Economics Bulletin

Volume 35, Issue 1

Growth, inflation, interest rate and informality: Panel VAR evidence from OECD Economies

Salim Ergene
University of Virginia

Abstract

This paper attempts to examine empirically the dynamic relationship between inflation, growth and interest rate under the presence of informal economy by employing panel VAR techniques over the period from 1960-Q1 to 2010-Q4. The size of the informal economy is quarterly estimated to uncover the short run interactions between variables by following the two sector dynamic general equilibrium approach proposed in the literature. This paper empirically contributes that interest rate has a negative impact on both growth and the size of the informal activities, while inflation does not have a significant effect on them. The influence of interest rate on growth and the size of the informal economy is found to be robust to VAR order. The size of the underground economy has a positive impact on growth, however, the effects of growth on the size of the informal activities are not robust to VAR order. The causality from growth to the size of the informal activities depends on the order in the vector autoregression system. The empiric analysis proves that the fluctuations in interest rate are mostly carried out by the changes in inflation. The causal relation from inflation to interest rate is significantly stronger than the causal relation from interest rate to inflation.

Citation: Salim Ergene, (2015) "Growth, inflation, interest rate and informality: Panel VAR evidence from OECD Economies", *Economics Bulletin*, Volume 35, Issue 1, pages 750-763
Contact: Salim Ergene - salim.ergene@boun.edu.tr.
Submitted: January 08, 2015. **Published:** March 28, 2015.

1. Introduction

Informality has been a widespread phenomenon in the current literature. Many empirical studies look into the causes and effects of the informal economy on different macroeconomic variables. Even though improvements in estimation techniques give rise to explore many aspects of the informal economy, some issues are still not resolved.

In the existing literature, there are different descriptions of the informal economy. Ihrig and Moe (2004) defines it as a sector that produces legal goods, but does not comply with government regulations. Schneider, Buehn and Montenegro (2010) define it as a set of market-based economic activities that are consciously covered up from government in order not to face with regulation and taxation.

The main features of the informal economy are described in the related growing literature. It has restricted access to many financial tools and uses cash more extensively compared to the formal economy. Therefore, many monetary aggregates are inevitably the main indicators of the size of the informal activities. Furthermore, this parallel economy benefits from tax evasion. Under these circumstances, inflation comes to the agenda, because many governments rely on indirect taxation through positive rates of inflation under the presence of tax evasion system (See Roubini and Sala-i Martin, 1995 and Elgin and Uras, 2013). A positive nominal interest rate plays a significant role to collect indirect inflation tax, since agents must trade off the benefits in carrying out transactions by holding cash against the cost in terms of forgone interest earnings. In other words, a positive nominal interest rate redistributes tax burden from income tax to inflation tax in the informal economy which imply a positive seigniorage revenue. Although many governments benefit from this positive seigniorage revenue, someone has to pay the costs of inflation in the economy. Therefore, many papers attempt to examine the costs, benefits and welfare effects of inflation.

There is a significant amount of research that examines the optimal rate of inflation. Friedman (1969) proposes a monetary policy rule that generates a zero nominal interest rate, corresponding to a zero inflation tax and to a negative rate of inflation. Sidrauski (1967) and Turnovsky and Brock (1980) and Chamley (1985) argue that the optimal inflation tax is zero. However, Phelps (1973) and Bailey (1956) show that the optimal inflation tax is positive and Friedman's rule is not optimal under the presence of distortionary taxes. Roubini and Sala-i Martin (1995) provides that positive nominal interest rate is optimal under imperfect tax collection. Guidotti and Vegh (1993) examine the public finance motive behind inflation. The authors argue that it is optimal to finance government budget through a combination of income tax and inflation tax. Many studies prove that Friedman rule is not optimal if some fraction of the economy evades taxes as in the case of parallel economy. Many papers imply that positive rates of inflation are the results of inefficiencies in the tax collection system.

Despite the common assumption in the monetary policy literature that the optimal inflation rate is zero, there exist current controversial theoretical studies. Ascari et al.(2007) show that even low positive trend inflation has strong effects on optimal monetary policy. Moreover, Ascari (2004) reveals that a very mild level of positive inflation implies huge changes in the steady state output level. Kim et al.(2009) indicates that the optimal level of inflation for the U.S. economy is about 0.35% per year. Furthermore, Zaid (2013) reveals that optimal monetary policy features positive inflation in the long run; the optimal annual long run inflation rate for the U.S. economy is slightly below 1% with a money demand motive

and around 2% otherwise. Arseneau et al. (2008) show that the optimal rate of inflation is quite volatile. Faia (2009) supports that optimal policy features deviations from price stability. These theoretical studies shed light on the effects of guiding forces behind inflation. Many monetary authorities all over the world conduct different policy tools to decrease the fluctuations in price index and to maintain it in a target interval in the light of these theoretical studies. This paper attempts to analyse empirically the dynamic relationship between inflation, growth and interest rate under the presence of country specific variable, the size of the informal economy, over the period from 1960-Q1 to 2010-Q4 to uncover the short run reaction of a variable to different shocks.

