The effect of emigration and remittances on labour supply of the left-behind: Evidence from Nepal

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Abstract

Rapid increases in work-related emigration and subsequent inflows of remittances have raised policy concerns about impacts on labour supply in emigration-source countries. The growing literature in this area ignores spillover effects from emigration and remittances in one locality affecting outcomes in nearby localities. A two-wave panel of 500 localities in Nepal is used here, along with destination driven exogenous changes in predicted emigration rates, to identify impacts of emigration and remittances on labour supply. There is a positive impact on labour supply, but just for females. Also, emigration and remittances are associated with labour shifting out of agriculture as farm work is less preferred in remittance receiving households. While the spillover effect of emigration is as large as the direct effect, spillovers are limited to rural localities. Given the typical nature of rural labour markets, emigration-driven remittances help to overcome borrowing constraints and boost local activity that increases local wage rates and creates additional employment opportunities for the non-emigrants.

Keywords: labour supply, emigration, spillovers, remittances, Nepal

JEL Codes: D1, J22, O13, O15

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1. Introduction

Labour export to countries like India and MENA (Middle East and North Africa) region is an important source of livelihood in Nepal. The impacts of emigration and remittances are often linked with the poverty reduction achieved by Nepal and other countries (Acharya & Leon-Gonzalez, 2012; Acosta et al., 2008; Adams Jr & Page, 2005; Gupta et al., 2009; Lokshin et al., 2010). Yet little is known about how these changes affect the labour force participation of the left-behind. While there is a literature on general equilibrium and spillover effects of emigration (Marchiori et al., 2013; Weyerbrock, 1995), effects on labour supply are largely ignored. It is likely that emigration and the resulting non-labour income in the form of remittances not only affect the sending locality but also neighbouring localities if the labour markets or other markets are spatially interconnected (e.g. being either adjacent or connected by road networks). These spatial linkages can significantly shape livelihoods (Abbay & Rutten, 2016; Banerjee et al., 2020; Dillon et al., 2011; Gibson & Rozelle, 2003; Jacoby & Minten, 2009; Shrestha, 2020). Given this potential importance, this paper aims to identify the direct and spatial spillover effect of emigration on the labour supply of non-migrants.

While there has been recent attention to this question, the extant studies are based on direct effects, often within the same household. For example, negative effects of emigration on labour supply of remaining male or female household members are found in Tajikistan (Justino & Shemyakina, 2012), Jamaica (Kim, 2007), Nicaragua (Funkhouser, 2006), Pakistan (Mughal & Makhlouf, 2013) and rural Mexico (López-Feldman & Escalona, 2017). These effects also show up in cross country studies (Chami et al., 2018). Similarly, Cabegin (2006), Funkhouser (2006) and Melkonyan and Grigorian (2012) have found upward shifts in reservation wages and change in occupation choice of the left-behind non-migrants. For Nepal, the similar studies by Lokshin and Glinskaya (2009), Phadera (2016), and Shrestha

(2017) all explore the effects of emigration on labour supply without considering any spatial spillovers.

Yet spillover effects are commonly studied in other areas, including the information flows and innovation from foreign direct investment (FDI) on firms' productivity growth and domestic industrial growth (Cainelli & Lupi, 2010; De Lucio et al., 2002; Henderson, 2003; Song & Son, 2019). While remittances are also a source of external finance for development, similar studies to identify spillover effects of emigration and remittances hardly exist. In order to fill this gap, this paper examines direct and spatial spillover effects of emigration, using different methods to consider 'nearby' localities, in terms of both straight-line and road distance. The need for such an analysis is because if emigration-driven development in one locality affect the outcomes in other locality, by ignoring spillover effect then the total impact of emigration on development in source areas is likely to be understated.

The main results use geographic proximity based interconnectedness matrix (to capture the potential spillover effects), which is also most commonly used in the literature to show interconnectedness between localities or firms (Cainelli & Lupi, 2010; Song & Son, 2019).[2] However, the interconnectedness among localities is often not limited to geographic proximity but it also depends on the spatial pattern of roads or other transportation networks, the pattern of markets and so forth (Abbay & Rutten, 2016; Boussauw et al., 2012; Gibson et al., 2017). In the context of Nepal with the mountainous topography, where average elevation can range from anywhere between 700 to 6000 meters, the geographic distance between two localities may not always be an appropriate measure of interconnectedness. The travel time and travel cost to go from one 'nearby' locality to another vary considerably across the country and this variation may affect their interconnectedness. As highlighted by Shrestha

[2] Typically, geographic coordinates (latitude and longitude) of localities are used to draw a straight line distance, and localities that fall within some preset distance are defined as interconnected neighbours.

(2020), there are several reasons for this heterogeneity in interconnectedness. First, localities on a North-South axis are more connected via road than are localities that lie on an East-West axis. Second, the barriers to commute between geographically nearby localities are much higher and costlier in the hills and mountains than is the case in Nepal's low land regions.

