# The impact of migration and remittances on labor supply in Tajikistan

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## Abstract

This paper examines the labor supply effects of migration and remittances in Tajikistan – a major labor migrant sending and remittance dependent country in Central Asia. We contribute to the literature by effectively addressing the common methodological issues that result in biased estimates in analyses of migration and remittances. Our empirical work accounts for the endogeneity of migration and remittances with respect to the labor supply decisions of household members left home, and for self-selection of migrants and remittance senders through the application of a control function approach. The second contribution of the paper is that we apply our empirical model to unique high-frequency household panel data that further helps to remedy methodological problems present in cross-sectional studies. The findings suggest that having a migrant member and receiving remittances increase reservation wages of the household members left home, and thereby reducing their labor supply participation and economic activity rates.

**Key words:** Migration, remittances, labor market participation, economic activity rate, endogenous switching, Tajikistan

## 1. Introduction

Tajikistan has been experiencing unprecedented out-migration since its independence in 1991. In the early years of its independence, migration was mostly driven by cultural and ethnic motivations triggered by the collapse of the Soviet Union and the consequent civil war. More recently, however, migration is being driven by economic reasons – seeking better job opportunities abroad and improving earning potentials. With productivity growth and job creation not catching up with rapid population growth, only about a half of the total working-age population is registered employed in Tajikistan in 2017 (World Bank, 2017). The lack of job opportunities at home drives many Tajiks seek out employment abroad, with a popular destination being Russia due to its past historical and cultural connections. A recent nationally representative household survey conducted by the World Bank and the German Federal Enterprise for International Cooperation (GIZ) (2013) shows that almost 40% of households

have at least one member migrated abroad to work. Of which, about 90% go to Russia.

The contribution of labor migrants to the Tajikistan economy is enormous. Remittances received from labor migrants have constituted 30-50% of the country's GDP since 2006 (World Bank, 2017). Indeed, Tajikistan is one of the most remittance-dependent country with the share of remittances in GDP ranking among the highest in the world. The remittance flows provide the most important source of external funds in the country, surpassing the foreign direct investment and official development assistance flows by more than 10 times. At the macro level, the remittances sent by labor migrants substantially contribute to GDP growth and poverty reduction, while creating an excess dependency on the economies of remittance source countries. Most research of migration and remittances in Tajikistan focus on their impacts on economic growth and poverty reduction at the macro level. However, understanding how these large migrant and remittance flows affect migrants' origin households and their economic behaviors is important to reduce Tajikistan's excessive dependency on remittances and exposures to external turbulences.

Migration and remittances can have various potential impacts on the left-behind household members' labor market decisions (Démurger 2015). First, migration through remittances could increase the reservation wage of non-migrant household members and thereby reduce their labor supply. Second, remittances may lift the liquidity constraint faced by migrant households and create more opportunities for non-migrant household members in productive entrepreneurship activities. Third, a loss of income contribution of a migrant household member in the short-run could lead to non-migrant member who was previously not engaged in paid employment seek employment to replace the lost income.

The interest on labor market participation in general lies on its bearing on long-term economic growth. With migration and remittances figuring substantially in the development discourse in Tajikistan, the need to determine whether migration and remittances have a positive, or detrimental, impact on long-term economic growth becomes more urgent. The labor supply effect of migration and remittances is particularly important for countries like Tajikistan. Global evidences are not conclusive on whether international migration and remittances affect the labor supply of the left-behinds positively or negatively. With international migration becoming a familiar and sometimes preferred occupational choice for many Tajiks, the reservation wage effect can be detrimental to the nation's growth potential in the long-run, through the slowed development of domestic labor market and lower human capital accumulation. This negative effect of migration and remittances has become a concern for policy makers who try to enhance domestic job opportunities. Job creation remains to be a daunting task, as found out by one of the authors of this paper after interviewing some high officials at the Tajikistan's Ministry of Labor. Domestic jobs continue to be unattractive as wages remain low. With migration to Russia as a familiar occupational option, and as an option which provides better wages, people are not willing to work at the wage level the Ministry can

provide.

Past empirical studies on Tajikistan are limited, with most of them suggesting that the reservation wage effect discourages families of migrants to work. For example, Abdulloev (2013) finds that satisfaction regarding jobs offered in Tajikistan is significantly lower for families who have international migrants. Using the Tajikistan Living Standards Survey (TLSS) conducted in 2003, Justino and Shemyakina (2012) find a negative effect on household labor supply. However, these studies used cross-sectional data which are not ideal when dealing with the issue of endogeneity of migration and remittances. Furthermore, these studies used data collected in early 2000s and may not be able to capture the situation after Russia's economic decline in 2014 and the resulting stricter regulations on immigrants implemented in 2015.

Therefore, the objective of this paper is to contribute to the scarce empirical literature on the impact of migration on non-migrants' labor supply in Tajikistan. The contribution of the paper is twofold. First, we analyze the latest and unique data collected through the ongoing "Listening to Tajikistan (L2TJK)" project that is being conducted by the World Bank. Employing the Telephone Assisted Personal Interview (TAPI) technique, the L2TJK, collects socio-economic data of 800 households every two weeks. As of November 2017, the project has collected 32 rounds of high frequency panel data. At each round, the data show that more than 30 percent of households have at least one migrant member on average. Since the interviews are conducted frequently, the data allow us to detect the instantaneous responses of households to various shocks without severe recall errors. To the best of our knowledge, there has been no study which uses high frequency panel data similar to the L2TJK on this topic. Second, our empirical strategy addresses common methodological issues – endogeneity and selection bias – present in studies of migration and remittances, by applying a control function approach based on Murtazashvili and Wooldridge (2016). Estimating the impact of remittances and migration on the labor market participation of household members left behind needs to consider the possibility of endogeneity, simultaneity, and self-selection. Decisions on international migration, remittances, and domestic labor market participation are likely to be made simultaneously or causing each other. Moreover, migrants are remitters are not randomly selected sample population, but individuals who self-select into the activities. The advantage of Murtazashvili and Wooldridge (2016) approach is that not only does it correct for the selection bias, it also is less restrictive and less computationally expensive compared to competing models.

Our results show a large reservation wage effect. On average, if a household sends a migrant, or receives remittances, the labor market participation rate of the left-behind declines by 8 and 11 percentage points respectively. This is higher than the estimates by Justino and Shemyakina (2012) in the similar definition, whose number ranges from 5 to 8 percent. The results can be alarming, if the goal is to reduce dependency on migration.
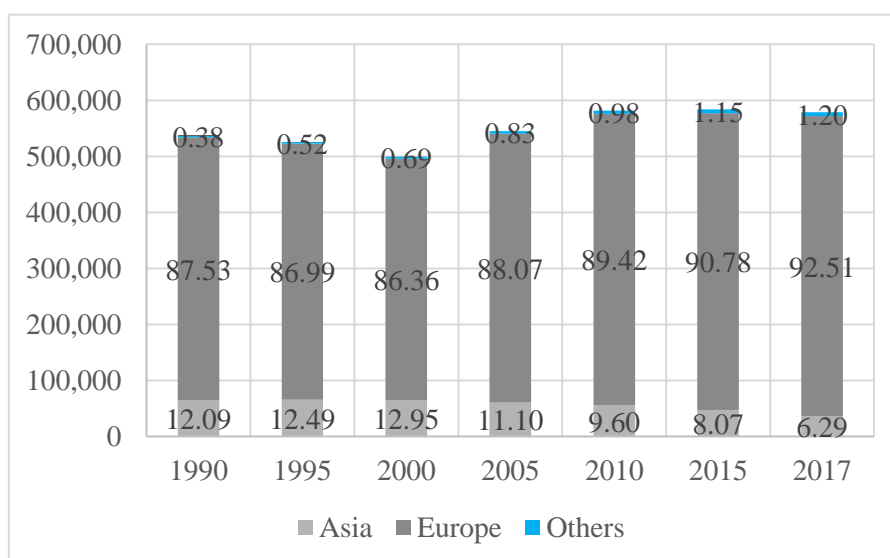
The rest of the paper is organized as follows: Section 2 discusses recent patterns of migration, remittances, and labor market in Tajikistan. Section 3 reviews the related literature on the impacts of remittances on labor supply. Sections 4 and 5 describe methodology and data employed in the analysis. Section 6 presents and discusses results. Section 7 concludes. Additionally, we perform a robustness check analysis in the appendix.

## 2. Migration, remittances, and domestic labor market patterns in Tajikistan

In the neoclassical theory of migration, the reasons why people migrate are often categorized into push and pull factors that are related to the economic context of the flow of labor (Kurekova 2011). These factors pertain to the relational drivers of migration, both from the migrant-sending country perspective (push), and from the migrant-receiving country (pull). Both push and pull factors coincide to make Tajikistan one of the biggest exporters of labor in the region. High wage differentials between Tajikistan and Russia as well as other destination countries are often cited as major pull factors, while a shortage of job creation relative to the population growth and low wages are considered as main push factors.