Many studies attempt to examine the impact of the size of the informal economy on growth. The existing literature reveals ambiguous relationship between these variables. On the one hand, Loayza (1997), Johnson et al. (1997), Massenot and Straub (2011), and De Soto (1989) argue that the increase in the size of the underground economy harms the economic growth. Loayza (1997) provides that 1% increase in the size of the informal economy decreases growth by 1.2%. However, the findings of these empirical studies are not completely accepted. On the other hand, Nabi and Drine (2009), and Eliat and Zinnes (2000) provide a positive relationship between growth and the size of the shadow economy. The reason for this positive correlation is that the reduction in the production of legal goods in the formal economy is compensated by an increase in the informal activities which ensures economic growth.

Cross country observations and theoretical studies reveal the strong positive relationship between inflation and the size of the hidden economy. Koreshkova (2006) provides that high inflation rates are optimal for countries with large informal economies. The study shows that under the existence of tax evading system, government has incentives to inflate. Therefore, the size of the underground economy is positively associated with inflation rate. Moreover, the negative correlation between growth and inflation has been the subject of many empirical studies (See g. Adam and Bevan, 2005; Andres and Hernando, 1997; Bose et al., 2007; De Gregorio, 1993). In addition, many studies examine the linkage between economic growth and interest earnings. However, there is no consensus on the causality of this relationship. From one side, more productive investment results might ensure growth with high interest rates, on the other side, it reduces the amount of investment which decreases the growth potential of the system.

Informality poses different economic, social and political challenges across countries. The impacts of the underground economy are being taken into account before setting policies. For this reason, many studies attempt to reveal the relationship between the size of the informal economy and other macroeconomic variables. However, the dynamic relationship between inflation, interest rate and growth under the existence of the informal economy is not tested empirically for OECD economies. They are strongly correlated with each other, therefore, this paper might contribute to the existing literature by uncovering the impacts of a variable on others.

The size of the informal economy is estimated by following the two sector dynamic general equilibrium approach in Elgin and Oztunali (2012). Even though it has a decreasing trend over the period from 1960-Q1 to 2010-Q4, it is dramatically different for each country. The countries included in the VAR are Australia, Austria, Canada, Finland, France, Germany, Italy, Japan, Norway, Sweden, UK, USA. This paper also aims to test the causality relation-

ship between growth and the size of the informality by considering the other variables for twelve OECD economies, because the current literature provides ambiguous relationship.

The rest of the paper is organized as follows: In the next section, the econometric methodology and the selection of data are introduced. Next, in section 3, I provide the empirical results of dynamic relationship between variables. In the last section I provide concluding remarks.

2. Econometric Methodology and Data

2.1 Data And Cross Country Observations

The size of the informal economy is defined as a percentage of official GDP. There are different approaches to estimate the size of the hidden economy. It is reported by Schneider, Buehn and Montenegro (2010) for 162 countries in an annual basis for the 9 years. In addition, by using two sector dynamic general equilibrium model, Elgin and Oztunali (2012) developed an approach to estimate the size of the informal economy. In this paper, it is estimated by the methodology proposed in Elgin and Oztunali (2012) for twelve advanced economies over the period from 1960:Q1 to 2010:Q4.

In the current literature, many paper attempts to measure the size of the informal activities by using different approaches. The main approaches are classified by Schneider (2005) under three different categories: direct approaches, indirect approaches and MIMIC approaches. Direct approaches mostly rely on surveys or tax auditing and other compliance methods. This method includes all the drawbacks of surveys. The results depend on the voluntary replies to questions, but people might hesitate to give answers related to fraudulent behaviors. Therefore, it is hard to calculate the true estimate of the size of the informal activities. Indirect approaches use many macroeconomic relationships to estimate the size of the underground economy. For example, the difference between the expenditure and the income might be considered as an indicator for the size of informal activities. Other indicators stated by Schneider (2005) are official and actual labor force participation, transactions and national income, electricity consumption and GDP. This approach is mostly criticized due to its simplifying assumptions. Model approaches take into account the different reasons of shadow economy rather than considering only one indicator to calculate the true estimate of the size of the informal activities. These approaches in the literature have many fundamental drawbacks. Schneider (2005) represents the extensive review and critics of these approaches. Two sector dynamic general equilibrium approach is employed by Elgin and Oztunali (2012). This model based approach allows to estimate the size of the informal economy by taking into account the micro level incentives. The results of this method is robust to the changes in parameters. Moreover, when the authors relax the assumption that government revenues equal spending, the measure of the informal economy is still robust. The detailed robustness checks are represented in Elgin and Oztunali (2012). This paper employs the similar approach in quarterly frequency to uncover the short run interactions.