Given the limitations of geographical proximity measures, this study also uses a road network based measure for interconnectedness. This reflects the critical impact of roads on livelihoods (Gibson & Rozelle, 2003; Shrestha, 2020). For this study, I consider localities interconnected if they are joined by a road link, with the nearest neighbour estimation approach used. For interconnected localities, emigration and remittances in locality i may affect local wages and economic activity in the same locality and in nearby locality j. Likewise, there may be a shift in labour supply to engage in new economic activities in both i and j, as a result of emigration from, and remittances into, locality i.[3] There is also a general equilibrium effect of remittance as this additional source of income is generally spent in locally produced goods which helps in the reinvigoration of the local economy. Moreover, there is also a within-locality local multiplier. Emigration has a cross-household effect in which emigration from one household may affect the labour supply decision of other households in the same locality (Posso, 2012). Ignoring this effect may understate the impacts of emigration on non-migrant households.

In order to study these issues, I use the 2008 National Labour Force Survey (NLFS-II) and the 2010 National Living Standard Survey (NLSS-III) 2010 to construct a two-period panel of 499 localities based on village average. An advantage of taking village averages is that within-village spillovers are captured, which may be missed in household level data. The within village spillover is likely to be important in Nepal because households living in the

[3] The direct effect of emigration may reduce the total labour supply from the sending locality which may affect the local wage rate in the same locality and its neighbours. Similarly, the inflow of remittances may help to reinvigorate the local economy and increase economic activities in the surrounding locality.

same village are often interdependent. For instance, (non-monetary) family labour exchange is very common in the rural agriculture sector, where members of two households jointly work their farmland in rotation to avoid using paid labour. From both national surveys the labour force participation (LFP) rate for each village for age group 17 to 65 is calculated. A disaggregated analysis further considers participation in agriculture and non-agriculture separately and participation of males and females separately.

The endogenous nature of migration poses a major challenge to identifying impacts of emigration and remittances on the left-behind (Gibson et al., 2011). The two-wave panel that I construct allows for both time fixed effects and village fixed effects where the effect of time-invariant unobservable factors on outcome variable and migration is ruled out. Nevertheless, if time-varying village characteristics correlate with both village-level emigration and domestic labour market trends, the empirical results could be biased. In order to deal with this threat to the validity of the analysis, I use an instrumental variables approach that exploits village-level variation in predicted emigration rates. These predictions use the destination country-specific demand for migrants, and so are plausibly exogenous at the village level. The predicted emigration rate is based on a time trend emigration rate which depends on the baseline (in 2001) village share of migrants in each destination. I assume that a demand shock (change in demand for migrants) in the destination would primarily affect villages that have stronger pre-existing migrant networks to that destination. The variation in predicted emigration rates is determined by factors outside of Nepal, and so it should only affect labour supply decisions in Nepal through the channel of emigration and remittances.

The results show that, after accounting for endogeneity, the direct effect of emigration is to increase the labour force participation rate of the left-behind; a pattern that would not be apparent if endogeneity was ignored. This positive effect is limited to the female workforce with no significant effect on males. There is also a fall in the labour force participation rate in

agriculture sector as farm work is less preferred in households that receive remittance income. In addition to finding an overall increase in labour supply, I find that the spillover effect of emigration occurs through geographic proximity and road link interconnectedness and is as large as the direct effect. I find that the overall increase in labour supply is linked with the rise in local wage rate and economic activities (through general equilibrium effect) that incentivises non-migrants from interconnected localities to participate in the labour market. However, these spillover effects occur primarily for rural localities. One likely reason is that the rural labour market is financially constrained and has limited in-migration, so emigration plays a greater role to overcome borrowing constraints and reinvigorating the local economy that creates employment opportunities for non-migrants. Whereas the urban labour market has a large formal or semi-formal credit institution and a repository of the reserve labour force due to rural-urban migration (Harris & Todaro, 1970), so financial constraints are less binding and the boost provided by emigration and remittances may be less needed to stimulate the local economy.

The outline of this paper is as follows. Section two briefly discusses emigration and remittances in Nepal, followed by the discussion of data and econometric model in section three. The estimated results are broadly discussed in section four, and the final section has the conclusions.

2. Context: Migration from Nepal

Nepal has a long history of work-related migration. As far back as the 19th century, Nepalese used to migrate to Lahore city in Punjab. The long open border and visa-free mobility have traditionally made India the most attractive and lowest-cost destination as a way for Nepalese to escape domestic unemployment. Since 1981 the share of migrants working in India has declined sharply; census data show the share was over 90% in 1981, then 77% in 2001 and just 38% in 2011. However, for poor regions in Nepal like the Far-western and Mid-western

region, India continues to be an important destination, with these two regions accounting for 36% and 48% of total Nepalese migrants in India in 2011 and 2001 (CBS, 2001, 2011). This outflow of labour force to India is sustained by the well-established migrants' network which helps new migrants to find jobs in Indian cities, often on a seasonal basis.

A more recent development for Nepal since 1990 is the rising share of migrants going to high-income destinations after the government allowed private recruiters to recruit Nepali labour force to Gulf countries and Malaysia. After 2001 (when the intensity of Nepal's civil conflict was high), the number of people migrating to high-income destinations has increased substantially. The rise in civil conflict, stagnant economic growth, political instability, high unemployment and rise in demand for the Nepali worker in MENA and Malaysia has further fuelled outflow of labour force. For instance, in 1994/95, around 3600 people have secured a work permit, and this number has increased by more than 100,000 work permits in a single year from 2001 onwards.

