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The Impact of Migration and Remittances on Labor Supply in Tajikistan

Enerelt Murakami[*], Eiji Yamada[†], and Erica Sioson[‡]

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 in two ways. First, we effectively address 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 at home, and for the self-selection of migrants and remittance senders through the application of a control function approach. Second, 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 increases the reservation wages of the household members left at home, thereby reducing their labor supply and economic activity rate. This result is robust to different model specifications and definitions of migration and remittances.

Keywords: Migration, remittances, labor market participation, economic activity rate, endogenous switching, Tajikistan

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1. Introduction

Tajikistan has experienced unprecedented out-migration since achieving 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 subsequent civil war. More recently, however, economic reasons are driving migration, Tajiks are seeking better job opportunities abroad to improve their earning potential. With productivity, growth, and job creation not catching up with rapid population growth, only about a half of the total working-age population was registered employed in Tajikistan in 2017 (World Bank 2017). The lack of job opportunities at home drives many Tajiks to seek employment abroad, with a popular destination being Russia due to 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 percent of households have at least one member abroad in work, of which about 90 percent are in Russia.

The contribution of labor migrants to the Tajikistan economy is enormous. Remittances received from labor migrants have constituted 30 to 50 percent of the country's GDP since 2006 (World Bank 2017), making Tajikistan one of the most remittance-dependent countries in the world. The remittance flows provide the most important source of external funds in the country, surpassing foreign direct investment (FDI) and official development assistance (ODA) flows by more than ten times. At the macro level, the remittances sent by labor migrants substantially contribute to GDP growth and poverty reduction but create an excessive dependency on the economies of remittance-source countries. Most research on migration and remittances in Tajikistan focuses on their impacts on economic growth and poverty reduction at the macro level. However, understanding how these large migrant and remittance flows affect migrants' households and their economic behavior in the home country is also important if the

Government is to reduce Tajikistan's excessive dependence on remittances and exposure to external turbulence.

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

The interest in labor market participation derives in general from 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. Nevertheless, the global evidence is not conclusive on whether international migration and remittances affect the labor supply of the left-behinds positively or negatively.

Past empirical studies on Tajikistan are limited, with most of them suggesting that the reservation wage effect discourages the families of migrants from working. 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 the early 2000s and do not capture the situation after Russia's

economic decline in 2014 and the resulting stricter regulations on immigrants implemented in 2015.

The objective of this paper is therefore to contribute to the scarce empirical literature on the impact of migration on non-migrant labor supply in Tajikistan. The contribution of the paper is twofold. First, we analyze the latest data collected through the ongoing "Listening to Tajikistan (L2TJK)" project that is being conducted by the World Bank. Employing a Telephone Assisted Personal Interview (TAPI) technique, the L2TJK collects the socio-economic data of 800 households every two weeks. As of November 2017, the project had 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 the 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). When estimating the impact of remittances and migration on the labor market participation of household members left behind, we need 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 cause each other. Moreover, migrants and remitters are not drawn from a randomly selected sample population, but from individuals who self-select into these activities. The advantage of the Murtazashvili and Wooldridge (2016) approach is that not only does it correct for selection bias and endogeneity, 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 members

declines by 8 and 11 percentage points respectively. This is higher than the estimates by Justino and Shemyakina (2012) using a similar definition, whose results range from 5 to 8 percent. 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 the 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 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, which provides better wages, people are not willing to work at the domestic wage level.

The rest of the paper is organized as follows: Section 2 discusses the recent patterns of migration, remittances, and the labor market in Tajikistan. Section 3 reviews the related literature on the impacts of remittances on labor supply. Sections 4 and 5 describe the methodology and data employed in the analysis. Section 6 presents and discusses results. Section 7 performs robustness checks for different specifications, and Section 8 concludes the paper.

