

Does the tax undermine the effect of remittances on shadow economy?

Abstract

There are considerable studies regarding the contribution of international migrants' remittances to economic growth while there is lack of studies who investigate the impact of remittance on shadow economy. This study explores empirically, the effect of remittances and its interaction effect with tax on shadow economy by using panel data covering the period 2004-2015 and applying GMM method for 141 countries. The empirical model, in which a remittance-recipient government, operating in tax environment of some regimes (imposition of different levels and kinds of taxes), predicts a negative effect of remittances on shadow economy is mitigated by higher tax regime. In other words, the paper argues that a well-established negative correlation between remittances and shadow economy has been weakened by tax rule. The study contributes to the current literature on public policy that gives importance to know the causes of shadow economy and increase remittances effect. The baseline results are robust to various computations of macroeconomics variables, institutions variables and freedom variables.

Keywords Remittances. Shadow economy. Tax regime. Panel technique

JEL Classification O17. H24. H71. F24

1 Introduction

The shadow economy is a long-lasting problem, from the last few decades, many policy makers and researchers have tried to explore its different aspects because it weakens trust in the tax system, distorts competition, puts consumers and businesses at risk, decreasing the costs of non-compliant businesses compared to their competitors and can lead to the exploitation of workers (OECD, 2017).

Since, its inception there is no clear agreement on definition of shadow economy (Öğünç and Yilmaz, 2000) because it is very diversified, heterogeneous and sophisticated. Keith Hart (1973) who discovered this area of knowledge and is considered the pioneer of this domain of knowledge defines informal sector as an economic sector which goes ahead of official service, big companies and factories. He considers that “informal sector activities are beyond government services.” According to Keith Hart (1973), there are two types of informal activities i.e. illegitimate and legitimate activities. By legitimate activities, he means small scales economic activities who contribute to economic growth, even though at low level, like homemade production, personal services and manual labor. On the other hand, by illegitimate activities he means, the activities whose contribution to economic development are doubtful and which are not essentially criminal activities like pick pocketing, begging, streetwalking and scavenging. A dominant scholar of this area, Schneider (1986), defines the shadow economy as “all economic activities that add value to the economy and which are required to be taken into account in national income of a country but currently are absent from national accounting”.

Remittances and shadow economy are associated in three ways. Firstly, the remittances will become a part of recipient household income which as a result can be saved or may be allocated to spend over goods and services in official economy as well as shadow economy (Combes and Ebeke, 2011). Secondly, the allocation of remittances has been affected by inter-sectoral adjustment costs as Yang (2008) found that positive migrant shocks cause greater human capital accumulation and private enterprise in recipient households. Finally, the association of remittances with shadow economy through Dutch Disease i.e. remittances appreciate recipient country local currency and thus shrink growth of official economy and increase shadow economy (Chatterjee and Turnovsky, 2018).

But in literature, most of the studies have explored different aspects of remittances, to the best of authors' knowledge, there are few studies who have considered the impacts of remittance on shadow economy. Among them are Chatterjee and Turnovsky (2018) who examine the association between shadow economy and remittances for 56 developing countries using general equilibrium approach and found that under some situations, remittances increase shadow economy and inflows of remittance may be driven by productivity shocks in the receiving country. Another related study is Njangang et al. (2018) who investigated remittances and shadow economy nexus in 30 Sub-Saharan African countries and found that remittances increase the size of shadow economy.

1.1 Significance of the paper

This study reconciles two independently investigated areas of development economics. Studied have focused on different aspects of remittances and its contribution to official economy, such as remittances and growth nexus (Gapen et al., 2009; Meyer and Shera, 2017; Acosta et al., 2009; Clemens and McKenzie, 2014; Catrinescu et al., 2009), contribution to financial development (Bettin and Zazzaro, 2012; Aggarwal et al., 2011; Demirguc-Kunt and et al., 2011), role in household expenditure (Adams and Cuecuecha, 2010; Osili, 2004). Alternatively, the studied have focused on different aspects of shadow economy such as measurement of its size (Schneider and Enste, 2000; La Porta and Shleifer, 2014), its determinants (Dell'Anno, 2016; Friedman et al., 2000), its reaction over economic fluctuation (Loayza and Rigolini, 2011; Fernandez and Meza, 2015) and connexion with inequality (Chong and Gradstein, 2007; Ahmed, et al., 2007). But there is no organised investigation which cover the connexion between remittances and shadow economy in spite of their relative scope and possible association.

This paper is going further to add value to the existing literature whereas considering tax regimes while analysing the impact of remittances on shadow economy. As the previous study have covered either combined effect of remittances or segmental effect of remittances. Such as Combes and Ebeke (2011) have studied the impact of remittances on household consumption expenditure while Alcaraz et al. (2012) have explored the relationship between remittances with investment. This study will cover the literature by looking the association of remittances with shadow economy condition on tax. While other researchers have look at remittances association with self-employment and aggregate labour supply (Durdu and Sayan (2010); Posso, 2012; Shapiro and Mandelman, 2016).

This paper is different from the previous work and extends the extant literature on numerous ways. Firstly, two of the existing studies explore linear correlation between the remittances and the shadow economy while this study goes beyond and incorporate the role of tax that can potentially affects their association. Secondly, it contributes to the development policy by considering external factors of shadow economy. Thirdly, this paper has used a large sample of 141 countries and utilised latest date available. Fourthly, this study captures general aspect of shadow economy (Biswas et al., 2012; Bittencourt et al., 2014; Berdiev and Saunoris, 2016) as well as role of institutions in shadow economy (Torgler and Schneider, 2007). Fifthly, this is largest study about shadow economy as it includes large set of cross-sections, interaction and hence can be assumed to be more reliable.