Lately, the skill-related migration to developed countries like North America, Europe and South Korea has also increased and people from a relatively developed region like central and eastern Nepal are migrating to high-income destinations. The better income-generating prospect, a better quality of education and life and strong social capital are some of the important drivers of diversification in international migration. Overall, the number of people who have emigrated has increased to 1.9 Million (7.7 % of the total population) in 2011 from 0.76 Million (3.3% of the population) in 2001 (CBS, 2001, 2011). As a result, one-third of households have at least one migrant member abroad mostly in the 15-59 age group (CBS, 2008, 2010).

Subsequently, the inflow of remittances has also increased and now it plays an important part in the stability of the economy. Nepalese households and economy are heavily reliant on remittances to finance imports and consumption and to maintain the balance of

payments. The total value of remittances from formal sources increased from USD 55 Million in 1993 to USD 147 million in 2001. Thereafter, with a decade-long civil conflict and with political instability, remittances are ever more important, increasing from USD 3.3 billion in 2011 to USD 6.3 billion in 2017. The value of remittances relative to national GDP was only 2.4% until 2001 but increased to 21.6% in 2010 and 31% in 2016 which has placed Nepal as a sixth ranked country in the world in terms of remittances relative to GDP. In addition to the formal channel, Nepal also receives a large amount of undocumented remittances from the informal channel, especially from India. About 55% of households receive remittances, with an average value per household of around USD 730 per annum (CBS, 2010). The massive surge in remittance inflows has increased household disposable income and led to a massive decline in poverty, which fell from 42% in 1996 to 25% in 2010.

In the last two decades, Nepal has also experienced a structural transformation but triggered by foreign employment rather than job creation in the manufacturing sector that would occur in a Lewis-type model. The outflow of labour to foreign employment deprived both agriculture and manufacturing sector of a cheap local labour supply. These two sectors are facing labour shortages, and often agricultural households either have to rely on the family exchange labour or leave arable land barren (Jaquet et al., 2019; Kharel et al., 2019). Meanwhile, even as Nepal exports labour the manufacturing sector is partly relying on labour coming from India, and in the absence of a cheap local labour force, some factories are forced to shut down. Therefore, understanding the impacts of emigration and remittances on labour supply in Nepal is a major policy issue which the analysis here aims to contribute to.

3. Data and Methods

The analysis relies upon the 2008 Nepal Labour Force Survey (NLFS II) and 2010 Nepal Living Standard Survey (NLSS III). The commonality between these two surveys is that the primary sampling units (which I also refer to as villages or localities) for NLSS III are a

subset of those used for the NLFS II. This design was to take advantage of the cartographic segmentation and household listing already carried out in 2008 (CBS, 2010). From 799 PSU in NLFS II (half urban and half rural), 174 urban and 325 rural PSU were randomly selected to provide a sample of 499 PSUs for the NLSS III (CBS, 2010). In both surveys the selection of households within PSUs is random, so it is possible to construct village averages from the household data.[4] This use of village level averages allows for inter-household spillovers, and lets me construct a two wave panel of 499 villages. The use of village-level averages also helps to mitigate the effects of measurement error in the household-level data.

These two surveys have information about international migration and remittances, domestic migration and remittances, age, gender, literacy, education and employment status of the household members, household land ownership and so on. This study includes 41,693 (56% of the total population in the survey from NLFS II) and 15,505 (54% of the surveyed population from NLSS III) non-migrating workforce aged 17 to 65. The total number of migrants (in the same age range) in NLFS II and NLSS III are 18,418 and 8,438 respectively, which is equivalent to 25% and 30% of the surveyed population.[5]

The detailed data on wage and non-wage employment, agriculture and non-agriculture employment and self-employment activities allow me to calculate Labour Force Participation (LFP) rates for each locality.[6] The LFP rate is further disaggregated into a male rate and a female rate and rates for the agriculture and non-agriculture sectors. The LFP rates are the outcome measures in the empirical results section below. One important point to note that an individual can engage in more than one job (maybe in agriculture and non-agriculture sector),

[4] In NLFS II, 20 households are surveyed per PSU (which are either individual wards or sub-wards or groups of neighboring wards (CBS, 2010)). In NLSS III, 12 households were randomly selected per PSU.
[5] A migrant is defined as a member of a household currently away from home (residing in foreign destination) for at least six consecutive months at the time of the survey.
[6] I followed NLFS II definition to construct LFP rate as the ratio of economically active population (employed and unemployed) to total population aged 17 to 65. Someone managing his/her own business in agriculture or non-agriculture sector or both is considered as self-employed.

and agriculture and non-agriculture work can be self-employment activity. Therefore, with multiple sources of livelihood, we may observe an increase in labour supply with unchanged or reduction in LFP in one of these sectors (agriculture or non-agriculture sector).

The variable of main interest is the locality emigration rate per 1,000 population.[7] The other covariates are average household size, average quantity of land owned per household (a proxy for wealth), the gross enrolment rate at the higher secondary level (level 12), the share of the working-age (age 15-60) in total population, the share of the working-age population with at least basic level education (grade ≥ 8), average literacy rate and the share of emigrants with at least basic level education (grade ≥ 8). International emigration may be a two-step process, where someone first migrates domestically and then moves to a foreign country once they accumulate sufficient resources. Therefore, I also include the domestic migration rate and the average remittances received from domestic migrants as additional controls. The definitions and summary statistics of all variables that are used in the main results are presented in Table 1.