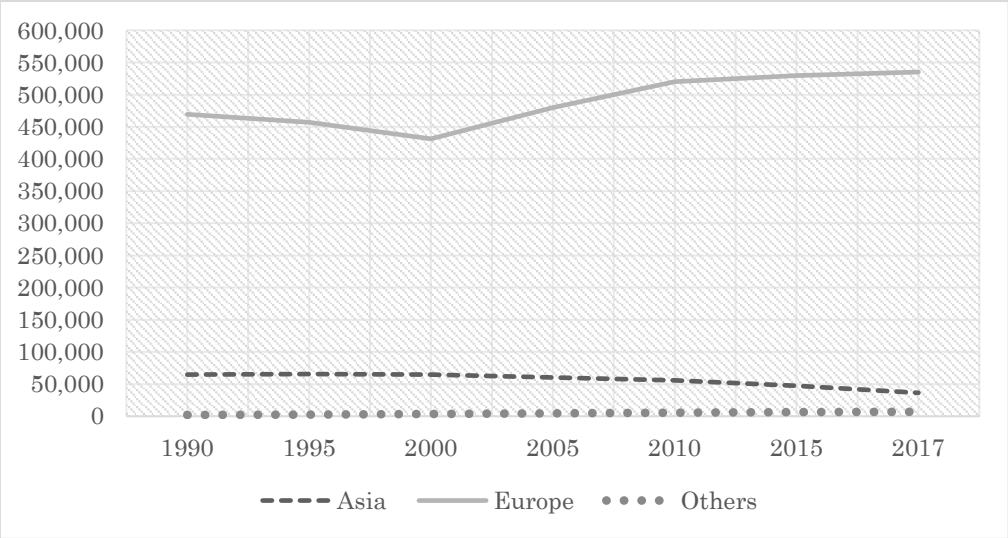
2. Migration, remittances, and domestic labor market patterns in Tajikistan

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. Large wage differentials between Tajikistan and Russia as well as other destination countries are often

cited as major pull factors, while a shortage of jobs relative to the population growth and low wages in the former are considered as the 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 highest number of Tajiks with about 92.51 percent of the migrant Tajik population being in Europe in 2017, a considerable increase from the 87.53 percent in 1990. Most of these migrants are in Russia, and the majority are involved in itinerant jobs from spring to fall, often in the construction industries (Erlich 2006). In 2013, the World Bank and GIZ found that about 40 percent of households in Tajikistan have at least one migrant member.

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



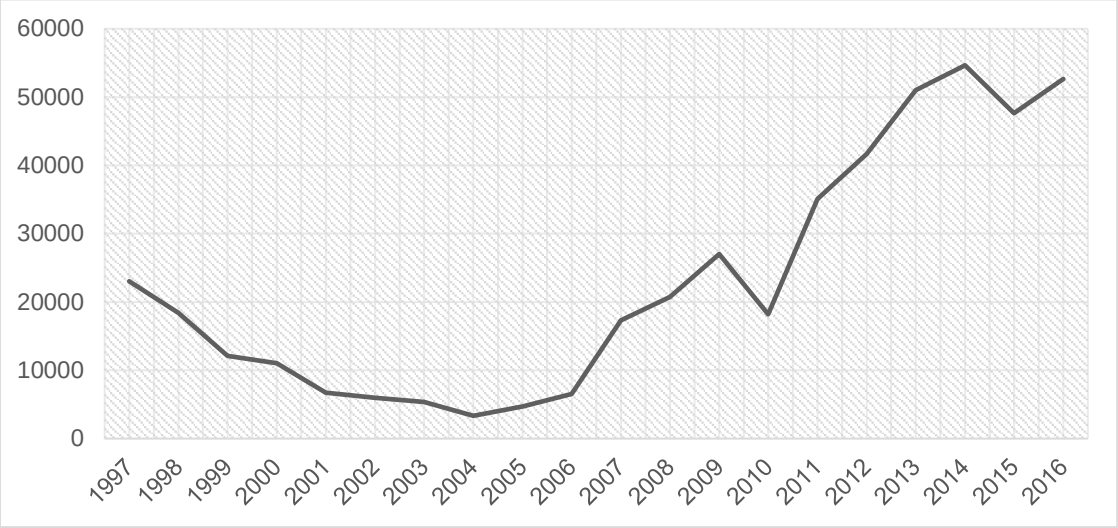
Source: UN DESA 2017.

The growth of migrant workers shows 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 had 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 economic activity within Russia. Before this, migratory flows from Tajikistan to Russia had 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 begin to push Tajiks to migrate and work, primarily in Russia. While some Tajiks migrate to other countries to work, Russia remains the main destination for the majority. This results in Tajikistan being dependent, hence vulnerable, to changes in the Russian economy.

