statistical time series of the Greek economy” published by the

Department of Economic Studies of the Bank of Greece for the years 1960-1991 and since 1991, from the "Monthly Statistical Bulletin" of the Bank of Greece (2004). LIQTOASE and CPSGDP are derived from the World Development Indicators Database. INVGDP is derived from the "Main national account aggregates of the Greek economy" published by the Ministry of National Economy. The rest of the data concerning macroeconomic and some financial figures comes from the database of the International Monetary Fund (IMF). All data is expressed in real prices as the ratio of nominal prices to the GDP deflator. GDP deflator is defined as the ratio of current prices to constant prices referenced to 2000 and is also taken from the IMF database.

4. EMPIRICAL RESULTS

Table 1 gives the descriptive statistics of the related variables. We observe that the mean and medium values are very close, implying stable time series of proxy measures, during sample periods covering from 1960 to 2005, while standard deviations are relatively high, due to the fact that we use proxies in levels.

Table 1 about here

Before we apply the Granger causality tests we have to test for stationarity of the time series into consideration. For this reason we employ Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) stationarity tests. To perform the ADF test we consider the following process of data generation

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \varepsilon_t$$

$$\Delta X_t = \alpha + \beta T + \delta X_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta X_{t-j} + \varepsilon_t$$

Where Δ is the operator of the first-order difference; X_t is the variable under consideration; T is the linear time trend and t stands for time; p is the lag order; and ε_t is the white noise disturbance term with zero mean. The first of the process is with intercept, while the second is with trend and intercept. The null hypothesis is that H_0: $\delta=0$ against H_1: $\delta\neq0$ and the computed τ-values are compared with the MacKinnon's tables of critical values (MacKinnon, 1996). If the computed τ-values are greater than the MacKinnon critical values then H_0 is rejected and the variable is stationary. In the case that the τ-values are less than the critical values then the null hypothesis of non-stationarity is not rejected. Rejection of H_0 implies that the variable X_t is integrated of order zero [I(0)]. If the time series become stationary in first differences, then they are integrated of order one [I(1)]. Similarly and in order to perform the Phillips-Perron test we also rely on the previous regressions. This test controls for higher order serial correlation.

The optimal number of lags is determined by using the Akaike Information Criterion (AIC) and the Schartz Criterion (SC). Autocorrelation is explored using the Breusch-Godfrey test. Tables 2-3 present the unit root tests. According to the test results, all variables are I(1), with the exception of PRICREPUBCRE, which is I(2) at all significant levels.

Tables 2-3 about here

To consider dynamic causality, direction and timing between financial and real sector, we estimate bivariate vector autoregressive models, based on AIC and SC criteria and we conduct cointegration tests, according to Maximum Eigenvalue and Trace tests. Specifically, a VAR model can be presented as

$$\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} \alpha_{1,0} \\ \alpha_{2,0} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(1)} & \beta_{12}^{(1)} \\ \beta_{21}^{(1)} & \beta_{22}^{(1)} \end{bmatrix} \begin{bmatrix} X_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \beta_{11}^{(2)} & \beta_{12}^{(2)} \\ \beta_{21}^{(2)} & \beta_{22}^{(2)} \end{bmatrix} \begin{bmatrix} X_{t-2} \\ Y_{t-2} \end{bmatrix} + \dots + \begin{bmatrix} \beta_{11}^{(p)} & \beta_{12}^{(p)} \\ \beta_{21}^{(p)} & \beta_{22}^{(p)} \end{bmatrix} \begin{bmatrix} X_{t-p} \\ Y_{t-p} \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix}$$

If we define Z_t as $Z_t = \begin{bmatrix} X_t \\ Y_t \end{bmatrix}$ then we have

$$Z_t = \alpha + \beta_1 Z_{t-1} + \beta_2 Z_{t-2} + \dots + \beta_p Z_{t-p} + e_t$$

Where Z_t is a vector that contains the system variables; $\beta_1, \beta_2, \dots, \beta_p$ are parameters; α is the deterministic element of the VAR model; e_t is the vector of random errors distributed with zero mean and Ω variance matrix. Using the maximum likelihood method and the Johansen cointegration strategy we are able to estimate the cointegrating vectors between the nonstationary variables.

Table 4 presents the extracted results, which show that the only cointegration equations are traced between SPREAD-INVGDP, DEFGDP-SPREAD, DEFGDP-TOTCREGDP and DEFGDP-AMGDP.