(Table 1 about here)

Neither the NLFS II nor the NLSS III survey gathered GPS (global positioning system) coordinates during their fieldwork. Yet it is necessary to know the location of each village in order to estimate spillover effects. Therefore I have retrospectively geo-coded each village, based on Village and Municipality administrative data and using G*oogle Maps*. The locations of all 499 localities (PSUs) are shown in Figure 1(a).

(Figure 1 about here)

I allow for two types of interconnectedness when estimating spillover effects. The first uses geographic proximity and the second adds a road network to this. Specifically, I develop a geographic proximity-based interconnection matrix where I identify the closest five

[7] I derive emigration rate by dividing the number of emigrants from the village by the village total population.

interconnected localities, based on straight-line distance between the GPS coordinates of each locality. As discussed above, geographic proximity may be less appropriate if heterogeneity in geographic characteristics like elevation and topography interferes with straightline travel, as is the case for Nepal. Thus even if two localities are close or interconnected by geographic proximity, spillover may not take place between them if they are not connected by the road network. Therefore, the second approach uses recent data on Nepal's road network, which is extracted from the World Food Programme (WFP). The PSU coordinates and road network data are plotted in the map to draw road network interconnected matrix (see figure 1(b)).[8]

The road network data covers every road at the village level, even walking trails. However, I limit attention to highways and primary and secondary roads as these are the main medium for transportation. I then define interconnectedness based on two conditions: the geographic proximity of two localities must be the shortest, and the two localities must be within five kilometres (km) of the closest point on the road network.[9] If two shortest distance localities are outside a five km radius of the closest road network, they will be considered as non-neighbours or not interconnected. Based on these criteria I identify 349 (168 Urban and 181 Rural) localities and 334 (161 Urban and 173 Rural) localities as the first and second shortest distance neighbouring localities with road connectivity within a five km radius.

The Econometric Model:

There can be two offsetting effects of emigration and remittances on the labour supply of the left behind. They may decrease their labour supply if reservation wages rise as remittances (non-labour income) increase the demand for leisure. Conversely, emigration may increase local wages due to former workers going abroad and also if remittances are invested in

[8] This is the same road network data used in Shrestha (2020). The survey data are from 2008 and 2010 so it may affect which localities are defined as neighbours if new road networks have developed recently.

[9] The GPS coordinates of a village are the points which represent the center point of the locality based on its geographic size. Road networks often pass through the population settlement area which is not necessarily the centroid of the village. To allow for this, I have kept a margin of 5 km which will essentially help to determine if a village is connected with the road link or not.

businesses so that local labour demand rises, and with higher local wages the substitution effect would outweigh the income effect, so labour supply should rise. Given this ambiguity, empirical estimates are needed. Initially, spillovers are not considered, so the model is:

$$Y_{it} = \mu_i + \lambda_t + \beta X_{itmig} + \theta X_{it} + u_{it} \quad (1)$$

$$u_{it} \sim N(0, \sigma^2 l_N) \quad (2)$$

In equation (1), the NT × 1 vector of dependent variables (labour force participation rates) are denoted by Y_{it}, and these are modelled as depending on μ_i and λ_t village and time fixed effects, on the variable of main interest – the locality emigration rate – as denoted by matrix X_{itmig} and other control variables (such as average holdings, the working age population share and so forth) in matrix X_{it}. The β and θ are vectors of coefficients for X_{itmig} and X_{it}, and u_{it} is a NT × 1 vector of error terms which is clustered at the village level.

To examine the spillover effect on labour supply, the interconnectedness matrix based on geographic proximity and the road network is used, following the identification strategy applied by Brinkman and Mok-Lamme (2019). The models are as follows;

$$Y_{it} = \mu_i + \lambda_t + \delta X_{jtmig} + \theta X_{it} + u_{it} \quad (3)$$

$$u_{it} \sim N(0, \sigma^2 l_N) \quad (4)$$

Equation (3) is similar to Eq. (1), but this time X_{jtmig} is the emigration rate of interconnected locality j and δ is the response coefficient.

The two models discussed thus far, for direct effects (or own-estimation) and for the spillover effects, include village and time fixed-effects to reduce endogeneity bias, which may arise from unobserved village characteristics that correlate with labour supply and emigration. To the extent that these unobserved characteristics are time-varying, the fixed effects strategy will not remove all endogeneity bias. It is quite likely that village characteristics like labour market condition and access to credit vary over time and are correlated with both emigration and labour supply (Adams Jr, 2011). Moreover, in both the

2008 and 2010 datasets, I observe strong regional heterogeneity in emigration rates. Therefore, the spatial variation to identify the own-effect (and spillover effects) is not necessarily random, and if time-varying village characteristics are correlated with both village-level emigration and domestic labour market trends, the empirical results are likely to be biased.

Therefore an instrumental variable estimation approach for both Eq. (1) and (3) can be used to overcome endogeneity bias (Acosta, 2011; Acharya & Leon-Gonzalez, 2014; Calero et al., 2009; Koska et al., 2013). Specifically, I follow the strategy of Theoharides (2018) to predict the locality level emigration rate to various destinations using historical (baseline) emigration patterns (from the 2001 census data). This relies on the fact that historical emigration to a destination is a good predictor of subsequent emigration, due to network effects. I then use destination-specific time trend instruments in a standard two-stage least squares estimation approach for Eq. (1) and (3).

