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21 January 2009

Online at https://mpra.ub.uni-muenchen.de/48765/
MPRA Paper No. 48765, posted 01 Aug 2013 10:19 UTC

Income Inequality and FDI in Turkey: FM-OLS (Phillips-Hansen) Estimation and ARDL Approach to Cointegration

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2009

Abstract

This paper examines the long-run impact of foreign direct investment (FDI) on and the other determinants of income inequality in Turkey. Using a linear income inequality model, we apply the (ARDL) approach to cointegration which is more appropriate for estimation in small sample studies. The long-run results are also estimated by using the fully modified ordinary least squares (FMOLS) method. These methodologies, while proven to produce reliable estimates in small sample sizes, provide a check for the robustness of results. The data span for the study is from 1990 to 2006. The empirical results indicate the existence of a cointegration relationship among the variables. The results also point to a positive impact of FDI on income inequality which is consistent with other past studies. The positive impact of FDI growth rate on income inequality is shown to be significant in the short-run but not in the long-run.

Key Words: *Income inequality, foreign direct investment, FMOLS estimation, ARDL estimation, Turkey.*

Jel Classification: *D31, F21, C32, C13*

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1. Introduction

The literature has focused on income inequality in recent decades. There has been plenty of research on the relationship between income inequality and other variables. The literature indicates that income and wage inequality has been rising in many countries since 1970s. There is supporting evidence, for both developed and developing countries, for the increase in inequality. In fact, Caselli (1999) states that "income and wage inequality has been rising in the United States, as well as in several other countries". Furthermore, Bernstein and Mishel (1997) and McDonald and Yao (2003) report that starting in the early 1970s, income and wage inequality has increased quite sharply in the U.S. Nevertheless, there are some studies on developing countries examining the issue of income and wage inequality. However, recent studies from developing countries also indicate a rise in income and wage inequality. Miles and Rossi (2001) claim that wage dispersion had increased significantly in developing countries, despite the openness to trade of these economies. Moreover, Diwan and Walton (1997); Dev (2000) and some others state that income and wage inequality has increased in devoloping countries like Mexico and some other countries in Latin America.

The number of studies examining the income inequality has increased in line with the rising inequality. Many previous studies have contributed to this literature. In these studies, the relationships between income inequality and varied factors which influence the overall distribution of income have been investigated. Economists have been interested in how other factors affect the income inequality. For instance, Rapanos (2004) examines the effects of a change in the minimum wage on income distribution and employment in a developing economy. Saunders (2005) investigates the recent trends in wage income inequality in Australia. The author reports that full-time earnings inequality has increased since the mid-1970s for both men and women. His findings show that further labor market deregulation

would create more inequality of wage outcomes. Furthermore, Kijima (2006) analyses how and why the inequality has been accelerated in India. The author argues that the wage inequality in urban India started increasing before 1991.

On the other hand, the relationship between trade liberalization and inequality has received considerable attention in recent years. As Choi (2006) states, there has been plenty of research on the realtionship between trade and income inequality within countries. Within this context, Wood (1997) examines the relationship between openness and wage inequality in developing countries. He states that the experience of East Asia indicates that "greater openness to trade tends to narrow the wage gap between skilled and unskilled workers in developing countries". In Latin America, however, increased openness has widened wage differentials. Additionally, Munshi (2008) provides panel data evidence on trade liberalization and wage inequality in Bangladesh. His results indicate some weak evidence that openness contributes to a reduction in wage inequality between skilled and unskilled workers. Cornia (2005) analyses the relationship between within-country income inequality and policies of domestic liberalization and external globalization. The author argues that inequality often rose with the introduction of such reforms. Gourdon (2007) presents new results on the sources of wage inequalities in manufacturing taking into account South-South trade. The author observes increasing wage inequality is more due to the South-South trade liberalization than to the classical trade liberalization with northern countries.