In two sector dynamic general equilibrium approach, employment data is necessary to estimate the size of the informal economy. Moreover, hours data is used to check the robustness of estimates and the results are robust. This approach overcomes the many difficulties of previous methods used to estimate the size of the informal activities. This method allows

to estimate the size of hidden economy by considering the micro foundations rather than relying on the statistical methods. It is robust to other measures and allows to extend the data substantially. Unfortunately, employment data is available for limited number of OECD economies which restricts the cross country variation. This drawback is compensated by the large number of observations. The balanced panel data for twelve developed economies is used to reveal the dynamic relationship between growth, interest rate, inflation and the size of the informal economy. The following table represents the descriptive statistics of data:[1]

Table 1: Descriptive Statistics

	Observations	Mean	Std. Dev	Minimum	Maximum
GDP Growth	2448	0.5695838	1.112010	-5.547810	8.242708
Interest Rate	2448	6.4378880	3.6546570	0.090000	20.480000
Inflation	2448	1.1194910	1.1237220	-2.882704	9.450970
The Size of The Informal Economy	2448	16.805930	5.7177850	8.321862	39.772170

Even though there exists a decreasing trend in the size of the informal economy, it is dramatically different across countries. The data reveals that the size of the informal economy is positively correlated with growth. Panel GMM analysis produces highly significant positive coefficient for the size of the hidden economy. Furthermore, although the mean of inflation for developed economies is significantly lower than developing economies, inflation rates are dramatically different across countries. Inflation is negatively correlated with growth across countries.

2.2 Methodology

In this paper, panel data vector autoregression techniques are employed to compute the variance decompositions and the impulse response functions. The panel VAR is estimated by using the package provided in Love and Zicchino (2006). In this econometric model, all the variables are treated as endogenous by taking into account the individual heterogeneity with panel data approach. Helmert transformation is employed to remove fixed effects which are correlated with regressors. In the literature, some studies refer it as the backward and forward orthogonal deviations operator (See Keane and Runkle, 1992). By this panel VAR package, forward means are removed from the system. The coefficients are estimated by the GMM and lagged regressors are used as the instrumental variables. The ordering of variables in the vector autoregression analysis is dramatically important. Therefore, all the variables are placed in the decreasing order of exogenity in the VAR system. In other words, the variables are listed earlier in the system affect the other variables comtemporaneously.

I use the following reduced form econometric model to estimate the coefficients and to compute the impulse responses:

$$z_{it} = \Gamma_0 + \Gamma(L) z_{i(t-1)} + y_i + \epsilon_{it} \tag{1}$$

[1]Data sources: FRED and OECD Stats-National Accounts

where z_{it} is the vector of stationary variables, $\Gamma(L)$ is the matrix polynomial of the lag operator, y_i is a vector of country specific effects and ϵ_{it} is the vector of errors.

3. Empirical Results

In macroeconomics, many variables have means, variance that change over time are called non-stationary. The results that involve non-stationary variables might be spurious which imply a linkage between variables where, in fact, there does not exist. Stationarity is also extremely important in the vector autoregression system. For this reason, it is analysed for all variables by panel data unit root tests. They are developed by Levin, Lin and Chu (2002), Im, Pesaran and Shin (1997), Harris and Tzavalis (1999), Hadri (1999) and Breitung (2000). Hadri LM test suggests the null hypothesis that all panels are stationary. However, all the other tests propose the null that panels contain unit roots. The table 2 represents the $p-values$ of tests for each variable, where gdp is the GDP per capita growth rate, $inte$ is interest rate, and inf is the inflation rate, $infor$ is the size of the informal sector:

Table 2: Panel Unit Root Test Results

	Levin-Lin-Chi	Harris Tzavalis	Breitung	IPS	Fisher-type	Hadri LM
$grgdp$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$\Delta(1)grgdp$	0.0000	0.0000	0.0000	0.0000	0.0000	0.9999
$inte$	0.0978	0.0830	0.0016	0.7500	0.9522	0.0000
$\Delta(1)inte$	0.0000	0.0000	0.0000	0.0000	0.0000	0.2807
inf	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$\Delta(1)inf$	0.0000	0.0000	0.0000	0.0000	0.0000	0.9998
$infor$	0.0000	0.5055	1.0000	0.0000	0.0000	0.0000
$\Delta(1)infor$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$\Delta(2)infor$	0.0000	0.0000	0.0000	0.0000	0.0000	0.9999

Hadri LM test rejects the null hypothesis for all variables and the first difference in the size of the informal economy. However, the $grgdp$, $inte$ and inf are tested in their first differences and they are all stationary according to the Hadri LM test. Although the null hypothesis for $\Delta(1)infor$, $\Delta(1)$ shows the first difference in the related variable, is rejected by Hadri LM test, the test cannot reject the null when a few outliers are eliminated in the first four years. The change in the size of the informal activities in these years is higher which causes higher deviations from mean in the first difference. The other panel unit tests give the evidence of stationarity in the first difference. These results might be related with the power of panel unit root tests. Therefore, the size of the informal activities in the first difference is used in this paper. Moreover, all the models are tested by using the size of the informal activities in the first and second difference, but the results substantially do not depend on the difference level. Although other tests reject the stationarity of first difference in growth, the null hypothesis that all the panels are stationary can not be rejected by Hadri LM test. Therefore, $z_{it} = (\Delta(1)grgdp, \Delta(1)inte, \Delta(1)inf, \Delta(1)infor)$ is used in VAR as a

vector of stationary variables. The effects of variables are examined in different models by changing the VAR order.

