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Cross-Country Wage Differentials

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Abstract

The main purpose of this article is to identify the major determinants of the wage level in the long run in the Armenian economy and assess the relative importance of these factors compared to other countries. We use annual macro-data for the period 1995-2014 for 55 developed and developing countries. Using econometric models for panel-data analysis we found positive correlation between real wages and productivity and negative correlation between real wages and unemployment. We also found that higher bargaining power and higher reservation wage are associated with real average wage increase. The policy relevant result is that after controlling for productivity and unemployment real average wage in Armenia is higher than in most of the countries in the sample and the main potential explanatory factor behind this phenomenon is remittances, which constitute relatively big share of GDP and act as a reservation wage for remittance receiving individuals.

JEL classification: E24, C23.

Keywords: Labor Market, Long-run Wage Equation, Remittance

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1. Introduction

Studies of wage determination in the long-run offer many insights into important issues related to price stability, competitiveness and economic growth. Wages constitute an important part of the firms costs and have an impact on their price setting behavior. A standard new Keynesian Philips curve will suggest a positive relationship between marginal costs of firms and inflation (see Gali 2008). Therefore from the monetary policy perspective, it is important to identify main factors that affect wages in the long run. Besides, wages can affect economic growth, through their effect on consumption, investment and export. From one hand wages represent an important source of household income, thereby higher wages can increase consumption and thus aggregate demand, from the other hand higher wages can decrease investment and export, due to higher costs and reduced profitability of firms. Net effect of wages on aggregate demand thus depends on the relative magnitude of the change of demand components and the time period which is considered, as in the long run lower wages can also increase consumption through the gains in investment and export, which will create new jobs and increase household income. Therefore understanding wage determination is a crucial element for policy design.

In the past decade much research has focused on wage determination. Some of the estimated wage equations have structural form (Blanchard and Katz 1997), while others have reduced form representation (Nunziata 2005, Camareo et al (2016). In this paper we use econometric models to estimate the long-run wage equation for a sample of developed and developing countries also taking into account bargaining power and reservation wage of workers. The final purpose of this analysis is to identify main factors affecting wage level in the long run and assess the relative importance of these factors in Armenia.

The estimated stylized wage curve for a panel of countries suggests positive relationship between real average wages and productivity and negative relationship between real average wages and unemployment. We also found that higher bargaining power and higher reservation wage are associated with real average wage increase. Our contribution to the econometric literature is that we found a positive relationship between share of remittances in GDP and real average wages in a dynamic panel framework including both developed and developing countries.

The remaining sections of this paper are as follows. Section 2 introduces brief literature review, section 3 introduces the theoretical framework which is used to construct the wage equation, section 4 discusses the data and the statistical concepts, section 5 presents the econometric methods and the estimation results, section 6 discusses policy implications of the results and section 7 concludes.

2. Literature Review

Wage equation has been extensively studied since the seminal work by Philips (1958).The wage curve suggested by Blanchflower and Oswald(1994) posits a negative relationship between level of wages and unemployment rate, Blanchard and Katz (Blanchard and Katz, 1999) estimated the real wage as the function of unemployment, given the reservation wage and labor productivity. Some of the empirical literature focused on reduced form regressions for wage determination. Nunziata (2005) presented an empirical analysis of the determinants of labor costs, with particular reference to labor market institutions, and found significant impact of LMI's on labor costs, Camarero et al (2016) estimated an equilibrium wage equation for Euro Area and showed that equilibrium wage has a positive and proportional relation with productivity and negative relation with unemployment and more flexible labor market is consistent with long-run wage moderation.

Recent dramatic falls in labor share in many developed and developing countries have focused researchers on the determinants of the labor share, which was considered to be roughly constant over a long period of time (Kaldor 1957). However the falling labor income shares suggest, that wages can deviate from productivity growth in the long run due to developments in globalization, technological change (see IMF 2007a, EC 2007), financial deepening and welfare state retrenchment (Stockhammer 2013) through the particular effect of the latter variables on the bargaining position of the workers.

The impact of remittances on average wage are so far largely unknown. There are some empirical studies that investigate the effect of remittances on labor supply decisions. Amuedo-Dorantes and Pozo (2006) found that women in rural areas work fewer hours in response to increases in remittances in Mexico. Grigoryan and Melkonyan (2011) demonstrated that the remittance inflows have negative effect on working hours in Armenia. Justino and Shemyakina (2012) found that on average men and women from remittance-receiving households in Tajikistan are less likely to participate in the labour market and supply fewer hours. In contrast Karymshakov et al (2016) did not find any strong evidence of remittance-dependency behaviour of left behind household members in Kyrgyzstan.

3. Theoretical Background

In this section we present a stylized model of wage determination in the spirit of marginal productivity theory and bargaining theory of wages:

According to marginal productivity theory, in the environment of perfect competition wages correspond to the marginal product of labor and can be derived from the profit

maximizing behavior of firms. This is a standard result in neoclassical literature. For example if we assume Coob-Douglas production function

$$A_t = A_t K_t^{\alpha} L_t^{1-\alpha} \tag{1}$$

Where Y_t is total real output, A_t is technology, K_t is capital, L_t is labor input and α is labor share. Firms maximize their profits subject to the production function, taking the price level P_t and wages W_t as given

$$P_t Y_t - W_t L_t - R_t K_t \tag{2}$$

Which yields the optimality condition

$$\frac{W_t}{P_t} = (1-\alpha) A_t K_t^{\alpha} L_t^{-\alpha} = (1-\alpha)\frac{Y_t}{L_t} \tag{3}$$

Meaning that firms hire up labor up to the point where its marginal product equals the real wage. It is worth emphasizing that this theory have some limitations in practice. For example not all firms at aggregate level maximize their profits, there is a government sector and non-profit organizations, and also perfect competition is very strong assumption in reality, but nonetheless productivity is considered the main driver of the real wages in the long-run.

According to the bargaining theory of wages if perfect competition assumption is abandoned wages are determined as a result of bargaining process between firms and workers, typically represented by labor market institutions. Other things equal a higher bargaining power of workers will lead to an increase in wages. First of all the relative bargaining power of sides will depend on unemployment rate. The wage demands from workers tend to be more moderate when the unemployment is high, as they will find it harder to obtain work if laid off by their current employer. Conversely if pool of unemployed is small, firms tend to satisfy wage demands as it will be difficult for them to find new workers if one left the job. The bargaining power of workers will also depend on the strength of labor market institutions, government intervention in the social and economic well-being of its citizens and reservation wage, the lowest wage rate at which a worker would be willing to accept a job.