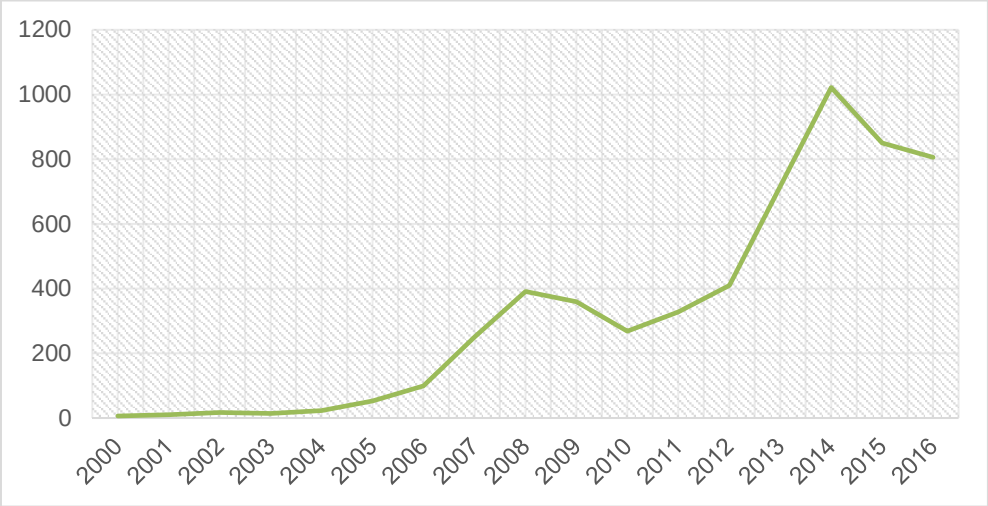
Figure 2. Arrived Tajiks in Russia, 1997-2016



Source: Russian Federation Federal State Statistics Services (2017).

Figure 2 shows a steady decrease in the number of arriving Tajiks in Russia from 2000 to 2005. From more than 11,000 in 2000, it dropped 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 temporarily employed migrants from the Commonwealth of Independent States (CIS) member countries, including Tajikistan (Mukomel 2014). By 2007-2008, Russia was implementing liberal migration reform, resulting in a consistent increase in arrivals, reflected in the steady arrivals of Tajiks until 2008, when the numbers plummeted in 2010 following the Global Financial Crisis. Subsequently, migration rates rebounded and steadily increased until 2014. From 54,658 entrants in 2014, the numbers however dropped to 47,638 in 2015. This reflects the revision of the visa-granting procedures implemented in 2015 by Russia. However, by 2016, there was a relative increase in numbers as arrived Tajiks increased to 52,676. This pattern is also reflected in Figure 3 showing a decline in the number of working Tajiks in Russia by 2015.

Figure 3. Number of Tajiks with work permits in Russia (in thousands)

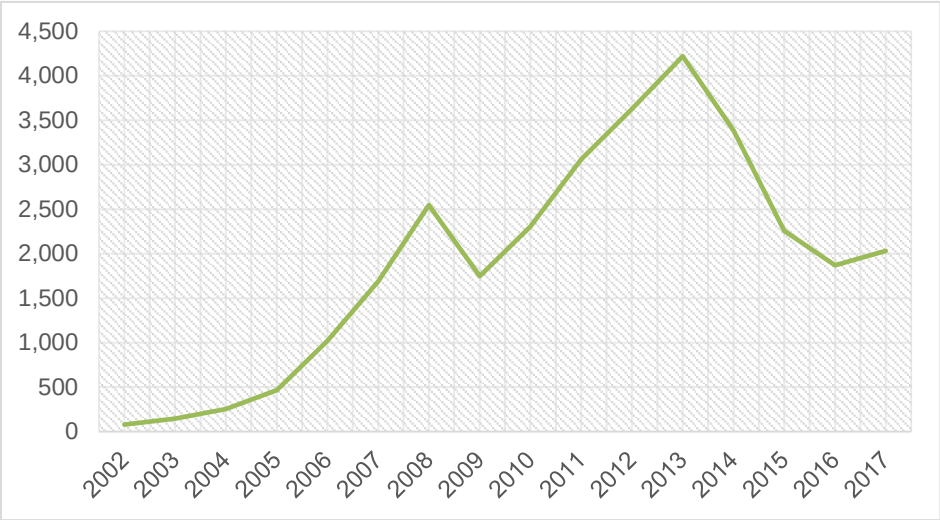


Source: Russian Federation Federal State Statistics Services (2016).

The aggregate flow of remittances to Tajikistan is volatile (Figure 4) just like the number of Tajik migrants which is largely affected by the migration policy of the Russian government. 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, remittances fell to 1.748 billion from 2.544 billion in 2008, reflecting the impact of the Global Financial Crisis felt through its impact on Russia. By 2010, remittance inflows to the country had recovered, accounting for 31 percent of the country's GDP or about 2.254 billion US Dollars.

By 2011, migrant remittances inflows amounted to 2.68 billion US Dollars (41.7 percent of GDP) and steadily increased until they reached a 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 2014 after the devaluation of the Russian ruble. This is also backed by the 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 2013 with a relative increase in 2016, though the share of remittances to GDP 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.