Table 4 about here

In the above cases of cointegration we detect the existence of a short and long term relationship through Granger Causality tests and Vector Error Correction Model respectively. The short-run Granger causality is tested by the joint significance of the coefficients of the differenced explanatory variables by using the *F*-statistics while the long-run causality is implied through the significance of the *t*-test(s) of the lagged error correction term(s). However the VECM indicates econometric exogeneity of the variables if both the *t* and *F* tests are insignificant.

According to Granger Causality tests, SPREAD seems to cause INVGDP, while DEFGDP doesn't seem to interact with SPREAD in the short run at a 5% significance level. On the other hand DEFGDP causes TOTDEPGDP and AMGDP causes DEFGDP at the same level of significance. With the exception of INVGDP-SPREAD, in all other cases there seems to be a long term relationship between all variables mentioned above, as all the adjustment coefficients towards long run equilibrium are statistically important.

Tables 5-6 about here

In analyzing the results, attention is given on the impulse response functions and forecast error variance decomposition. Impulse response functions show how one variable responds over time to a single innovation in itself or another variable. Innovations in the variables are represented by shocks in the error terms in the equations. Specifically, we observe that for instance, after a 1% point increase in spread, the response of INVGDP is negative, reaching a peak of –0.02%, after seven years, indicating that the more the banks become competitive, which is expressed by a low spread, the more INVGDP is promoted.

After a 1% improvement of DEFGDP, SPREAD declines reaching a negative peak of –0.68%, in five years and then is stabilized at about –0.55%. On the contrary, TOTCREGDP reacts positively to a 1% shock of DEFGDP, meaning that an improvement of DEFGDP stimulates TOTCREGDP, which reaches a maximum of 0.03%, after 9 years. Finally DEFGDP is determined by AMGDP, negatively reacting to it, as a 1% increase in AMGDP, leads to a –0.017% decline of DEFGDP.

At the same time, we compute forecast error variance decomposition, which seem to reinforce the results of the impulse response functions, by determining the relative importance of each variable in generating fluctuations in other variables. According to Figure 2, the results show that SPREAD explains more than 69.37% of INVGDP fluctuations, while INVGDP doesn't seem to be important for SPREAD, after ten years ahead. Also, DEFGDP explains 42.08% of SPREAD, while SPREAD shocks explain 34.22% of DEFGDP.

Moreover, DEFGDP explains 30.05% of TOTCREGDP, while the reverse relationship is relatively weak. Also, AMGDP explains 66.03% of DEFGDP fluctuations, while there is a lower significance (20.6%), in the opposite direction.

Figures 1-2 about here

Additionally, taking into consideration the break point of financial liberalisation in Greece, which was in the late 1980's and in order to test the stability of our results over time, we implemented the same methodology, by dividing our sample into two sub periods 1960-1987 and 1987-2005. The results indicated no cointegration relationships in the sub periods.

According to the above analysis, real sector variables tend to predict financial variables and vice versa, but cannot definitely be considered the cause of each other, as there can both respond to other changes of the economic environment. As there is a problem in the interpretation of VAR's, due to "observational equivalence" (Cochrane, 1998), we use a multivariate model that also looks at the monetary sector of the economy, in an attempt to analyze the interactions between real, financial and monetary sector. The VAR model includes GDP and GFCF, as real sector indicators, DR as a monetary indicator and TOTDEP and AMGDP as indicators of financial depth and efficiency respectively.

Table 7 about here

The Granger Causality tests show that GDP causes DR and TOTDEP, while TOTDEP causes DR at a 5% level of significance. According to the VEC model as well as the impulse response and variance decomposition analysis, there seems to be a long term relationship, as shown in Figures 3-4. We also note that AMGDP explains a significant degree of GDP (21.7%) and GFCF fluctuations (26.18%), which to some extent verifies the results of the bivariate models that financial liberalization promotes growth.

Figures 3-4 about here

5. CONCLUDING REMARKS AND POLICY IMPLICATIONS

From the results of our VAR analysis we see that the linkage between financial and real development is relatively weak in Greece as the only cointegration equations are between SPREAD-INVGDP, DEFGDP-SPREAD, DEFGDP-TOTCREGDP and DEFGDP-AMGDP. We also examine a multivariate VAR model, which includes monetary, financial and real variables among which we detect a cointegrating equation.