Therefore, in order to fill these gaps, this study attempts to answer the following questions:

- 1) Is there any correlation between remittances and shadow economy?
- 2) Is tax rule interrupt/moderate the linkage between remittances and shadow economy?

The paper follows the following structure. Discussion on remittances and shadow economy are highlighted in the next literature review section 2, in subsequent section 3, theoretical underpinning is discussed. Consequently, in section 4, data, variables, model and results are presented. Finally, section 5 concludes the paper.

2 Literature Review

The literature regarding shadow economy has increased significantly over the periods (see for instance, Torgler and Schneider, 2007, Bittencourt et al., 2014; Capasso and Jappelli, 2013; Blackburn et al. 2012; Berdiev and Saunoris, 2016). The size of shadow economy (% of GDP in 2004/05) in developing countries was 36.7%, in transition countries 38.8% and in OECD countries 14.8% while in term of monetary value the black market is estimated to be USD 10 trillion and if it were to be a country, it would be the second largest economy in the world (Schneider, 2007 and Neuwirth, 2011). On the other hand, many researchers have shown significant motivation and interest regarding international remittances because of the surge in its value and volume. Global remittances have increased at 7% from \$573 billion in 2016 to \$613-billion in 2017 while flow to middle and low-income economies grown at 8.5% from \$429 billion to \$466-billion (world bank, 2018). It should be noted that these statistics only show official remittances flow while the accurate size of remittances, adding shadow channels is significantly larger (World Bank, 2018). Similarly, the cost of remittances significantly affects the belabour of sender, especially poor migrant workers are very sensitive to the remittances costs, thus as a result, migrant workers will shift from official channels to unofficial and shadow channels (world bank,2018). Therefore, sending remittances through these unofficial channels like friends, family members, villagers and particularly ‘hawala’¹ arrangement create big room to study the linkage between remittances and shadow economy.

The flow of remittances is one of the major source of income for many countries. The recipient households either allocate remittances to the consumption of goods and services or saved. In case of consumption, remittances increase the demand for goods and services and thus increase aggregate demand in the overall economy (Ratha, 2003; Ashraf et al., 2015 and Chatterjee and Turnovsky, 2018; Randazzo and Piracha 2018; Giuliano and Ruiz-Arranz, 2009) which rises the gross output of the official economy and as a result shadow economy decreases because an increase in official economy decreases shadow economy (Bajada and Schneider, 2005; Schneider and Enste, 2000; Feld and Schneider, 2010). On the other hand, allocation of remittances for saving lead to increase investment (Orozco and Fedewa, 2006; Chatterjee and Turnovsky, 2018) and make faster the investment multiplier. As a result, the goods and services in the official economy increase and thus creates employment opportunities in official economy (Justino and Shemyakina, 2012; Kim, 2007; Jadotte, 2009). Consequently, workers and businesses switch to official economy and shadow economy decreases (Bajada and Schneider, 2005; Schneider and Enste, 2000; Feld and Schneider, 2010). Similarly, remittances increase the level of education, income, consumption and saving of the recipient households (Ivlevs, 2016; Yang, 2008; Ashraf et al., 2015; Bjuggren et al., 2010) while all these factors keep individuals and businesses to stay and operate in formal economy and enjoy the benefits and facilities of official economy. Basing above arguments that remittances increase the income level of recipient households and thus increase both consumption and saving. Consequently, output and investment in the official economy increase while increasing official economy reduces

¹ Literally means payment or debt transfer, generally it refers to some money that is passed on to a trusted third party for delivery.

shadow economy. Therefore, the negative association between remittances and shadow economy have been predicted.

On the other hand, tax is affecting the labour-leisure trade-off and is eating the leisure time of workers. So, as to maintain labor-leisure at the prior level, they are joining shadow economy. Therefore, tax burden is considered one of the main casual factor of shadow economy and it is empirically established that there is positive association between tax and shadow economy (Schneider, 2005; Hassan and Schneider 2016; Giles and Johnson, 2002; Bitzenis et al, 2016; Tanzi, 1983; Schneider and Enste, 2000; Fleming et al., 2000). Cebula (1997) finds for United States that shadow economy will rise by 1.4% with a 1% increase in marginal federal personal income tax rate. Similarly, Johnson et al. (1998b) and Loayza (1999) explore positive connotation between size of shadow economy and tax burden. It is primarily the tax burden which pushes individuals into the shadow economy, because they are compel to search for other means of income in order to fulfil their livelihoods. In the same way, after paying income tax, individuals are left with lower after disposable income. When disposable income decreases, consequently saving and consumption also decreases. Additionally, the price of goods and services also rise with an increase in tax rate and therefore push individuals towards to shadow economy (Loayza 1999; Schneider 2005). Similarly, it is also worthwhile for the individuals to switch to shadow economy as there is no tax at all while operating in shadow economy.

On the other hand, the size of shadow economy decreases with in an increase in income level (Benjamin et al. 2014). As remittances increase the income level of households (Giuliano and Ruiz-Arranz, 2009; Lim and Basnet, 2017) and having high income will keep the individuals to stay in official economy and start businesses and jobs in official economy. At country level, according to Medina and Schneider (2017), the size of shadow economy in low-income countries is 37.24% and in high-income countries is 29.17% respectively which also signify that having low income means high size of shadow economy.

Consistent with the above discussion that remittances increase while tax decreases the income level of recipient households. Because increase in tax on income will lead to decrease the impact of remittances on income and thus on saving and consumption as portion of income is going to the pay the tax, therefore in order to evade the tax, the receiving household may conceal income and switch shadow economy. Furthermore, the effect of tax not only effect the leisure-labour trade off of recipient households but at the same time reduce their consumption and saving levels. Thus, the tax may undermine the positive impact of remittances on households' income.