Having the upper described theoretical concepts in mind, we construct and estimate a long-run wage equation of the following form

$$Wage_t = \beta_1 Wage_{t-1} + \beta_2 Productivity_t + \beta_3 Unemployment_t + other factors \tag{4}$$

The priori expected signs for the coefficients are as following, $\beta_1, \beta_2 > 0, \beta_3 < 0$. Other

factors include remittances, globalization, bargaining coverage, and government spending, which are assumed to affect average wages via their effect on reservation wage or bargaining power. We assume that remittances can increase reservation wage, as they are an alternative source of income for the remittance receiving individuals and can reduce incentives to work. Government expenditure captures some costs, which can also increase reservation wage (unemployment benefit, social benefits etc.), therefore we expect remittances and government expenditure to have positive impact on average wages. The inclusion of lagged wages is justified by two reasons. First it accounts for nominal rigidities and second, as discussed in Blanchard and Katz (1997), much psychological research, and fairness models of wage determination, suggest that workers aspirations in job search and wage bargaining are likely to be shaped by their previous earnings. In this context lagged wages account for reservation wage. This type of relationship between wages, productivity and unemployment given the reservation wage is consistent with most efficiency-wage and bargaining models (see Blanchard and Katz 1997) and also with Blanchflower and Oswald‘s 1994 wage curve.

4. Data

We use annual data of 55 countries from 1995 to 2014. Sample includes both developed and developing countries mainly from Europe and Asia, and also there are some countries from Latin America. Data of average wages were collected from OECD, ILO and UNECE databases. According to the OECD methodology the average wage is calculated by dividing the national-accounts based total wage bill to the average number of employees in the total economy, which is then multiplied by the ratio of the average usual weekly hours per full-time employee to the average usually weekly hours for all employees. Many countries in our sample are emerging economies with less developed statistical system and the only indicator of average wages is the total wages divided by the number of all employees including both full-time and part-time workers, therefore we re-adjust the measure of average wage for OECD countries by dividing it to the ratio of the average usual weekly hours per full-time employee to the average usually weekly hours for all employees, so that the concept of average wage is the same across countries.

In order to make international comparisons plausible and account for price level differences average wages are calculated at 2011 constant prices and 2011 constant PPP‘s. Productivity is calculated by dividing the level of GDP to the average number of employees, which is again measured at 2011 constant prices and 2011 constant PPP‘s. Data of GDP at current national prices, GDP deflator, government spending and unemployment rate are collected from IMF‘s world economic outlook database, employment is taken from PENN

world tables. PPP conversion factor for GDP series and remittances as a share of GDP are obtained from the World Bank database and bargaining coverage is from ILO database. Data for Armenia is a combination of releases of National Statistical Service and the Central Bank estimates. All the variables are used in log levels except those which are in percentage terms, thus the coefficients of the regressions can be interpreted as elasticities

5. Econometric Methods and Estimation Results

As a common starting point, we first investigate the possibility of non-stationarity in times series, using panel unit root tests. For the whole sample with developing and advanced economies panel unit root test proposed by Levin, Lin and Chu (2002) reject common unit root process for all variables, however for some variables many of individual unit root tests fail to reject the null hypothesis of the availability of unit root process in the data.

[Table 2, Table 3]

Our approach assumes homogeneity of coefficients across various economies, which sometimes cannot hold. The main motivation to use panel analysis though is that given the unbalanced panel, time periods for some countries are very short, which inhibits the analysis of each country separately. However the coefficient estimates should be interpreted with caution as the poolability assumption (the slope coefficients are the same across individuals) is likely to hold only as an approximation in our sample.

We estimated a reduced form equation which is known in the literature as dynamic panel data model due to the presence of the lagged dependent variable among explanatory variables.

$$Y_{i,t} = \alpha + \beta Y_{i,t-1} + X_{i,t}^{'}\gamma + \alpha_i + \epsilon_{i,t} \text{ for } i = 1 \text{ to } N, t = 1 \text{ to } T \tag{5}$$

Where α_i are the (unobserved) individual effects, which are already correlated with the lagged dependent variable by construction and $\epsilon_{i,t}$ are the error (idiosyncratic) terms.

The first specification(model 1 of Table.4) will be a standard fixed effects estimator (see Wooldridge 2002). But as discussed in the literature there is a serious difficulty with the one-way fixed effects model in the context of a dynamic panel data (DPD) model particularly in the small T, large N" context. As Nickell (Econometrica, 1981) shows, this arises because the demeaning process which subtracts the individuals mean value of Y and each X from the respective variable creates a correlation between regressor and error. Nickell demonstrates that the bias in estimating a dynamic fixed effects model is of order $\frac{1}{T}$ and can be quite sizable in small T context and if the coefficient of the lag is positive then the persistence

of Y will be underestimated. However the bias becomes less important as T increases and with dimension of 20 time periods as in our case it can be negligible. One can also show that the bias of AR(1) coefficient will be positive (see Appendix B) if we estimate the model with OLS regression due to positive correlation between lagged dependent variable and the composite error term $(\alpha_i + \epsilon_{i,t})$, therefore the comparison of OLS and FE estimators can be useful benchmark for deciding the magnitude of bias.

Further we present tree models based on Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998), which are designed for dynamic panel models with few time periods and large cross sections. This estimators are robust for autocorrelation and heteroscedasticity within individual errors and don‘t demand strict endogeneity assumption, which is likely not to hold in our case, as the productivity and unemployment can both be affected by the developments in average wage. These are GMM estimators that instrument the lagged dependent and predetermined variables. Model 2 (Table.4 in the appendix) performs first difference transformation in order to eliminate unobserved individual effects and is often called difference GMM estimator. Model 3 performs orthogonal deviations transformation, which is more efficient given the unbalancedness of the panel. Model 4 is the extension of the difference GMM estimator which is called system GMM. The modification of this model includes both level variables instrumented with lagged differences and differenced variables instrumented with lagged levels.

[Table 4]

The purpose of considering different models is to be confident with the results, as each model relies on certain assumptions about the underlying data and the relationship of the variables, which will probably affect the result. For example the difference GMM approach deals with the problem of non-stationarity because it uses first difference transformation of the data and deals with endogeneity by using lagged variables as instruments, but the performance of this model is well established when the number of individuals is large. System GMM estimator has a lower bias and more efficiency when the cross-sections are small, however it comes with the cost of additional assumption that the variables are mean-stationary. Having the pros and cons of the described estimation strategies, we present different specifications rather than relying on certain model.

The estimates are presented in Table 4. As theory predicts all the models suggest that wages have positive correlation with productivity and negative correlation with unemployment: Higher unemployment tends to decrease the bargaining power of workers and is associated with wage restraints, while in countries with lower unemployment worker‘s bargaining position is more improved, they dont accept any level of offer given that the pool of unem-

ployed is very small and firms must compete with each other to hire workers. The coefficients of lagged wages and productivity are significant at 1 percent level in all specifications. Our findings are consistent with those of Nunziata (2005) and Camareo et al. (2016).

As discussed earlier the OLS estimator of lagged dependent variable is positively biased and FE estimator is negatively biased so we can conclude that the true coefficient is between 0.83 and 0.91 (see Table 5), which is very small interval and suggests that the bias of FE model is small and it performs quite well. In contrast the results of model 2 and 3 are outside the bounds of their OLS and FE counterparts. Although they should be consistent, they cannot be presumed to be superior in this context.