We observe that there doesn't seem to be a causal relationship leading from financial depth, but only from financial efficiency, as defined above, to the development of the real sector, through the impact of SPREAD on INVGDP and AMGDP on DEFGDP. It seems that the degree of financial liberalization expressed by the proxies SPREAD and AMGDP has a positive influence on the ratio of investments to GDP and public deficit, respectively.

On the other hand, the results indicate that real sector defines the role of finance, according to the "demand leading hypothesis" (Robinson, 1952; Gupta, 1984; Demetriades and Hussein, 1996). Specifically, through causality tests, impulse response functions and variance decomposition analysis, we observe that DEFGDP is crucial for the evolution of TOTCREGDP and GDP for TOTDEP, which is in agreement with the restricted and government directed role of financial institutions.

An aggravation of public deficit creates a need for public lending, increasing deposit rates and consequently the ratio of liquid liabilities to asset banks. On the contrary, it leads to a decrease in TOTCREGDP, as lending rates are kept at very high levels, in an attempt to face inflation.

Taking into consideration the results of this econometric analysis, we conclude that the restrictions of the Greek financial system mitigated its role to the development of economy, although there is a sign of a two-way relationship between finance and growth (Thornton, 1996), through efficiency measures of the financial system.

Spread, which is used as a proxy of the competitiveness of the banking system, was proved to be a stimulating factor. Consequently, it is important that Greek banks try to approach the spread of the average European banks, by improving the quality of their services, diversifying products and expanding their activities.

A promising path of research would be to use quarterly after 1987 data, in order to find out whether the liberalization of the financial system in Greece, which gradually took place after the late 80's, reinforced its role and made it capable of supporting a sustainable economic development.

For future extensions of our work, it would also be interesting to examine the relationships between financial and real sector, in economies which experienced similar macroeconomic characteristics, such as Ireland, Portugal and Spain, with the hope of finding similarities that would contribute to the implementation of relative effective policies.

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Table 1: Descriptive statistics

Variables	*Mean*	*SD*	*Median*	*Max*	*Min*
Financial sector					
Financial depth					
TOTDEPGDP	0,61	0,23	0,72	0,97	0,18
TOTCREGDP	0,46	0,11	0,47	0,63	0,75
LIQTOASE	13,30	4,28	17,00	18,00	3,00
Financial efficiency					
CPSGDP	0,44	0,13	0,43	0,85	0,26
MABAN	0,02	0,02	0,01	0,08	0,00
PRICREPUBCRE	5,97	2,09	5,90	11,67	2,09
SHOLON	1,47	0,35	1,34	2,34	0,99
SPREAD	4,99	2,22	4,91	9,23	2,00
AMGDP	0,29	0,10	0,28	0,55	0,11
Real secror					
GDP	276,48	112,7	255,28	526,49	96,51
GFCF	61,13	27,43	57,17	127,85	18,34
INVGDP	0,22	0,02	0,22	0,25	0,19
S	0,26	0,05	0,27	0,38	0,12
Monetary policy					
LR	15,49	7,23	12,89	29,45	6,79
DR	10,14	5,57	9,25	20,67	2,23
Fiscal policy					
DEFGDP	-0,06	0,05	-0,04	-0,01	-0,21
PUBCONGDP	0,15	0,02	0,15	0,20	0,11

