

The Shadow Economy and Globalization: A Comparison Between Difference GMM and System GMM Approaches

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Abstract

In a general classification, the economy of any country is divided into two parts of official and invisible economies. Invisible activities drop outside the scope of the law and official economy and strongly affect socioeconomic development and the formal sector of all countries. These activities which are known under various titles including the shadow economy are influenced by various factors. This paper examined the effects of globalization on the shadow economy. The study was conducted for a selection of developing countries and transition economies during the period from 1999 to 2009 using Differenced Generalized Method of Moments (Difference-GMM) and System Generalized Method of Moments (System-GMM) approaches. Finally, a comparison was made between these two approaches. The results of the study indicated the superiority of System GMM approach in comparison with Differenced GMM. Due to the results of the System GMM as the superior approach, there was an inverse relationship between the shadow economy and globalization. In other words, less economic freedoms and restrictions in various economic areas such as taxation and investments increase the size of the shadow economy. The increase of the shadow economy can be considered as a threat to the national output.

Keywords: Shadow Economy, Globalization, Generalized Method of Moments estimator, Developing countries, Transition economies.

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1. Introduction

In making efforts to assess the state of the global economy, we usually make use of official statistics of production, trade, investment and other

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macroeconomic variables, but it should be noted that in addition to the formal activities conducted under the state and law supervision, some economic activities drop out of the government supervision circle and can affect the socio-economic development of the country, significantly. These unobserved economic activities are known under various titles including the shadow economy, underground economy, hidden economy, black economy, informal economy, parallel economy, etc. However, there are differences between these concepts in practice the definition of non-visible activities depends on the purpose of researchers. According to Schneider (2005) and Schneider et al (2010), underground economy, domestic informal economy and the shadow economy have separate definitions.

Underground economy includes all illegal activities and classic crimes like robbery, dealing drugs and alcoholic beverages. Household informal economy refers to all important household activities that are not registered in the national accounts. The shadow economy includes all market-based legal productions of goods and services that are deliberately concealed from the surveillance of public authorities due to one of the following reasons:

- a) To avoid payment of income, value added or other taxes;
- b) To avoid payment of social security costs;
- c) Failure to observe certain legal standards such as minimum wages, maximum working hours, safety or health standards
- d) Refusing to meet certain administrative procedures, such as filling in administrative questionnaires or other forms.

In the present survey, we mentioned the term shadow economy and used the Schneider et al (2010) definition for the analysis of data. Shadow economy is a real phenomenon with significant concepts that needs a deep and considerable attention. Countries all over the world, especially developing countries and transition economies in which the shadow economy has more extensive dimensions, have always had a great deal of concerns about this growing phenomenon. On one hand, the shadow economy, due to its invisible nature, causes the economic performance of countries to remain hidden. The shadow economy would be a real challenge to the efficiency of distributive and allocative policies of the governments. It causes a great reduction in the public income of governments, the creation of powerful illegal institutions and changes the consumption patterns of societies (Dominguez, 1975). On the other hand, shadow activities are considered as the main causes of the labor and commodity market inefficiency which attracts workers to the informal

sector of the economy and creates an unfavorable competition between official and unofficial firms (Enste, 2003). Furthermore, this phenomenon has other negative consequences including the disruption of policies, high levels of corruption, economic offenses and the public discontent as well.

The existence of such extensive issues confirms the importance of studying the shadow activities and the identification of shadow economy determinants more than ever, especially in developing countries and transition economies in which economic infrastructures have considerable roles in their economic growth. Schneider et al (2010) suggested that the size of the shadow economy in transition economies and developing countries is larger than developed countries.