[Table 5]

As we are interested in relative position of average wages in Armenia compared to the sample given the level of productivity and unemployment rate, we recover the unobserved individual effects (α_i in the equation 5) which were eliminated during the transformation of the models. Using the coefficient estimates of lagged wages, productivity, unemployment and assuming that the period averages of the idiosyncratic error term are zero ($E_t[\epsilon_{i,t}] = 0$) we can calculate the fixed effects (α_i) by subtracting the period averages of explanatory variables from the period average of the dependent variable.

$$\alpha + \alpha_i = \widehat{Y}_{i,(1,T)} - \hat{\beta}\widehat{Y}_{i,(0,T-1)} - \widehat{X}'_{i,(1,T)}\hat{\gamma}, \text{ where } \widehat{Y}_{i,(0,T-1)} = \frac{1}{T-1}\sum_{t=0}^{T-1} Y_{i,t} \tag{6}$$

Then we standardize the $\alpha + \alpha_i$ around zero by subtracting the mean value. It should be noted here that thought the fixed effects are unbiased, $E[\alpha_i] = \alpha_i$, they are inconsistent as N tends to infinity.

[Figure 1, Figure 2]

Figure 1 shows the standardized fixed effects from 4 models. As we can see from the graphs the country specific effects for the wage determination in Armenia are quite high relative to the sample average in all 4 graphs, which points to the fact that after controlling the effects of productivity and unemployment, real average wages in Armenia are higher than in most of the countries in the sample. High wages combined with the persistent high unemployment is indicating a badly functioning labor market with high structural unemployment, which is a subject for a future research.

Figure 2 shows the individual effects from the FE estimation by country.

[0]average unemployment in Armenia is 20 percent

We also present additional variables besides productivity and unemployment, which are significant in the regression.

[Table 6, Table 7]

Table 6 and 7 summarize result with FE estimator and system GMM estimator. Lets consider the empirical results in more detail. The coefficient of remittances is positive and significant at 1 percent level in both specifications, as expected. Remittances can increase average wages both through the demand side and the supply side of the economy. From the demand side remittances are a source of financing for consumption and investment expenditures, which will boost aggregate production and lead to increase in wages. From the supply side remittances are a source of non-labor income, which increase reservation wage and reduce supply of labor for remittance receiving individuals, thus increasing the average level of wages. Although the task of distinguishing between these effects in our model specifications is not trivial, we do believe that the supply side effects outpace those of demand side ones.

The supply and demand effects should have opposite effects on the unemployment rate. The demand effect should decrease unemployment, while the supply effect should increase it.

[Figure 3]

Figure 3 shows the correlation between unemployment rate and share of remittances as a percent of GDP at the same sample used for estimation. Although not much can be inferred from the graph, the positive correlation suggests that the supply side effects can be substantial compared to the demand side ones. In a nutshell, remittances do contribute to higher wages and mostly through the supply side of the economy; however the precise measurement of the magnitude of each sides effect warrants further research with structural model. Finally in this paper rather than disentangling the exact transmission channels, we seek for the total causality of remittances to wages after controlling for productivity.

The variable accounting for globalization isn‘t significant for the whole sample, but if we multiply it with dummy variable which accounts for high income countries we get statistically significant and negative coefficient though with small magnitude. There are two possible explanations for this finding. First, traditional trade theory built on Stolper and Samuelson (1941) argues that the abundant factor will gain after trade liberalization. For advanced countries this is capital, whereas labor is the abundant in developing countries, therefore globalization is supposed to bring benefits to labor in developing and capital in advanced countries. The main effect of trade on income distribution in this theory is via relative prices. In contrast the Political Economy approach to globalization is related to relative bargaining

position of capital and labor (Rodrik 1997). According to this approach globalization is supposed to benefit more to mobile factor, which is capital both in developing and developed countries. The negative coefficient of globalization for high income countries suggest that the workers in developed countries have been hurt, however it is doubtful whether the workers in developing countries have benefited or not, so we cannot say which theory is superior. Recent empirical literature focuses on the effects of Globalization on labor income share (see IMF (2007a), European Commission (2007) and Stochammer (2013)). For example IMF (2007a) and European Commission (2007) estimated in a sample of developed countries and found negative correlation between openness of the economy and the labor income share, Stockhammer (2013) found negative correlation using a sample of both developed and developing countries, which is supportive for the Political Economy approach. Similarly our results indicate about the impact of globalization on average wages, which is closely related to the labor income share.

Government spending is used as a proxy for government intervention in labor market. Government intervention refers to any support that provides financial assistance to individuals or households. This can include social benefits, family benefits, unemployment benefits etc. Any financial support in our framework can be considered as an alternative income which increases reservation wage and can reduce the labor supply of the individuals or family members. The results indicate that higher government expenditure is associated with average wage increase, and the coefficients are significant in both specifications. As for case with remittances, here also government spending can affect wages through the demand side, however we are interested in total effect after accounting for productivity and we only use government expenditure as a share of GDP to account for relative size of government assuming that all kind of benefits should be high in countries where government share is high. Thus according to our results the size of welfare state is also associated with unit labor costs increase.

Bargaining coverage is defined as the share of employees to whom a collective agreement applies. The definition of the bargaining coverage already suggests that the increase in bargaining coverage should be associated with increase in bargaining power of workers and lead to an increase in average wages. The hypothesis is confirmed by the results, though the coefficient is significant only in FE estimator.

Table 8 presents fixed effects estimators with two-way error component model. As we can see from the table the inclusion of the time effects doesnt affect the results.

[Table 8]

Some of the other factors besides productivity and unemployment are only available for

shorter periods and for fewer countries thereby the inclusion of the all variables together can significantly decrease the sample and have adverse effect on the results, thats why they are analyzed separately.

The analysis of average wage determination so far suggests that the fundamental factors that shape the real average wage level of a country are productivity (total value added per employee) and unemployment. Besides these fundamental drivers, wages can also be affected by the developments in the relative bargaining power of workers and the change in reservation wage.

Lets confront the results we found to the stylized facts in the Armenian economy. In particular we concentrate on the finding that real average wage in Armenia is high relative to sample average after controlling for productivity and unemployment. We analyze the potential candidates, which can stand behind the higher wages in Armenian relative to economic fundamentals. First, labor market in Armenia is very flexible, with 45 % informal employment[1] and relatively low bargaining coverage rate (25 %).

[Figure 4]

Second, share of government expenditures in Armenia is also among the smallest in the sample and besides the size there are no direct unemployment benefits since 2014 compared to the average of 70 percent Net Replacement Rates in OECD countries.

[Figure 5]

So roughly speaking there is no evidence that high wages in Armenia are a result of strong collective bargaining or government intervention. Another potential driver of high level of wages after productivity and unemployment have been controlled is remittances. Remittances constitute on average 15 percent of GDP. Figure 6 shows the unobserved individual effects after controlling for remittances.

[Figure 6]

Country fixed effects for Armenia decrease significantly after accounting for remittances and appear somewhere in the middle. Thus due to our analysis we can confidently claim that remittance inflows hold the real wages higher in Armenia compared to what the existing levels of productivity and unemployment would suggest.