Consider the migration network in terms of the share of people who had migrated from village i to destination country k by 2001 (out of the total number of people who had migrated to k from Nepal). The total number of migrants who migrated to destination k in each year t (2008 or 2010 given the timing of panel) is then summed. To predict the total number of migrants from the village in each survey year (that is, in 2008 and 2010), I weight the total migrants to destination k by the 2001 village i migrants share to destination k. The predicted migrant flows (demand for migration) from each village then is:

$$M_{ikt}^{p} = \sum_{i}^{n} M_{kt} \frac{M_{ik}^{2001}}{M_{k}^{2001}} \tag{5}$$

Where M_{ikt}^{p} is the predicted number of people migrating to destination k from village i in year t (2008 or 2010), M_{kt} is the total number of people who had migrated from Nepal to destination k by year t (2008 or 2010), and $\frac{M_{ik}^{2001}}{M_{k}^{2001}}$ is the village i migrants share in total

national migrants to destination k in the past (in 2001 in this case, which is when the baseline migration network is measured). The predicted number of migrants is normalized by dividing M_{ikt}^{p} by the total village population each year.

The performance of this IV depends on stability of the distribution of migrants across destinations over time (Theoharides, 2018). For Nepal's five development regions, these distributions across destinations are quite stable. For example, India remains a favourite destination for people from the mid-west and far-west regions while relatively developed regions like central and eastern regions prefer sending migrants to MEOA (Middle East and Other Asia). The relationship between 2001 and 2011 migrants share is also quite strong, as villages continue to send migrants to destination countries at a similar rate, with just a small fall for India and a rise for MEOA. Therefore, these instruments should be reasonably good predictors of the actual migration rate. A distinction is made between the predicted migration rate to India and the predicted migration rate to MEOA, considering that these two are the major migrants' destinations, and one is a lower-cost and lower-return destination (India).

While the migration trends from different parts of the country are quite uniform and stable over time, the shares of the two major destinations have shifted. According to CBS (2001, 2010), emigration to India has a falling share, whereas the share of migrants going to MOEA has increased from 20% in 2001 to a little over 55% in 2011. Given that emigration to MOEA is more expensive, these changing shares may imply that regions or villages are continuously sending migrants for foreign employment, and the remittances are helping households to improve welfare and to finance further emigration to higher cost destinations. So, the two predicted migration variables derived from Eq. (5) are a good predictor of current emigration rates. The estimated result should show the effect of emigration on labour supply while ruling out reverse causation that would occur if the current labour supply affects migration. These two predicted emigration rates are derived from the migration network from

a decade before, and so labour supply in 2008 or 2010 should not affect historical migration. In other words, given that the IVs are external to the local labour supply, they are unlikely to be correlated with unobservable characteristics.

4. Results and discussion

In this section, I outline the first stage and main results. The OLS and IV estimates of direct and spillover effects of emigration on labour supply are then reported. The first stage result for the IV regression is in Table 2 using two instruments, the predicted emigration rate to India and to MOEA. As expected, the coefficient on instrumental variables that are derived from Eq. (5) have strong first-stage effects on the emigration rate after controlling for village and time fixed effects. Results are closely associated with the recent migration trends in Nepal; the share of migrants in India has decreased to 37% in 2011 (from 75% in 2001), the share in MEOA has increased to 56% in 2011 (from 20% in 2001) (CBS, 2001, 2011). The localities have also altered the destination; those sending migrants to India earlier are now sending to MOEA. This shift in the destination is also evident from the sign of coefficients of the instrumental variables, which is negative for India and positive for MOEA. The *F*-test for excluding the instruments is 13.77 which easily exceeds the usual threshold of ten needed for not having weak instruments. The weak instrument test statistics are also presented in the second-stage results tables.

(Table 2 about here)

The main results are reported in Table 3 to 6, first for the direct effects and then the spillover effects. Sub-sample results are given for male and female labour force participation rates, for agriculture and non-agriculture, and for urban and rural localities. An alternative specification to test for spillover effect using market-based interconnectedness and a Spatial Durbin Model (SDM) is presented in Table 7. One additional table, with estimates of the impact of emigration on the local agriculture wage rate, is presented in A.1 (this is a cross-

sectional IV model designed to illustrate a causal pathway that lies behind the main results for the impact of emigration and remittances on labour supply).

Direct effect of emigration on Labour force participation rate

First, I look at the direct effect of emigration on the labour force participation rate. Table 3 column 1 presents results from an OLS model for the full sample. The corresponding instrumental variable results are in column 2, while columns 3-6 presents sub-sample results using instrumental variables. Note that all of the instrumental variable results rely on the destination-driven predicted migration model reported in Table 2, and the F-tests for excluding the instruments give values of at least 14.5, which is in excess of the usual rule of thumb for the F-test to exceed ten to avoid a weak instruments problem.