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



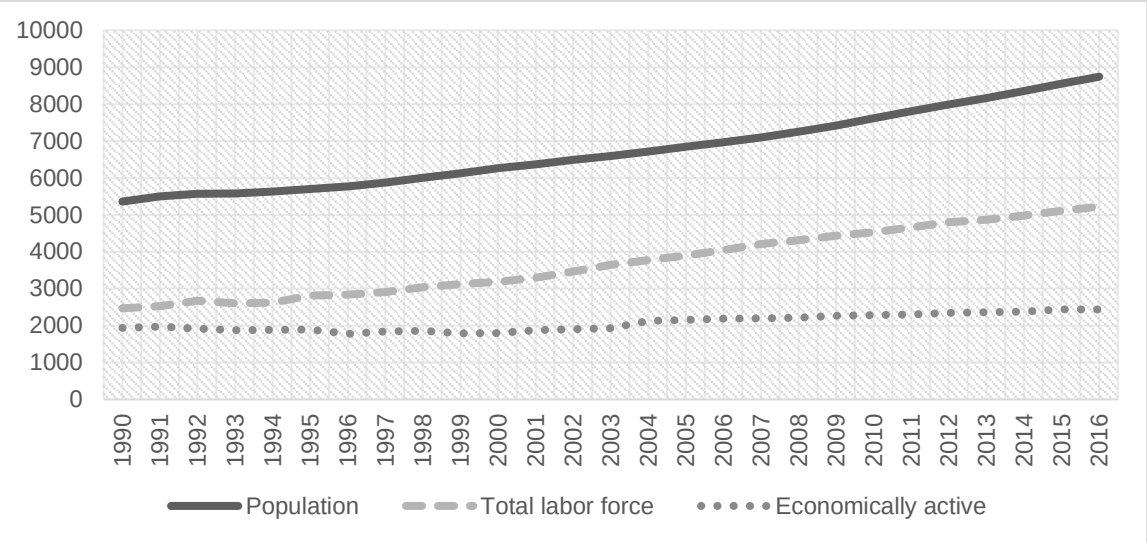
Source: World Bank (2017).

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, some forms of employment in the country vanished. A sharp rise in unemployment due to the closure of many enterprises together with high birth rates became strong push factors in the wake of the Soviet Union's collapse (Olimova 2010). Employment in industrial production declined from 21 percent in 1991 to eight 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 have pulled Tajiks towards migrating (Erlich 2006, Olimova 2010). Tajiks looking for a job elsewhere have found jobs in Russia, filling a demand for unskilled labor in that country.

So, a combination of high unemployment and high population growth have served as push factors driving people out of the country to work in Russia. Figure 5 shows the total population, vis-à-vis total labor force and the economically active population from 1990 to 2016. These data show 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 in certain years even decrease, but high birth rates have contributed to a rapid and continuous increase in population. The current median age is around 22 years, suggesting a young population with a potentially large labor force. However, as noted, while the potential labor force has increased because of natural population growth, the population engaged actively in the economy has not increased as fast. Looking at the registered unemployed we see that by the first quarter of 2016, 54,000 Tajiks were registered unemployed, 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.

Figure 5. Population, labor force and economically active, 1990-2016 (in thousands)



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

In a report by the European Union in 2010, job creation was 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 probably attributable to the slow growth of job creation. The 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 (Strokova and Ajwad 2017). 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 possible reason is that firms in the private sector 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 is the highest."

We can see from the data presented above that a combination of push and pull factors contribute to many Tajiks leaving for other countries to find work. A couple of conclusions can be drawn: (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 the historical relations between Russia and Tajikistan as well as the 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 impacts of migration and remittances on other development indicators such as consumption, immediate well-being, increases in per-capita income, and on compensation for negative shocks have been substantiated in the literature (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 has been

attributed to several 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: first, that remittances can decrease participation in the labor market; second, that remittances have no effect on the labor supply; and third, that remittances 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 and Rodriguez-Oreggia 2009). 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 thus increase the reservation wage of members left in the household. Studies such as Acosta (2007), Acosta, Lartey, and Mandelman (2009), Chami, Fullenkamp, and Jahjah (2005) and Chami, Hakura, and Montiel (2012) also contribute to the evidence that remittances can have negative effects on labor supply and hours worked by members left in the home country. Kim (2007) in a study on Jamaica using fixed-effect regression looked 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 remittances (Adams 2011).

Chami, Fullenkamp and Jahjah (2005) note the negative effect of remittances on growth and productivity. Chami, Hakura and Montiel (2012) conclude that positive technological shocks can induce labor supply through an increase in real wages, and that remittances in response can contract, reducing demand for leisure over labor, which in effect would increase the 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 the perspective that remittances can reduce the labor supply has dominated the literature, it has not been 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 are in fact a household decision regarding labor allocation, then these inflows may not have such huge impacts on a household's domestic work effort. In this vein, 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 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 that showed that an increase in remittances would have a negative impact on the labor force participation of members left in the household but would also have a positive impact on self-employment. This study however was not without shortcomings. Adams (2011) note that like the Kim (2007) study, Funkhouser (1992) did not control for selection in the receipt of remittances and therefore the results could be biased.