[1]Employment protection legislation, which does not cover the informal employment is also a subject to relative bargaining power which can push the wages up (see Nunziata 2005, Camareo et al. 2016, for the effects of employment protection legislation on wages)

Figure 2 and 6 summarize the unobserved individual effects before and after controlling for remittances for every country. Not surprisingly the country fixed effects for some of other remittance receiving countries are also high relative to the sample average. For example in Bosnia and Herzegovina, Georgia, Nicaragua and Kyrgyz Republic real average wage is also high relative to what level of productivity and unemployment would suggest. In contrast individual effects are very small for Tajikistan, which is the top remittance-receiving country in terms of the relative size in GDP. However the data for unemployment[2] in Tajikistan is probably registered unemployment and not the actual level, which is based on surveys like in other countries. So the fixed effects of Tajikistan are not comparable in this context.

6. Policy Implications

In this section we present the implications of our findings for economic growth and monetary policy. The key point of our work is that after accounting the effects of productivity and unemployment real average wage in Armenia is higher than in most of the sample countries and the large part of this is due to remittance inflows. In other words the persistent inflows of remittances increases unit labor costs, therefore exerting upward pressures on the long-run real exchange rate and afecting competitevness of the economy. This implication is also consistent with the earlier work on real exchange rate determination for Armenia by Grigoryan and Dallakyan (2009) and is in line with theoretical predictions of Hinkle and Montiel (1999). So remittance inflows have a negative impact on the private sector investment and therefore on the long-run economic growth.

From the monetary policy perspective our findings suggest that remittances can affect prices not only from the demand side but also from the supply[3] side of the economy and this channel can be useful for understanding the transmission of the remittance inflow shock in Armenia. One implication of this supply channel is high level of prices in the long-run. Besides high level of prices, the huge amount of remittances lowers the demand management opportunities for monetary policy, as the internal demand appears to be highly dependent on exogenous shocks.For example Igityan (2017) demonstrates in an estimated DSGE model the transmission of structural shocks hitting Russian economy to Armenia through migration and remittances.

Economic theory insists that this kind of distortions should be compensated by the economic policy. In particular a few countries impose some sort of direct or indirect tax

[2]Average unemployment rate in Tajikistan is about 2 percent according to IMF database

[3]A standard New Keyenesian Philips curve suggests positive correlation between real unit labor costs and inflation (see Gali 2008).

on remittances. For example there was a direct tax of 0.3 pesos for every 200 pesos in Philippines, which was removed recently. Alternatively some countries impose an implicit tax on remittances requiring the recipients to convert the remittances to local currency at uncompetitive exchange rates. Though taxing remittances will somewhat solve the problem, but it is not free of negative consequences. A remittance tax can drive money inflows underground and it will require additional costs to account and control these informal money inflows. Therefore as a short term solution to weaken the negative consequences of these money inflows can be an additional tax on consumption, as the remittances are mainly directed towards spending on goods and services. The additional tax will be both revenue for government and will decrease the negative effects of remittances on competitiveness. But in order to fully understand the costs and benefits of the above described methods a further research is needed.

The policy which is directed to stimulate the supply and increase the productivity will be a long-term solution to this problem and other thing being equal will decrease the impact of remittances on unit labor costs, as the magnitude of the impact on wages will be small when the level of productivity is high. The proof is that remittances dont have a significant role in any developed country, as the share of remittances in the economy is small. So the increase in productivity will be accompanied by the decrease in competitiveness gap of the Armenian economy.

7. Conclusion

In this paper we estimated an equilibrium wage equation for a sample of developed and developing countries over the period 1994-2014 using dynamic panel data analysis techniques. Our estimation results are in line with theoretical predictions. In particular productivity has a positive and statistically significant impact on real average wages, while high unemployment tends to decrease it. Our result also indicates that bargaining power and reservation wage have a significant impact on real average wages.

Comparison of cross-section fixed effects suggests that after controlling for productivity and unemployment real average wage in Armenia is higher than in most of the countries in the sample. The higher wages compared to the level that fundamentals would suggest are in turn the result of remittance inflows. The inflow of remittances here acts as a reservation wage and reduces the willingness to work, thereby also leading to persistently high unemployment rate and elevated unit labor costs compared to countries which do not receive remittances.

The relatively high level of unit labor costs is leading to higher price level and overvaluation of the real exchange rate, which in turn affects the competitiveness of the economy.

Elevated unit labor costs create constraints for monetary policy also. Thus to minimize the described negative consequences, we suggest implementation of structural reforms to increase productivity and to tax consumption.

Appendix A. Tables and Figures

Table 1: Variable Definitions

Wage	National accounts total wage bill divided by average number of employees at constant 2011 prices and constant 2011 ppp's
Productivity	GDP per employee at constant 2011 prices and constant 2011 ppp's
Unemployment	Unemployment rate, %
Remittance	Remittances as a % of GDP
Globalization	Imports plus exports as a % of GDP
Government expenditure	Government expenditure as a % of GDP
Bargaining coverage	share of employees to whom a collective agreement applies, %
Dummy_high_income	Dummy variable accounting for high income countries

Table 2: Unit Root Tests

Variables	**Common unit root Ho: Unit root**	**Individual unit root Ho: Unit root**		
	Levin, Lin, Chu	IM, Pes., Shin W	ADF-Fisher chi-square	PP-Fisher chi-square
Log(wage)	-4.47 (0.0000)	0.61 (0.72)	131.3 (0.08)	155.1 (0.003)
Log(productivity)	-3.33 (0.0004)	2.67 (0.99)	94.6 (0.85)	163.3 (0.00)
Unemployment	-12.8 (0.000)	-8.13 (0.00)	283.8 (0.00)	201.7 (0.00)
Remittance	-6.06 (0.000)	-4.31 (0.00)	209.5 (0.00)	201.8 (0.00)
Globalization	-4.73 (0.000)	-1.78 (0.03)	141.4 (0.02)	147.0 (0.01)
Share of gov. exp.	-10.74 (0.000)	-6.23 (0.00)	255.3 (0.00)	318.8 (0.00)
Bargaining coverage	2.94 (0.99)	3.3 (0.99)	54.4 (0.67)	79.0 (0.05)

Note:Assumes individual intercept only. Automatic lag selection based on Schwarz information criterion. P values are in parentheses.

Table 3: Unit Root Tests

variables	**Common unit root Ho: Unit root**	**Individual unit root Ho: Unit root**		
	Levin, Lin, Chu t	IM, Pes., Shin W	ADF-Fisher chi-square	PP-Fisher chi-square
Log(wage)	-3.14 (0.0008)	-0.01 (0.49)	136.0 (0.04)	120.8 (0.22)
Log(productivity)	-3.76 (0.0001)	1.22 (0.88)	98.4 (0.77)	87.5 (0.94)
globalization	-13.3 (0.000)	-7.17 (0.00)	319.3 (0.00)	232.8 (0.00)
Bargaining coverage	-22.92 (0.000)	-3.77 (0.00)	63.5 (0.17)	72.5 (0.04)

Note:Assumes individual intercept and individual trend. Automatic lag selection based on Schwarz information criterion. P values are in parentheses.