The first thing to note from Table 3 is the contrast between the OLS and IV results, which suggests that time-varying factors correlated with emigration and labour supply will bias OLS results, even with village fixed effects and a rich set of control variables. All of the subsequent results reported, therefore, use the instrumental variables approach. According to the IV results in column 2, a rise in the emigration rate by ten persons per 1,000 population would increase the labour force participation rate of the left-behind by 1.3 percentage points ($p < 0.05$). Thus it appears that the income effect from remittances increasing the demand for leisure is outweighed by a substitution effect that induces more labour supply. Indeed, there is evidence that higher local emigration rates increase the local wage rate (see Table A.1) which would induce this substitution effect of greater labour supply.

The results in columns 3 and 4 of Table 3 show that the higher LFP rate is entirely due to female labour supply. While there is no change in the male LFP rate, the female LFP rate would rise by 2.7 percentage points for every 10 more emigrants per 1000 population from a locality (significant at $p<0.01$). There are several reasons for this gendered pattern. First, emigration has contributed significantly to empowering women in Nepal (Gartaula et

al., 2010; Maharjan et al., 2012) which has increased their mobility and participation in the labour market, especially in the agriculture sector. Second, other members of households may have to participate in the labour market to replace the initial income loss as a worker leaves local employment due to emigration (Posso, 2012), especially as it takes time for emigrants to get established and begin sending remittances (Gibson et al., 2013; McKenzie & Rapoport, 2011). Also, remittances may increase investment in self-employment/small enterprises, and this boost in local economic activities may increase demand for female-specific tasks.

(Table 3 about here)

Table 3 column 5-6 shows the impact of emigration on labour force participation in agriculture and non-agriculture. This is of particular interest as the agriculture sector in Nepal is facing labour shortages, and over time there has been a notable increase in cultivable lands that are left barren. The result from this study is consistent with previous studies which have found that the left-behind shift out of agriculture either increase leisure or move to non-farm employment. For instance, every ten person per 1,000 population increase in emigration would reduce labour force participation rate in agriculture sector by 1.1 percentage point ($p < 0.05$). In the case of non-agriculture sector, the effect is positive but very small and imprecise. In Nepal, the agriculture sector is less attractive due to its low productivity with farm wages or agricultural self-employment hardly generating sufficient income for the household to achieve a high standard of living. Therefore, for households that have alternative sources of income in the form of remittances, farm work is less preferred. Also, the left-behind often change the sector of employment and shift to self-employment activities because remittances help them to overcome borrowing constraints and start a new enterprise (Sousa & García-Suaza, 2018). This result is also comparable to the recent studies like Acosta (2007), Amuedo-Dorantes and Pozo (2006), and López-Feldman and Escalona (2017)

which highlighted the role of emigration in the reallocation of the labour force in other countries.

Spillover effect of emigration on Labour force participation

In this section, I examine the spillover effect where emigration in one locality affects outcomes in interconnected neighbouring localities. I look at the spillover effects in the first five nearest neighbours, initially based on geographic proximity. Later, I also compare the spillover effect in rural and urban localities separately because these localities have quite different labour markets and in-migration trends.

(Table 4 about here)

Each column of Table 4 presents the results of Eq. (3), for each of the five nearest neighbour interconnected localities. There is strong evidence of spillover effects on the labour supply of non-migrants. A rise in emigration from a locality by ten persons per 1,000 population would increase labour force participation rates in neighbouring localities by 0.2 to 1.2 percentage points (estimates are statistically significant for four out of five columns). For the first two neighbours, the effects are similar to the direct (own-) effect in Table 3 (column 2), so it is likely that the combined effect (direct and spillover effect) of emigration would be at least twice the size of direct effect. The extant literature tends to ignore this spillover effect, which may operate through the increase in local wage rates and economic activities in the same and surrounding localities that are important sources of labour market adjustment (Brandsma et al., 2014; Shrestha, 2017). For instance, remittances sent home by emigrants are generally spent on locally produced goods that not only affect the economic activities of the sending locality but also of the interconnected localities, which creates incentives for non-migrants in those neighbouring localities to participate in the labour market.

Next, it is useful to think about how this spillover effect operates in rural and urban localities separately. This comparison is important because urban labour markets are more

integrated than rural ones. Also, rural-to-urban migration due to the wage differential is very common and an important source to sustain equilibrium in the urban labour market (Harris & Todaro, 1970), but the same is not so for the rural labour market (i.e. urban-to-rural migration is rare). In Table 5, I examine the spillover effect for the first three nearest neighbours for both Urban and Rural localities. I limit the interconnected neighbours to the three nearest localities. The first three and last three columns report the results for urban localities and rural localities respectively. The notable feature of Table 5 is that the coefficients are precisely estimated only for the rural locality, and spillover occurs only between the first two nearest neighbours. The magnitude of spillover effect in first two nearest neighbours in the rural locality is 0.9 and 1.3 percentage points (significant for both at $p< 0.05$), which is similar to the results in Table 3 and 4, for every ten person per 1,000 population increase in emigration.

There are several reasons for this effect on the rural locality. Rural labour markets are less integrated and are financially constrained due to the lack of formal financial institutions. So, emigration has a large effect on rural locality compared to urban as remittances help to boost the local economy by overcoming financial constraints in the absence of formal credit. Similarly, remittances are generally spent in locally produced goods in the rural locality, which increases the local economic activities and affects the surrounding localities. The urban labour market has a reserve labour force and has a large formal or semi-formal credit institution, therefore, emigration has limited impact as urban labour markets rely less on remittance to boost economic activities.