To summarize, previous studies have focused either on remittance or shadow economy, very few studies have explored the association between remittances and shadow economy. This study contribute to the existing empirical literature by incorporating the role of tax that can potentially affects remittance and shadow economy association. Similarly, in contrast to available literature which discussed eternal factors of shadow economy, the present study identified external factors of shadow economy. Finally, this is largest study about shadow economy which considered large sample of 141 countries and utilized largest data.

4 Methodology

4.1 Data

This paper uses panel data for 141 countries. The selection of countries is due to the data limitations — the data on shadow economy and remittances are available only for these countries. The data on shadow economy comes from Medina and Schneider (2017) study. They estimated index of shadow economy by using multiple indicators and multiple causes (MIMIC) model which are considered to be the best method to estimate the size of shadow economy as compared to currency demand, electricity consumption and other methods. The data of institutions variables are retrieved from The Heritage Foundation and the remaining variables are collected from the World Bank's World Development Indicators (WDI) database.

4.2 Variables

The selection of variables is based on the robust and established determinants of shadow economy. The influencing factors of shadow economy consist of four segments i.e. tax and social security contribution burden, intensity of regulations, Public sector services and Official economy (Buehn and Schneider, 2012). The study has used (RQ) regulation quality in percentile rank (ranges from 0 (lowest) to 100 (highest) rank), (COC) control of corruption in percentile rank (ranges from 0 (lowest) to 100 (highest) rank), (PS) political stability in percentile rank (ranges from 0 (lowest) to 100 (highest) rank), (VA) voice and accountability in percentile rank (ranges from 0 (lowest) to 100 (highest) rank), (TAXB) tax burden in score (scale of 0 i.e. highest tax (lowest tax freedom) to

100 i.e. lowest tax (highest tax freedom)), (INVF) investment freedom in score (scale of 0 (lowest freedom) to 100 (highest freedom)), (PR) property rights in score (scale of 0 (lowest property rights) to 100 (highest property rights)), (FF) financial freedom in score (scale of 0 (lowest freedom) to 100 (highest freedom)), (GI) government integration in score (scale of 0 (lowest integration) to 100 (highest integration)), (ECOF) economic freedom in score (scale of 0 (lowest freedom) to 100 (highest freedom)), (BF) business freedom in score (scale of 0 (lowest freedom) to 100 (highest freedom)), (GE) general government final consumption expenditure as a % of GDP, (T) trade as a % of GDP, (EDUS) school enrolment secondary as a % of gross), (GCF) gross capital formation in current US\$, (FDI) foreign direct investment as a % of GDP, (POP) population in total counts, (U) unemployment as a % of total labour force, (GDP) gross domestic product growth in annual percentage. (SE) Shadow economy as a % of GDP is dependent variable and (REM) remittances in current US\$ is focal variable. The four segments i.e. tax and social security contribution burden, intensity of regulations, Public sector services and Official economy have been captured by the variables mentioned above. For details refer table 3.

4.3 Model

In order to examine the impact of remittances on shadow economy, the following equation has been established.

$$se_{it} = \alpha + \gamma se_{it-1} + \delta rem_{it} + \chi taxb_{it} + \lambda (taxb_{it} * rem_{it}) + \beta ins_{it} + \theta eco_{it} + \mu_i + \nu_t + \varepsilon_{it} \quad (1)$$

Following Arsić et al. (2015), the following interactive equation has been developed.

$$\frac{\partial(\text{shadow economy})}{\partial(\text{remittances})} = \tau_0 + \tau_1 taxb \quad (2)$$

In the common fashion, if ε_{it} and x_{it} may be correlated then by utilizing instrumental variables estimation, one can get a consistent estimator. The main logic is to find an instrument that is highly correlated with x_t and simultaneously remain independent of ε_{it} . By using instrumental variable, one can overcome the issue of endogeneity i.e. the correlation between ε_{it} and x_{it} . But if there is no correlation between x_{it} and ε_{it} (cor $x_{it}\varepsilon_{it} = 0$) or x_{it} remain uncorrelated with ε_{it} , then x_{it} itself can be used as instrument and in this way all the simple estimators such as OLS are special case of GMM estimation.

The dependent variable is dynamic in nature and have persistence nature where present size of shadow economy has to some extend dependency on pass size. Therefore, instead of static models i.e. OLS, fixed effect (FE) or random effect (RE), the above equation (1) is estimated using GMM estimator proposed by Arellano and Bond (1991). GMM has several advantages over other panel models, firstly, GMM is extensively used to analyse panel data in order to address the issue of endogeneity which is normally appeared in panel data estimation (Blundell and Bond, 1998). Secondly, GMM also address the biasness which arises due to country-specific and time-specific effects. Finally, GMM estimator also circumvents reverse causality or simultaneity issues. But GMM estimator also required to uphold two conditions. Firstly, the residual term (ε_{it}) does not show serial correlation AR (2). Secondly, validity of the instruments i.e. the instruments created to overcome the issue of endogeneity must be valid which is tested by Hansen and Sargan tests (the high p-values of Hansen and Sargan tests for instrument validity indicate valid instruments). The standard errors are computed using the Windmeijer (2005) finite-sample correction. The Hansen test of the overidentifying restrictions and the Arellano and Bond (1991) test to control for serial correlation in the residuals confirm the validity of instruments.