Figure 1 shows the distribution of migrant Tajiks in different parts of the world. Data from the United Nations Population Division, Department of Economic and Social Affairs (UN DESA, 2017) shows that Europe hosts the most number of Tajiks with about 92.51 percent of the migrant Tajik population in Europe in 2017, a considerable increase from 87.53 percent in 1990. Most of these migrants are in Russia, majority of whom are involved in itinerant jobs in Russia from spring to fall, often in construction industries (Erlich 2006). In 2013, the World Bank and GIZ note that about 40 percent of households have at least one migrant member.

**Figure 1. Stock of migrant Tajiks in the world by continent, 1990-2017 (in thousands)**
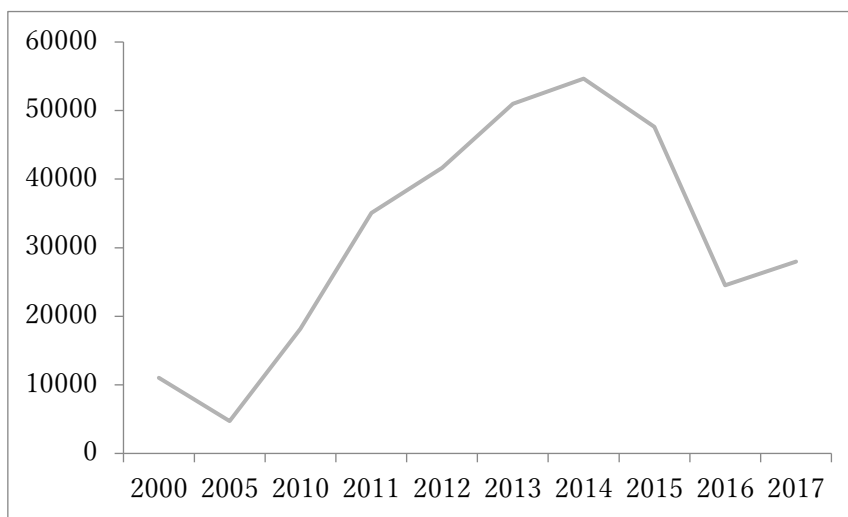


Source: UN DESA 2017

The growth of migrant workers show a consistent number of the Tajik population engaged in migratory flows. By 1999, according to the TLSS, about 1.5 percent of households had migrant workers. This grew to 5 percent in 2007. By 2008, the total number of labor migrants according to the Ministry of Labor was 805,000, compared to 224,000 in 2003 (Olimova 2010). Brown, Olimova and Boboev (2008) find that 37.3 percent of households had at least one migrant member and that about 700,000 people, about 500,000 of whom were working in Russia, were considered temporary migrants.

By the end of 2008 and beginning of 2009, the number of labor migrants declined by a fourth, as many Tajik migrants returned to Tajikistan largely because of the global financial crisis of 2008 and the sharp decline in the economic activity of Russia. Migratory flows from Tajikistan to Russia heightened during the breakup of the Soviet Union and the ensuing civil war in Tajikistan. The civil war displaced as much as 20 percent of the country's population (Yormirzoev 2017), becoming the main push factor for migration. The succeeding years saw a combination of job shortages, demographic pressures and limited land area push and pull Tajiks to migrate and work primarily in Russia. While some Tajiks migrate to other countries to work, Russian remains the main destination for majority of the Tajik migrants. What this leads to is a dependence on the Russian economy, making Tajikistan vulnerable to changes in the Russian economy.

**Figure 2. Arrived Tajiks in Russia, 2000, 2005, 2010-2017**



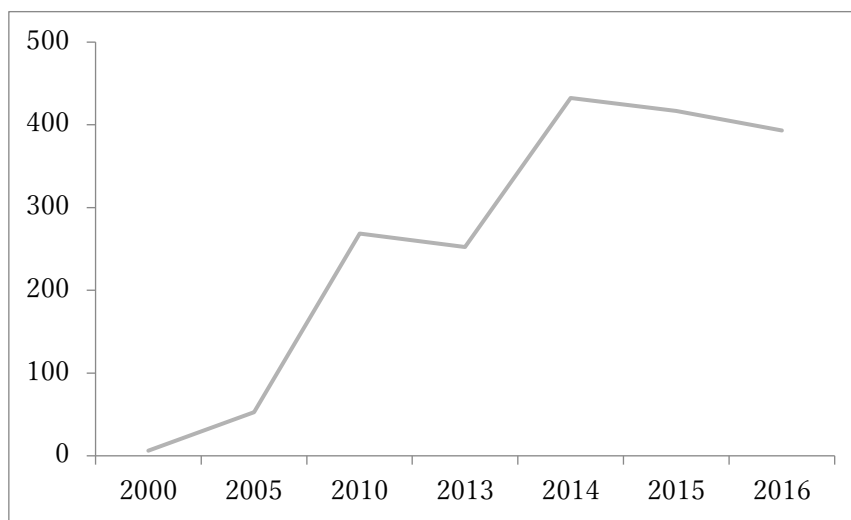Source: Russian Federation Federal State Statistics Services (2017)

Figure 2 shows a steady decrease in the number of arriving Tajiks from 2000 to 2005 in Russia. From more than 11,000 in 2000, it dropped to more than half in 2005. This is most probably attributable to the migration policy reform that was implemented to simplify the arrivals and settlements of migrants which affected specifically temporarily employed

migrants from the Commonwealth of Independent States (CIS) member countries, including Tajikistan (Mukomel 2014). By 2007-2008, Russia had been implementing a liberal migration reform, resulting to a consistent increase in arrivals, here reflected in the steady arrivals of Tajiks until 2010. From 54,658 entrants in 2014, the numbers however dropped to 24,521 in 2016. This reflects the revision of the visa-granting procedures implemented in 2015 by Russia. By 2017, we see a relative increase in numbers as arrived Tajiks increased to 27,970. This is also reflected in Figure 3 showing a decline in the number of working Tajiks in Russia by 2015.

**Figure 3. Working Tajiks in Russia (in thousands)**



Source: Russian Federation Federal State Statistics Services (2016)
Notes: 2000-2010 refer to number of Tajiks engaged in labor activities in Russian Federation. 2013-2015 refer to number of Tajiks with valid patent to perform labor activities.

**Figure 4. Remittance inflows to Tajikistan, 2002-2017 (US$ million)**



Source: World Bank (2017)

6

The number of Tajik migrant entrants depend on changes on the Russian government's migration policy changes as demonstrated earlier, making the flow of remittances volatile as well. Migrants' remittances account for a significant portion of the small country's GDP making it extremely vulnerable to changes in the Russian economy. Migrant remittance inflows to Tajikistan experienced a steady increase from 2002 to 2008, almost doubling each year until 2009. In 2009, remittance inflows fell to 1.748 Billion from 2.544 Billion in 2008 reflecting the impacts of the Global Financial Crisis through the impacts of the crisis in Russia. By 2010, remittance inflows to the country recovered and increased again accounting for 31 percent of the country's GDP at about 2.254 Billion US Dollars. This reflects the more liberal migratory policies implemented by Russia years previous. By 2011, migrant remittances inflows amount to 2.68 Billion US Dollars (41.7 percent of GDP) and steadily increased until it reached its peak in 2013 at 4.219 Billion US Dollars (43.5 percent of GDP). The share of remittance to the country's GDP dropped to 36.6 percent in 2013 reflecting changes in the Russian migration policies. This is also backed by data in Figure 3 where the numbers of Tajik workers in Russia declined in the same year. The decline in remittances has been consistent since after 2013 with a relative increase in 2016, though the share of remittances to GDP has continued to drop to 26.9 percent in that year. By 2017 migrant remittance inflows were reduced by more than half at 2.031 Billion US Dollars.
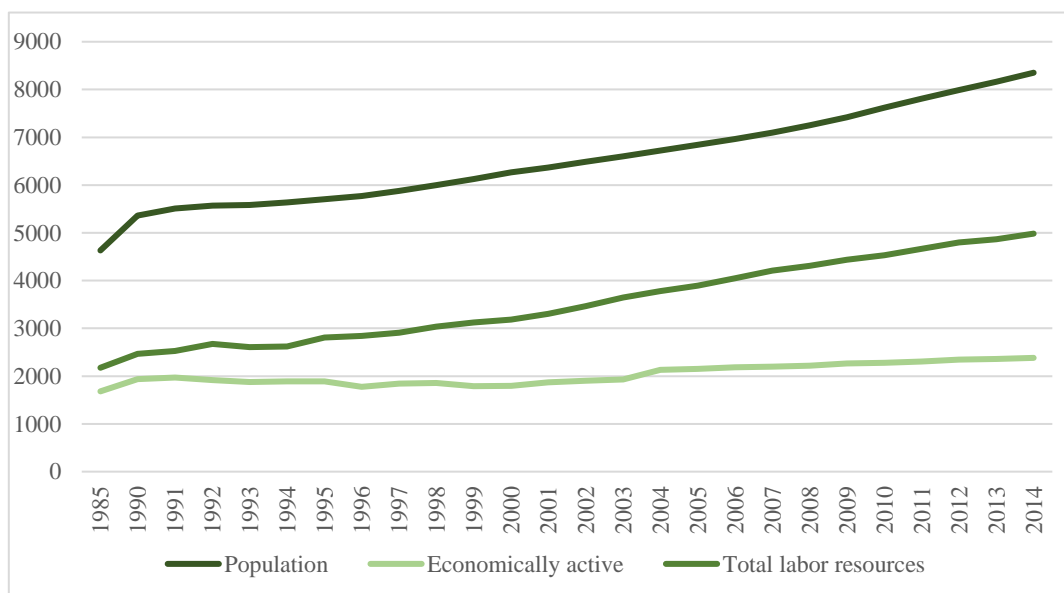
Another important factor to consider driving Tajiks to migrate to Russia is the lack of employment opportunities in the country. After the civil war in the 1990s, different forms of employment in the country have vanished. A sharp rise in unemployment due to the closure of many enterprises and high birth rates became strong push factors in the wake of the Soviet Union collapse (Olimova 2010). Employment in industrial production was recorded to decline at 21 percent in 1991 to 8 percent in 2003. Most shifted to agriculture, retail trade, services and household production while some stopped looking for jobs completely (Olimova 2010). Since 1994-1995, on the other hand, Russia's sustained economic growth, comparatively high wages, ease of migration, and labor shortages in Russia have pulled Tajiks to migrate (Erlich 2006, Olimova 2010). Tajiks looking for job elsewhere found jobs in Russia, filling a demand for unskilled labor in the country.