(Table 5 about here)

As discussed earlier, given the heterogeneity in spatial features of Nepal (the country is composed of low lands, hills and mountains), the localities separated by the shortest geographic distance are not necessarily interconnected. So, in addition to geographical distance interconnectedness, I introduce a road network among localities. In this case, two

shortest distance localities would be defined as interconnected localities or neighbours if they have access to the road network in their vicinity. Therefore, I develop the interconnected neighbouring matrix by restricting the neighbourhood to those localities that have a road network in its vicinity. This time, I limit interconnected locality only for the first two neighbours. Similar to the above results, Table 6 (columns 1 and 2) shows that the spillover effect of emigration is still positive and significant on the labour supply. The effect on labour force participation rate is as large as 1.1 percentage points ($p < 0.05$) for an additional ten person per 1,000 population increase in emigration. From this result, it implies that the spillover effect continues to operate and matters to the locality irrespective of how we define interconnectedness.

(Table 6 about here)

The strong spillover effect is consistent with the fact that emigration and remittances have unintended consequences on interconnected localities. The results also show that the change in local wage rates and the boost in economic activities (that occurs through general equilibrium effects) are the important mechanisms that create employment opportunities in surrounding localities and incentivise non-migrants to engage in economic activities.

Robustness test

I use two different approaches to check the robustness of spillover effect. First I redefined the interconnected matrix based on geographic proximity to the common market which plays a greater role to connect two localities. More specifically, neighbours are interconnected via the common market for employment, trade and so on rather than just the physical distance or road link. Therefore, with this specification emigration from one locality affects outcomes in the interconnected locality through the market. To redefine interconnectedness, I include the coordinates of 77 major markets across the country and linked them with the PSU coordinates (see Figure 2). The neighbouring matrix is now a

combination of the shortest geographic distance between localities as well as the access to a common marketplace.[10]

(Figure 2 about here)

Second, I use Spatial Durbin Model which by design addresses spatial heterogeneity issues when labour force participation in one locality is not independent in space from other (neighbouring) localities. Spatial model corrects the estimation bias that may arise from the spatial heterogeneity and autocorrelation of labour force participation over space (LeSage & Pace, 2009, 2010). In SDM, spatial lag of labour force participation and emigration (the average in neighbouring localities) are included as an additional regressor.[11] The coefficient on the spatially lagged of labour force participation rate is 0.21 and is statistically significant at the $p<0.01$ level. Thus, there is strong evidence of spatial spillover of labour force participation.

The results from the common market neighbouring matrix (second stage regression) and SDM are reported in Table 7. Even after restricting the interconnectedness to the closest market place (in column 1), the main conclusion continues to hold. The result illustrates that the increase in emigration by ten person per 1,000 population would increase the labour force participation rate by 1.1 percentage points, which is similar to the result in table 4. Similarly, with the SDM (in Table 7), the indirect impact, which includes both local and global spillover effect, of an increase in emigration by ten person per 1,000 population would increase the labour force participation rate by 0.59 percentage points at $p < 0.05$. These results illustrate

[10] The major challenge in developing market based interconnectedness is that locality can have access to more than one local market at a time and people do not necessarily stick to one closest local market, they commute to multiple markets. Also, it is not necessary that two shortest distance neighbours also have the shortest distance to the same common market. Given this challenge, I use a loose definition of local market interconnectedness and limit interconnectedness to the first closest neighbour only. In this case, two shortest geographic distance localities are considered as interconnected if they are also within the 15 km radius from the point of any common market. If first shortest distance localities are outside the 15 KM radius from any of the common market then it is treated as non-neighbours and we assume there is no spillover between these localities. This has yielded 320 (172 rural and 148 urban) first shortest distance localities connected via local market.

[11] An intuitive discussion and example of these direct, indirect and total effects in SDM is provided in Gibson (2019).

that the main results are robust to a different definition of interconnectedness and spatial heterogeneity and autocorrelation of emigration and labour supply.

(Table 7 about here)

5. Conclusion

Work-related migration is a major income-generating household activity in Nepal. The rise in emigration which is also accompanied by labour shortage for domestic industries has raised policy concerns questioning its impact on labour supply of non-migrants. While many studies have analysed the direct (own-) effect of emigration on the labour supply, none have explored the spatial spillover effect although studies note the possibility of general equilibrium and spillover effects. Typically, emigration and subsequent remittances inflow not only affect the sending locality but they may affect nearby interconnected localities. Therefore I developed a locality interconnection matrix based on the geographic distance and the road network to measure these spillover effects. For this study, I developed a two-period panel of 499 localities in Nepal and used variation in the predicted emigration rate as a plausible instrument variable to overcome endogeneity concerns.

After accounting for endogeneity, I find that the direct (own) effect of an increase in emigration rate by ten person per 1,000 population is associated with an increase in the labour force participation rate by around 1.3 percentage points. The positive effect of emigration is limited to the female labour force, and there would be 2.6 percentage points increase in labour force participation for every ten person per 1,000 population increase in emigration. The positive effect occurs through the rise in local wage rates that outweigh income effect from remittances increasing the demand for leisure and induce substitution effect of greater labour supply. The other possible channels are an increase in women economic empowerment and mobility (especially in the agriculture sector) and a boost in local economic activities. While emigration has an overall positive effect on labour force

participation rate, the left-behind members shift out of agriculture, either increase leisure or move to non-farm employment, as this sector is considered as low productive and working on the farm is less preferred in remittance receiving households.