Table 4: Estimation of Base Equation With Diferent Methods

Dependent variable log(wage)	FE	GMM FD	GMM OD	System GMM
Model	1	2	3	4
Log(Wage(-1))	0.83***	0.62 ***	0.73***	0.83***
	(36.07)	(100.0)	(132.6)	(52.7)
Log(Productivity)	0.12***	0.35***	0.21***	0.15***
	(5.34)	(52.8)	(33.3)	(10.3)
Unemployment	-0.34***	-0.27***	-0.32***	-0.18**
	(-7.32)	(-10.8)	(-20.3)	(-2.13)
Constant	0.35***			
	(2.09)			
Sargan J stat		51.1	54.48	53.49
		(0.42)	(0.3)	(1.0)
AB test AR(2)		-2.05**		-1.82*
		(0.04)		(0.06)

Notes: t-statistics are in parentheses, * p < 0.1; ** p < 0.05; *** p < 0.01
Model 1. cross-section fixed effects, coefficient covariance method white cross-sections.
Model 2. Two step GMM estimation, first difference transformation, coefficient covariance matrix white periods. Instrument list: Wage(-4), Productivity(-3), Unemployment(-3).
Model 3. Two step GMM estimation, orthogonal deviations transformation, coefficient covariance matrix white periods. Instrument list: Wage(-4), Productivity(-3), Unemployment(-3).
*Model 4.*Two step GMM estimation, first difference transformation, Robust standard errors using Windmeijers (2005) correction, Instruments for first difference equation: wage(-3) Productivity(-2) Unemployment(-2), Instruments for level equation: diff(Wage(-3)) diff(Wage(-4)) Diff(Productivity(-2)) Diff(Unemployment(-2))
* Arellano-Bond serial correlation test fails to reject the null hypothesis of no serial correlation, therefore deeper lags of variables are used as instruments. Anyway Sargan's test of overidentifying restrictions is valid for every specification meaning that the orthogonality condition of the instruments isnt violated.

Table 5: Estimation of The Base Equation With OLS and FE Estimator

Dependent variable log(wage)	OLS	Fixed Effects
Log(Wage(-1))	**[0.91***]**	**[0.83***]**
	(69.5)	(36.07)
Log(Productivity)	0.06***	0.12***
	(4.88)	(5.34)
Unemployment	-0.03	-0.34***
	(-1.23)	(-7.32)
Constant	0.21***	0.35***
	(5.15)	(2.09)

Notes: t-statistics are in parentheses, * p < 0.1; ** p < 0.05; *** p < 0.01

Table 6: Estimation Results with FE Estimator

Dependent variable log(wage)	Fixed effects estimation One-way error component model					
Log(Wage(-1))	0.83***	0.80***	0.83***	0.82***	0.81***	0.70***
	(36.07)	(36.6)	(37.1)	(37.6)	(34.5)	(24.54)
Log(Productivity)	0.12***	0.15***	0.12***	0.13***	0.14***	0.25***
	(5.34)	(8.14)	(5.4)	(5.44)	(5.32)	(7.6)
Unemployment	-0.34***	-0.31***	-0.35***	-0.33***	-0.42***	-0.28***
	(-7.32)	(-7.5)	(-7.5)	(-7.14)	(-6.6)	(-6.39)
Remittance		0.32***				
		(6.6)				
Globalization			-0.001			
			(-0.22)			
Globalization* dummy_high_income				-0.02***		
				(-2.73)		
Government expenditure					0.13**	
					(2.47)	
Bargainig coverage						0.04**
						(2.18)
Constant	35.8***	25.7	35.4*	29.3	28.2	29.4
	(2.0)	(1.37)	(1.93)	(1.48)	(1.33)	(1.19)
Observations	898	871	898	898	873	408

Notes: t-statistics are in parentheses, * p < 0.1; ** p < 0.05; *** p < 0.01

***** cross-section fixed effects, coefficient covariance method white cross-sections.

****** According to World Bank classification high-income economies are those with a GNI per capita of 12,476 dollars or more

Table 7: Estimation Results With System GMM Estimator

Dependent variable Log(Wage)	System GMM estimator					
Log(Wage(-1))	0.83***	0.85***	0.83***	0.85***	0.78***	0.94***
	(52.7)	(36.9)	(37.1)	(43.8)	(30.6)	(40.6)
Log(Productivity)	0.15***	0.14***	0.12***	0.14***	0.19***	0.05***
	(10.3)	(6.6)	(5.4)	(7.87)	(8.9)	(2.66)
Unemployment	-0.18**	-0.30***	-0.35***	-0.27***	-0.21***	-0.26***
	(-2.13)	(-4.7)	(-7.5)	(-2.6)	(-2.9)	(-3.3)
Remittance		0.31***				
		(2.9)				
Globalization			0.008			
			(0.446)			
Globalization* dummy_high_income				-0.02***		
				(-3.07)		
Government expenditure					0.12**	
					(1.98)	
Bargainig coverage						-0.01
						(1.24)
Observations	898	871	898	898	873	408
N instruments	125	125	125	123	162	95
AB test AR(2)	-1.82*	-1.94*	-1.86*	-1.77*	-1.72*	-3.2
	(0.06)	(0.051)	(0.062)	(0.075)	(0.084)	(0.59)
Sargan j statistic	53.49	51.9	52.8	53.9	43.6	40.2
	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)

Notes: t-statistics are in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

***** AB test is Arellano-Bond test for zero autocorrelation in first-differenced errors, only t statistics for lag of order 2 are considered, as the first differenced errors have first order autocorrelation by construction themselves.

****** In order to get a manageable number of instrument they are restricted to one or two lags of variables.

******* According to World Bank classification high-income economies are those with a GNI per capita of 12,476 dollars or more

Table 8: Estimation Results with FE Estimator

Dependent variable Log(Wage)	Fixed effects estimation Two-way error component model					
Log(Wage(-1))	0.84***	0.81***	0.84***	0.83***	0.82***	0.65***
	(35.5)	(36.1)	(35.1)	(35.8)	(33.2)	(13.95)
Log(Productivity)	0.12***	0.16***	0.12***	0.12***	0.14***	0.28***
	(4.54)	(6.65)	(4.4)	(4.51)	(4.44)	(5.96)
Unemployment	-0.31***	-0.26***	-0.31***	-0.29***	-0.40***	-0.35***
	(-5.92)	(-6.04)	(-6.07)	(-7.14)	(-6.08)	(-7.7)
Remittance		0.32***				
		(6.5)				
Globalization			0.002			
			(0.28)			
Globalization*				-0.02***		
dummy_high_income				(-2.42)		
Government expenditure					0.19**	
					(3.11)	
Bargainig						0.04**
coverage						(2.43)
Constant	0.28	0.1	0.27	0.32	0.15	0.37
	(1.26)	(0.44)	(1.18)	(1.43)	(0.53)	(1.09)
Observations	898	871	898	898	873	408

Notes: t-statistics are in parentheses, * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

***** cross-section fixed effects and period fixed effects, coefficient covariance method "white cross-sections".

****** According to World Bank classification high-income economies are those with a GNI per capita of 12,476 dollars or more

Fig. 1. Individual effects from the 4 models considered in the table 4, the marked one coresponds to Armenia