Table 2: Unit root ADF test-Annual data 1960-2005

Variables	Deterministic	Levels		First difference	
			Probability		Probability
TOTDEP	intercept	1,2976	0,9983	-4,9741	0,0002
	trend and intercept	-1,7493	0,7123	-5,1697	0,0006
TOTDEPGDP	intercept	-1,5212	0,5139	-6,4029	0,0000
	trend and intercept	-1,3843	0,8522	-6,4800	0,0000
TOTCREGDP	intercept	-2,0935	0,2483	-4,0241	0,0033
	trend and intercept	-2,3205	0,4133	-3,9417	0,0192
LIQTOASE	intercept	-0,8523	0,7936	-6,2547	0,0000
	trend and intercept	-2,7036	0,2403	-6,2239	0,0000
CPSGDP	intercept	0,0061	0,9540	-3,3730	0,0174
	trend and intercept	-4,0875	0,0136	-3,5333	0,0481
MABAN	intercept	-1,8472	0,3532	-8,6176	0,0000
	trend and intercept	-2,0012	0,5833	-8,9790	0,0000
PRICREPUBCRE	intercept	-0,8985	0,7784	-2,2241	0,2012*
	trend and intercept	0,4971	0,9989	-3,2427	0,0909*
SHOLON	intercept	-2,0196	0,2776	-4,6988	0,0005
	trend and intercept	-1,7332	0,7176	-4,6917	0,0028
SPREAD	intercept	-1,3586	0,5935	-5,4115	0,0001
	trend and intercept	-1,0609	0,9239	-5,4517	0,0003
AMGDP	intercept	-1,6647	0,4419	-7,4285	0,0000
	trend and intercept	-1,3236	0,8691	-7,6267	0,0000
GDP	intercept	1,5026	0,9991	-5,8575	0,0000
	trend and intercept	-0,3336	0,9872	-6,1484	0,0000
GFCF	intercept	0,2354	0,9720	-5,0091	0,0002
	trend and intercept	-2,1940	0,4810	-4,9952	0,0011
INVGDP	intercept	-2,6580	0,0895	-6,8655	0,0000
	trend and intercept	3,3086	0,0782	-6,8425	0,0000
S	intercept	-2,3629	0,1585	-5,8498	0,0000
	trend and intercept	-1,6948	0,7346	-7,1389	0,0000
DR	intercept	-1,0464	0,7282	-4,2788	0,0015
	trend and intercept	0,3673	0,9984	-4,7189	0,0023
LR	intercept	-1,4916	0,5280	-3,2272	0,0253
	trend and intercept	-0,6431	0,9708	-3,5732	0,0445
DEFGDP	intercept	-1,9898	0,2899	-7,2016	0,0000
	trend and intercept	-2,6424	0,2649	-7,1810	0,0000
PUBCONGDP	intercept	-1,8289	0,3622	-9,5162	0,0000
	trend and intercept	-1,9555	0,6091	-8,4797	0,0000

**unit root at a 5% level of significance*

Table 3: Unit root -Phillips-Perron test-Annual data 1960-2005

Variables	Deterministic	Levels		First difference	
			Probability		Probability
TOTDEP	intercept	1,2539	0,9980	-4,9814	0,0002
	trend and intercept	-2,1308	0,5152	-5,1750	0,0006
TOTDEPGDP	intercept	-1,5212	0,5139	-6,4029	0,0000
	trend and intercept	-1,3843	0,8522	-6,4800	0,0000
TOTCREGDP	intercept	-2,0935	0,2483	-4,0242	0,0033
	trend and intercept	-2,3205	0,4133	-3,9418	0,0192
LIQTOASE	intercept	-1,5043	0,5224	-10,0470	0,0000
	trend and intercept	-3,1491	0,1078	-9,9565	0,0000
CPSGDP	intercept	0,0061	0,9540	-3,3730	0,0174
	trend and intercept	-4,0875	0,0136	-3,5333	0,0481
MABAN	intercept	-3,4358	0,0152	-8,8632	0,0000
	trend and intercept	-1,6793	0,7424	-23,5585	0,0000
PRICREPUBCRE	intercept	-1,3166	0,6128	-2,0325	0,2723*
	trend and intercept	0,8377	0,9997	-3,1493	0,1093*
SHOLON	intercept	-2,6026	0,1006	-4,8006	0,0004
	trend and intercept	-1,9913	0,5886	-4,7305	0,0025
SPREAD	intercept	-1,4549	0,5465	-5,4187	0,0000
	trend and intercept	-1,3444	0,8629	-5,4517	0,0003
AMGDP	intercept	-1,6155	0,4665	-7,5242	0,0000
	trend and intercept	-1,3236	0,8691	-7,9842	0,0000
GDP	intercept	1,4745	0,9990	-5,8445	0,0000
	trend and intercept	-0,3990	0,9847	-6,1501	0,0000
GFCF	intercept	0,0436	0,9575	-4,9388	0,0002
	trend and intercept	-1,5865	0,7827	-4,8709	0,0015
INVGDP	intercept	-2,7048	0,0813	-6,8655	0,0000
	trend and intercept	-3,3086	0,0782	-6,8462	0,0000
S	intercept	-2,3923	0,1504	-5,8503	0,0000
	trend and intercept	-1,6173	0,7677	-7,5714	0,0000
DR	intercept	-1,0565	0,7247	-4,2788	0,0015
	trend and intercept	-0,0373	0,9945	-4,7484	0,0021
LR	intercept	-1,2362	0,6500	-3,2272	0,0253
	trend and intercept	0,2322	0,9976	-3,5886	0,0430
DEFGDP	intercept	-1,7768	0,3861	-10,4491	0,0000
	trend and intercept	-2,8035	0,2047	-11,1500	0,0000
PUBCONGDP	intercept	0,8865	0,9944	-9,3038	0,0000
	trend and intercept	-1,6342	0,7633	-9,4964	0,0000