A combination of high unemployment and high population growth served as push factors driving people out of the country to work in Russia. Figure 5 below shows the total population, vis-à-vis total labor resources and the economically active population from 1985 to 2014. Data shows that as the population and the number of people considered as part of total labor resources constantly increase, the number of people who are economically active does not. The increase in the economically active population tends to be slow and at certain years even decrease. High birth rates have contributed to a rapid and continuous increase in population. Current median age is around 22 years old suggesting a young population with a big labor force. However, as noted, while the labor force resources do increase as a result of

the population growth, the population engaged actively in the economy does not increase as fast. Looking at the registered unemployed however we see that by the first quarter of 2016, 54,000 Tajiks are considered registered unemployed which is a drop from the 57,000 registered in the first quarter of 2015. However, this is not the complete story as many unemployed Tajiks remain unregistered at the unemployment office.

In a report by the European Union in 2010 job creation is highlighted as among significant areas of concern (EU 2010). No inventory on job creation is available however and it becomes impossible to assess the opportunities for employment growth (EU 2010). According to a report by Strokova and Ajwad (2017) for the World Bank, the potential workforce however is growing but it remains underutilized, most attributable to the slow growth of job creation. Majority of those working are employed in the informal sector in low quality jobs. More than 60 percent of the total employment in the country is employed in agriculture and related sectors as seen in Figure 5. The service sectors employ about 30 percent of the employed population, more than the population employed by the industry sector at less than 20 percent. One attributable reason is that firms in private sectors remain small and young (Strokova and Ajwad 2017). In general, Strokova and Ajwad (2017) note that "labor has moved out of the more productive sectors, such as industry, into low-productivity services and agriculture sectors, where domestic job creation was the highest".

**Figure 5. Population, Labor Resources and Economically Active, 1985-2014 (in thousands)**



Source: Statistical Agency of Tajikistan. (2017). Statistical agency under the President of the Republic of Tajikistan. Retrieved 9 1, 2017, from http://www.stat.tj/en/

We see from data presented above that a combination of push and pull factors contribute to many Tajiks leaving for other countries to work. A couple of conclusions can be

drawn from here: (1), high birth rates combined with slow job creation, especially in more productive sectors drive people to look for jobs elsewhere; (2) a combination of historical relations between Russia and Tajikistan as well as higher wages in the former make Russia a preferred destination for many Tajik migrants; and (3) the number of Tajiks migrating to work in Russia and most importantly the amount of remittances sent back to Tajikistan remains volatile, affected by changes in Russia's migration policies and its economy.

## 3. Literature review

The literature on the impacts of migration and remittances on other development indicators such as consumption, immediate well-being, increase in per-capita income and compensate for negative shocks have been more substantiated (see Ratha 2013, Acosta, Calderon, Fajnzylber and López 2008, Hildebrandt and McKenzie 2005) while the long-term effects of migration and remittances especially on productivity remain inconclusive. This inconclusiveness in the literature has been attributed to a number of methodological issues such as selection bias, reverse causality, and omitted variable bias (Adams, 2011). Given this, we identify three strands of literature that discuss the impacts of remittances on labor supply, namely, first, remittance can decrease participation in the labor market; second, remittance has no effect on labor supply; and third, remittance can increase liquidity allowing households to invest in human capital.

Following the neo-classical model of labor supply, it is assumed that individuals allocate time to both market and non-market activities. According to this perspective, the decision in allocating time to these activities is determined by a number of factors such as wage and non-labor income (Cox-Edwards Rodriguez-Oreggia, 2009). The labor-leisure theory notes that remittances if considered as non-labor income can decrease the propensity of non-migrant household members to participate in the labor market. Receipts of remittances can increase the reservation wage of members left in the household. Studies such as Acosta (2007) Acosta, Lartey, and Mandelman (2007), Chami, Fullenkamp, and Jahjah (2005), and Chami, Hakura, Montiel (2012) contribute to the evidence that remittances can have negative effects of remittances on labor supply and hours worked by members left in the home country. Kim (2007) in a study on Jamaica using fixed-effect regression looks at the factors that drive a wedge between productivity and reservation wages and note that recipient household heads regardless of gender tend to work fewer hours than non-recipient heads. One criticism of the Kim (2007) study, however, is that it did not control for selection in the receipt of remittance (Adams 2011).

Chami, Fullenkamp and Jahjah (2005) in an earlier study note of the negative effect of remittances on growth and productivity. In a study in 2012, Chami, Hakura and Montiel (2012) conclude that positive technological shocks can induce labor supply through an increase in real wage, and that remittances in response can contract reducing demand for

leisure over labor, which in effect would increase labor supply.

Acosta (2007) in a study using a two-stage least-squares model and instrumental variable approach on a four-year panel survey in El Salvador, highlighted the importance in looking at groups and noted that women are more likely to quit the labor market than men, but that both men and women do reduce hours worked when their households receive remittances.

While perspective that remittances can reduce labor supply has dominated the literature, this is not unchallenged. If remittances are considered as labor income and as income that otherwise the migrant member would contribute to the household if he or she has not left the country, then there should be no effect on labor supply. Jansen, Vacaflores and Naufal (2012) indicate that if remittances are not just a gift from relatives, nor additional non-labor income, but is in fact a household decision regarding labor allocation, then these inflows may not have such huge impacts on household's domestic work effort. In this light, studies such as Assaad (2011), Cabegin (2006), Cox-Edwards and Rodriguez-Oreggia (2009) and Funkhouser (1992) argue that there is no effect.

Another interesting finding related to this is that while involvement in the formal labor market has decreased among remittance-receiving households, involvement in the informal sector has increased suggesting that household members of remittance-receiving households tend to favor work that provides more mobility and flexibility. This is supported by the Funkhouser (1992) study using fixed effects which showed that an increase in remittances would have a negative impact on labor force participation of member left in the household but would also have a positive impact on self-employment. The study however is not without shortcomings. Adams (2011) note that like the Kim (2007) study, Funkhouser (1992) also did not control for selection in the receipt of remittances and therefore the results could be biased.

Cabegin (2006), on the other hand, used two-stage probit-OLS on a study on remittance-receiving households in the Philippines. In a study that somehow corrects the biases in the Funkhouser (1992) and Kim (2007) studies, she noted that for married couples, participation in migration abroad of one partner can change the labor participation and supply of the other partner. Her findings are somewhat similar to Acosta (2007) though she argued that this operates differently for men and women. She further found out that having school-aged children can reduce market participation for married women in respect to full-time paid employment. The effects however is limited for married men though results suggest that an increase in the migrant wife's remittance can reduce the likelihood of non-employment for men. The change in labor supply can be a result of the change in roles household members assume upon out-migration of the migrant member.

This is especially true if it is the household head that migrated. In a 2007 study on the labor market inactivity of migrant-sending households in Moldova, Dennis, Mahmoud and Trebesch (2007) offers a new perspective on understanding labor-leisure theory as it applies

to remittances and migration. They argue that the inactivity in the labor market of remittance-receiving households was not because they consume more leisure, but because of intra-household labor substitution and increased university enrolment. This is further elaborated by Assaad (2011) in their study on the labor supply responses of women left behind in Egypt. Using cross-sectional data from the Egypt Labor Market Panel Survey of 2006, they found that while a male household member's migration can induce women in rural Egypt to respond to this migration by increasing their labor supply, women are more likely to engage in unpaid family work. The reason for this is that the a household member's migration ultimately meant loss of labor for the remaining members, and women are expected to replace this labor.