Due to estimations, the shadow economy constitutes an average of 28.3% of GDP in developing economies, 41.1% of GDP in transition economies (Eastern Europe and Central Asian countries) and 19.4% of the GDP in OECD¹ member countries. Over 50 years, the coexistence of formal and informal occupations in developing countries and transition economies has attracted the attention of so many researchers and policy makers. There is a considerable amount of literature that seeks to answer the question why the volume of the shadow economy is so large in developing and transition economies. Dell'Anno and Solomon (2008) and Gerxhani (2004) discussed that the concept of the shadow economy was taken from the literature on the issues of developing countries. Also, Tanzi (2000) believed that the shadow economy in developing countries is worse than developed countries, because there are less value added taxes exemption, more social security taxes and generally there are more barriers to operations in the formal sector of developing countries. For the first time, this study investigated the effects of globalization on the shadow economy for a selection of developing countries and transition economies. To this end, great efforts were made to follow econometric principles, carefully. The study was conducted for a selection of developing countries and transition economies (67 countries) during the period from 1999 to 2009 using Differenced Generalized Method of Moments (Difference-GMM) and System Generalized Method of Moments (System-GMM) approaches (Appendix (1)).

¹Organization for Economic Cooperation and Development

2. Theoretical Literature and Empirical Studies

The concept of informal activities was applied by Hart (1971) for the first time. He examined the economies of third world countries and believed that the informal economy was only a part of labor market in which individuals try to maintain their livelihood. However, in the literature on informal activities, the International Labor Organization (ILO) report in 1972 for Kenya was considered as the first reference for discussing informal activities along with the formal labor market. In this report, the increase of unemployment rate which represents the decrease of employment opportunities in the formal market along with income inequality and poverty were introduced as the main reasons of agents' tendency toward the shadow activities. From 1970s onwards, different groups of scholars have paid a great attention to this phenomenon. Most of the surveys have considered the relationship between underground economy and welfare. For example, Bhagwati and Hansen (1973) investigated the effects of informal activities on the social welfare. They found that this relationship is affected by the synchronization or lack of synchronization between legal trade and smuggling. These researchers believed that in the non-synchronization of legal trade and smuggling, social welfare may increase or decrease, but in the synchronization of these two phenomena social welfare necessarily decreases. After that, Bhagwati and Srinivasan (1974) confirmed Bhagwati and Hansen (1973) view and acknowledged that when facing with restrictions on legal trade and the existence of smuggling under competitive conditions, smuggling may increase or decrease the welfare. However, Sheikh (1974) criticized the results of Bhagwati and Hansen research. He indicated that in the synchronization of trade and smuggling, the welfare of the society may increase or decrease but we can't conclude that the welfare of the society necessarily decreases.

In the following years, researchers began to investigate the causes of smuggling. Pitt (1981) introduced the difference between the domestic price of smuggling and the price including tariffs as the main cause of the smuggling phenomenon and indicated that in the synchronization of legal trade and smuggling under competitive circumstances, firms tend to do more illegal trade activities when there is a great difference between the domestic prices of smuggling and prices including tariffs. Norton (1988) investigated the effects of smuggling on agricultural commodities trade among the member countries of Economic Community of Europe. Using a theoretical model. He indicated that an increase in the international trade

costs, including the increase of the tariff rates of commodity imports to domestic markets, increases the volume of smuggling. These measures already took steps in this regard for identifying non-visible activities. Until now, broad surveys have been conducted in the context of estimating and understanding the causes of the shadow economy. No study has ever been conducted in the field of the relationship between globalization and the shadow economy, although, the current literature suggests a relationship between the shadow economy and factors like tax burden, regulations, trade restrictions and corruption which all are sub-dimensions of the globalization index. In the following, some of the most important empirical studies of the relationship between the shadow economy and the economic factors will be reviewed.

Enste (2009) analyzed the effects of regulations on the shadow economy activities for 25 developed countries over the period from 1995 to 2005 using a random effect model. This study includes a comprehensive regulation index for five major areas (labor market, capital market, commodity market, education or innovation and quality of institutions).