Furthermore, Anderson et al. (2006) investigate the relationship between globalization, co-operation costs, and wage inequalities. The authors report that the globalization "tends to narrow the gap between developed and developing countries in the wages of less-skilled workers, but to widen the wage gap within developed countries between highly-skilled and less-skilled workers". Miles and Rossi (2001) investigate the effects of market forces or government intervention on wage inequality. They find that "in Uruguay most of the increase

in wage dispersion could be explained by a significant increase in public wages and a decrease of minimum wage". Moreover, Cortez (2001) evaluates the impact of the educational expansion and changes in labor market institutions on wage inequality among Mexican workers using a simulation technique. The author concludes that "while increases in the relative rate of return of higher education would have induced an increase in wage inequality, changes in the composition of the educational distribution would have led to a stronger decline in wage inequality".

There is also increasing interest in examining the relationship between foreign direct investment (FDI) and income inequality in recent years. Bircan (2007), Sun (2007), Jensen and Rosas (2007), Stringer (2006), Choi (2006), Tang and Selvanathan (2005), Basu and Guariglia (2007) and te Velde (2003), among others, examine how FDI affect income inequality. In this paper, we attempt to investigate the relationship between FDI and income inequality in Turkey. Our major motivation is that there is a significant increase in FDI inflows to Turkey during the recent years. In fact, FDI inflows to Turkey reached about 10 billion dollars in 2005, which was 2.8 billion dollars in 2004. It was realized around 20 billion dollars in 2006 and about 22 billion dollars in 2007. However, between 1980 and 2000, the total amount was around 15 billion dollars. Another motivation is the rising income inequality in Turkey. In fact, as Bircan (2007) states, income and wage inequality is high in Turkey.

The main purpose of this paper is to analyse the relationship between income inequality and FDI in Turkey. We investigate how FDI inflows affect domestic income inequality by using ARDL (Autoregressive distributed lag model) approach to cointegration. The remainder of the paper is organized as follows: Section 2 presents the literature review and an overview of previous studies. Section 3 gives econometric methodology and data for relationship between FDI inflows and domestic income inequality in Turkey. Section 4 analyses the

relationship for long-run and short-run by using ARDL modeling and gives empirical results. Section 5 evaluates our results.

2. Literature Review

As mentioned above, there is increasing interest in examining the relationship between FDI and income inequality in recent years. In other words, there are many studies which have investigated the effects of FDI on domestic income inequality. Choi (2006) states that as FDI have increased recently, concern about the effects of FDI on income inequality has heightened. However, there are very few studies which examine this issue in Turkey. In this section, we present the results of recent studies which analyse the relationship between income inequality and FDI. We should mention that theories regarding the impacts of FDI on income inequality are different and the empirical findings of FDI effects on income distributions are varied.

In his honors thesis, Bircan (2007) analyses the effects of FDI on wages and productivity in the manufacturing sector of Turkey over the period 1993-2001. He uses a panel dataset and estimates a series of econometric models to capture the impact of plant-level foreign equity participation on wages. His results indicate that "foreign plants pay on average higher wages to their workers, and both production and non-production workers benefit from foreign ownership". However, Bircan (2007) finds that non-production workers benefit more from foreign ownership than production workers. According to these results, we can argue that FDI might lead to increasing wage inequality both within and across the plants.

Choi (2006) analyses the relationship between FDI and income inequality within countries using pooled Gini coefficient 1993 to 2002 data for 119 countries. The author attempts to determine whether FDI affect domestic income inequality. Choi (2006) finds that income inequality, defined as the Gini coefficient, increases as FDI stocks as a percentage of GDP increase. Stringer (2006) examines the effects of FDI on income inequality in

developing countries. In his paper, the author uses industry level data in an attempt to further the understanding of the causal mechanisms behind the relationship of FDI and income inequality. Tsai (1995) investigates the relationship between FDI and income inequality by comparing models with and without geographical dummies. His study shows that the statistically significant correlation between FDI and income inequality was widely obtained in earlier studies.