Cabegin (2006), on the other hand, used the two-stage probit-OLS method in a study on remittance-receiving households in the Philippines. In a study that corrected the biases in the Funkhouser (1992) and Kim (2007) studies, she noted that for married couples, the 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 that having school-aged children can reduce

market participation for married women in respect to full-time paid employment. The effects however are limited for married men, though the results suggest that an increase in a migrant wife's remittances can reduce the likelihood of non-employment for men. The resulting change in the labor supply can be a function of the change in roles household members assume upon the out-migration of the migrant member.

This is especially true if it is the household head that migrates. In a 2007 study on the labor market inactivity of migrant-sending households in Moldova, Görlich, Mahmoud and Trebesch (2007) offer 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 is not because they consume more leisure, but because of intra-household labor substitution and increased university enrolment. This was further elaborated by Assaad (2011) in a 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, this study 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 remittances in terms of the increase in 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 enrollments. They also found out that remittances are being used to fund education when households are faced with economic shocks. Nsiah (2010) also came to a similar conclusion, on a much larger scale. In their study on remittances and growth in Africa, they found 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 aims to contribute to this debate. It is a response to the call for empirical evidence on the impacts of migration and remittances in Tajikistan. 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 other words, remittances and migration are endogenous to the labor market participation of household members left behind, because a household can self-select into the status of sending migrants or receiving remittances by an unobserved cause, which simultaneously affects their labor market participation at home. Furthermore, a shock to the labor supply of left behind members (e.g., job losses) can be a direct cause of the migration/remittance decision. Because of these omitted variables and the impact of reverse causality, simply regressing the labor market participation on migration/remittance status by OLS will deliver a biased estimate.

In the presence of endogeneity and self-selection bias, the estimation must consider the unobserved heterogeneity that simultaneously affects remittances/migration and labor market participation decisions. To correct for this endogeneity and selection bias, we employ a control function approach to estimate an endogenous switching regression model for panel data following Murtazashvili and Wooldridge (2016). This model is a type of two-stage estimation

where the first stage (the regime switching equation) estimates the determinants of the regime switching variable, and the impact of the regime switching variable on the outcome is estimated at the second stage (the outcome equation). We use a traditional endogenous switching regression model that allows different coefficients across two different regimes in the outcome equation of the following form:

$$y_{it1}^{(m)} = x_{it1}\beta_m + c_{i1m} + u_{it1m}, \quad t = 1, \cdots, T \text{ and } m = 0,1 \tag{1}$$

Where: $y_{it1}^{(m)}$ is the outcome variable, the labor market participation of members left behind, of household i in round t specific to the regime $m = 0,1$.

In our case, $m = 1$ indicates that the household has (a) migrant(s) or is receiving remittances, and $m = 0$ means otherwise; x_{it1} is the vector of explanatory variables; c_{i1m} is the household-specific unobserved heterogeneity in the regime m; u_{it1m} is an idiosyncratic error term; and T is the number of rounds in the panel data.[1] We assume that the explanatory variables x_{it1} may contain continuous endogenous explanatory variables (EEVs) and strictly exogenous explanatory variables z_{it1} with respect to the idiosyncratic error, u_{it1m}. In our model, x_{it1} contains only the strictly exogenous variables z_{it1}, which are uncorrelated with u_{it1m}.

Let y_{it2} denote our regime-switching endogenous binary variable, taking the value 1 if a household has (a) migrants or receives remittances and 0 otherwise. By substituting the following counterfactual framework:

$$\begin{cases} y_{it1}^{(0)} = x_{it1}\beta_0 + c_{i10} + u_{it10} \\ y_{it1}^{(1)} = x_{it1}\beta_1 + c_{i11} + u_{it11} \end{cases}$$

[1] As explained in Section 5 below, our data consists of $T = 32$ rounds.

into a generic expression for $y_{it1}^{(m)}$; $y_{it1} = (1 - y_{it2})y_{it1}^{(0)} + y_{it2}y_{it1}^{(1)}$, we can rewrite the regime dependent outcome equation (1) into a switching regression equation with constant coefficients as:

$$\begin{aligned} y_{it1} &= x_{it1}\beta_0 + y_{it2}x_{it1}(\beta_1 - \beta_0) + c_{i10} + y_{it2}(c_{i11} - c_{i10}) + u_{it10} + y_{it2}(u_{it11} - u_{it10}) \\ &= x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + c_{i10} + y_{it2}(c_{i11} - c_{i10}) + u_{it10} + y_{it2}(u_{it11} - u_{it10}) \end{aligned} \quad (2)$$

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

Let $e_{it0} \equiv c_{i10} + u_{it10}$, $e_{it1} \equiv c_{i11} + u_{it11}$, and $v_{it1} \equiv e_{it1} - e_{it0}$ and assume that

$$e_{it0} = \bar{z}_i\rho_0 + \eta_{it0} \quad (3)$$

$$v_{it1} = \bar{z}_i\rho_1 + \eta_{it1} \quad (4)$$

Where: $\bar{z}_i = \frac{1}{T}\sum_{t=1}^{T} z_{it}$, and (η_{it0}, η_{it1}) are assumed to be independent of z_{it}.