In the above equation (2), the influence of remittances on shadow economy is a function of the tax which is showed by the coefficient (τ_1). In equation (1), the se_{it} is measure of size of shadow economy, rem_{it} denotes focal variable remittances, $taxb_{it}$ represents tax burden, $taxb_{it} * rem_{it}$ denotes interactive term i.e. the impact of remittances on shadow economy as a function of tax. ins_{it} is a measure of institutional variables which have close association with shadow economy, for instance, tax burden, regulation quality, business freedom, monetary freedom control of corruption etc. and eco_{it} includes all other macro-economic variables such as GDP, government spending, inflation etc. Similarly, $\gamma, \delta, \chi, \beta, \lambda$ and θ are parameters to be estimated inside the model. The paper includes a one-period lag se_{it-1} of the dependent variable as a right-hand side variable to control for possible persistency in the size of shadow economy and to cover the possibility that the size of shadow economy may remain smooth over time. ν_t refers to common unobserved shocks (period-fixed effect) and is approximated by time dummy variables. μ_i states country-fixed effect and is approximated by country dummy variables, that is inclusion of period fixed-effects (ν_t) is to control for any unobserved time-variant effects and country fixed-effects (μ_i) is to control for omitted time-invariant country characteristics. Where i and t denote country and time

respectively and the error term ε_{it} contains all other unobserved time-varying and country-varying sources of variation in the size of shadow economy which are not included in the model. As mentioned, dynamic specification with the included lagged dependent (se_{it-1}) variable as regressor, least squares estimation methods (OLS) provide biased and inconsistent results (Nickel, 1981; Köster and Pelster 2017). Additionally, other factors could also affect size of shadow economy, but these factors are tough to quantify and thus not considered in the model. This unobserved heterogeneity across countries and times induce biased coefficients too.

To handle these issues, this research utilizes the GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998). GMM controls for persistence of the dependent variable, endogeneity and unobserved heterogeneity. GMM estimator address these issues by employing lagged values of the se_{it-1} in levels and in differences as well as lagged values of other independent variables that are probably considered to cause endogeneity. Instruments validity is tested by Hansen test and Sargan test of overidentification restrictions while Arellano and Bond (1991) test of AR (1) and AR (2) are employed for serially uncorrelated residuals. Windmeijer (2005) finite-sample correction is employed for standard errors computation. Realizing the issue of too many instruments, the study maintains the criteria of having number of instruments less than number of groups. The study also considers where needed to collapse the instruments in order to avoid possible instrument proliferation and to limit the number of lags of the endogenous variables (Roodman, 2009).

4.4. Results and Discussion

The focus of this empirical analysis is to estimate the impact of remittances on shadow economy and then see the conditional effect i.e. as a function of the tax on the shadow economy. The first column in Tables 1 and 2 present the baseline regression while the other models are extensions of this basic specification. Taking into consideration the following Tables 1 and 2, the selection of dynamic model has been justified as lagged dependent variable is highly significant across all specifications. The significant of AR (1) and insignificant of AR (2) as well as insignificant of Sargan statistics show that diagnostic tests are passed. Similarly, Sargan and AR (2) probability values endorse that restrictions of over-identifying are right while in second order the errors become auto-correlated.

Firstly, starting for linear relationship between remittances and shadow economy, Tables 1 and 2 (baseline model (1)) shows that an increase in remittances reduce shadow economy. One possible justification for this result is that increase in remittances lead to increase supply of money in the economy, so the aggregate economy's response is expansionary, as a result private capital and output increasing in official sectors of the economy (Chatterjee and Turnovsky, 2018). Remittances increase aggregate demand by increasing disposable income of the receipt households, such excessive demand lead to increase goods and services and thus overall output which compel businesses to move from informal sector to official economy as a result shadow economy decreases. This result is also in line with dualist school of thought who believe that shadow economy is the consequence of downfall in the economic growth and development whereby economy fails to accommodate all labor force (ILO, 1972). On the other hand, if official economy grows these labor force return back to benefit from official economy and thus shadow economy declines. This negative impact can also be justified from the perspective and disposable income. As flow of remittances become a part of receipt family deposable income while disposable income consists of saving and consumption.

$$Y_{it} = C_{it} + S_{it} \quad (3)$$

So, the part of income goes on consumption are the remaining add to saving. The distribution of income between saving and consumption depend upon marginal propensity to consume (MPC)² and marginal propensity to save (MPS)³. In case of increase in consumption, aggregate demand in the economy will increase which result an increase in official economy output and businesses as well as entrepreneurs would move to official sector. On the other hand, in case of increase in saving will increase investment as investment is a function of saving.

$$S_{it} = I_{it} \quad (4)$$

² The marginal propensity to consume (MPC) is the fraction of a change in disposable income that is consumed. For example, if \$100 of remittances are added to disposable income, and \$65 of that \$100 is consumed, the MPC is 65%.

³ The marginal propensity to save (MPS) is the fraction of a change in disposable income that is saved. For example, if \$100 of remittances are added to disposable income, and \$35 of that \$100 is saved, the MPS is 35%.

The above equation demonstrates that the total amount of saving in the economy is equal to the total amount being invested as an increase investment⁴ leads to the accumulation of capital which as a result leads to increase official economy growth (Vaaler, 2018). There is a lot of empirical literature where increase in official economic growth leads to reduce shadow economy for instance (Medina and Schneider, 2017 and Arsić⁵ et al. 2015). Finally, it is concluded that tax undermine the effect of remittances on shadow economy.