In this section, the results of different models are presented. Loayza (1997), Johnson et al. (1997), Massenot and Straub (2011), and De Soto (1989) propose that the increase in the size of the informal economy harms the economic growth. Notwithstanding, Nabi and Drine (2009), and Eliat and Zinnes (2000) claim that the increase in the size of the hidden economy might compensate the decrease in the formal economy which ensures the economic growth. Adam and Bevan (2005), Andres and Hernando (1997), Bose et al. (2007), De Gregorio (1993) supports the hypothesis that growth and inflation rates are negatively correlated. Koreshkova (2006) proposes that governments rely on inflation tax under the presence of large tax evasion system. Hence, the direction from the size of the informal activities to growth, inflation and interest rate is tested in model 1. It is supposed in model 2 that inflation is determined more exogenously and its effects are examined on other variables comtemporaneously. The direction from growth to the size of the informal activities, inflation and interest rate is tested in model 3 to reveal the dynamic relationship. In model 4, the impacts of inflation on growth, the size of the informal economy and interest rate are analysed. The variables listed earlier in the VAR system are more exogenous. By following the Taylor rule, interest rate is treated as a more dependent variable in all models. Moreover, interest rate is listed earlier in VAR to examine the robustness of the results. The main findings of the following models are examined by different VAR order, and most of the results are found to be robust to VAR order. Table 3 represents the order of variables is used in the vector autoregression system.

Table 3: Variables listed in VAR

Model 1	$z_{it} = (\Delta(1)infor, \Delta(1)grgdp, \Delta(1)inf, \Delta(1)inte)$
Model 2	$z_{it} = (\Delta(1)inf, \Delta(1)infor, \Delta(1)grgdp, \Delta(1)inte)$
Model 3	$z_{it} = (\Delta(1)grgdp, \Delta(1)infor, \Delta(1)inf, \Delta(1)inte)$
Model 4	$z_{it} = (\Delta(1)inf, \Delta(1)grgdp, \Delta(1)infor, \Delta(1)inte)$

In figure 1, impulse response analysis provide that the size of the informal economy positively affects growth, but the affect dies out within a few periods. In contrast, growth has a negative impact on the size of the informal economy. The shock to interest rate negatively affects growth and the size of the hidden economy. The transactions in hidden economy are mostly based on cash, since the underground economy has limited access to other financial tools. A positive shock to interest rate increases the opportunity cost of holding money which might imply a decrease in the informal activities. Moreover, the fluctuations in interest rate are mostly explained by the changes in inflation. The effects of the positive inflation shock on the size of the informal economy are ambiguous.