The results of the study suggested that in addition to the tax burden, increased regulation in the five areas are of the main reasons for increasing the size of the shadow economy. In another survey, Lee (2005) investigated the effect of taxes on the formal economy of 78 developing and developed countries for ten years of 1960, 1970, 1980, 1990, 1992, 1994, 1995, 1996, 1997 and 1998. Lee (2005) conducted this survey using Ordinary Least Square (OLS) method. The results of the study indicated that there is a negative significant correlation between tax and informal economy for developing countries, but the value of correlation for developed countries is closed to zero. Other results of this study indicated that more GDP per capita, less government corruption and unemployment leads to smaller volume of informal economy. Although, Lee's results (2005) indicated the negative effect of taxes on the underground economy, some studies have shown the positive effect of taxes on the underground economy. Wang et al (2012) studied the asymmetric reaction of the underground economy to the effective rate of taxes. This survey was conducted for Taiwan for the period of 1962-2003. The results of this study in which the size of underground economy was computed using both cash deposit ratio and currency demand approaches, shown the direct relationship between these two variables; in other words, the size of the underground economy and shadow activities increases with the increase of

tax burden. On the other hand, this study indicated that the effect of direct taxes on the shadow economy was stronger than indirect taxes. Nikpoor et al (2009) examined the causal relationship between the shadow economy and foreign investment for 145 countries of the world. This investigation was conducted for five periods of 1999-2000, 2000-2001, 2001-2002, 2003-2004 and 2004-2005 using a panel Granger causality test. On the other hand, they analyzed the effects of foreign investments on the shadow economy using System GMM approach. The study indicated that the foreign investment is the cause of the shadow economy. Reversely, the shadow economy can be considered as the cause of investments as well.

The results of the study indicated that more foreign investment leads to the less shadow economy and the larger size of the shadow economy is followed by larger investments.

3. Methodology and Model

Eugenio et al (2004) argued that in most models, as well as growth models, the explanatory variables of the model have a strong endogeneity property or the value of the dependent variable in the previous periods affect the model or both situations co-exist. As the nature of the current debates was similar to the growth models, to overcome these issues the Arellano and Bond model (dynamic) model was utilized to analyze data. Generally, the regression model for the analysis of the relationship between variables can be expressed as follows:

$$y_{it} = \alpha + \beta y_{i,t-1} + \gamma x_{it} + u_{it} \quad (1)$$

Where y is the dependent variable for the country i in year t , $y_{i,t-j}$ are the lags of the dependent variable and $x_{i,t-l}$ are the explanatory variables. In the current study the explanatory variables include economic freedom index, Gini index is a representative for income distribution, GDP per capita based on the purchasing power parity (PPP) (base year of 2005), population aged over 65 years and foreign investment. The symbols of the variables were as follows:

$\ln \text{shadow}_{i,t}$: Logarithm of the shadow economy (dependent variable) for country i in year t ;

$\ln \text{shadow}_{i,t-1}$: Logarithm of the shadow economy lags for the previous period;

$\ln \text{efw}$: Logarithm of the economic freedom index;

$\ln \text{gdp}$ = Logarithm of the gross domestic product (GDP)

$\ln \text{gini}$: Logarithm of the Gini Index;

Ln age: Logarithm of age for the population aged over 65 years;

Ln fdi: Logarithm of the foreign investment;

Clearly, various restrictions to economic activities by governments in financial markets, investment and trade, as well as property rights (which are sub-components of Economic Freedom Index), economic freedom decreases and individuals and firms tend to do more shadow activities.

Schneider et al (2010) believed that economic freedom has a negative correlation with the shadow economy.

The effect of GDP on the shadow economy is ambiguous (sometimes positive and sometimes negative). On one hand, Arimah (2001) argued that in some countries like Nigeria, certain aspects of the informal economy were assigned to the formal economy. Thus, an increase in the growth rate of the informal economy, increase the relative size of the shadow economy as the result of increased demand of firms for goods and services in the formal economy. On the other hand, the decrease of GDP per capita causes the increase of poverty and thereby reduces the tendency of individuals toward the shadow economy. Schneider et al (2010) indicated that there is a negative relationship between GDP per capita and the shadow economy in developing countries. GDP per capita effects on the shadow economy is ambiguous (sometimes positive and sometimes negative). With the increasing of poverty and growing income inequality, deprived classes of the community underlie the poverty line and this phenomenon creates many of the social issues. Therefore, people of the deprived classes turn into the illegal activities like shadow economy to satisfy their socio-economic needs. According to recent theories, sometimes the increase of the shadow economy is the result of increase in the number of retired individuals. Therefore, in this paper, the number of individuals older than 65 years was selected as an indicator for retirement.