Finally, another group of studies point to the positive impacts of remittance in terms of increasing liquidity allowing households to invest in human capital, and to some extent financial capital. Calero, Bedi and Sparrow (2009), using data from Ecuador, note that remittances can facilitate human capital investments. They used data on availability of bank offices in source countries as instruments to understand whether remittances can increase school enrollment. They also found out that remittances function as remittances, being used to fund for education when households are faced with economic shocks. Nsiah (2010) also came to a similar conclusion, in a much larger scale. In their study on remittances and growth in Africa, they found out that remittances can provide alternative ways to finance investments thereby overcoming liquidity constraints.

This study on the impact of migration and remittances on the labor supply of left-behind household members aim to contribute to this debate. This study is a response to the call for empirical evidences on the impacts of migration and remittances. As mentioned, the importance of labor market participation lies on its bearing on long-term economic growth. With many Tajiks migrating and with remittances constituting substantial shares in the country's GDP, the need to determine whether migration and remittances have a positive, or detrimental, impact on long-term economic growth becomes more urgent.

## 4. Methodology

Estimating the impact of remittances or migration on the labor market participation of household members left behind needs to consider the possibility of endogeneity and self-selection. In the presence of endogeneity and self-selection bias, the estimation must consider unobserved heterogeneity that simultaneously affects remittances/migration and labor market participation decisions. To correct for the endogeneity and selection bias, we employ a control function approach to estimate an endogenous switching regression model for panel data following Murtazasgvili and Wooldridge (2016). We take a traditional endogenous switching regression model that allows different coefficients across two different regimes of the following form:

$$y_{it1}^m = x_{it1}\beta_m + c_{it1} + u_{it1m}, \qquad t = 1, \cdots, T \qquad (1)$$

where $x_{it1}$ is the vector of explanatory variables, $c_{it1}$ is the household-specific unobserved heterogeneity in the regime $m = 0,1$, and $y_{it1}^m$ is regime-specific outcome. We assume that the explanatory variables $x_{it1}$ may contain continuous endogenous explanatory variables and strictly exogenous explanatory variables $z_{it1}$ with respect to the idiosyncratic errors, $u_{it1m}$. By substitution, we get the following switching regression model with constant coefficients:

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}(\beta_1 - \beta_0) + c_{i10} + y_{it2}(c_{i11} - c_{i10}) + u_{it10} + y_{it2}(u_{it11} - u_{it10})$$
$$= x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + c_{i10} + y_{it2}(c_{i11} - c_{i10}) + u_{it10} + y_{it2}(u_{it11} - u_{it10}) \qquad (2)$$

where $y_{it2}$ is the regime-switching endogenous binary variable. In model (2), the regime-switching variable interacts with both time-invariant and time-varying observable and unobservable variables. Following Murtazasgvili and Wooldridge (2016), we allow for the correlation between unobservables and the strictly exogenous explanatory variables by applying the Mundlak (1978) device.

Let $e_{it0} = c_{it10}$, $e_{it1} = c_{i11} + u_{it11}$, and $v_{it1} = e_{it1} - e_{it0}$ and assume that

$$e_{it0} = \bar{z}_i\rho_0 + \eta_{it0} \qquad (3)$$
$$v_{it1} = \bar{z}_i\rho_1 + \eta_{it1} \qquad (4)$$

where $\bar{z}_i = \frac{1}{T}\sum_{t=1}^T z_{it}$ and $(\eta_{it0}, \eta_{it1})$ are assumed to be independent of $z_i$. Substituting (3) and (4) into (2) gives:

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + \bar{z}_i\rho_0 + y_{it2}\bar{z}_i\rho_1 + \eta_{it0} + \eta_{it1} \qquad (5)$$

In our case $y_{it1}$ is the regime-specific continuous outcome variable that accounts for the labor force participation rate of household members remaining at home. The regime switching variable $y_{it2}$ is a binary variable that accounts for a household migration state or a remittance receipt state. The binary response correlated random effects model for $y_{it2}$ is then given by:

$$y_{it2} = 1 \ [\kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2 + v_{it2} > 0] \qquad (6)$$

where

$$(\eta_{it0}, \eta_{it1}, v_{it2}) \text{ are assumed to be independent of } z_i, \text{ and } v_{it2} \sim N(0,1) \qquad (7)$$

The error term $v_{it2}$ is allowed to have serial correlation.

We are interested in estimating the structural equations of a household's labor force participation rate and economic activity rate given by Equation (1) with a reduced form selection equation for a migration state or a remittance receipt state given by Equation (6). Under the assumption (7), we can write

$$E(v_{it2}|y_{it2}, z_i) = h(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2) \tag{8}$$

where $h(\cdot)$ is the generalized error function, determined by

$$h(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2) = y_2\lambda(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2)$$
$$-(1 - y_2)\lambda(-y_{it2}, \kappa_{t2} - z_{it}\pi_2 - \bar{z}_i\delta_2) \tag{9}$$

where $\lambda(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2)$ is the inverse Mills ratio (IMR). Then, we assume that

$$E(\eta_{it0}|v_{it2}) = \xi_0 v_{it2} \text{ and } E(\eta_{it1}|v_{it2}) = \xi_1 v_{it2} \tag{10}$$

where $\xi_0 = 0$ and $\xi_1 = 0$ imply that selection is exogenous. By iterated expectations,

$$E(\eta_{it0} + y_{it2}\eta_{it1}|y_{it2}, z_i) =$$
$$\xi_0 h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2) + \xi_1 y_{it2}h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2)$$
$$\tag{11}$$

These generalized error terms are added into Equation (5) to correct for the endogeneity of the regime switch variable, $y_{it2}$ (migrate/not migrate or remit/not remit). Then Equation (5) becomes

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + \bar{z}_i\rho_0 + y_{it2}\bar{z}_i\rho_1 + \xi_0 h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2)$$
$$+\xi_1 y_{it2}h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2) + \omega_{it}$$
$$\tag{12}$$
$$E\big((\omega_{it})|y_{it2}, z_i\big) = 0 \tag{13}$$

where $\omega_{it}$ is the implied error in Equation (11).
To consistently estimate coefficient of (12), we follow a two-step procedure proposed by Murtazasgvili and Wooldridge (2016). In the first stage, we estimate a pooled probit model of the following form for the selection equation (6).

$$P(y_{it2} = 1) = \Phi(\kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2 + v_{it2}) \tag{14}$$

and obtain generalized residuals from the estimated coefficients as:
$$\hat{\mu}_{it2} = h_{it2}\big(y_{it2}, \hat{\kappa}_{t2} + z_{it}\hat{\pi}_2 + \bar{z}_i\hat{\delta}_2\big) = y_{it2}\lambda\big(\hat{\kappa}_{t2} + z_{it}\hat{\pi}_2 + \bar{z}_i\hat{\delta}_2\big)$$
$$-(1 - y_{it2})\lambda\big(-\hat{\kappa}_{t2} - z_{it}\hat{\pi}_2 - \bar{z}_i\hat{\delta}_2\big) \tag{15}$$

In the second stage, we estimate the structural equation (12) for the household labor force participation rate by adding generalized residuals obtained in the first stage as additional explanatory variables. The empirical model is given by

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + \bar{z}_i\rho_0 + y_{it2}\bar{z}_i\rho_1 + \xi_0\hat{\mu}_{it2} + \xi_1 y_{it2}\hat{\mu}_{it2} + \omega_{it} \qquad (16)$$

$$i = 1, \cdots, N, \qquad t = 1, \cdots, T$$

In our empirical model, $x_{it}$ contains only exogenous variables. Thus, we estimate the model (16) by pooled OLS for all $N$ and $T$. As the model (16) has a generator regressor problem, we bootstrap to obtain standard errors. The joint significance of $(\xi_0\hat{\mu}_{it2}, \xi_1 y_{it2}\hat{\mu}_{it2})$ in (16) implies the endogeneity of self-selection of the migration or remittances. We test it by the Wald statistic with two-degrees of freedom.

## 5. Data

We utilize data from the World Bank's Listening to Tajikistan (L2TJK) survey. This phone-based high frequency panel survey monitors a variety of indicators including migration, income and employment, wellbeing and life satisfaction of households, and access to water and electricity services. A sample of 800 households was drawn from a nationally representative face-to face survey comprised of 3000 households in Tajikistan conducted in the spring of 2015. Our analysis covers 32 rounds of the L2TJK survey from May 2015 to November 2017 in which households were initially interviewed in 10-day intervals, changing to two-week intervals after the sixth wave of the data collection. Households who refused to participate and households who dropped out were replaced with households from the same primary sampling unit (PSU). The Japan International Cooperation Agency Research Institute (JICA-RI) joined the World Bank to contribute to the financing of the L2TJK survey from the 31st round and added additional questions that cover special issues about migration and remittances in the survey questionnaire form.

For each round of the L2TJK survey, we obtained information on household characteristics such as the number of employed and unemployed, the number of children under 18 years old, the number of elderly above 60 years old, and the household head's age, gender, and educational level. Based on the main interview data, we constructed variables for migration and remittance statuses, labor force participation rate, and economic activity rate of the household members remaining in Tajikistan. While such high-frequency panel dataset is unique, it is not free of limitations. Due to the nature of the data collection method that makes the high frequency household panel data possible, most indicators are collected at household level. Therefore, the individual level data for health, education, and labor market participation are not observed, leaving us not able to estimate more detailed results by gender and age. Despite this limitation, the high frequency panel dataset improves the efficiency of econometric estimates and allows us greater capacity to capture variations in household behavior regarding labor supply.