Besides, Tsai (1995) suggests that "the level of economic development, the direct role of government and, to a smaller degree, the significance of the agriculture sector is crucial determinants of income inequality". Furhermore, Te Velde (2003) analyses FDI and income inequality in Latin America experiences and argues that income inequality is persistently and relatively high in almost all Latin American countries. The author reviews different data sources and states that "all findings support the conclusion that in most countries the relative position of skilled workers has improved over much of the late 1980s and early 1990s". Moreover, te Velde (2003) mentions that not all types of workers necessarily gain from FDI to the same extent. The author argues that review of micro and macro evidence shows that, at a minimum, FDI is likely to perpetuate inequalities.

Furthermore, Jensen and Rosas (2007) examine the relationship between the investments of multinational corporations (foreign direct investment) and income inequality in Mexico. They use an instrumental variables approach and find that increased FDI inflows are associated with a decrease in income inequality within Mexico's thirty-two states. Moreover, Tang and Selvanathan (2005) examine the relationship between FDI inflows and regional income inequality using data for the period 1978 to 2002 at national, rural and urban levels. They find that FDI inflows are one of the main factors that have led to increasing of regional income inequality at national level, as well as rural and urban regions of China.

Nevertheless, a part of studies examine the relationship between FDI, growth and income inequality. For instance, Sun (2007) investigates the relationship between FDI, economic growth, and income inequality in a pooled time-series cross-section statistical model with 68 countries from 1970 to 2000. The author finds that there is no effect of FDI stocks on income inequality while the effect of FDI inflows on income inequality is non-linear. Additionally, Basu and Guariglia (2007) examine the interactions between FDI, inequality, and growth, both from an empirical and a theoretical point of view. They use a panel of 119 developing countries and observe that FDI promotes both inequality and growth. Furthermore, Giovannetti and Ricchiuti (2005) analyse the effects of new patterns of FDI on growth and inequality, with particular attention to the Mediterranean Partner Countries.

3. Methodology and Data

As mentioned above, income inequality is relatively high in Turkey. The links between FDI and income inequality are complex, however, we attempt examine the relationship in Turkey. In the econometric analysis, we do not use only FDI for determinant of income inequality. FDI can be expected to increase inequality in contrast to prediction by traditional trade theory that FDI reduces inequality in developing countries because FDI would allow developing countries to specialise in less-skilled intensive activities. Nevertheless, there are many possibly opposing effects, empirical testing is required.

The Gini coefficient is one of many measures that describe how income is distributed among households. The Gini index is measured as the Gini coefficient multiplied by 100. The Gini coefficient is a ratio with values between 0 and 1, with 0 representing perfect income equality and 1 being perfect inequality. Thus, higher values of the index indicate increasing inequality and lower values explain otherwise.

The Gini index is denoted by the following equation:

$$\sum_i \sum_j \left| y_i - y_j \right| \Big/ 2N^2 \bar{y}$$

This index can be expressed geometrically using the Lorenz Curve. Lambert and Aronson (1993) decomposed the Gini index into three parts as follows:

$$GINI = GINI_B + \sum_i \frac{N_i}{N} GINI_{Wi} + R_i$$

where N and N_i are the population of the whole country and its subgroup i respectively $(N = \sum_i N_i)$. $GINI_B$ denotes the GINI index of whole country when the income distributions in all groups are perfectly equalized. The second term is population weighted average of GINI indices of each of the groups ($GINI_{wi}$).

The following basic linear model will be used to test the hypothesis of causality and long-run relationship and explore the effect of the independent variables FDI, Population Growth Rate, Inflation Rate, GDP Growth Rate, and Literacy Rate for the income inequality.

$$GINI = f(FDIGR, GDPGR, POPGR, INF, LR) \qquad (1)$$

FDIGR as (Foreign Direct Investment Growth Rate), GDPGR as (Gross Domestic Growth Rate), POPGR as (Population Growth Rate), INF as (Inflation Rate), LR as (Literacy Rate), GINI as (denote the inequality - gini coefficient index). Gini data is obtained from UNCTAD (United Nations Conference on Trade and Development) and TURKSTAT (Turkish Statistical Institute). FDIGR is in percentage change from TURKSTAT. INF is captured in annual percentage changes with the GDP deflator from TURKSTAT. GDPGR is in percentage change from TURKSTAT. LR is in annual percentage change from TURKSTAT. POPR is in percentage change from TURKSTAT.