Figure 1: Model 1

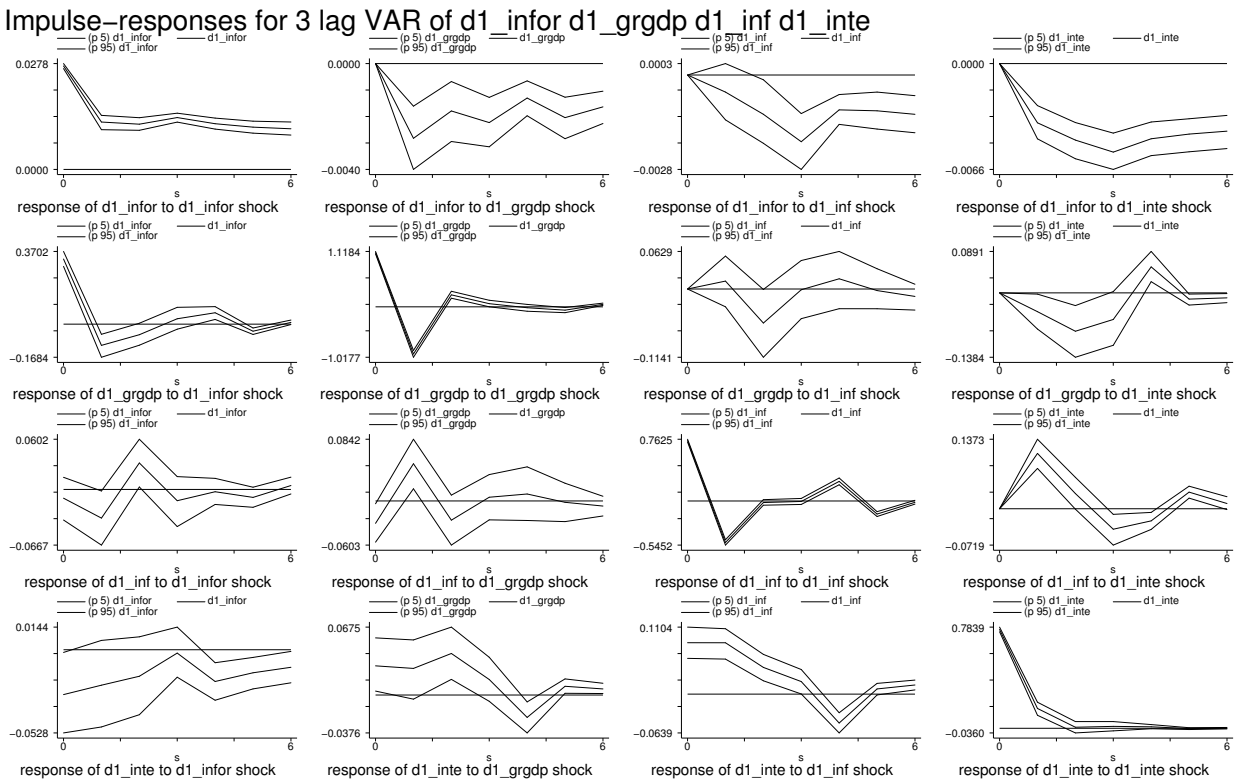
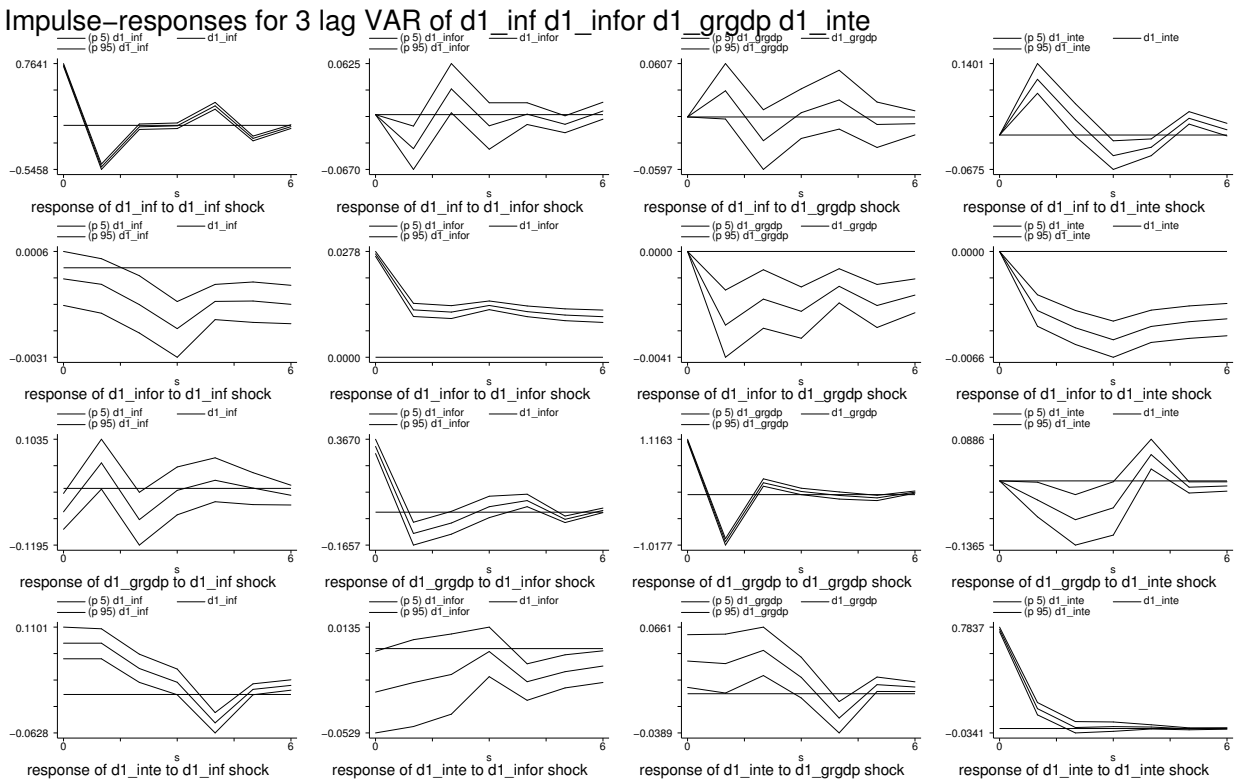


Figure 2 represents the results of model 2 in which it is assumed that inflation rate influence other variables comtemporaneously. Interest rate has a negative impact on both growth and the size of the informal activities. The positive changes in the size of the hidden economy positively influences growth, but the effect dies out after a few periods. Growth has a positive impact on both inflation and interest rate, but it has a significant negative effect on the size of the underground economy. There exist no significant impacts of inflation shock on growth and the size of the underground economy.

In figure 3, it is assumed that growth is more exogenous than other variables. Interest rate negatively influences growth and the size of the informal economy, however, positively affects inflation. The size of the underground economy has a positive impact on growth, however, the effects of growth on the size of the informal sector are found not to be robust to VAR order. Growth positively influences both the size of the informal economy and interest rate.

Model 4 shows that the impact of interest rate on growth and the size of the hidden economy is robust to VAR order. Similarly, the size of the informal sector has negative impact on interest rate and inflation, but positively influence growth. Model 4 proves that the impact of growth on the size of informal activities are not robust to VAR order.