The remittance receiving status variable was constructed as a dummy variable that accounts for any receipt of remittances by a household from its migrant members during a

survey round. Similarly, the migration variable is a binary variable that takes on the value of 1 if a household has sent at least one member abroad. These two dummy variables serve as regime-switchers in our structural model of the labor force participation and the economic activity rate. We use both remittances and migration as regime-switchers because many Tajik migrants are short-term seasonal migrants and do not remit but bring the money home with them. Later, we also show our results with continuous variables for remittance amount and number of migrants for robustness checks.

The dependent variable of the structural model is either a household's labor force participation rate or the economic activity rate of the remaining household members. The labor force participation rate variable was constructed as a ratio of the number of working household members to the household size. The economic activity rate adds the number of household members who are actively seeking an employment to the number of working household members. Tables 1 and 2 present summary statistics of the main variables of our interest for the pooled data.

**Table 1 Summary statistics of variables of interest by migrant status**

|  |  | Total sample | | Non-migrants | | Migrants | |
|---|---|---|---|---|---|---|---|
|  |  | Mean | Std. Err. | Mean | Std. Err. | Mean | Std. Err. |
| Remittance receiving | | 0.098 | 0.002 | | (omitted) | 0.304 | 0.005 |
| Migrant sending | | 0.323 | 0.003 | | (omitted) | 1.000 | 0.000 |
| Labor force participation rate | | 0.209 | 0.001 | 0.237 | 0.002 | 0.150 | 0.002 |
| Economic activity rate | | 0.337 | 0.002 | 0.374 | 0.002 | 0.260 | 0.003 |
| Household size | | 6.703 | 0.019 | 6.234 | 0.020 | 7.687 | 0.036 |
| Number of elderly aged above 60 | | 0.432 | 0.004 | 0.402 | 0.005 | 0.496 | 0.008 |
| Number of children below 18 | | 2.634 | 0.011 | 2.544 | 0.013 | 2.824 | 0.021 |
| Number of disabled | | 0.152 | 0.003 | 0.165 | 0.003 | 0.126 | 0.004 |
| Household head's age | | 53.55 | 0.085 | 52.558 | 0.107 | 55.632 | 0.132 |
| Male headed | | 0.792 | 0.003 | 0.807 | 0.003 | 0.763 | 0.005 |
| Female headed | | 0.208 | 0.003 | 0.193 | 0.003 | 0.237 | 0.005 |
| Head's marital status: | Married | 0.784 | 0.003 | 0.782 | 0.003 | 0.789 | 0.004 |
| | Divorced | 0.035 | 0.001 | 0.041 | 0.002 | 0.021 | 0.002 |
| | Widowed | 0.152 | 0.002 | 0.141 | 0.003 | 0.175 | 0.004 |
| | Separated | 0.009 | 0.001 | 0.011 | 0.001 | 0.004 | 0.001 |
| | Not registered | 0.012 | 0.001 | 0.015 | 0.001 | 0.007 | 0.001 |
| | Single | 0.008 | 0.001 | 0.010 | 0.001 | 0.004 | 0.001 |
| Head's education level, years | | 10.891 | 0.018 | 10.995 | 0.022 | 10.673 | 0.029 |
| Number of observations | | 25,550 | | 17,303 | | 8,247 | |

Source: Authors' computation based on the L2TJK

**Table 2 Summary statistics of variables of interest by remittance status**

|  | Non-remitters | | Remitters | |
|---|---|---|---|---|
|  | Mean | Std. Err. | Mean | Std. Err. |
| Remittance receiving | | (omitted) | 1.000 | 0.000 |
| Migrant sending | 0.249 | 0.003 | 1.000 | 0.000 |
| Labor force participation rate | 0.216 | 0.001 | 0.142 | 0.003 |
| Economic activity rate | 0.348 | 0.002 | 0.241 | 0.005 |
| Household size | 6.571 | 0.019 | 7.914 | 0.072 |
| Number of elderly aged above 60 | 0.421 | 0.004 | 0.538 | 0.014 |
| Number of children below 18 | 2.597 | 0.011 | 2.980 | 0.039 |
| Number of disabled | 0.155 | 0.003 | 0.128 | 0.008 |

15

| | | | | | |
|---|---|---|---|---|---|
| Household head's age | | 53.282 | 0.090 | 56.014 | 0.242 |
| Male headed | | 0.796 | 0.003 | 0.759 | 0.009 |
| Female headed | | 0.204 | 0.003 | 0.241 | 0.009 |
| Head's marital status: | Married | 0.784 | 0.003 | 0.789 | 0.008 |
| | Divorced | 0.036 | 0.001 | 0.021 | 0.003 |
| | Widowed | 0.150 | 0.002 | 0.175 | 0.008 |
| | Separated | 0.009 | 0.001 | 0.004 | 0.001 |
| | Not registered | 0.013 | 0.001 | 0.008 | 0.002 |
| | Single | 0.008 | 0.001 | 0.004 | 0.001 |
| Head's education level, years | | 10.928 | 0.019 | 10.554 | 0.057 |
| Number of observations | | 23,044 | | 2,506 | |

Source: Authors' computation based on the L2TJK

The data show that 32.3 percent of the total households have at least one migrant member; however, only 9.8 percent receive remittances from their migrant members. The summary statistics also suggest that households with migrants have lower labor force participation and economic activity rates than non-migrant sending households. The indicators are even lower for remittance receiving households than migrant sending households.

In total, we have two dependent variables and two regime-switching variables, leading to four endogenous switching model specifications. Each endogenous switching model has one endogenous component which is the endogenous regime-switching variable. Thus, we need at least one instrument in the first stage probit model that is not included in the structural model. We employed two instruments: monthly wage rates at the migration destination and the number of migrants at the primary sampling unit (PSU).

The instrumental variables (IVs) are chosen on the basis of the theoretical and empirical literature of migration. The Harris-Todaro (1970) model predicts that the most important determinant of migration is the wage differentials between home and destination. Practically, it is difficult to construct a variable for wage differentials because wage data can only be observed for an individual at either home or foreign countries, but not simultaneously. Thus, for a practical reason, we use wage data at destination countries, assuming that wage rates are higher in foreign than in home. For the wage data, we compiled data on monthly wages in local currencies from the major destination countries, including Russia, Kazakhstan, China, Turkey, South Korea, the United States, and Ukraine from corresponding months and quarters of 2015 to 2017 to match with the L2TJK data. Monthly wage data for Russia comes from the Russian Federation Federal State Statistics Services. Data for Kazakhstan came from the Ministry of National Economy of the Republic of Kazakhstan Committee on Statistics. Hourly wage data for Turkey came from the Turkish Statistical Institute and data on the quarterly wage of migrant laborers in China came from the National Bureau of Statistics of China. To be comparable, amounts in local currencies were converted into US Dollars using historical exchange rates from the United States Department of the Treasury. For non-migrant sending households, we took the average wage of the all destination countries except the United States and South Korea as negligible share of migrants work in these countries.

16

**Table 3 Summary Statistics of IVs**

| Instrumental Variables | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Number of migrants in PSU | 2.29 | 1.94 | 0 | 11 |
| Wage differential | 3995.97 | 953.71 | 2578.44 | 13501.08 |
| Number of observations | 25,550 | | | |

Source: Authors' computations

Furthermore, the New Economics of Labor Migration (NELM) theory emphasizes the importance of the network effect of migration as an important determinant of labor migration. Particularly, it argues that personal networks at destination could reduce migration and thereby promote more migration. Past empirical studies that test the NELM hypothesis often use the number of migrants in the community or presence of return migrants as proxies for migration network. Thus, we follow the past literature and use the number of migrants in the community for migration network. In this paper, we use the PSU as a community as it is the smallest unit that the sample was drawn. The survey has 150 PSUs, each containing 5-10 households. We constructed the instrumental variable by adding up migrant households in the PSU. Table 3 summarizes the two instrumental variables.

## 6. Results and Discussion

We applied the approach described in Section 4 to four separate cases of combinations of two endogenous regime-switching variables and two response outcome variables. We take a household's migration and remittance receiving statuses as regime-switching variables, and household's labor force participation rate and economic activity rate as response outcome variables. In the first stage, we estimated two pooled probit models of migration and remittances statuses respectively for all households and rounds. Since each structural model has one endogenous component, we need to include at least one instrumental variable in the first stage probit models for robust estimations. As described in the previous section, we have two instruments: wage rates at destinations and the number of migrants at the PSU. By selecting wage rates and the number of migrants as instruments, we assume that they have no direct effect on household's labor supply decisions once we control for the household's migration or remittances decision. Table 4 reports the first stage coefficient estimates for the probit models.