The results of interaction effects in Table 1 and 2, different specifications (as reported in columns 1 to 8) indicate that each specification is positively significant which indicates that the impact of remittances to reduce shadow economy is mitigated by the tax. The coefficients of the interaction between remittances and shadow economy can be explained with the help of below equation. For example, in model (1) in table 1 provides:

$$\frac{\partial(\text{shadow economy})}{\partial(\text{remittances})} = -9.6637 + 0.1269\text{tax}_{it} \quad (5)$$

By estimating equation (5) at the average value of remittances, the findings suggest that the impact of remittances on shadow economy are weakened in a higher tax regime. This findings supports the view of legalist school who proposes that shadow economy is a response to over-regulations. According to de Soto (1989), with the intention of evading business registration costs, businesses move to shadow economy. It is almost impossible for the micro, small and medium enterprises to follow the complicated regulations and bureaucratic procedures and taxation of government. Therefore, in order to avoid such regulations, taxation and procedures, these firms operate in the shadow economy.

The marginal effects state the probable change in shadow economy for a unit change in remittances. In other words, as the tax burden decreases i.e. (32 towards 97 rank) (close to 0 high tax and close to 100 low tax), the impact of remittance in reducing shadow economy increases. That is to say that high tax regime can adversely affects the otherwise negative impact of remittances on shadow economy. Putting conversely, the partial effect of remittances on shadow economy is decreasing with high tax regime.

The study finds the coefficient of interactive term i.e. rem_taxb (Remittances*Tax burden) significant and positive. It indicates that the impact of remittances on shadow economy is undermined by tax. The coefficient of rem_taxb can be calculated for example for the economy of Austria and for the year 2004, as $-9.6637+0.1269(43.5) = -4.14$. This interactive coefficient (-4.14) indicates that the impact of remittances on shadow economy is even though still negative but is much less compared to without interactive term (-9.6637). This result accomplish that tax undermine the negative impact of remittances on shadow economy.

⁴ Woodruff and Zenteno (2007) and Yang (2008) present empirical evidence that migration and remittances increase both self-employment and investment through the expansion of microenterprises.

⁵ Low productivity, coupled with other factors, causes a vicious circle in which low productivity makes business entities turn to the informal sector, which, as a rule, decreases productivity further. In these circumstances, the business model of many companies means they can be profitable (or, indeed, even survive) only if they fail to comply with their tax obligations, either wholly or in part.

Table 1 Remittances and its interaction with tax and shadow economy

SE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L.SE	0.6776*** [0.060]	0.6732*** [0.057]	0.4368*** [0.070]	0.5365*** [0.116]	0.4551*** [0.072]	0.4439*** [0.072]	0.3886*** [0.069]	0.3715*** [0.073]	0.6642*** [0.080]
LREM	-9.6637*** [3.210]	-7.4296*** [2.828]	-9.6732** [4.030]	-6.9149** [2.868]	-11.7619*** [4.462]	-11.1251*** [3.911]	-9.4724** [4.636]	-9.7783* [5.036]	-6.3282** [2.426]
T	-0.0423*** [0.010]	-0.0322*** [0.008]	-0.0440*** [0.016]	-0.0569* [0.030]	-0.0641*** [0.018]	-0.0615*** [0.016]	-0.0487*** [0.015]	-0.0474*** [0.015]	-0.0367** [0.016]
TAXB	-2.6003*** [0.840]	-2.0651*** [0.776]	-2.4120** [1.042]	-1.5165** [0.755]	-2.9386** [1.182]	-2.7745*** [1.040]	-2.4047* [1.232]	-2.4504* [1.361]	-1.5084** [0.661]
GDP	-0.2187*** [0.033]	-0.2210*** [0.033]	-0.1389*** [0.028]	-0.1279* [0.075]	-0.1314*** [0.030]	-0.1309*** [0.028]	-0.1321*** [0.027]	-0.1337*** [0.027]	-0.1827*** [0.058]
GE	0.3072*** [0.068]	0.2955*** [0.066]	0.3746*** [0.070]	0.4544** [0.176]	0.3735*** [0.075]	0.3631*** [0.075]	0.3739*** [0.067]	0.3615*** [0.066]	0.4634*** [0.153]
REM_TAXB	0.1269*** [0.041]	0.0998*** [0.037]	0.1194** [0.050]	0.0795** [0.036]	0.1487** [0.057]	0.1399*** [0.050]	0.1199** [0.060]	0.1245* [0.066]	0.0788** [0.032]
FF	-0.0052 [0.013]		-0.0231 [0.017]						-0.0597* [0.031]
GCF	-0.0000* [0.000]	-0.0000** [0.000]	-0.0000*** [0.000]						
EDU	-0.0537** [0.025]	-0.0571** [0.023]							
RQ		-0.0486*** [0.017]							
FDI		-0.0050*** [0.002]							
LPOP			1.4944 [1.060]	1.4198* [0.773]					
BF				-0.0461* [0.026]	-0.0243 [0.017]				
U					0.0413 [0.061]	0.0547 [0.058]	0.1112 [0.068]	0.1090 [0.069]	-0.0658 [0.092]
PR							-0.1091** [0.050]		
ECOF								-0.2008*** [0.067]	
Constant	211.7857*** [66.599]	169.4630*** [59.174]	187.7416** [80.518]	124.6381** [56.492]	250.1513*** [91.922]	235.5935*** [81.189]	211.4282** [95.167]	221.6637*** [102.722]	131.8402*** [50.041]
Observations	1119	1119	1414	1425	1414	1414	1414	1414	1414
Instruments	48	53	48	51	75	75	51	43	67
Groups	127	127	132	133	132	132	132	132	132
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