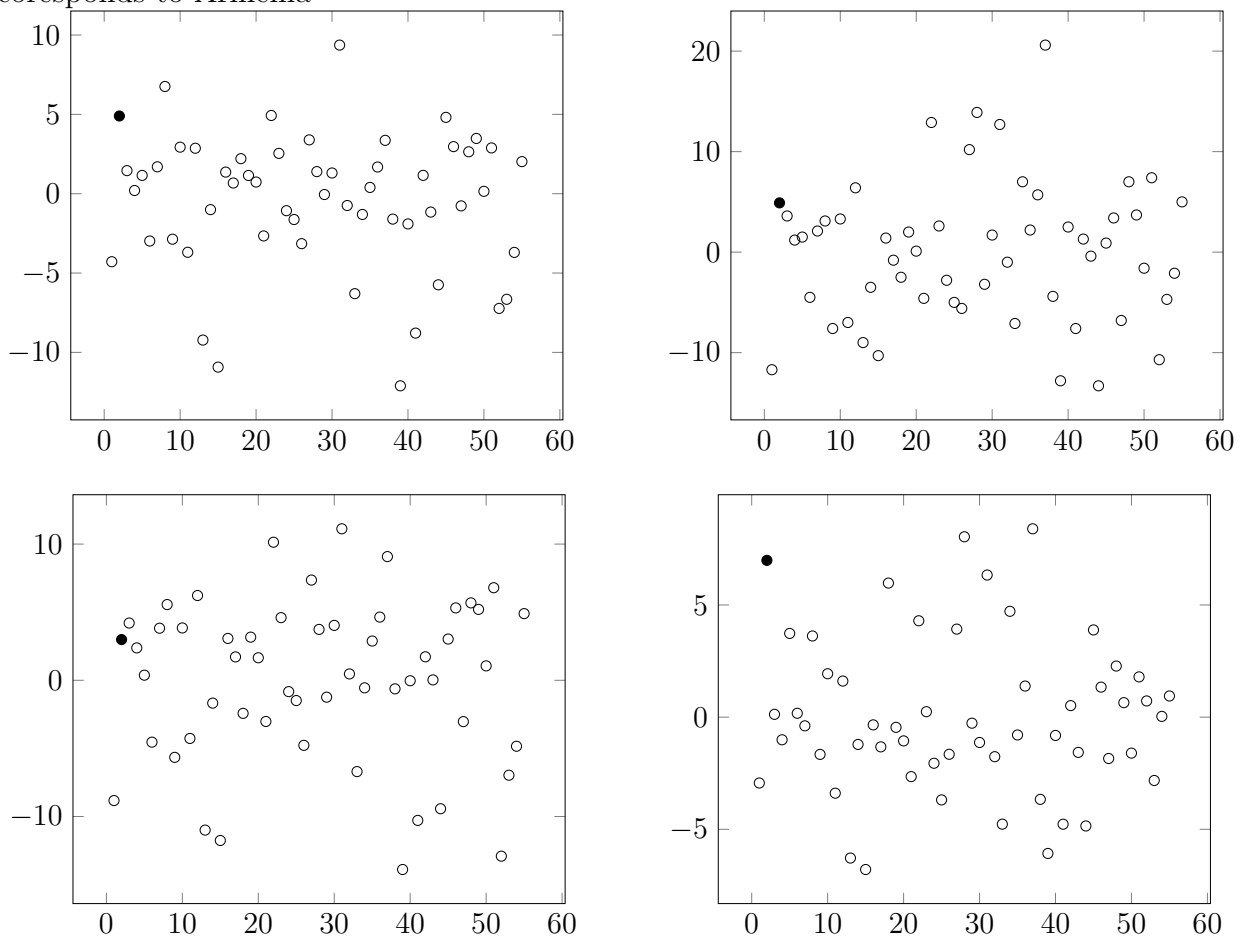


Fig. 2. Individual effects from the FE estimation (model 1 in table 4)

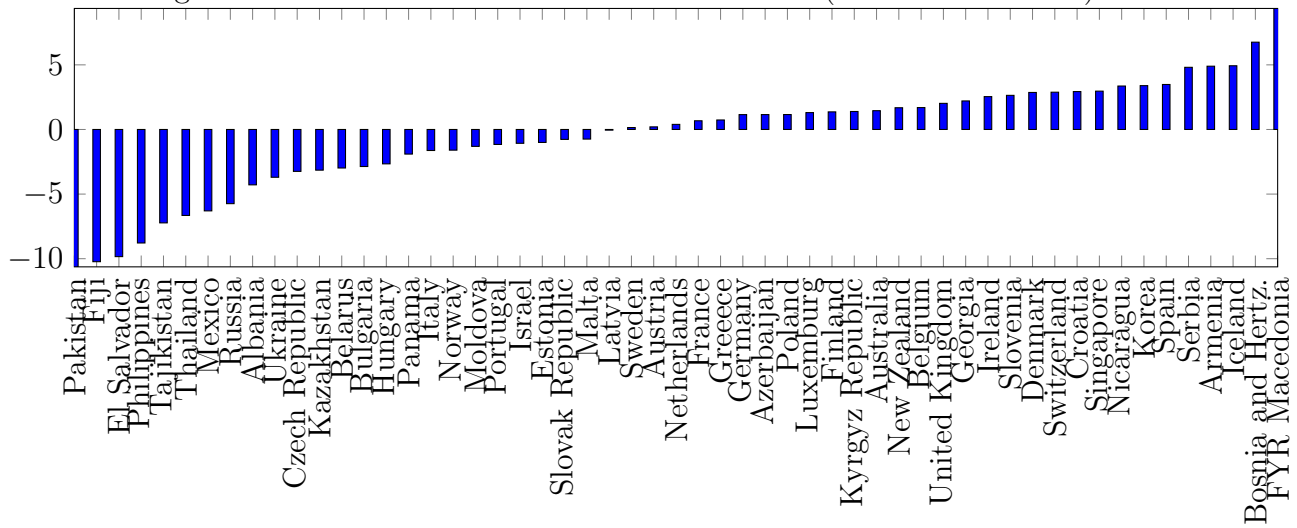


Fig. 3. Remittances and Unemploymant in the sample countries, averages of 1994 and 2014, the marked one coresponds to Armenia