* unit root at a 5% level of significance

Table 4: Cointegrating vectors /Mag eigenvalue test and Trace test: Bivariare models

	Trace test	***Max eigen***
invgdp spread (VAR lag=1)		
H_o: r=0*	16,7178	14,8014
H_o: r≤1	1,9164	1,9164
defgdp spread (VAR lag=1)		
H_o: r=0*	17,5484	15,7774
H_o: r≤1	1,7635	1,7635
defgdp amgdp (VAR lag=1)		
H_o: r=0*	16,9516	14,4538
H_o: r≤1	2,4978	2,4978
Critical value 0,05 (allow for linear deterministic trend in data)		
H_o: r=0	**15,4947**	**14,2646**
H_o: r≤1	**3,8415**	**3,8425**
defgdp totcregdp (VAR lag=1)		
H_o: r=0*	11.4889	11.4838
H_o: r≤1	0.0049	0.0049
Critical value 0,05		
H_o: r=0	**12,3209**	**11,2248**
H_o: r≤1	**4,1299**	**4,1299**

r = number of cointegrating vectors
Lags are defined according to AIC and SC
**Rejection of Ho (Ho:There is no cointegration relation)*

Note: The rest of the cointegrating equations, which proved to be insignificant are available upon request.

Table 5: Vector Error Correction models

Explanatory Variables	***d(invgdp)***	***d(spread)***
Short run: F-statistic		
D(invgdp(-1))	-0,0271	1,7730
D(spread(-1))	-0,0011	0,2039
Ac-t statistic	0,0017	0,0220
ECT-t statistic	-0,3786*	-3,3636
	d(defgdp)	**d(spread)**
Short run: F-statistic		
D(defgdp(-1))	-0,0082	14,8074*
D(spread(-1))	0,0021	0,3116*
Ac-t statistic	-0,0012	0,0675
ECT-t statistic	-0,3464*	-13,3266*
	d(defgdp)	**d(totcregdp)**
Short run: F-statistic		
D(defgdp(-1))	-0,0678	-0,0468
D(totcregdp(-1))	0,2263	0,0131
Ac-t statistic	-0,0017	0,0040
ECT-t statistic	-0,2366*	0,2986*
	d(defgdp)	**d(amgdp)**
Short run: F-statistic		
d(defgdp(-1))	-0,1627	0,8492*
d(amgdp(-1))	-0,6372	0,1669
Ac-t statistic	-0,0009	0,0033
ECT-t statistic	-1,9862*	-2,1098*

**Statistically significant at a 5% level*

Table 6: Granger Causality tests of bivariate models

Granger Causality tests	F statistic	Probability
Spread doesn't Granger cause Defgdp	3,6641	0,0636
Defgdp doesn't Granger cause Spread	1,1815	0,2810
Defgdp doesn't Granger cause Totcregdp	7,1278	0,0113
Totcregdp doesn't Granger cause Defgdp	1,8225	0,1854
Spread doesn't Granger cause Invgdp	11,9348	0,0013
Invgdp doesn't Granger cause Spread	0,0067	0,9352
Defgdp doesn't Granger cause Amgdp	0,9949	0,3252
Amgdp doesn't Granger cause Defgdp	9,0872	0,0047

Table 7: Results of the augmented VAR model

1)Cointegrating vectors /Mag eigenvalue test and Trace test

gdp gfcf dr amgdp totdep (var lag=1)

	Trace test	***Max eig test***
H_o: r=0	84,9796	42,6776
H_o: r≤1	42,3020	19,429
H_o: r≤2	22,8729	12,0771
H_o: r≤3	10,7958	8,3277
H_o: r≤4	2,4681	2,4681
Critical values 0,05		
H_o: r=0	69,8188	33,8769
H_o: r≤1	47,8561	27,5843
H_o: r≤2	29,7971	21,1316
H_o: r≤3	15,4947	14,2646
H_o: r≤4	3,8414	3,84146