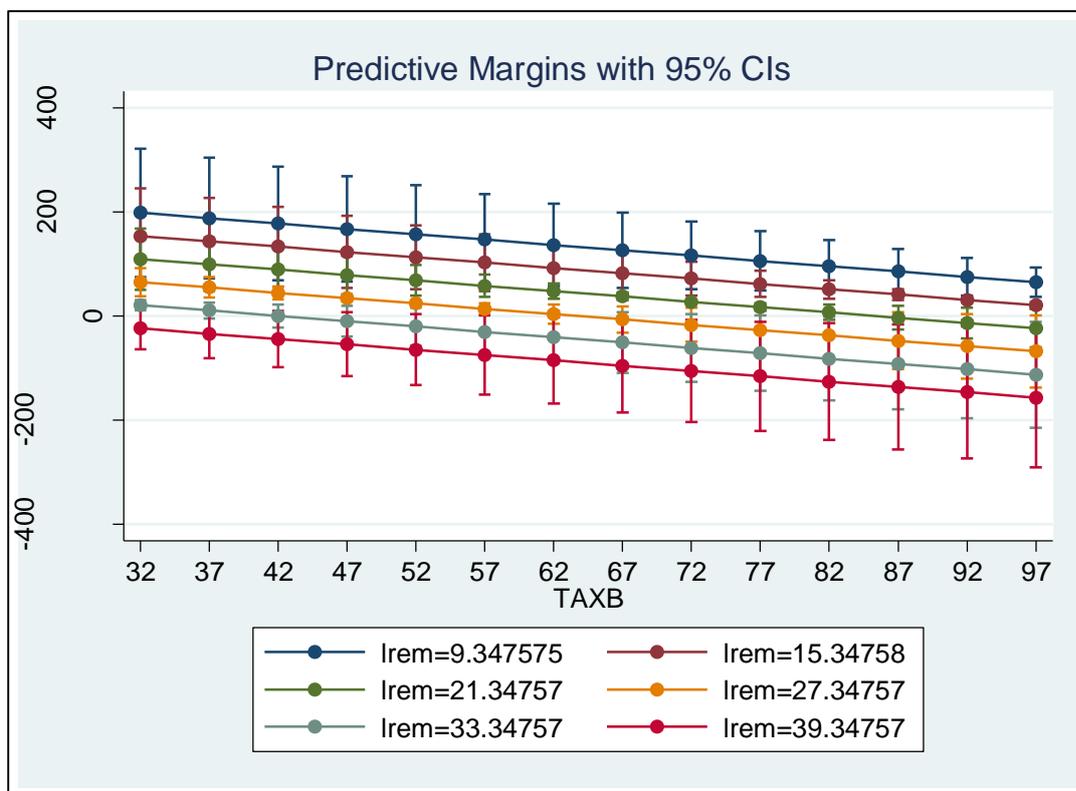
AR(2)	0.4010	0.5054	0.6013	0.6904	0.6177	0.6123	0.5606	0.6988	0.9872
Sargan(p-Val)	0.1324	0.2234	0.8512	0.9907	0.9958	0.9940	0.9347	0.7309	0.7999
F-Stats	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 2 Remittances and its interaction with tax and shadow economy

SE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
L.SE	0.3870*** [0.076]	0.5687*** [0.124]	0.3997*** [0.067]	0.4018*** [0.090]	0.3698*** [0.083]	0.4081*** [0.072]	0.5687*** [0.124]	0.6732*** [0.057]	0.6755*** [0.058]
LREM	-10.9525** [4.514]	-8.0235** [3.971]	-8.8721* [4.529]	-11.6680** [4.601]	-9.9012** [3.846]	-9.3624* [5.607]	-8.0235** [3.971]	-7.4296*** [2.828]	-7.3924*** [2.766]
T	-0.0477*** [0.014]	-0.0207 [0.024]	-0.0465*** [0.013]	-0.0559*** [0.017]	-0.0532*** [0.016]	-0.0474*** [0.015]	-0.0207 [0.024]	-0.0322*** [0.008]	-0.0334*** [0.009]
TAXB	-2.8278** [1.195]	-1.8969* [1.081]	-2.2998* [1.211]	-2.9479** [1.226]	-2.4425** [1.007]	-2.3866 [1.491]	-1.8969* [1.081]	-2.0651*** [0.776]	-2.0490*** [0.751]
GDP	-0.1250*** [0.027]	-0.1957** [0.076]	-0.1317*** [0.026]	-0.1242*** [0.030]	-0.1235*** [0.028]	-0.1255*** [0.027]	-0.1957** [0.076]	-0.2210*** [0.033]	-0.2253*** [0.033]
GE	0.3828*** [0.064]	0.3306* [0.189]	0.3809*** [0.068]	0.4135*** [0.072]	0.4340*** [0.078]	0.3617** [0.068]	0.3306* [0.189]	0.2955*** [0.066]	0.2915*** [0.070]
REM_TAXB	0.1397** [0.057]	0.0949* [0.053]	0.1133* [0.058]	0.1494** [0.059]	0.1235** [0.049]	0.1197* [0.072]	0.0949* [0.053]	0.0998*** [0.037]	0.0989*** [0.036]
GCF								-0.0000** [0.000]	-0.0000** [0.000]
EDU								-0.0571** [0.023]	-0.0543** [0.025]
RQ						-0.0735*** [0.028]		-0.0486*** [0.017]	-0.0496*** [0.016]
FDI								-0.0050*** [0.002]	
U	0.1167** [0.058]	-0.1230 [0.135]	0.0910* [0.054]	0.1074 [0.068]	0.1028* [0.060]	0.0835 [0.060]	-0.1230 [0.135]		
COC	-0.0776*** [0.023]								
PS		-0.0949*** [0.030]					-0.0949*** [0.030]		
VA			-0.0926** [0.036]						
INVF				-0.0451** [0.018]					
GI					-0.0894*** [0.027]				
Constant	241.2828** [94.152]	176.2452** [80.315]	199.9922** [93.059]	248.7835** [95.447]	216.1197*** [80.050]	206.4435* [116.033]	176.2452** [80.315]	169.4630*** [59.174]	168.7440*** [57.591]
Observations	1414	1414	1414	1414	1414	1414	1414	1119	1119