In this paper, we have concentrated on the preparation of properties of time series data before estimation of GINI modeling. We have to start 1990 for time series analysis because

we focus on FDI and inequality relation but which is not exactly start of FDI inflows[1]. Most of the studies have found it difficult to find data (especially quarter and monthly long-term time series) for Turkey. Data is available for the period 1990-2006 (17 years) for all the variables included in the subsequent estimations.

Looking into the stationary of the macroeconomic time series data from 1990-2006, we will make a further analysis of two way stationary and long-run relationship of the determinants and specially FDI when the underling variables are I (1). The residual-based co-integration tests are inefficient and can lead to contradictory results, especially when there are more than I (1) variables under consideration.

Income inequality model is estimated within the context of recent developments in econometric methodologies, particularly with respect to cointegration analysis and error correction models that allow estimation of both the short-run and long-run. In this regard we use two different methodologies—the autoregressive distributed lag (ARDL) approach to cointegration (Pesaran and Shin 1995) and the fully modified ordinary least squares (FMOLS) of Phillips and Hansen (1990)—to derive the long-run coefficients. These methodologies, while proven to produce reliable estimates in small sample sizes[2], provide a check for the robustness of results. In what follows we briefly explain these two methodologies.

In the static formulation of the cointegration regression is

$$y_t = \mu + \delta t + \theta' x_t + \nu_t \qquad (2)$$

Where $\Delta x_t = e_t$, (3) and $\xi_t = (\nu_t, e_t')'$ follows a general linear stationary process.

[1] Up until 1980, the cumulative level of FDI had amounted to $228 million with an average annual inflow of $90 million. In January 1980, following a serious balance of payments crisis, the government of Süleyman Demirel announced a reform program to open up the Turkish economy by replacing the prevalent import substitution strategy by an outwardly oriented liberalization program. This program aimed at establishing a free market, and an outward-oriented economy, the better to integrate Turkey with world markets. In 1983, the civil government of Turgut Özal replaced the Ulusu government but the implementation of the liberalization program in Turkey remained a high priority. In 1989, Turkey fully liberalized its capital account. This operation, which was supposed to increase Turkey's attractiveness to foreign investors, was the last step of the financial liberalization that the country initiated in the early 1980s. Thanks to these reforms, FDI inflows increased significantly. The authorized investment amounted to $6.4 billion between 1980 and 1990 while the average value per year was $456.3 million in the same period.

[2] Time period is not long enough but these methodologies is the best for this stituation.

In this case the OLS estimation of δ and θ are consistent, but in general the asymptotic distribution of OLS estimator of θ involves the unit root distribution as well as the second-order bias in the presence of the contemporaneous correlation that may exist between ν_t and e_t. Therefore, the finite sample performance of the OLS estimator is poor, and in addition, nuisance parameter dependences, inference on θ using the usual t-test in the OLS regression of (2) is invalid. To overcome these problems, Phillips and Hansen (1990) have suggested the fully modified OLS (FM-OLS) estimation procedure that asymptotically takes account of these correlations in a semiparametric manner. FM-OLS assume that ν_t and e_t in (2) and (3) follow the general correlated linear-stationary process.

$$\nu_t = A_1(L)u_t \text{ and } e_t = A_2(L)\varepsilon_t \qquad (4)$$

where $\xi_t = (\nu_t, e_t')'$ are serially uncorrelated random variables with zero means and a constant variance. Assuming $A_1(L)$ and $A_2(L)$ are invertible. The FMOLS takes into account the presence of a constant term and a possible correlation between the error term and the differences of the regressors.