As required by the two-step estimation procedure, the probit models in Table 4 also include time averages of all explanatory variables except for time-invariant variables, and regional and time dummy variables as they are perfectly collinear with the constant term. The results in Table 4 suggest that the most estimated coefficients are statistically significant and the directions of the effect of household characteristics on migration and remittances decisions are consistent across models, with larger magnitudes for the migration decision in general.

**Table 4. First stage coefficient estimates: Determinants of the migration and remittances decisions**

| | Remittances | Migrant |
|---|---|---|
| Household size | 0.065 | 0.147 |
| | (5.30)*** | (12.33)*** |
| Number of elderly (60+) | 0.004 | 0.049 |
| | (0.100) | (1.290) |
| Number of children (<18) | -0.044 | -0.141 |
| | (-2.26)** | (-7.82)*** |
| Number of disabled | -0.085 | -0.145 |
| | (-2.86)*** | (-5.53)*** |
| Head's age | 0.041 | 0.057 |
| | (4.80)*** | (7.57)*** |
| Head's age squared | 0.000 | -0.001 |
| | (-4.23)*** | (-7.00)*** |
| Female headed | 0.245 | 0.274 |
| | (5.98)*** | (6.99)*** |
| Head's marital status (Reference: Married) | | |
| Divorced | -0.316 | -0.385 |
| | (-3.80)*** | (-5.27)*** |
| Widowed | -0.129 | -0.064 |
| | (-2.61)*** | (-1.37) |
| Separated | -0.461 | -0.958 |
| | (-2.79)*** | (-5.99)*** |
| Not registered marriage | -0.239 | -0.521 |
| | (-1.94)* | (-4.70)*** |
| Single | -0.520 | -0.896 |
| | (-2.70)*** | (-4.37)*** |
| Head's education in years | -0.027 | -0.014 |
| | (-2.84)*** | (-1.70)* |
| Time averaged variables | Yes | Yes |
| Regional dummies | Yes | Yes |
| Time dummies | Yes | Yes |
| Instruments | | |
| Number of migrants in the PSU | 0.155 | 0.279 |
| | (18.36)*** | (31.12)*** |
| Wage rate at destination | 0.0002 | 0.005 |
| | (16.32)*** | (63.07)*** |
| Constant | -3.892 | -20.77 |
| | (-17.94)*** | (-61.07)*** |
| Number of observations | 25,550 | 25,550 |

Source: Authors' estimates

Notes: ***, ** and * indicate statistical significance at 1 percent, 5 percent, and 10 percent respectively. t-statistics are in parentheses.

Time variables are survey rounds.

The results suggest that larger households with a married, older and female head tend to send migrants abroad. Households with more elderly members aged over 60 tend to send migrants and receive remittances, whereas households with handicapped members are less likely to send migrants and receive remittances. Having more children below 18 years of age significantly reduces the probability of having a migrant household member. The educational level of household head is negatively related to migration and remittances.

The explanatory variables that serve as instruments in our endogenous switching

model are statistically significant in both probit models. As the number of migrants in the PSU increases, the probability of sending migrants and receiving remittances increases. This is consistent with the migration literature that suggests that the migration network is an important determinant of the migration decision. While we did not take into account the wage differentials as predicted by the Todaro model, our results suggest that higher wages at the migration destinations attract migrants and increase the probability of sending remittances. We exclude these two explanatory variables (the number of migrants at the PSU and the wage rate at the destination) from the structural equations of the household labor supply in order to exploit them as instruments. Thus, it is assumed that the number of migrants at the PSU and the wage rate at the destination have no direct effect on the labor supply decisions at home.

In the second stage of the estimation procedure, the structural equations of the household labor supply are augmented with the generalized residuals obtained from the estimates of the first-stage probit models to correct for the endogeneity and the self-selection bias. Table 5 reports the parameter estimates of the household labor supply measured by household's labor force participation and economic activity rates.

**Table 5 Second-stage coefficient estimates: the determinants of labor force participation and economic activity rates**

| Dependent variable | Labor supply | Labor supply | Economically active | Economically active |
|---|---|---|---|---|
| Regime-switcher variable | Remittance | Migrant | Remittance | Migrant |
| Remittances/Migrants | -0.112 | -0.080 | -0.198 | -0.097 |
| | (-2.55)** | (-3.56)*** | (-3.36)*** | (-3.69)*** |
| Household size | -0.004 | -0.007 | -0.001 | -0.004 |
| | (-2.63)*** | (-3.90)*** | (-0.82) | (-1.56) |
| Number of elderly (60+) | -0.022 | -0.028 | -0.040 | -0.049 |
| | (-4.86)*** | (-5.21)*** | (-6.30)*** | (-6.64)*** |
| Number of children (<18) | -0.023 | -0.024 | -0.042 | -0.044 |
| | (-10.59)*** | (-10.44)*** | (-14.88)*** | (-13.29)*** |
| Number of disabled | -0.038 | -0.047 | -0.043 | -0.053 |
| | (-14.83)*** | (-17.00)*** | (-13.14)*** | (-15.29)*** |
| Head's age | 0.002 | 0.002 | 0.005 | 0.005 |
| | (1.93)* | -1.620 | (4.93)*** | (4.00)*** |
| Head's age squared | 0.000 | 0.000 | 0.000 | 0.000 |
| | (-1.51) | (-1.18) | (-4.10)*** | (-3.46)*** |
| Female headed | -0.020 | -0.027 | -0.024 | -0.039 |
| | (-4.71)*** | (-4.37)*** | (-4.64)*** | (-5.42)*** |
| Head's marital status (Reference: Married) | | | | |
|   Divorced | 0.097 | 0.096 | 0.092 | 0.090 |
| | (9.18)*** | (7.93)*** | (10.30)*** | (7.86)*** |
|   Widowed | 0.000 | 0.005 | -0.021 | -0.009 |
| | 0.000 | -0.740 | (-3.22)*** | (-1.04) |
|   Separated | 0.222 | 0.247 | 0.206 | 0.211 |
| | (9.47)*** | (10.80)*** | (9.35)*** | (8.45)*** |
|   Not registered marriage | -0.036 | -0.039 | -0.048 | -0.045 |
| | (-3.73)*** | (-4.28)*** | (-3.94)*** | (-3.16)*** |
|   Single | 0.058 | 0.051 | -0.015 | -0.027 |
| | (2.82)*** | (2.08)** | (-0.73) | (-1.06) |
| Head's education in years | 0.005 | 0.005 | -0.003 | -0.003 |
| | (4.61)*** | (4.67)*** | (-2.40)** | (-2.19)** |

19

| | | | | |
|---|---|---|---|---|
| Time averaged variables | Yes | Yes | Yes | Yes |
| Regions | Yes | Yes | Yes | Yes |
| Rounds | Yes | Yes | Yes | Yes |
| Interactions with remittances/migrant | | | | |
| Household size | 0.002 | 0.008 | 0.007 | 0.008 |
| | -0.670 | (2.92)*** | -1.190 | (2.34)** |
| Number of elderly (60+) | 0.026 | 0.019 | 0.036 | 0.033 |
| | (1.92)* | (2.37)** | (1.94)* | (2.93)*** |
| Number of children (<18) | 0.012 | 0.005 | 0.007 | 0.006 |
| | (2.07)** | -1.400 | -0.870 | -1.190 |
| Number of disabled | 0.034 | 0.034 | 0.065 | 0.059 |
| | (3.68)*** | (6.19)*** | (4.99)*** | (7.42)*** |
| Head's age | 0.009 | 0.005 | 0.012 | 0.006 |
| | (3.02)*** | (2.51)** | (3.28)*** | (2.56)** |
| Head's age squared | 0.000 | 0.000 | 0.000 | 0.000 |
| | (-3.28)*** | (-2.58)*** | (-3.27)*** | (-2.29)** |
| Female headed | -0.017 | 0.017 | 0.009 | 0.048 |
| | (-1.35) | (1.83)* | -0.560 | (4.40)*** |
| Divorced | -0.068 | -0.046 | -0.062 | -0.047 |
| | (-2.64)*** | (-2.23)** | (-1.66)* | (-1.97)** |
| Widowed | 0.025 | -0.012 | 0.011 | -0.034 |
| | -1.470 | (-0.95) | -0.530 | (-2.39)** |
| Separated | -0.223 | -0.263 | -0.120 | -0.108 |
| | (-3.65)*** | (-6.89)*** | (-0.97) | (-2.00)** |
| Not registered marriage | -0.022 | 0.008 | -0.055 | -0.023 |
| | (-0.69) | -0.330 | (-1.06) | (-0.76) |
| Single | 0.152 | 0.073 | 0.266 | 0.129 |
| | (2.68)*** | -1.330 | (6.15)*** | (2.59)*** |
| Head's education in years | -0.007 | -0.003 | 0.000 | 0.004 |
| | (-2.56)** | (-1.89)* | -0.010 | -1.510 |
| Time averaged variables with interaction | Yes | Yes | Yes | Yes |
| Regions with interaction | Yes | Yes | Yes | Yes |
| Rounds with interaction | Yes | Yes | Yes | Yes |
| Generalized residuals from Stage 1 | 0.068 | -0.023 | 0.119 | -0.019 |
| | (7.85)*** | (-3.32)*** | (11.21)*** | (-1.98)** |
| Interacted generalized residuals | -0.057 | 0.030 | -0.082 | 0.032 |
| | (-3.57)*** | (3.79)*** | (-3.86)*** | (3.11)*** |
| Constant | 0.119 | 0.113 | 0.310 | 0.331 |
| | (6.19)*** | (5.19)*** | (13.44)*** | (12.09)*** |
| Number of observations | 25,550 | 25,444 | 25,550 | 25,444 |

Source: Authors' estimates

Notes: ***, ** and * indicate statistical significance at 1%, 5%, and 10% respectively. t-statistics are in parentheses.