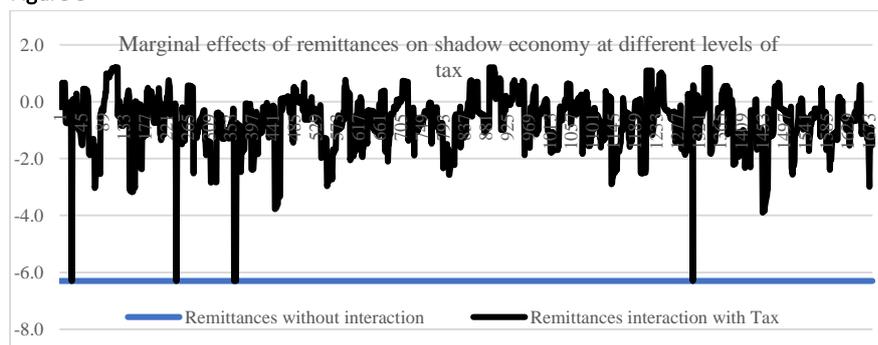
Instruments	51	35	51	59	67	43	35	53	48
Groups	132	132	132	132	132	132	132	127	127
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.5154	0.9495	0.7566	0.3646	0.8175	0.7988	0.9495	0.5054	0.4657
Sargan (p-Val)	0.8654	0.4514	0.9060	0.3791	0.4889	0.4130	0.4514	0.2234	0.1082
F-Stats	0.0000	0.0000		0.0000			0.0000	0.0000	0.0000

Figure 2: Margins effects of remittances on shadow economy at different tax levels



The above figure 2 depicts the impact of remittances on shadow economy condition on tax. As it is mentioned in variables section that the tax burden score has a scale from 0 i.e. highest tax (lowest tax freedom) to 100 i.e. lowest tax (highest tax freedom). So, at 32 level of tax, the impact of remittances (39.34757) on shadow economy is close to 0, as the level of tax decreases and tax freedom increases the impact of remittances also increases. For example, at 97 level of tax, the impact of remittance (39.34757) on shadow economy is close to -200. Therefore, it can be said that as the country gets tax freedom or level of tax is getting lower (moving from 32 to 97), the impact of remittances on shadow economy become stronger (moving away from 0 toward higher negative values -200). It should also be noted that the movement towards negative values shows that remittances reduces shadow economy.

Figure 3



Both of the above figures shadow that without interacting remittances with tax, the impact on shadow economy is around -0.6 while after interaction with tax, the impact of remittances is playing around -0.03.

Table 3 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
se	1,679	29.8	12.1	8.0	69.1
l.se	1,539	30.0	12.2	8.0	69.1
lrem	1,572	20.4	2.1	9.3	25.0
t	1,677	91.5	56.7	21.1	442.6
taxb	1,670	75.2	12.6	32.0	99.9
gdp	1,678	4.0	4.5	-36.7	38.0
ge	1,665	15.4	4.9	2.0	31.6
rem_taxb	1,565	1524.3	283.4	655.3	2124.1
ff	1,670	53.3	18.6	10.0	90.0
edus	1,287	81.9	28.9	8.8	163.9
rq	1,680	52.9	27.7	0.5	100.0
fdi	1,679	6.4	20.5	-58.3	451.7
lpop	1,680	16.2	1.6	12.5	21.0
bf	1,670	65.4	16.2	23.4	100.0
u	1,668	8.1	5.3	0.1	37.6
pr	1,670	46.6	24.4	0.0	95.0
ecof	1,670	61.3	10.1	21.4	90.1
u	1,668	8.1	5.3	0.1	37.6
coc	1,680	49.0	29.5	0.0	100.0
ps	1,680	45.7	27.5	0.5	100.0
va	1,680	49.8	28.6	1.9	100.0
invf	1,670	54.2	20.7	0.0	95.0
gi	1,670	41.7	22.2	0.0	97.0

5. Conclusion

By embedding interaction of tax, to the remittances, shadow economy nexus in a dynamic GMM models, this study links two crucial dots in development economics. In case of shadow economy, studies have concentrated primarily on causes, determinants, size and measurement of shadow economy without counting external transfer which is one of the important determining factor of shadow economy whereas in case of remittances, researcher have focused primarily on remittances association with official economy and ignoring their linkage with shadow economy. This paper is an attempt to incorporate not only external transfer into the shadow economy model but also at the same time examines interaction of tax which significantly effects these association. Firstly, the research study finds negative association between remittances and shadow economy. Secondly, the paper findings also predicts negative and significant effect of remittances on shadow economy is mitigated by higher tax regime.

This study is the first of its nature to see the association between remittances and shadow economy in a more truthful way characterized by the presence of the tax. There is a close association between remittances and shadow economy because flow of remittances on one hand increase the recipient household disposable income and thus transformed to the growth of official economy in terms of channelling thorough consumption and saving ($S=I$) while on the other hand, remittances proved to be expansionary and accordingly increase output of formal and informal economies, while the presence of high tax may mitigate both likelihoods and transformed more resources to shadow economy. The results show that higher size of shadow economy and remittances ineffective are likely to occur in an economy having high tax level.