The assumptions (3) and (4) impose strict exogeneity of z_{it} with respect to the idiosyncratic errors (u_{it11}, u_{it10}). Substituting (3) and (4) into (2) gives:

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

The binary response correlated random effects model for y_{it2} is given by:

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

Where: $1[\cdot]$ is an indicator function, κ_{t2} is a round fixed effect, and:

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

The error term v_{it2} is allowed to have serial correlation within the panel (i). We are interested in estimating the structural equations of a household's labor force participation rate and economic activity rate as 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:

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

Where: $h(\cdot)$ is the generalized error function,[2] determined by:

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

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

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

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

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

[2] See Murtazashvili and Wooldridge (2016) for the definition.

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:

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + \bar{z}_i\rho_0 + y_{it2}\bar{z}_i\rho_1 + \xi_0 h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2)$$
$$+\xi_1 y_{it2} h_{it2}(y_{it2}, \kappa_{t2} + z_{it}\pi_2 + \bar{z}_i\delta_2) + \omega_{it} \quad (12)$$

$$\mathrm{E}\big((\omega_{it})\big|y_{it2}, z_{it}\big) = 0 \quad (13)$$

Where: ω_{it} is the implied error in Equation (11).

To consistently estimate the coefficient of (12), we follow a two-step procedure as proposed by Murtazashvili and Wooldridge (2016). In the first stage, we estimate a pooled probit model of the following form for the selection equation (6):

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

and obtain generalized residuals from the estimated coefficients as:

$$\hat{\mu}_{it2} = h_{it2}\big(y_{it2}, \hat{\kappa}_{t2} + z_{it}\hat{\pi}_2 + \bar{z}_i\hat{\delta}_2\big) = y_{it2}\lambda\big(\hat{\kappa}_{t2} + z_{it}\hat{\pi}_2 + \bar{z}_i\hat{\delta}_2\big)$$
$$-(1 - y_{it2})\lambda\big(-\hat{\kappa}_{t2} - z_{it}\hat{\pi}_2 - \bar{z}_i\hat{\delta}_2\big) \quad (15)$$

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:

$$y_{it1} = x_{it1}\beta_0 + y_{it2}x_{it1}\gamma_1 + \bar{z}_i\rho_0 + y_{it2}\bar{z}_i\rho_1 + \xi_0\hat{\mu}_{it2} + \xi_1 y_{it2}\hat{\mu}_{it2} + \omega_{it} \quad (16)$$
$$i = 1, \cdots, N, \quad t = 1, \cdots, T$$

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 this 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, the 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 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 at 10-day intervals, changing to two-week intervals after the sixth wave of the data collection. Households who refused to participate 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 to 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 the elderly above 60 years old, and the household head's age, gender, and educational level. While this 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, individual level data for health, education, and labor market participation are not observed, leaving us unable 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.

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 the 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 the 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
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.

Based on the main interview data, we constructed variables for migration and remittance status, labor force participation rate, and economic activity rate of the household members remaining in Tajikistan (see Tables 1 and 2). The remittance receiving status variable was constructed as a dummy variable to account for the 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 labor force participation and the rate of economic activity. 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 as a robustness check.

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 component that 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) were chosen on the basis of the theoretical and empirical literature of migration. The Harris-Todaro (1970) model predicts that the most important determinants of migration are the wage differentials between home and destination. However, it is difficult to construct a variable for wage differentials because wage data can only be observed for an individual in either home or foreign countries, but not simultaneously. Thus, for a practical reason, we use wage data from destinations, assuming that wage rates are higher in foreign countries than at home. For these wage data, we compiled information on monthly wages in local currencies from the major destination countries, including Russia, Kazakhstan, China, Turkey, South Korea, the United States, and Ukraine from the corresponding months and quarters of 2015 to 2017 that match with the L2TJK data. Monthly wage data for Russia came from the Russian Federation Federal State Statistics Service. 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 enable comparison, the 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 a negligible share of Tajik migrants work in these countries.

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 rate at destination	3995.97	953.71	2578.44	13501.08
Number of observations	25,550			

Source: Authors' computations.