According to Nikpoor et al (2009) the impact of foreign direct investment (FDI) on the shadow economy is ambiguous. Some argued that if investment firms lower taxes to increase FDI, a tax competition occurs between firms to attract FDI. Tax competition transmits the tax burden among various factors of production (capital to labor) and different types of economic activities. The cost of labor relative to capital increases as well and leads to the propensity of the labor force to the shadow economy.

Thus, according to this view, an increase in the investments results in increases in the size of the shadow economy. In contrast, there is another view that argues higher FDI will positively affect the tax income of the

governments. For example, it is expected that higher levels of investment in a country lead to the increase of output and therefore, the income tax on goods and services increases as well. Generally, according to this view, it is argued that FDI leads to reformation in the tax system and reduces tax evasion. Reduction of the tax evasion is considered as the reduction of the shadow economy. So, according to this view, it is expected that the shadow economy decreases with the increase of FDI.

In this model it is assumed that $u_{it} = \mu_i + \lambda_t + v_{it}$ where μ_i, λ_t and v_{it} are unobserved place effect, constant time effect and a disturbance term respectively and all have identically independent distributions ($\mu_i \sim IID(0, \sigma_\mu^2)$, $\lambda_t \sim IID(0, \sigma_\lambda^2)$, $v_{it} \sim IID(0, \sigma_v^2)$). As in this model, y_{it} is a function of μ_i and also, $y_{i,t-j}$ is a function of μ_i , therefore, $y_{i,t-j}$ is correlated with disturbance term and is known as an endogenous variable. Baltagi (1995) believed that in the presence of endogenous and dynamic regressors fixed effect estimators and Generalized Least Square estimators do not result in consistent estimates. According to Mileva (2007), in addition to the presence of lags of dependent variable on the side of explanatory variables and the existence of endogenous regressors in the model (endogenous variable is the one which has correlation with the error terms) there are other factors that cause the inefficiency of GLS. 2SLS, OLS, fixed effects and random effects including the correlation between fixed effects (fixed effects), such as geographic and demographic factors with explanatory variables (presence of autocorrelation) and the availability of short and long periods of time. Baum et al (2003), Roodman (2006) and Wooldridge (2006) introduced heteroscedasticity as factors that cause the inefficiency of these methods. To resolve these problems, Arellano and Bond (1991) presented a GMM estimator as an instrumental variable estimator (IV) where the lags of endogenous regressors and the current values of exogenous variables are used as instruments. This process starts with making difference of variables and therefore it is called Difference Generalized Method of Moments (Difference GMM).

Sometimes, the instruments used in Difference GMM approach are weak and this factor causes the problem of biased coefficients in finite samples. In these circumstances, the System Generalized Method of Moments (System-GMM) approach provides additional instruments and can dramatically relieve the weakness of the Difference GMM approach and improve the efficiency of coefficients. Thus, the system GMM is preferred to Difference GMM. Arellano and Bond introduced two other estimators named one-step and two-step estimators which two step

estimator was more efficient. For implementation of these approaches, diagnostic tests including Sargan and Hansen tests should be conducted.

Sargan and Hansen are of the predetermined restrictions that its null hypothesis refers to the validity of instruments (non-existence of autocorrelation between instruments and error terms). The first order and second order correlation tests investigate the presence of first order and second order serial correlations in first differenced error terms. The Difference GMM and System GMM are consistent when there is no second order serial correlation in the error terms of the first differenced equations.

3-1. Diagnostic Tests (Heteroscedasticity test and autocorrelation tests)

As it was noted above, heteroscedasticity and autocorrelation are the main reasons of using System GMM and Difference GMM approaches. Detecting the presence of autocorrelation and heteroscedasticity are issues that require great attention in empirical researches. As in time series data when talking about the panel data we should investigate the presence of heteroscedasticity between disturbance term and the autocorrelation.