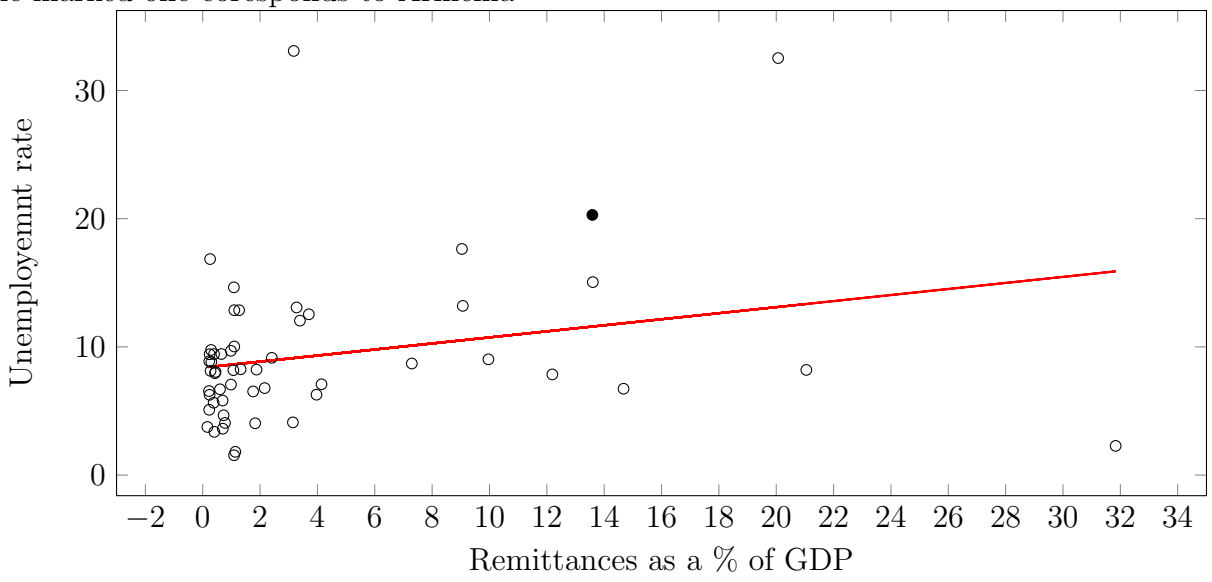


Fig. 4. Bargaining Coverage rate in the sample countries, marked one coresponds to Armenia

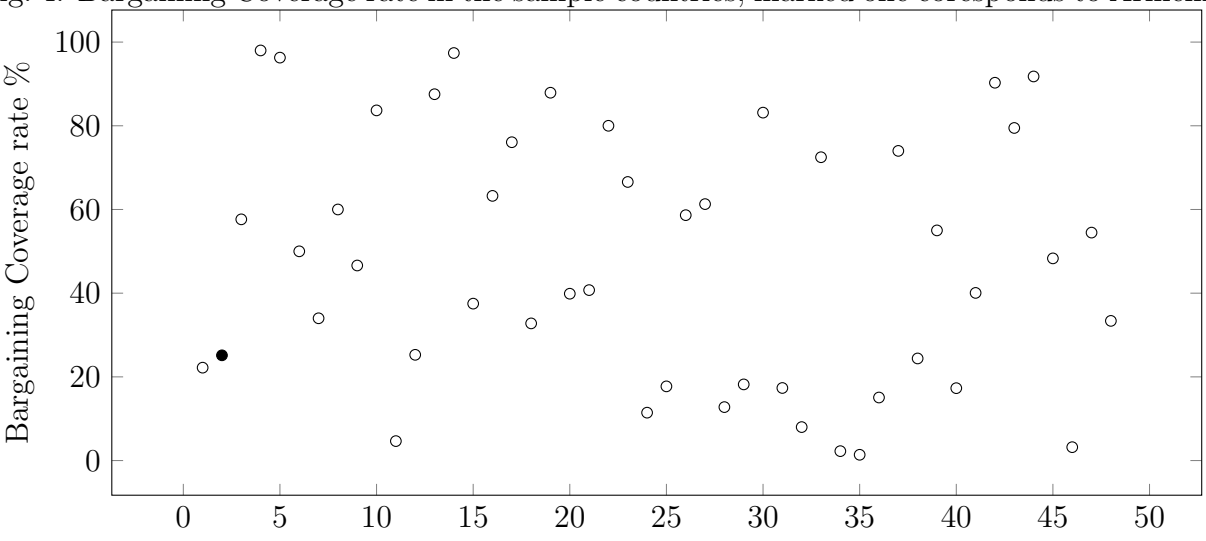


Fig. 5. Unemployment Benefits Net Replacement Rates in OECD Countries and Armenia, Averages of 6 Family Types and Diferent Earnings Levels

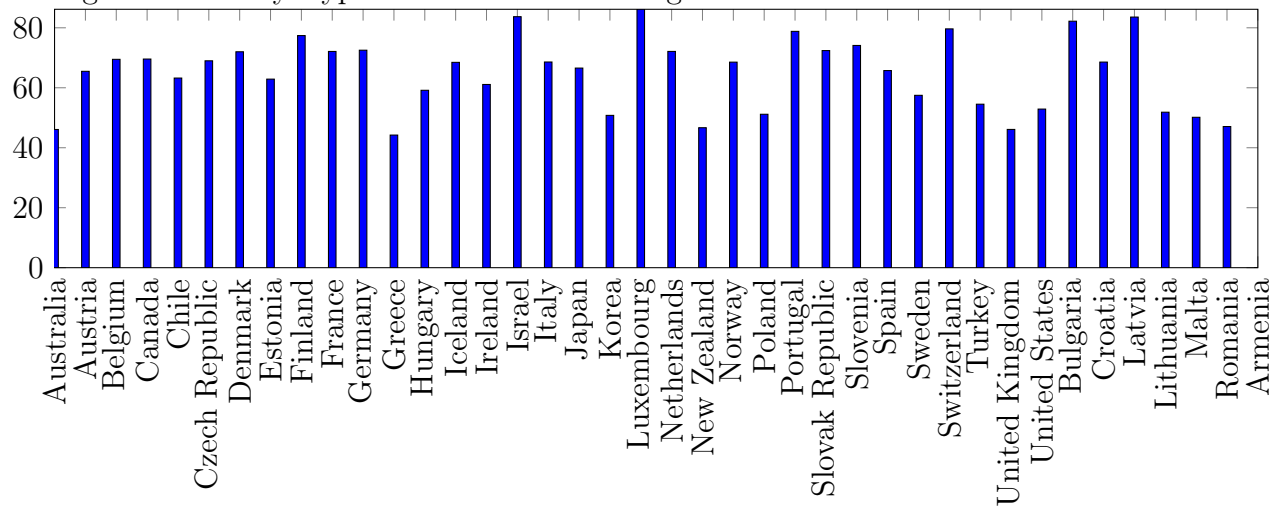
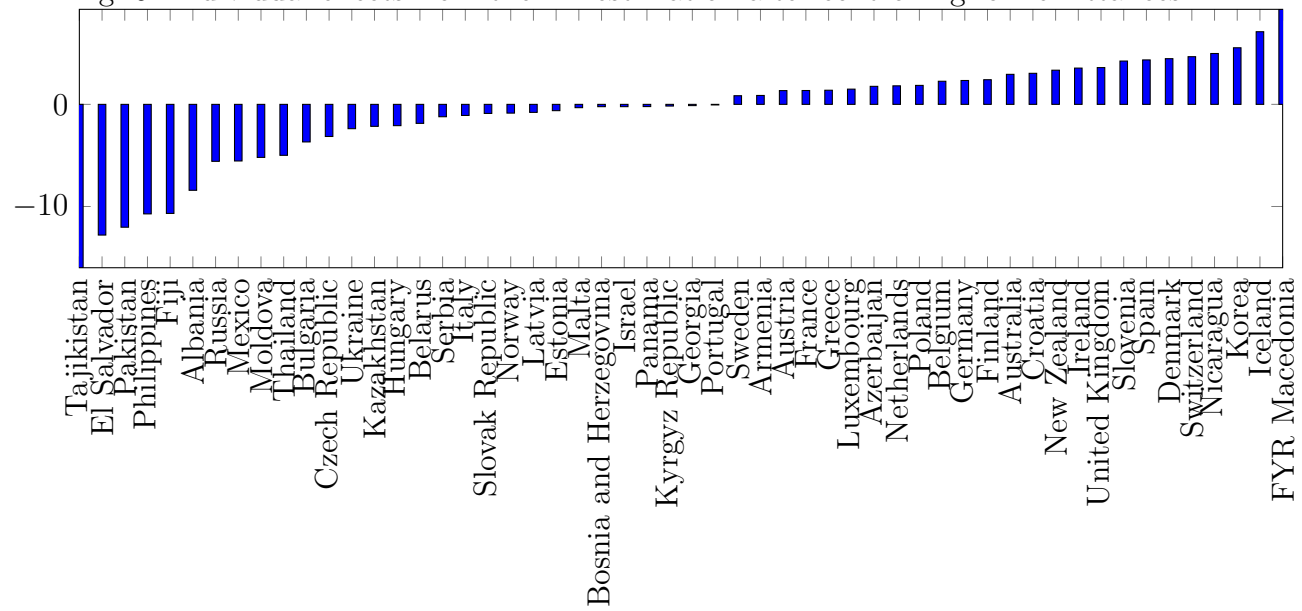