Finally, the New Economics of Labor Migration (NELM) theory emphasizes the importance of the network effect of migration as a key determinant of labor migration. Particularly, it argues that using personal networks in the destination could reduce migration costs and thereby promote more migration. Past empirical studies that test the NELM hypothesis often use the number of migrants in the community or the presence of return migrants as proxies for a migration network. Thus, we follow past literature and use the number of migrants in the community as a proxy for the migration network. In this paper, we use the PSU as a community as it is the smallest unit that the sample could be drawn from. The surveyed sample 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 with 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 estimate two pooled probit models of migration and remittances status 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 in destinations and the number of migrants in the PSU. By selecting wage rates and the number of migrants as instruments, we assume that they have no direct effect on household labor supply decisions once we control for household migration or remittance decisions. 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 the 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 most estimated coefficients are statistically significant and the directions of the effect of household characteristics on migration and remittance decisions are consistent across the models, with larger magnitudes for the migration decision in general.

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. Finally, 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 decision to migrate. While we did not consider 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 in the PSU and the wage rate in the

destination) from the structural equations of the household labor supply to exploit them as instruments. Thus, it is assumed that the number of migrants in the PSU and the wage rate in a destination have no direct effect on labor supply decisions at home.

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

	Remittances	Migrants
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.

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 on the parameter estimates of the household labor supply as measured by household 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)**
Time averaged variables	Yes	Yes	Yes	Yes
Regions	Yes	Yes	Yes	Yes
Rounds	Yes	Yes	Yes	Yes
Interactions with remittances/migrants				
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 the 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 using 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 as 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 magnitude, 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 the 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 a 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 past research in the Tajikistan context. Justino and Shemyakina (2012) also observe negative impacts from 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 reduces 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, having handicapped members and with a female head are likely to have lower labor force participation rates, whereas the household head's age and education may increase their participation rates. The effects on the economic activity rates for non-migrant and non-remittance receiver households also follow the same pattern.

For migrant supplying 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 a lower 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.

7. Robustness check with alternative specifications

We conduct several robustness checks to confirm the validity of our main results. We estimated three 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 models that we estimated include an Anderson-Hsiao (1981) type dynamic panel model, a standard fixed-effect model, and a lagged-dependent variable (ANCOVA) model. The results are consistent with our main results, although the magnitude of the estimates is slightly lower except for the impact of the economic activity rate coefficients on the remittance status. For both continuous endogenous explanatory variables, the negative

effects are significantly and consistently observed, which further supports our findings in relation to the regime-switching regression. Generally the magnitude of the impact of remittances is larger than that of migration, implying that remittances have much larger income effect that discourages labor market participation on non-migrant household members.

Our benchmark panel model for robustness check is as follows:

$$y_{it} = \beta D_{it} + \gamma X_{it} + \theta y_{i,t-1} + \mu_i + \epsilon_{it} \quad (17)$$

Where: y_{it} is the outcome variables such as labor supply and economically active labor participation; and D_{it} are key explanatory variables of interest, such as the status of remittance and migration. In addition to the discrete dummy variables we use in the main text, D_{it} also includes the continuous treatment variables, amount of remittance and number of migrants from each household. μ_i represents household i's time-invariant unobserved characteristics, and ϵ_{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 past shocks can affect the present decision. This is the reason for including the lagged dependent variable, $y_{i,t-1}$, in the right-hand-side of (17).

In practice, we use the first differenced equation of (17) so that we can eliminate μ_i:

$$\Delta y_{it} = \beta \Delta D_{it} + \gamma \Delta X_{it} + \theta \Delta y_{i,t-1} + \Delta \epsilon_{it} \quad (18)$$

In addition to our key identification challenge, the endogeneity of ΔD_{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 instrument $\Delta y_{i,t-1}$ with $y_{i,t-2}$ as suggested by

Anderson and Hsiao (1981). Thus, in (18) we instrument two endogenous variables ΔD_{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 equation (18) are summarized in Table 6. 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. Columns (1) and (5) of Table 6 report the results when D_{it} is the dummy of receiving remittances. Receipt of remittances reduces the labor force participation rate by 9.2 percentage points and the economic activity rate by 27.1 percentage points. Columns (2) and (6) show the results when the remittance dummy is replaced by the log of the remittance amount. The results are consistent with the results using the remittance dummy, and they suggest that doubling remittances reduces the labor force participation rate by 1.3 percentage points and the economic activity rate by 3.9 percentage points. The effect of the presence of migrant(s) is displayed in columns (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 ratio, with an 8.6 percentage points decline. As the continuous counterpart of the dummy of the presence of migrants, 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, requires the assumption that ϵ_{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 "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 equation (17). We take the first difference and estimate:

$$\Delta y_{it} = \beta_{FE}\Delta D_{it} + \gamma_{FE}\Delta X_{it} + \Delta\epsilon_{it} \quad (19)$$