R = number of cointegrating vectors
Lags are defined according to AIC and SC
**Rejection of Ho (Ho:There is no cointegration relation)*

2) VEC model

Short run: F-statistic	d(gfcf)	d(gdp)	d(amgdp)	d(dr)	d(totdep)
D(gfcf(-1))	0,6594*	1,0577*	-0,0044	0,0416	-0,2765
D(gdp(-1))	-0,1247	-0,1794	0,0009	-0,0152	0,1334
D(amgdp(-1))	43,7843*	105,7071*	-0,2405	5,5314	-41,6785
D(dr(-1))	1,7169*	2,9989*	-0,0120	-0,0437	4,4327
D(totdep(-1))	0,0544	0,0049	0,0002	0,0209	0,0078
	1,6770	8,9917*	-0,0037	-0,1918	9,4375*
ECT-t statistic	-0,7762*	-1,3892*	0,0057*	0,1327*	-1,3344*

**Statistically important at a 5% level*

Specification tests:

LM. Stat: 21,86 Prob. 0,64 (lag 2)
Chi.-sq: 204 Prob. 0,10

Figure 1: Impulse responses of biVARiate models

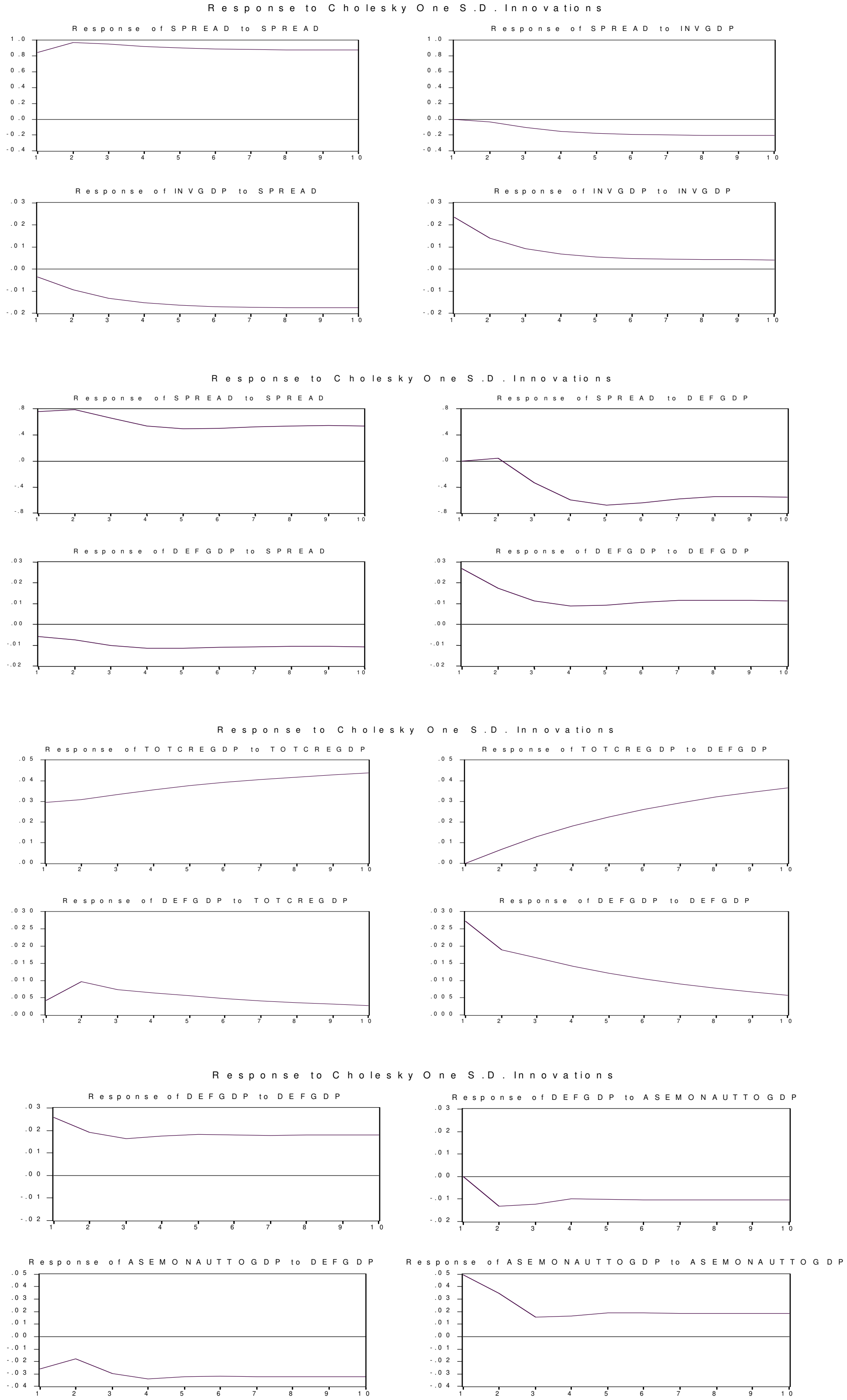

Figure 2: VARiance decomposition of biVARiate VAR models

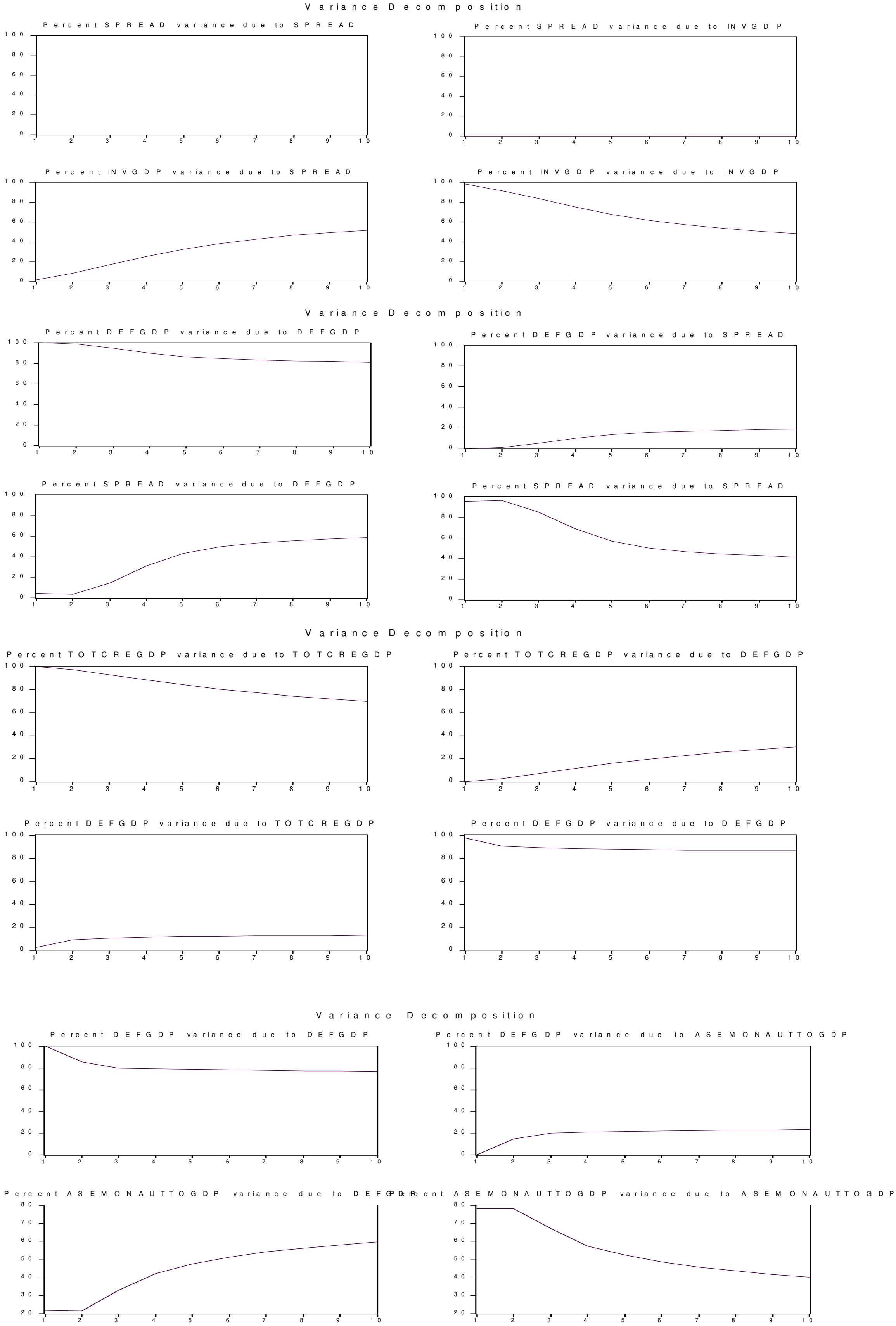

Figure 3 Impulse responses of the augmented VAR model

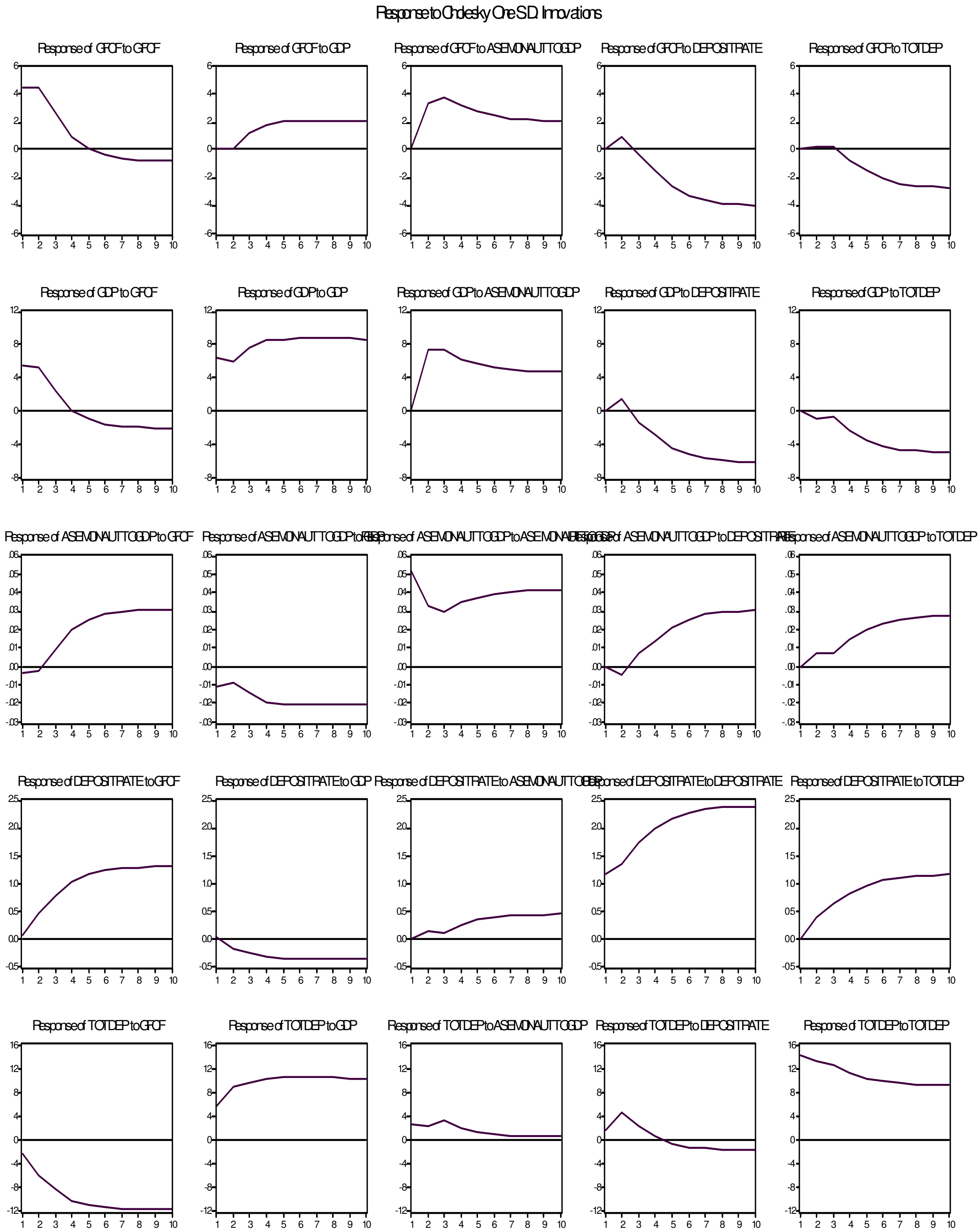

Figure 4: VARiance decomposition of the augmented VAR model