Unfortunately, these two important issues are neglected in empirical studies using panel data approach. Therefore, when using the Arellano and Bond approach (System GMM and Difference GMM), it is required to conduct heteroscedasticity and autocorrelation tests. Wiggins and Poi (2003) presented Likelihood-Ratio (LR) test for detection of heteroscedasticity. According to them, the panel data test for detection of heteroscedasticity between the disturbance terms, we use the restricted and unrestricted estimates of the regression model and the restricted model is nested into the unrestricted model. Wooldridge (2002) suggested a new and simple test for detection of autocorrelation in panel data in which the disturbance term follows first order autoregressive (AR (1)) process. In the following, first of all the diagnostic tests (heteroscedasticity test and autocorrelation tests) were conducted and then the suggested model was estimated using two Difference GMM and System GMM approaches. Finally, these two approaches are compared with each other.

3-2. Data

Data for the size of the shadow economy for 1999-2007 was gathered from studies conducted by Schneider et al (2010) using MIMIC approach and for the year 2008 from Elgin and Öztunali (2012) using Two- Sector Dynamic General Equilibrium Model as percent of GDP. For the year 2009 the five year moving average method was used. Data of Economic

Freedom Index was gathered from Fraser Institute. Data of Gini index, GDP and population aged over 65 years and foreign investment data are available at World Bank database.

4- The Results of the Diagnostic Tests and Estimation of the Model

4-1. The Results of the Diagnostic Tests

The results of the LR and Wiggins and Poi (2003) tests for detection of heteroscedasticity in panel data presented in Table (1) as follows:

Table (1)Results of the LR Test for Panel Data (Nesting the restricted model into the unrestricted model)

| χ^2 statistic of LR | Degrees of freedom | P-value |
|--------------------------|--------------------|---------|
| 807.42 | 59 | 0.000 |

Source: Survey Calculations

As it can be seen in Table (1), the probability of the corresponding statistic is less than 5%, therefore, we can reject the null hypothesis of the LR test for the homoscedasticity. In other words, data had the problem of heteroscedasticity.

The results of the Wooldridge autocorrelation test presented in Table (2). The null hypothesis of the Wooldridge test is the non-existence of first order autocorrelation between the disturbance terms of the regression model.

Table (2)Results of the Autocorrelation Test for Panel Data

| F statistic | Degrees of freedom | P-value |
|-------------|--------------------|---------|
| 15.700 | (1,58) | 0.0002 |

Source: Survey Calculations

The results of Table (2) indicated that the null hypothesis for the non-existence of the autocorrelation is rejected. In other words, data used in this study has the first order autocorrelation.

4-2. Estimation of the Model Using Difference GMM Approach

In this section, the corresponding model was estimated using Difference GMM approach at 95% level of confidence. In analyzing the impact of globalization on the shadow economy, the Gini index was used as a measure for the distribution of income. Per capital GDP was based on the purchasing power parity (base year 2005). The population aged over 65 years old and the foreign investment were used as control variables. Results of the model estimation using Difference GMM approach presented in Table (3).

Table (3): Results of the two-step Difference GMM, Arellano and Bond Dynamic Panel Estimation (Dependent Variable (Lnshadow))

| Variables | Coefficient | Statistic | P-value |
|---------------------------|-------------|-----------|---------|
| <i>L.Lshadow</i> | -0.21 | -5.47 | 0.000 |
| <i>Lefw</i> | 0.432 | 8.41 | 0.000 |
| <i>Lgini</i> | 0.422 | 13.52 | 0.000 |
| <i>Lgdp</i> | -0.231 | -5.98 | 0.000 |
| <i>Lage</i> | 0.279 | 5.10 | 0.000 |
| <i>Lfdi</i> | 0.009 | 14.27 | 0.000 |
| <i>Constant</i> | ---- | ---- | ---- |
| <i>AR(1) test</i> | ---- | -2.81 | 0.005 |
| <i>AR(1) test</i> | ---- | -1.64 | 0.101 |
| <i>Sargan/Hansen Test</i> | ---- | 47.68(30) | 0.021 |
| <i>Wald Test</i> | ---- | 7592.20 | 0.000 |

Source: Survey Calculations, Note: The model was estimated in STATA software using xtabond2 command.