Time variables are survey rounds.

All regressions reported in Table 5 contain full sets of regional and time dummy variables, time-averages of time-variant variables, and interactions of all variables with the dummies for whether the household has a migrant member or whether the household received remittances from its migrant members respectively. All continuous variables were de-meaned before being interacted with the regime switching dummies. Therefore, the estimated coefficient on the regime switching dummy variables can be meaningfully interpreted as average treatment effects. The remaining coefficients can be interpreted as the effect of migration/remittances on the labor supply rates for households with given average characteristics.

To prove the validity of the endogenous switching model, we test the joint significance of the generalized residuals terms by the Wald test with two degrees of freedom. In all models, we reject the joint insignificance of the generalized residual terms at p=0.01 level of significance, validating that the regime switching is endogenous.

According to the summary statistics reported in Tables 1 and 2, on average, the labor force participation and economic activity rates are lower for migrant sending and remittance receiving households. This observation is supported by our estimates of the structural equations presented in Table 5. The average treatment effect coefficients of the migration and remittances are all negative and highly statistically significant, implying that migrant sending and remittance receiving households have lower labor supply rates. In terms of magnitudes, the negative impact of remittances is larger than that of migrants. Our results show that the presence of a migrant member reduces the labor force participation rate of remaining household members by 8 percentage points, while the receipt of remittances reduces it by 11 percentage points. Furthermore, the response of the economic activity rate is larger than that of the participation rate. Having a migrant member reduces the household's economic activity rate by 9.7 percentage points compared to the 19.8 percentage point reduction due to the receipt of remittances.

Our results are consistent with related past research on Tajikistan. Justino and Shemyakina (2012) find negative impacts of migration and remittances on the labor force participation of both men and women, although they do not correct for the endogeneity and selection bias of migration and remittances. In terms of the degree of the impact, their findings show that receiving remittances and having a migrant member reduce the labor force participation rate of men by 8 percent and 1 percent respectively. The impacts for women are 5 percent and 2 percent respectively.

The effects of other determinants of household labor supply rates depend on whether the household has a migrant member and receives remittances. For non-migrant and non-remittance receiving households, large households with more young and old dependents, with handicapped members and with a female head are likely to have lower labor force participation rates, whereas the household head's age and education increases their labor force participation rate. The effects on the economic activity rates for non-migrant and non-remittance receiver households also follow the same pattern.

For migrant and remittance receiving households, the effects of the determinants should be discussed in conjunction with the results of the first stage probit model. Because migrant households tend to have fewer children aged below 18 and less number of disabled members, having these dependents increases their labor force participation rates, perhaps due to an increased need for income to take care of them. Also, older female-headed migrant households are more likely to participate in the labor market. The educational level of the household heads of migrant households is positively related to the economic activity rate, but

negatively with the participation rate, indicating some degree of mismatch in the labor market.

Finally, we conduct several robustness checks to confirm the validity of our results. We estimated four panel data models with both binary and continuous endogenous variables. For the continuous endogenous variables, we use the amount of remittances received and the number of migrant household members. The model that we estimated include a two-stage fixed effects model, ANCOVA model, a lagged dependent variable model, and a dynamic model with lags and leads. More detailed explanations about the models and results are presented in the appendix. The results are consistent with our main results, although the magnitude of the estimates is slightly lower. Particularly, when the endogenous variable is continuous, the magnitude of the impact is found to be smaller. Generally, the magnitude of the impact of remittances is larger than that of migration, implying that the remittances have much larger income effect that discourages labor market participation on non-migrant household members.

## 7. Conclusion

Out-migration has increased rapidly in Tajikistan and will likely to rise further in response to the economic incentives offered by neighboring countries, especially Russia. Private remittances from migrant workers contribute to Tajikistan's economy excessively, at its highest in 2008 making up almost 50 percent of its GDP. While remittance receipts in Tajikistan have been in decline as a result of migrants returning from Russia and economic slowdown in Russia, migration remains to be a lucrative and preferred choice of occupation for many Tajiks.

This paper explored the labor market impact of overseas out-migration and remittances in Tajikistan using unique high frequency household panel data, L2TJK. The analysis covered 32 rounds of the L2TJK survey collected between 2015 and 2017. To take into account the possibility of endogeneity and selection bias in the migration and remittances decisions, we employed a control function approach to endogenous switching regression for panel data developed by Murtazashvili and Wooldridge (2016). The advantage of applying the control function approach to endogenous switching regression is that it is less restrictive in that it allows serial correlation in the error term as well as heterogeneities to be correlated with time-varying explanatory variables. The approach is less computationally expensive than the full information maximum likelihood approaches.

Our results show that the having a migrant member or receiving overseas remittances reduces labor force participation and economic activity rates of the remaining household members. The remaining household members' participation in the labor market is more responsive to the remittances than migration. This result is in line with the past empirical studies of the type in Tajikistan and other countries, as well as theoretical findings. Our findings suggest that migration and remittances raise the reservation wages of members left in

the household according to the labor-leisure theory that states that remittances when considered as non-labor income, can decrease the propensity of non-migrant household members to participate in the labor market.

The results of the study add to the debate on how remittances and migration can ultimately impact development. There are a number of channels through which remittances and migration can impact the development of households – as buffer to shocks, increasing per-capita income of households, improvements in access to education, health and other well-being indicators of household members, among others. This paper looked at one channel, one that is important in assessing long-term economic growth.

The policy implication of the result depends on what migrant households are doing instead of working. If they are taking on unpaid household work previously borne by migrant members, it could imply a need to improve the wage labor market. Detailed information about the time use of household members is not available in Tajikistan and limits the possibility to perform more detailed analysis disaggregated by age and gender. This paper shows that collecting such data can improve our collective knowledge on impact of migration and remittances on domestic labor supply. While the results show that migration and remittances may have a negative impact on the labor market supply of the household members left behind, the results do not deny the possibilities of remittances and migration having positive impacts on other outcomes. Thus this paper encourages further study to piece together a more complete picture to be able to suggest better policy responses on how to channel remittances into development.

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**Appendix: Robustness check with alternative specifications**

For our main results, we employ the regime switching model by Murtazasgvili and Wooldridge (2016), taking dummy variables on household's remittance/migration status as the endogenous regime-switchers. Although this is a novel approach to tackle the issue of endogeneity of remittance and migration, a dominant concern in the empirical literature on migration and remittances, a few potential caveats of this methods can be pointed out. First, our variables of interest, remittance and migration, are constrained to be discrete due to the technical requirement of the regime switching model. With this restriction, the regime switching model allows us to understand only the extensive margin of the impact of remittance/migration. We have to use another method to further understand the effect including the intensive margin, such as the effect of the amount of remittance and the number of migrant. Second, the regime switching model is a pooled regression, in that we include the region and time dummies as well as a set of time-averaged variables in order to control for unobserved individual heterogeneity. However, these region and time dummies can be too coarse in terms of the level of aggregation to properly address the potential bias caused by individual-level or PSU-level unobservables.

In order to assess the robustness of our main estimates which could suffer from the aforementioned weaknesses, this appendix presents results of commonly employed panel regressions. Our benchmark panel model is as follows.

$$y_{it} = \beta D_{it} + \gamma X_{it} + \theta y_{i,t-1} + \mu_i + \epsilon_{it} \qquad \text{(A1)}$$

where, $y_{it}$ is the outcome variables such as labor supply and economically active labor participation. $D_{it}$ is our key explanatory variables of interest, such as the status of remittance and migration. In addition to discrete dummy variables we use in the main text, $D_{it}$ also includes continuous treatment variables which are the amount of remittance and number of migrants from each household. $\mu_i$ represents household $i$'s time-invariant unobserved characteristics. $\epsilon_{it}$ is a mean-zero idiosyncratic shock. If there is a serial correlation, meaning that the past idiosyncratic shock, $\epsilon_{i,t-1}$, is correlated with the current outcome, $y_{it}$, it is well known that the standard fixed effect model will not give a consistent estimate. For the variables related to labor supply, it is highly probable that the past shock can affect the present decision. This is the reason why we include the lagged dependent variable, $y_{i,t-1}$, in the right-hand-side of (A1).