Figure 2: Model 2



Although impulse response analysis examines the impacts of a variable on another one, it does not indicate the amount of contribution of each variable on another one. According to the variance decomposition results, approximately 1.5% and 8% of the fluctuations in the size of the informal economy are explained by growth and interest rate respectively in model 1. The impact of the size of the informal activities on growth is about 5.5%. The variance decomposition analysis proves that the main guiding force behind inflation is interest rate for OECD economies.

Similarly, in the second model, the fluctuations in the size of the hidden economy are mostly caused by growth and interest rate. The main guiding force behind the fluctuations in growth is the size of the informal economy.

In model 3, it is supposed that growth is more exogenous and affects other variables comtemporaneously. Now, approximately 4% change in the size of the underground economy is carried out by growth. When growth rate is the leading indicator for the size of the informal economy, higher percentage of fluctuations in the size of the hidden economy can be explained by growth. Moreover, in this model, the impact of the size of the informal economy on growth decreases from 5.5% to 2.1%. Model 3 proves that interest rate mostly explains the fluctuations in inflation. Variance decomposition of model 4 supports the findings of model 3.

The impacts of a variable on others are generally found to be robust with respect to vector autoregression order. Notwithstanding, variance decompositions shed light on the

Figure 3: Model 3

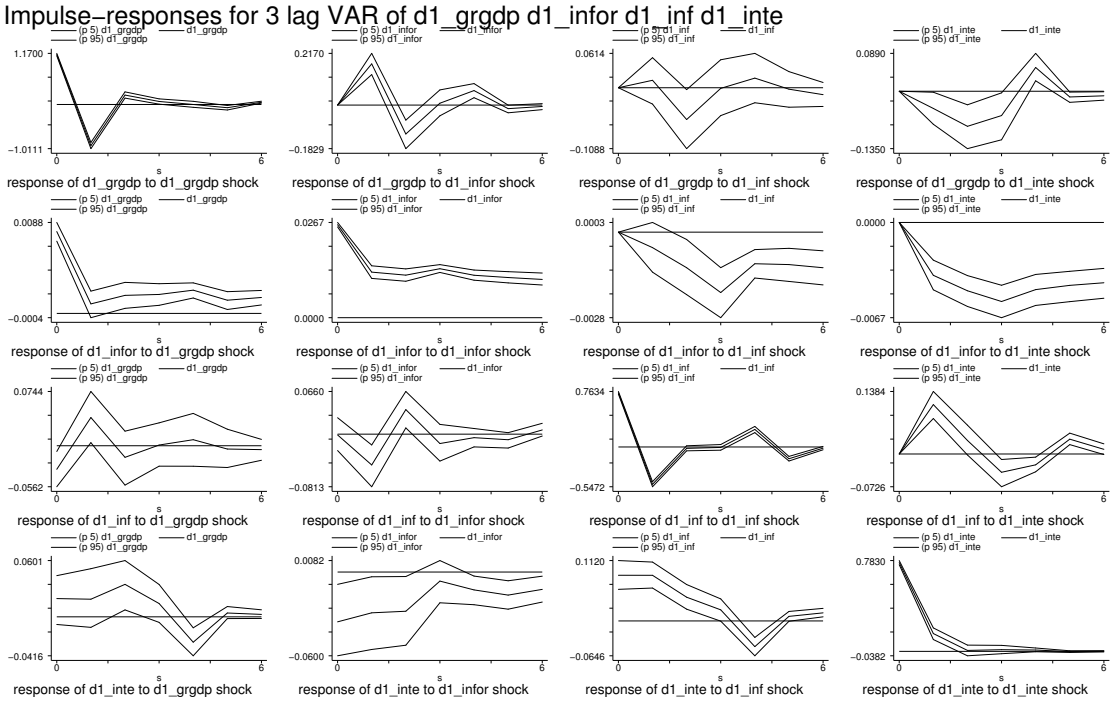
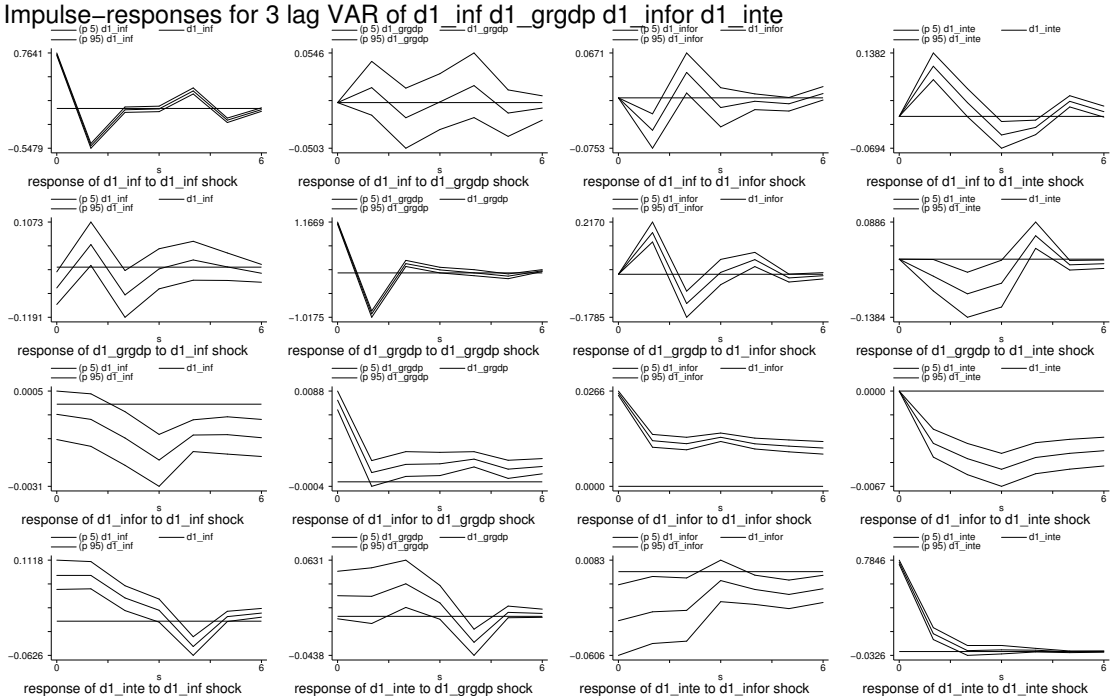