Results of the model estimation using Difference GMM approach indicated that all coefficients are significant but the sign of the *L.Lshadow*, *Lefw*, *Lfdi* weren't consistent with the theory. The coefficient of the *L.Lshadow* was negative and inconsistent with expectations. The *Lefw* was positive and inconsistent with the theory presented by Schneider et al (2010). On the other hand, the theory suggested the ambiguous effect of *Lfdi* on the shadow economy but based on the Difference GMM approach *fdi* has a positive effect on the shadow economy. Due to the Hansen statistic (or Sargan/ Hansen statistic) which has χ^2 distribution with degrees of freedom equal to number of restrictions, the null hypothesis for the non-existence of correlation between residuals and instrumental variables was rejected. Therefore, it can be said that the instrumental variables used in the model were invalid or endogenous. The null hypothesis of AR(1) and AR (2) tests is the non-existence of the correlation. As it was expected, due to the AR (1) test, the null hypothesis was not rejected meaning that there were correlations between variables after first order differencing. On the other hand, results of the AR (2) test after first order differencing indicated that disturbance terms were not correlated with each other, thus the null hypothesis was not rejected. Due to the results of the Wald test which has a χ^2 distribution with degrees of freedom equal to number of explanatory variables minus one, the null hypothesis that all coefficients are zero simultaneously was rejected at

95% level of significance. Therefore, the validity of the estimated coefficients was confirmed.

4-3. Estimation of the Model Using System GMM approach

After estimating the model with Difference GMM approach, once again, it was re-estimated at 95% level of significance using System GMM approach. The results of the estimation are presented in Table(4).

Table (4) Results of the two-step System GMM, Arellano and Bond Dynamic Panel Estimation (Dependent Variable (Lnshadow))

| Variables | coefficient | Statistic | P-value |
|---------------------------|-------------|-----------|---------|
| <i>L.Lshadow</i> | 0.370 | 15.82 | 0.000 |
| <i>Lefw</i> | -0.111 | -3.44 | 0.001 |
| <i>Lgini</i> | 0.475 | 24.91 | 0.000 |
| <i>Lgdp</i> | -0.166 | -13.02 | 0.000 |
| <i>Lage</i> | 0.220 | 8.64 | 0.000 |
| <i>Lfdi</i> | -0.002 | -3.70 | 0.000 |
| <i>Constant</i> | 1.714 | 29.37 | 0.000 |
| <i>AR(1) test</i> | ---- | -2.82 | 0.005 |
| <i>AR(2) test</i> | ---- | -0.40 | 0.690 |
| <i>Sargan/Hansen Test</i> | ---- | 51.08(38) | 0.076 |
| <i>Wald Test</i> | ---- | 12355.81 | 0.000 |

Source: Survey Calculations, Note: The model was estimated in STATA software using xtabond2 command.

As it can be seen in Table (4), all coefficients were significant and their signs were consistent with the theory. Lags of the dependent variable, Gini index and population aged over 65 years have positive effects on the shadow economy. Due to the Hansen statistic (or Sargan/ Hansen statistic), the null hypothesis for the non-existence of correlation between residuals and instrumental variables was not rejected and therefore, the instrumental variables used in the model were valid. As it was expected, due to the AR (1) test, the null hypothesis was not rejected that confirmed the existence of correlations between variables after first order differencing. Results of the AR (2) test after first order differencing indicated that disturbance terms were not correlated with each other, as well. Due to the results of the Wald test, the null hypothesis that all coefficients are zero simultaneously was rejected at 95% level of significance. Therefore, the validity of the estimated coefficients was confirmed.

4-4. Comparison of the Difference GMM and System GMM approaches

By making comparison between the results of the two approaches we can get interesting and remarkable points. In both approaches, AR (1) tests indicated the non-rejection of the null hypotheses, while the AR (2) tests suggested disturbance terms were not correlated in levels and therefore, the null hypothesis can't be rejected. These tests only investigate the validity of instruments and the non-existence of autocorrelation. The salient difference between Difference GMM and System GMM is due to the exogeneity of instruments and the Hansen/Sargan statistic degrees of freedom. The Sargan/Hansen statistic in GMM approach implies the rejection of the null hypothesis for the validity of instruments (exogeneity of instruments). In other words, this statistic indicates that the instruments used in Difference GMM are weak (endogenous instruments are called weak instruments) and causes the bias (inconsistency) of coefficients in small samples. This is the issue that the current survey faced it for the L.Lshadow and Lefw using Difference GMM approach. Furthermore, the degrees of freedom of the Hansen/Sargan statistic in Difference GMM approach are smaller than System GMM. Degrees of freedom presented in Table (5).