In practice, we use the first differenced equation of (A1) so that we can eliminate $\mu_i$;

$$\Delta y_{it} = \beta \Delta D_{it} + \gamma \Delta X_{it} + \theta \Delta y_{i,t-1} + \Delta \epsilon_{it} \qquad \text{(A1b)}$$

In addition to our key identification challenge, the endogeneity of $\Delta D_{it}$, $\Delta \epsilon_{it}$ is obviously correlated with $\Delta y_{i,t-1}$ as both have the common unobservable $\epsilon_{i,t-1}$. A conventional approach to deal with this endogeneity is to instrumenting $\Delta y_{i,t-1}$ with $y_{i,t-2}$ as suggested by Anderson and Hsiao (1981). Thus, in (A1b) we instrument two endogenous variables $\Delta D_{it}$ and $\Delta y_{i,t-1}$ by the first-differenced PSU level number of migrants, the first-differenced wage rate at the destination, and $y_{i,t-2}$.

The regression results for the equation (A1b) are summarized in the Table A1. The results are similar to our main results, both in terms of the sign and the magnitude of the estimates. Furthermore, the order of the magnitude among different combinations of dependent-explanatory variables is also consistent with that of our main results. The column (1) and (5) of Table A1 report the results when $D_{it}$ is the dummy of receiving remittances. Receipt of remittance reduces the labor force participation rate by 9.2 percentage points and the economic activity rate by 27.1 percentage points. Column (2) and (6) show the results when the remittance dummy is replaced by the log of remittance amount. The results are consistent with the results of remittance dummy, and they suggest that doubling remittance reduces the labor force participation rate by 1.3 percentage points, and it reduces the economic activity rate by 3.9 percentage points. The effect of the presence of migrant(s) is displayed in the column (3) and (7). The labor force participation rate declines by 3.2 percentage points if there is at least one migrant in the household. The effect is even larger for the economic activity ration, with a 8.6 percentage points decline. As the continuous counterpart of the dummy of the presence of migrant, we estimate the effect of the number of migrants as reported in columns (4) and (8). Adding one migrant will reduce the labor force participation by 1.8 percentage points while reducing the economic activity rate by 5.2 percentage points.

This Anderson-Hsiao estimator, though being widely used, needs an assumption that $\epsilon_{it}$ is not serially correlated, which could be too strong in some cases. Angrist and Pischke (2009) suggest testing the robustness with two alternative specifications, the fixed-effect estimation and the lagged-dependent estimation (sometimes called as "ANCOVA") which can jointly give a nice "bracket" (the upper-bound and the lower-bound) for the estimate. The fixed effect estimation ignores the lagged dependent variable from the equation (A1). We take the first difference and estimate

$$\Delta y_{it} = \beta_{FE} \Delta D_{it} + \gamma_{FE} \Delta X_{it} + \Delta \epsilon_{it} \tag{A2}$$

Instead, in the ANCOVA model, we drop $\mu_i$ from (A1) and estimate

$$y_{it} = \alpha + \beta_{AC} D_{it} + \gamma_{AC} X_{it} + \theta_{AC} y_{i,t-1} + \epsilon_{it} \tag{A3}$$

The results of the estimation of (A2) and (A3) are reported in Table A2 and A3,

respectively. For all the estimates, the results are quite similar to the corresponding values in the Table A1. Estimates in the columns (1), (3), (5), and (7) of each table are qualitatively the same as the corresponding results of the main results which appear in the columns 1 to 4 of the Table 4 in the main text, respectively.

Table A4 summarizes the coefficient across different specifications, so that the reader can easily compare the results.

From all of the estimation results, it is highly probable that our estimates on the impact of remittance and migration on labor supply of left-behinds, which is significantly negative and sizable, are stable across different empirical specifications.

# Table A1: Anderson-Hsiao Estimation (equation (A1b))

| VARIABLES | (1) ΔLabor Supply | (2) ΔLabor Supply | (3) ΔLabor Supply | (4) ΔLabor Supply | (5) ΔEconomically Active | (6) ΔEconomically Active | (7) ΔEconomically Active | (8) ΔEconomically Active |
|---|---|---|---|---|---|---|---|---|
| ΔRemittance | -0.0921** (0.0460) | | | | -0.271*** (0.0610) | | | |
| ΔRemittance Amount | | -0.0134** (0.00676) | | | | -0.0396*** (0.00898) | | |
| ΔMigrant | | | -0.0322** (0.0138) | | | | -0.0860*** (0.0170) | |
| ΔNumber of migrant | | | | -0.0178** (0.00862) | | | | -0.0518*** (0.0107) |
| ΔLabor supply (t-1) | 0.106*** (0.0233) | 0.108*** (0.0234) | 0.105*** (0.0233) | 0.105*** (0.0233) | | | | |
| ΔEcon. Active (t-1) | | | | | 0.0888*** (0.0200) | 0.0934*** (0.0199) | 0.0945*** (0.0191) | 0.0942*** (0.0191) |
| | | | | | | | | |
| Observations | 22,611 | 22,611 | 22,611 | 22,611 | 22,611 | 22,611 | 22,611 | 22,611 |
| R-squared | -0.112 | -0.115 | -0.092 | -0.091 | -0.223 | -0.224 | -0.084 | -0.083 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Regions | YES | YES | YES | YES | YES | YES | YES | YES |
| Rounds | YES | YES | YES | YES | YES | YES | YES | YES |

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Dependent variables are the labor force participation rate in level for the columns (1) to (4), and the economic activity rate for the column (5) to (8).

"Remittance Amount" is the log of (1 + remittance amount) in order to included households without remittance received into the sample.

"Number of migrant" is the raw number of migrant in the household.

The first stage results can be provided upon request.

## Table A2: First-Differenced Equation Model (equation (A2))

| VARIABLES | (1) Labor Supply | (2) Labor Supply | (3) Labor Supply | (4) Labor Supply | (5) Economically Active | (6) Economically Active | (7) Economically Active | (8) Economically Active |
|---|---|---|---|---|---|---|---|---|
| Remittance | -0.0803* | | | | -0.257*** | | | |
| | (0.0439) | | | | (0.0592) | | | |
| Remittance Amount | | -0.0117* | | | | -0.0376*** | | |
| | | (0.00643) | | | | (0.00867) | | |
| Migrant | | | -0.0268** | | | | -0.0772*** | |
| | | | (0.0126) | | | | (0.0158) | |
| # of migrant | | | | -0.0145* | | | | -0.0469*** |
| | | | | (0.00797) | | | | (0.0100) |
| | | | | | | | | |
| Observations | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 |
| R-squared | -0.002 | -0.003 | 0.012 | 0.012 | -0.116 | -0.112 | 0.011 | 0.011 |
| Number of hhid | 1,346 | 1,346 | 1,346 | 1,346 | 1,346 | 1,346 | 1,346 | 1,346 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Rounds | YES | YES | YES | YES | YES | YES | YES | YES |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The first stage results can be provided upon request.

## Table A3: ANCOVA Model (equation (A3))

| VARIABLES | (1) Labor Supply | (2) Labor Supply | (3) Labor Supply | (4) Labor Supply | (5) Economically Active | (6) Economically Active | (7) Economically Active | (8) Economically Active |
|---|---|---|---|---|---|---|---|---|
| Remittance | -0.129*** | | | | -0.202*** | | | |
| | (0.0151) | | | | (0.0197) | | | |
| Remittance Amount | | -0.0174*** | | | | -0.0268*** | | |
| | | (0.00198) | | | | (0.00260) | | |
| Migrant | | | -0.0410*** | | | | -0.0628*** | |
| | | | (0.00455) | | | | (0.00583) | |
| # of migrant | | | | -0.0278*** | | | | -0.0433*** |
| | | | | (0.00315) | | | | (0.00401) |
| | | | | | | | | |
| Observations | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 | 24,007 |
| R-squared | 0.396 | 0.399 | 0.419 | 0.417 | 0.400 | 0.407 | 0.437 | 0.436 |
| Controls | YES | YES | YES | YES | YES | YES | YES | YES |
| Regions | YES | YES | YES | YES | YES | YES | YES | YES |
| Rounds | YES | YES | YES | YES | YES | YES | YES | YES |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The first stage results can be provided upon request.

**Table A4: Results Summary Across Different Specifications**

| Dependent Variable | Remittance/migration Variables | (1)<br>Regime-Switching model | (2)<br>Anderson-Hsiao | (3)<br>Fixed-Effect | (4)<br>ANCOVA |
|---|---|---|---|---|---|
| Labor Supply | Remittance | -0.112** | -0.0921** | -0.0803* | -0.129*** |
| | Remittance Amount | N.A. | -0.0134** | -0.0117* | -0.0174*** |
| | Migrant | -0.080*** | -0.0322** | -0.0268** | -0.0410*** |
| | # of migrant | N.A. | -0.0178** | -0.0145* | -0.0278*** |
| Economically Acitive | Remittance | -0.198*** | -0.271*** | -0.257*** | -0.202*** |
| | Remittance Amount | N.A. | -0.0396*** | -0.0376*** | -0.0268*** |
| | Migrant | -0.097*** | -0.0860*** | -0.0772*** | -0.0628*** |
| | # of migrant | N.A. | -0.0518*** | -0.0469*** | -0.0433*** |

*** $p<0.01$, ** $p<0.05$, * $p<0.1$