Instead, in the ANCOVA model, we drop μ_i from (17) and estimate:

$$y_{it} = \alpha + \beta_{AC}D_{it} + \gamma_{AC}X_{it} + \theta_{AC}y_{i,t-1} + \epsilon_{it} \quad (20)$$

The results of the estimation of (19) and (20) are reported in Tables 7 and 8, respectively. For all the estimates, the results are similar to the corresponding values in Table 6. Estimates in the columns (1), (3), (5), and (7) of each table are qualitatively the same as the corresponding main results which appear in columns 1 to 4 of Table 4, respectively. Table 9 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 of the impact of remittances and migration on the labor supply of left-behinds, which is significantly negative and sizable, are stable across different empirical specifications.

Table 6. Anderson-Hsiao estimation (Equation 18)

VARIABLES	(1) Δ Labor Supply	(2) Δ Labor Supply	(3) Δ Labor Supply	(4) Δ Labor Supply	(5) Δ Economically Active	(6) Δ Economically Active	(7) Δ Economically Active	(8) Δ Economically Active
ΔRemittance	-0.0921**				-0.271***			
	(0.0460)				(0.0610)			
ΔRemittance Amount		-0.0134**				-0.0396***		
		(0.00676)				(0.00898)		
ΔMigrants			-0.0322**				-0.0860***	
			(0.0138)				(0.0170)	
ΔNumber of migrants				-0.0178**				-0.0518***
				(0.00862)				(0.0107)
ΔLabor supply (t-1)	0.106***	0.108***	0.105***	0.105***				
	(0.0233)	(0.0234)	(0.0233)	(0.0233)				
ΔEcon. Active (t-1)					0.0888***	0.0934***	0.0945***	0.0942***
					(0.0200)	(0.0199)	(0.0191)	(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 are 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) to included households without remittance received into the sample.
"Number of migrants" is the raw number of migrants in the household.
The first stage results can be provided upon request.

Table 7. First-differenced equation model (Equation 19)

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)		
Migrants			-0.0268**				-0.0772***	
			(0.0126)				(0.0158)	
# of migrants				-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 are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
The first stage results can be provided upon request.

Table 8. ANCOVA model (Equation 20)

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)		
Migrants			-0.0410***				-0.0628***	
			(0.00455)				(0.00583)	
# of migrants				-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 are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1
The first stage results can be provided upon request.

Table 9. Results summary across different specifications

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

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

8. Conclusions

Out-migration has increased rapidly in Tajikistan and is 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 recently been in decline because of migrants returning from Russia and the economic slowdown in Russia, migration remains to be a lucrative and preferred choice of occupation for many Tajiks.

This paper has explored the labor market impact of overseas out-migration and remittances in Tajikistan using the unique high frequency household panel data, L2TJK. The analysis covered 32 rounds of the L2TJK survey collected between 2015 and 2017. To consider 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 as it allows serial correlation in the error term as well as heterogeneities to be correlated with time-varying explanatory variables. This approach is less computationally expensive than the alternative full information maximum likelihood approaches.

Our results show that having a migrant member or receiving overseas remittances can reduce 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 remittances than to migration. This result is in line with past empirical studies of the type in Tajikistan and other countries, as well as previous theoretical constructs. 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 on development. There are several channels through which remittances and migration can affect the wellbeing of households – as a buffer to shocks, by increasing the per-capita income of households, through 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 implications of the results depend 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 of performing more detailed analysis disaggregated by age and gender. This paper shows that collecting such data can improve our collective knowledge of the 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 possibility of remittances and migration having a positive impact on other outcomes. Thus, this paper encourages further study to piece together a more complete picture that would allow us to suggest better policy responses on how to channel such remittances into development.

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Abstract (In Japanese)

要約

タジキスタンは、中央アジアにおける主要な移民送出国で、移民からの送金に対する依存度が高い。本稿は、タジキスタンにおいて、出稼ぎ移民と送金が本国に残る家族の労働供給に与える影響を検証している。移民・送金が家計の労働供給に与える影響を巡っては、従来から内生性の問題が指摘されてきた。本稿では、コントロール関数法を用いて高頻度の家計パネルデータを分析することにより、既存研究では見られなかった方法で内生性問題の克服を試みている。分析結果は、移民の送り出しと送金の受け取りにより、家族の留保賃金が上昇し、労働・経済活動への参加を減少されることを示唆している。この結果は、分析手法や移民・送金の定義を変えた場合でも同様に観察され、頑健であることが示された。

キーワード：移民、海外送金、労働参加、経済活動率、内生的スイッチング、タジキスタン