Fig. 6. Individual effects from the FE estimation after controlling for remittances



Appendix B. Dynamic Panel Bias

Consider the simplest autoregressive error component model

$$\begin{gathered} y_{n,t} = \alpha y_{n,t-1} + \epsilon_{n,t},\ n = 1, ...N, t = 1, ...T \\ \epsilon_{n,t} = u_n + w_{n,t},\ |\alpha| < 1 \end{gathered} \tag{7}$$

(u_n, n = 1,...N) are i.i.d. (0,σ_u^2), ($w_{n,t}$, n = 1,...N, t = 1,...T) are i.i.d (0,σ_w^2) and those two sequences of random variables are assumed to be mutually independent.

This model can be rewritten as the sum of three processes"

$$\begin{gathered} y_{n,t} = \alpha^t y_{n,0} + \tfrac{1-\alpha^t}{1-\alpha} u_n + v_{n,t}, \\ v_{n,t} = \alpha v_{n,t-1} + w_{n,t}, \\ v_{n,0} = 0. \end{gathered} \tag{8}$$

The OLS and Within(Fixed Effects) estimator of α is defined as

$$\hat{\alpha}_{OLS} = \frac{\sum_n \sum_t (y_{n,t} - \widehat{y})(y_{n,t-1} - \widehat{y}_{-1})}{\sum_n \sum_t (y_{n,t-1} - \widehat{y}_{-1})^2} = \alpha + \frac{\sum_n \sum_t (\epsilon_{n,t} - \widehat{\epsilon})(y_{n,t-1} - \widehat{y}_{-1})}{\sum_n \sum_t (y_{n,t-1} - \widehat{y}_{-1})^2}$$

$$\hat{\alpha}_{FE} = \frac{\sum_n \sum_t (y_{n,t} - \widehat{y}_n)(y_{n,t-1} - \widehat{y}_{n,-1})}{\sum_n \sum_t (y_{n,t-1} - \widehat{y}_{n,-1})^2} = \alpha + \frac{\sum_n \sum_t (\epsilon_{n,t} - \widehat{\epsilon}_n)(y_{n,t-1} - \widehat{y}_{n,-1})}{\sum_n \sum_t (y_{n,t-1} - \widehat{y}_{n,-1})^2}$$

$$\begin{gathered} \widehat{y} = \tfrac{1}{NT} \textstyle\sum_n \sum_t y_{n,t},\ \widehat{y}_{-1} = \tfrac{1}{NT} \sum_n \sum_t y_{n,t-1} \\ \widehat{y}_i = \tfrac{1}{T} \textstyle\sum_t y_{n,t},\ \widehat{y}_{n,-1} = \tfrac{1}{T} \sum_t y_{n,t-1} \\ \widehat{\epsilon} = \tfrac{1}{NT} \textstyle\sum_n \sum_t \epsilon_{n,t} = \tfrac{1}{NT} \sum_n \sum_t (u_n + w_{n,t}), \\ \widehat{\epsilon}_n = \tfrac{1}{T} \textstyle\sum_t \epsilon_{n,t} = \tfrac{1}{T} \sum_t (u_n + w_{n,t}) \end{gathered} \tag{9}$$

It follows from (8) that $y_{n,t-1}$ is a function of u_n. Therefore $y_{n,t-1}$ is correlated with error term $\epsilon_{n,t}$.This renders the OLS estimator biased and inconsistent. For the fixed effects (FE) estimator, the Within transformation wipes out the u_n ($\epsilon_{n,t} - \widehat{\epsilon}_n = w_{n,t} - \widehat{w}_n$), but ($y_{n,t-1} - \widehat{y}_{n,-1}$) will still be correlated with ($w_{n,t} - \widehat{w}_n$) even if $w_{n,t}$ are not serially correlated. This is because $y_{n,t-1}$ is correlated with $\widehat{w}_n$ by construction. the latter average contains $w_{n,t-1}$ which is obviously correlated with $y_{n,t-1}$.

As demonstrated in Sevestre and Trogonon (1985) the asymptotoic limits of OLS and FE estimators under the assumption that $y_{n,0}$ is correlated with individual effects and resid-

ual effects $Ey_{n,0}^2 = k_1\sigma_u^2 + k_2\sigma_w^2$, $Ey_{n,0}u_n = k_1\sigma_u^2$, where $k_1 = \frac{1}{1-\alpha}$, $k_2 = \frac{1}{\sqrt{1-\alpha^2}}$ tends to respectively

$$\text{plim}_{N,T\to\infty}\,\hat{\alpha}_{OLS} = \text{plim}_{N\to\infty}\,\hat{\alpha}_{OLS} = \alpha + \frac{p(1-\alpha^2)}{2p\alpha-\alpha+1}$$

$$\text{plim}_{N,T\to\infty}\,\hat{\alpha}_{FE} = \alpha \tag{10}$$

$$\text{plim}_{N\to\infty}\,\hat{\alpha}_{FE} = \alpha - \frac{(1-\alpha^2)(T-1-T\alpha+\alpha^T)}{T^2(1-\alpha)^2-T(1-\alpha^2)+2\alpha(1-\alpha^T)}$$

Where $p = \frac{\sigma_u^2}{\sigma_u^2+\sigma_w^2}$. So for OLS estimator the bias does not depend on the sample size and it is clear from (10) that the it overestimates the true coefficient.

When both N and T tend to infinity the within estimator of α is consistent, but when T is fixed and only N tends to infinity the bias of within estimator is negative and is increasing with α. For more detailed derivation of the asyptotic bias see Sevestre and Trognon (1985).

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