The empirical study is supporting the above-mentioned prediction by using panel data covering 141 countries over the period 2004-2015. The novelty of the study is the finding that remittances and tax not only along effects shadow economy but there is an interaction effect between both variables i.e. remittances and tax. The estimation of marginal effects of remittances on shadow economy at progressively higher values of tax

discloses a mitigated effect of remittances on shadow economy. A large tax give space to businesses and entrepreneurs to shift shadow economy even though if the same amount of remittances is adding to disposable income. Therefore, in order to make the flow of remittances more impactful, the policy makers need to consider tax policy because flow of remittances will become only fruitful and will be used in official economy if there is a small tax. By support legalist school of thought view with this empirical investigation, the study suggests reduction in taxes to increase the economy of scale of remittances.

Table 3 Description of variables

Sign	Variables	Indicator Name	Source
SE	Shadow Economy	Percentage Of GDP	Medina and Schneider (2017)
REM	Remittances	Personal Remittances, Received (Current US\$)	World Development Indicators
T	Trade	Trade (% Of GDP)	World Development Indicators
GDP	GDP	GDP Growth (Annual %)	World Development Indicators
GE	Government Expenditure	General Government Final Consumption Expenditure (% Of GDP)	World Development Indicators
Rem_Taxb	Remittances*Tax Burden	Interaction of Remittances with Tax Burden	Self-created
GCF	Gross Capital Formation	Percentage Of GDP	World Development Indicators
Edu	Education	School Enrolment, Secondary (% Gross)	World Development Indicators
Pop	Population	Population, Total	World Development Indicators
U	Unemployment	Unemployment, Total (% Of Total Labour Force)	World Development Indicators
FDI	FDI	Foreign Direct Investment, Net Inflows (% Of GDP)	World Development Indicators
Freedom Variables			
TAXB	Tax Burden	Score (Scale Of 0 i.e. Highest Tax (Lowest Tax Freedom) To 100 i.e. Lowest Tax (Highest Tax Freedom))	The Heritage Foundation
BF	Business Freedom	Score (Scale Of 0 (Lowest Freedom) To 100 (Highest Freedom))	The Heritage Foundation
FF	Financial Freedom	Score (Scale Of 0 (Lowest Freedom) To 100 (Highest Freedom))	The Heritage Foundation
INVF	Investment Freedom	Score (Scale Of 0 (Lowest Freedom) To 100 (Highest Freedom))	The Heritage Foundation
ECOF	Economic Freedom	Score (Scale Of 0 (Lowest Freedom) To 100 (Highest Freedom))	The Heritage Foundation
PR	Property Rights	Scale Of 0 (Lowest Property Rights) To 100 (Highest Property Rights)	The Heritage Foundation
GI	Government Integration	Score (Scale Of 0 (Lowest Integration) To 100 (Highest Integration))	The Heritage Foundation
Governance Variables			
COC	Control of Corruption	Percentile Rank (Ranges From 0 (Lowest) To 100 (Highest))	World Governance Indicators
PS	Political Stability	Percentile Rank (Ranges From 0 (Lowest) To 100 (Highest))	World Governance Indicators
VA	Voice and Accountability	Percentile Rank (Ranges From 0 (Lowest) To 100 (Highest))	World Governance Indicators
RQ	Regulation Quality	Percentile Rank (Ranges From 0 (Lowest) To 100 (Highest))	World Governance Indicators

Table 4 Country list

Albania	Chad	Greece	Lebanon	Peru	Turkey
Algeria	Chile	Guatemala	Lithuania	Philippines	Uganda
Angola	China	Guinea	Luxembourg	Poland	Ukraine
Argentina	Colombia	Guinea-Bissau	Madagascar	Portugal	United Kingdom
Armenia	Congo, Dem. Rep.	Guyana	Malawi	Romania	United States
Australia	Congo, Rep.	Haiti	Malaysia	Russian Federation	Uruguay
Austria	Costa Rica	Honduras	Mali	Rwanda	Venezuela
Azerbaijan	Cote d'Ivoire	Hong Kong	Malta	Saudi Arabia	Vietnam
Bahamas	Croatia	Hungary	Mauritania	Senegal	Yemen, Rep.
Bahrain	Cyprus	Iceland	Mauritius	Sierra Leone	Zambia
Bangladesh	Czech Republic	India	Mexico	Singapore	Zimbabwe
Belarus	Denmark	Indonesia	Moldova	Slovak Republic	
Belgium	Dominican Republic	Iran	Mongolia	Slovenia	
Belize	Ecuador	Ireland	Morocco	South Africa	
Benin	Egypt	Israel	Mozambique	Spain	
Bolivia	El Salvador	Italy	Namibia	Sri Lanka	
Botswana	Equatorial Guinea	Jamaica	Nepal	Suriname	
Brazil	Estonia	Japan	Netherlands	Swaziland	
Bulgaria	Fiji	Jordan	New Zealand	Sweden	
Burkina Faso	Finland	Kazakhstan	Nicaragua	Switzerland	
Burundi	France	Kenya	Niger	Tajikistan	
Cabo Verde	Gabon	Korea, Rep.	Nigeria	Tanzania	
Cambodia	Gambia	Kuwait	Norway	Thailand	
Cameroon	Georgia	Kyrgyzstan	Oman	Togo	
Canada	Germany	Lao PDR	Pakistan	Trinidad and Tobago	
Central African Republic	Ghana	Latvia	Paraguay	Tunisia	

Compliance with ethical standards

Conflict of interest

The authors declared that they have no conflict of interests.

Ethical approval

This article does not contain any studies performed by any of the authors with human participants or animals.

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