The use of ARDL estimation procedure is directly comparable to the semiparametric, FM-OLS approach of Phillips and Hansen to estimation of cointegrating relations. A choice between them has to be made on the basis of their small-sample properties and computational convenience.

We consider the following general ARDL (p; q) model:

$$\Delta y_i = \beta_0 + \pi_{yy} y_{t-1} + \pi_{yx} x_{t-1} + \sum_{i=1}^{p} \vartheta_i \Delta y_{t-i} + \sum_{j=0}^{q} \phi \Delta x_{t-j} + \theta w_t + \mu_t \qquad (5)$$

Here, π_{yy} and π_{yx} are long-run multipliers. β_0 is the drift and w_t is a vector of exogenous components, e.g., dummy variables. Lagged values of Δy_t and current and lagged values of Δx_t are used to model the short-run dynamic structure. The first step in the ARDL approach is to estimate equation (5) by ordinary least squares (OLS) in order to test for the existence of a long-run

relationship among the variables by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. We denote the test which normalize on *GINI* by F(GINI | FDIGRT, INF, LR, POPR, GDPGR). Two asymptotic critical values bounds provide a test for cointegration when the independent variables are I(d). A lower value assuming the regressors are I(0), and an upper value assuming purely I(1) regressors. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. In the second step, when there is a long run relationship between variables, there exists an error correction representation. Therefore, in the third step, the error correction model is estimated. The error correction model result indicates the speed of adjustment back to the long run equilibrium after a short run shock.

4. Empirical Analysis

This section presents emprical results on the relationship of income inequality (GINI coefficent) and FDIGR, GDPGR, INF, LR, POPGR in Turkey. As our focus is on Turkey in particular, we undertake a time series analysis of data from Turkey for previous 17 years (1990-2006). Logaritmic form does not appropriate for modelling because of percentage growth rate values (negative values) for all variables have been used to carry out empirical analysis.

The order augmented traditional ARDL approach has the additional advantage that it does not require pre-testing of the regressors for the presence of unit roots, a problem that afflicts other approaches to estimation of long run relations, such as the FM-OLS approach of Phillips and Hansen (Pesaran, 1997). Prior to determining whether all the series are integrated, this study examines the integrating order of all the variables by applying unit-root test (Dickey and Fuller-DF and Phillips-Peron-PP, e.g.). Unit-root test are classified into

series with and without unit roots, according to their null hypothesis, in order to conclude whether each variable is stationary. All the variables are first tested for stationarity using the Augmented Dickey-Fuller (ADF) and Phillips Peron (PP). GINI, FDIGR, LR, POP, INF, GDPGR are integrated at I (1). (Results are shown in the table A1 in the appendix section).

We start by testing for the existence of long-run relationships. The ARDL approach to cointegration involves the comparison of the F-statistics against the critical values which are extracted from Pesaran and Pesaran (1997)[3]. The calculated F-statistic when income inequality is the dependent variable F (GINI|FDIGR, INF, LR, POPR, GDPGR) = 61.8795 is higher than the upper bound critical value of 25.971 at the 5 per cent level of significance. This suggests that the null hypothesis of no cointegration cannot be accepted. (See table A2 in the appendix section) For each model a maximum of one lag was used. The estimated ARDL model presented here is based on the SBC. Results of the long-run model estimated by using the ARDL and FMOLS are presented in Table 1. The two methods provide similar results and have the expected signs, confirming the robustness of the long-run results. The comparable results are presented in Table 1.

In this paper, long-term results are expected in the basis of economic theory. FDI, however, is negative and in a few cases even significantly related to income inequality. The implication is that increased flow of FDI may have a positive effect on the distribution of income in developing countries. The estimated coefficients of the long-run relationship in the both methods show that FDIGR is positive and theoretically right sign but statistically insignificant indicating that FDI growth rate will increase inequality in the long-run. This result is expected for Turkish economy situation because of amount of FDI inflows are not enough to support inequality significantly in the long-term. Inflation rate and literacy rate are positive and LR is statistically significant but INF is not in the long run. Their sign is

[3] The ambiguities in the order of integration of the variables lend support to the use of the ARDL bounds approach rather than one of the alternative co-integration tests.

expected because when the inflation increase income inequality can increase. Population growth rate is positive and GDP growth rate is negative and statistically significant at the level of 5 -10 percent significance. Their sign is expected and meaningful for Turkey.