Figure 4: Model 4



contribution of each variable and give evidences about the directional causality relationship. The causality from growth to the size of the informal activities are found not to be robust to VAR order. Inflation explains approximately 3% of the fluctuations in interest rate, while about 1.7% of changes in inflation are explained by interest rate. Hence, the causality from inflation to interest rate is importantly stronger than the causality from interest rate to inflation. Moreover, the causality relationship from inflation to the size of the informal economy is more robust than the other way. According to the findings, the direction of causality from interest rate to the size of the informal economy is more powerful.

Table 4: Variance Decompositions

Model 1

	$\Delta(1)infor$	$\Delta(1)grgdp$	$\Delta(1)inf$	$\Delta(1)inte$
$\Delta(1)infor$	.89839705	.01478046	.00592804	.08089445
$\Delta(1)grgdp$	.05619985	.93557267	.00168729	.00654018
$\Delta(1)inf$	.0028413	.00470128	.97474951	.0177079
$\Delta(1)inte$	.0042894	.00643262	.03069671	.95858127

Model 2

	$\Delta(1)inf$	$\Delta(1)infor$	$\Delta(1)grgdp$	$\Delta(1)inte$
$\Delta(1)inf$	.97658159	.00334278	.00236773	.0177079
$\Delta(1)infor$	.00684137	.89679975	.01546443	.08089445
$\Delta(1)grgdp$	.00441938	.05599656	.93304388	.00654018
$\Delta(1)inte$	.02980361	.00410645	.00750867	.95858127

Model 3

	$\Delta(1)grgdp$	$\Delta(1)infor$	$\Delta(1)inf$	$\Delta(1)inte$
$\Delta(1)grgdp$	.97060375	.02116878	.00168729	.00654018
$\Delta(1)infor$	.04041937	.87275814	.00592804	.08089445
$\Delta(1)inf$	.00312871	.00441388	.97474951	.0177079
$\Delta(1)inte$	.0045788	.00614322	.03069671	.95858127

Model 4

	$\Delta(1)inf$	$\Delta(1)grgdp$	$\Delta(1)infor$	$\Delta(1)inte$
$\Delta(1)inf$	.97658159	.00121977	.00449074	.0177079
$\Delta(1)grgdp$	.00441938	.96785797	.02118247	.00654018
$\Delta(1)infor$	.00684137	.03967376	.87259042	.08089445
$\Delta(1)inte$	.02980361	.00550288	.00611224	.95858127

variance-decompositions: percent of variation in the row variable explained by column variable(10 periods ahead).

4. Concluding Remarks

This paper employs panel VAR approach to analyze the dynamic relationship between growth, the size of the informal economy, inflation and interest rate. The size of the informal economy is used as a country specific variable which differs importantly across countries, even though it has a decreasing trend.

The size of the informal economy is quarterly estimated over the period from 1960-Q1 to 2010-Q4 to uncover the short run interactions by following the same approach in Elgin and Oztunali (2012). Impulse response analysis provide that the size of the informal economy positively affects growth, while growth has a negative impact on the size of the informal economy in the first two models. However, the impacts of growth in the last two models are significantly positive and the causality from growth to the size of the informal economy is found not to be robust to VAR order.

This paper empirically contributes that interest rate has a negative impact on both growth and the size of the informal activities, while inflation does not have a significant influence on them. The effect of interest rate on growth and the size of the hidden economy is robust to VAR order. Moreover, the fluctuations in interest rate are mostly explained by the changes in inflation.

The variance decomposition analysis provides that the fluctuations in the size of the hidden economy are mostly caused by growth and interest rate. Moreover, the main guiding force behind the fluctuations in growth is the size of the informal economy. The causal relation from inflation to interest rate is importantly stronger than the causal relation from interest rate to inflation.