Table (5) Comparison of degrees of freedom

| Approach | Degrees of freedom |
|----------------|--------------------|
| Difference GMM | 30 |
| System GMM | 38 |

The results supported the superiority of System GMM approach in comparison with Difference GMM. In fact, the System-GMM approach makes it possible to introduce more instruments and can eliminate the weakness of the Difference GMM and improve the efficiency of estimated coefficients.

5- Conclusion

This study investigated the effects of globalization on the shadow economy for 67 developing countries and transition economies. This survey was the first study conducted for the investigation of the relationship between globalization and shadow economy for the period of 1999-2009 using Difference GMM and System GMM approaches. Finally, the results of the two approaches were compared with each other.

Empirical results confirmed the superiority of System GMM approach rather than Difference GMM approach. Due to the superior approach, globalization and economic openness leads to the reduction of the shadow economy. According to the other results, reduction of the GDP per capita, increase of the poverty (income distribution inequality) increase in the population aged over 65 years and the reduction of investments increase the size of the shadow economy. In fact according to the results of this survey the shadow economy expands with the increase of the poverty in the studied countries because the increase of poverty causes more individual to attract illegal activities like the shadow economy to satisfy their socio-economic needs. The effect of GDP on the size of the shadow economy was negative and significant, in other words, with the reduction of GDP and the per capita income more households tend to do more shadow activities to compensate their reduction of income. Increase in the population aged over 65 years old leads to the increase of the unemployment hours and individuals tendency to the shadow economy.

Reduction of the foreign investment, due to its negative effects on the tax system increases the shadow economy.

Therefore, some measures should be considered to reduce the shadow economy including the move towards globalization, reforms in tax system, development of foreign investments, reduction of regulations, increase of production and eradication of poverty.

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Appendix (1): The List of the studied countries

| | | | | | | | |
|----|------------|----|-------------|----|-------------|----|-----------------|
| 1 | Albania | 18 | El Salvador | 35 | Lithuania | 52 | South Africa |
| 2 | Algeria | 19 | Ecuador | 36 | Malaysia | 53 | Slovak Rep |
| 3 | Argentina | 20 | Egypt. | 37 | Macedonia, | 54 | Slovenia |
| 4 | Azerbaijan | 21 | Estonia | 38 | Malta | 55 | Thailand |
| 5 | Bahamas | 22 | Georgia | 39 | Mauritius | 56 | Trinidad Tobago |
| 6 | Belize | 23 | Guatemala | 40 | Mexico | 57 | Tunisia |
| 7 | Bolivia | 24 | Hong Kong | 41 | Moldova | 58 | Turkey |
| 8 | Botswana | 25 | Hungary | 42 | Morocco | 59 | Ukraine |
| 9 | Brazil | 26 | Indonesia | 43 | Nicaragua | 60 | Uruguay |
| 10 | Bulgaria | 27 | Iran. | 44 | Pakistan | 61 | Venezuela, |
| 11 | Chile | 28 | Israel | 45 | Panama | 62 | Vietnam |
| 12 | China | 29 | Jamaica | 46 | Paraguay | 63 | Yemen, Rep. |
| 13 | Colombia | 30 | Jordan | 47 | Peru | 64 | Honduras |
| 14 | Costa Rica | 31 | Kazakhstan | 48 | Philippines | 65 | Tajikistan |
| 15 | Croatia | 32 | Kuwait | 49 | Poland | 66 | Saudi Arabia |
| 16 | Czech Rep | 33 | Kyrgyz Rep | 50 | Romania | 67 | Sri Lanka |
| 17 | Dominican | 34 | Latvia | 51 | Russian Fed | | |