The below table 2 reports the short-run coeficient estimates obtained from ECM version of ARDL model and tests for normality of residuals, serial correlation, heteroskedasticity, and misspecification of functional form were applied to the ECM.

The ECM coefficient shows how quickly/slowly variables return to equilibrium and it should have a statistically significant coefficient with negative sign. The error correction term *ecm(-1)*, which measures the speed of adjustment to restore equilibrium in the dynamics model, appear with negative sign and is statistically significant at 5 percent level, ensuring that long-run equilibrium can be attained. The coefficient of *ecm(-1)* is equal to (-0.37881) for short-run model respectively and imply that deviation from the long-term inequality is corrected by 37.88 percent over the each year.

Short-run dynamics results also provide evidence that inequality increases with FDI not in log-run but also in short-run. In the short-run, FDIGR increases inequality by 73.11 percent each year which is greater than coefficient of FDIGR that is 10.68 percent as 1 percent increase in the value of FDI growth rate in long-run, and significant at 10 percent level. Inflation is also positively associated with inequality but insignificant at all percent level. Literacy rate in short-run is decreasing the inequality by having lower value, and significant at 10 percent level. POPR increases income inequality in short-run. GDPGR decreases income inequality in short-run by having lower value, and significant at 5 percent level. Finally inflation rate and population growth rate are major inequality increasing factors in short-run, and insignificant at all percent level respectively while coefficient of FDIGR is having increasing effect on inequality in short-run and significant at 10 percent level.

Diagnostic tests for serial correlation, normality, heteroscedasticity and functional form are considered, and results are also shown in Table 2. These tests show that short-run model passes through all diagnostic tests in the first stage. The results indicate that there is no evidence of autocorrelation and that the model passes the test for normality, and proving that the error term is normally distributed. Functional form of model is well specified and there is not existence of heteroscedasticity in model.

Finally, when analyzing the stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) are applied. A graphical representation of CUSUM and CUSUMsq are shown in Figure A1 and A2 in the appendix section. As it is clear from Figure 1 and 2, the plots of both the CUSUM and the CUSUMsq are with in the boundaries and hence these statistics confirm the stability of the long-run coefficients of regressors which affect the inequality in the country. Therefore, the stability of the error correction model used in this study is supported.

5. Conclusion

In the literature, there is a few empirical study of analyzing the relationship between FDI and income inequality but none exists in the case of Turkey. This study investigates the importance of FDI in inequality in the country. We apply FMOLS and ARDL methods to investigate the long-run relationships among inequality and FDIGR, in ECM version of this model showed that the error correction coefficient which determined speed of adjustment, had expected and significant negative sign. The results indicated that deviation from the long-term in inequality was corrected by approximately 37.88 percent over the following year or each year. The results of the diagnostic and stability tests indicated that model passed all the diagnostic tests. The error term was normally distributed. The CUSUM and CUSUMsq stability test showed that the estimated coefficients of the error correction model were stable.

Finally, this paper found FDI increases inequality in Turkey. This result represents that increasing FDI inflow has caused the income inequality in Turkey especially after 2001. This is in line with the literature that suggests FDI tends to worsen inequality when it flows into industries that are high-tech and it does not create much employment for the masses. Literacy rate and GDPGR reduce inequality but POPR and INF have an insignificant but adverse affect on income inequality. This study implies that policies that place FDI levels alone at the center of decisions will be insufficient in reducing inequality. Equal, if not more, attention should be paid to improving literacy rates and the overall technical skills of the work force as a sustainable solution to income inequality.

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