References

Adam, C.S. and Bevan, D.L. (2005) "Fiscal deficits and growth in developing countries" *Journal of Public Economics* **89**, 571-597.

Andres, J. and Hernando, I. (1997) "Does inflation harm economic growth? Evidence for the OECD" NBER working paper number 6062

Arseneau, D. and Chugh, S. (2008) "Optimal fiscal and monetary policy with costly wage bargaining"*Journal of Monetary Economics* **55**, 1401-1414.

Ascari, G. (2004) "Staggered prices and trend inflation: some nuisances" *Review of Economic Dynamics* **7**, 642-667.

Bailey, M.J. (1956) "The welfare cost of inflationary finance" *Journal of Political Economy* **64**, 93-110.

Bose, N., Holman, J.A. and Neanidis, K.C. (2007) "The optimal public expenditure financing policy: does the level of economic development matter?" *Economic Inquiry* **45**, 433-452.

Breitung, J. (2000) "The Local Power of Some Unit Root Tests for Panel Data" *Advances in Econometrics*, 15.

Chamley, C. (1985) "Efficient Taxation in a Stylized Model of Intertemporal General Equilibrium" *International Economic Review* **26**, 451-468.

De Gregorio, J. (1993) "Inflation, taxation and long-run growth" *Journal of Monetary Economics* **31**, 271-298.

De Soto, H. (1989) "The Other Path: The Invisible Revolution in the Third World" Harper Row: New York.

Elgin, C. and Uras, R. B. (2013) "Is Informality a Barrier to Financial Development?" *SERIES*, **4** , 309-331.

Elgin, C., and Oztunali, O. (2012) "Shadow Economies around the World: Model Based Estimates" Working Papers 2012/05, Bogazici University, Department of Economics.

Eliat Y. and Zinnes, C. (2000) "The Evolution of the Shadow Economy in Transition Countries: Consequences for Economic Growth and Donor Assistance" CAER II discussion paper number. 65

Faia, E. (2009) "Ramsey monetary policy with labor market frictions" *Journal of Monetary Economics* **56**, 570-581.

Friedman, M. (1969) "The Optimum Quantity of Money. The Optimum Quantity of Money and Other Essay" *Aldine Publishing*, 5-27.

Guidotti, P.E. and Vegh, C.A. (1993) "The optimal inflation tax when money reduces transactions costs: a reconsideration" *Journal of Monetary Economics* **31 (2)**, 189-205.

Ihrig, J. and Moe, K. (2004) "Lurking in the shadows: The informal sector and government policy" *Journal of Development Economics* **73**, 541-77.

Im, K.S., M.H. Pesaran and Y. Shin (1997) "Testing for Unit Roots in Heterogeneous Panels" Manuscript, Department of Applied Economics, University of Cambridge, UK.

Johnson, S., Kaufman, D. and Shleifer, A. (1997) "The Unofficial Economy in Transition" Brookings Papers on Economic Activity, 2, 159-221.

Keane, M.P. and Runkle, D.E. (1992) "On the Estimation of Panel-Data Models when Instruments are not Strictly Exogenous" *Journal of Business and Economic Statistics* **10**, 1-9.

Koreshkova, T.A. (2006) "A Quantitative Analysis of Inflation as a Tax on the Underground Economy" *Journal of Monetary Economics* 773-796.

Loayza, N.V. (1997) "The economics of the informal sector: A simple model and some empirical evidence from Latin America" World Bank Policy Research working paper number 1727.

Massenot, B. and Straub, S. (2011) "Informal Sector and Economic Growth: The Supply of Credit Channel" IDEI working Papers 685, Institut d'Economie Industrielle (IDEI),Toulouse.

Nabi, M. S. and Drine, I. (2009) "External Debt, Informal Economy and Growth" *Economics Bulletin* **29 (3)**, 1695-1707.

Phelps, E. (1972) "Inflation Policy and Unemployment Theory" W.W. Norton and Co. New York.

Roubini, N. and Salai-i Martin, X. (1995) "A growth model of inflation, tax evasion, and financial repression" *Journal of Monetary Economics* **35 (2)**, 275-301.

Schneider, F. (2005) "Shadow Economies Around the World: What do We Really Know?" *European Journal of Political Economy* **21**, 598-642

Schneider, F., Buehn, A. and Montenegro, C. E. (2010) "Shadow Economies all over the World" World Bank Policy Research working paper, 5356.

Schneider, F. and Enste, D.H. (2000) "Shadow Economies: Size, Causes, and Consequences" *Journal of Economic Literature* **38 (1)**, 77-114

Sidrauski, M. (1967) "Rational Choice and Patterns of Growth in a Monetary Economy" *The American Economic Review* **57**, 534-544.

Turnovsky, S. and William B. (1980) "Time Consistency and Optimal Government Policies in Perfect Foresight Equilibrium" *Journal of Public Economics* **13**,183-212.

Zaid, S.A. (2013) "Optimal monetary policy and downward nominal wage rigidity in frictional labor markets" *Journal of Economic Dynamics and Control* **37**, 345-364.