Moreover, the spillover effect of emigration on labour supply (based on the geographic distance and road network) is positive and this effect is as large as the direct effect. However, given the distinct nature of labour markets in rural and urban localities, the spillover effect is limited to the rural areas (without any significant impact on urban locality). There are several possible reasons for this pattern; first rural labour markets are less integrated and financially constrained, so emigration and remittances help in overcoming borrowing constraints and boost the local economy in the absence of formal credit. Also, remittance helps to boost the rural local economy and to generate employment opportunities as remittances are generally spent in locally produced goods. Second, the urban labour market has a reserve labour force and a large formal or semi-formal credit institution, which helps the urban locality to access credit, therefore the urban labour market does not depend on emigration to overcome borrowing constraints and boost the local economy. Most of the previous literature has ignored this spillover effect where the overall impact of emigration could be much larger than anticipated.

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Figure 1: a) Spatial Distribution of PSUs, b) PSU and Road network

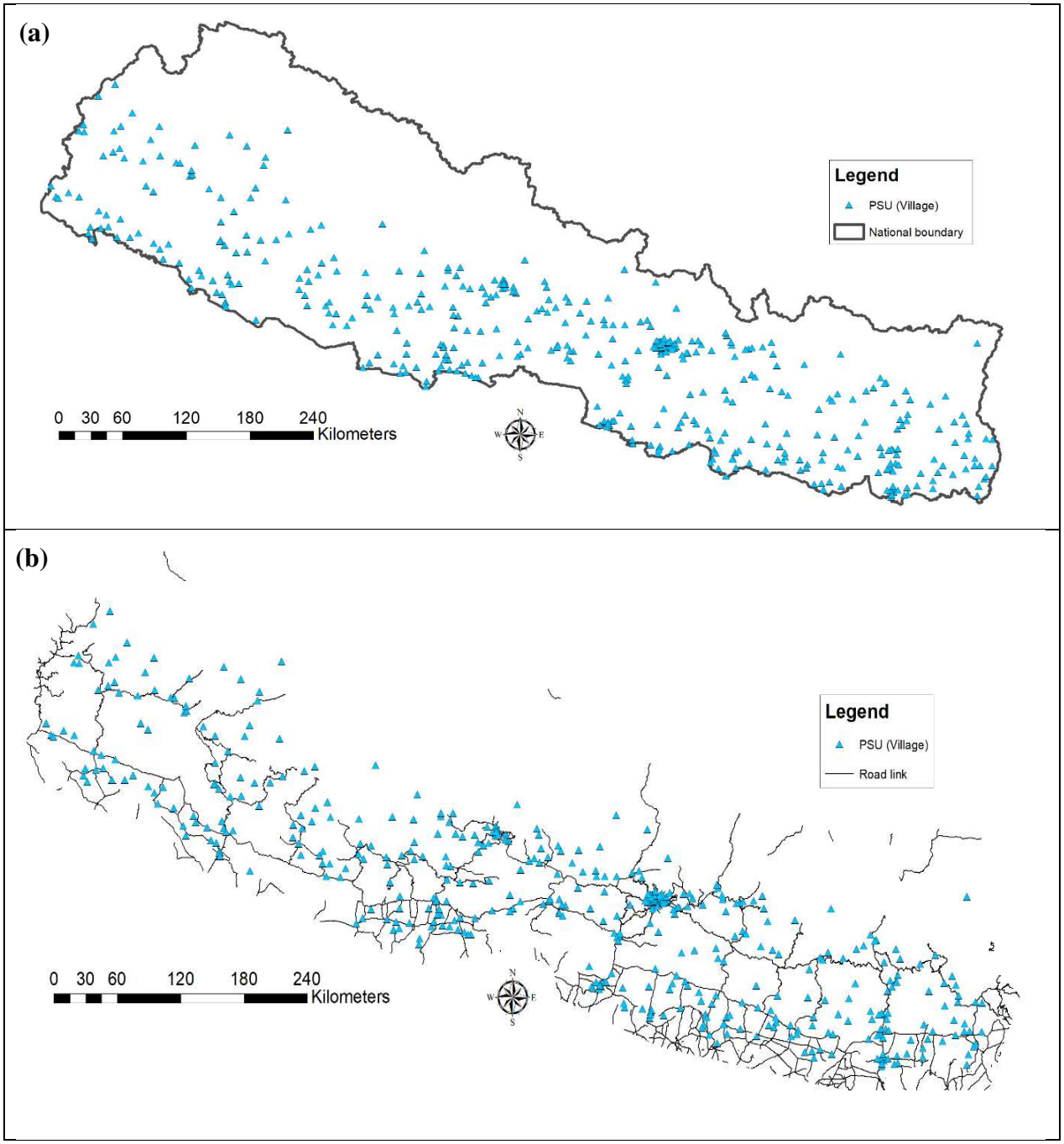

Figure 2: Spatial Distribution of PSU and local market

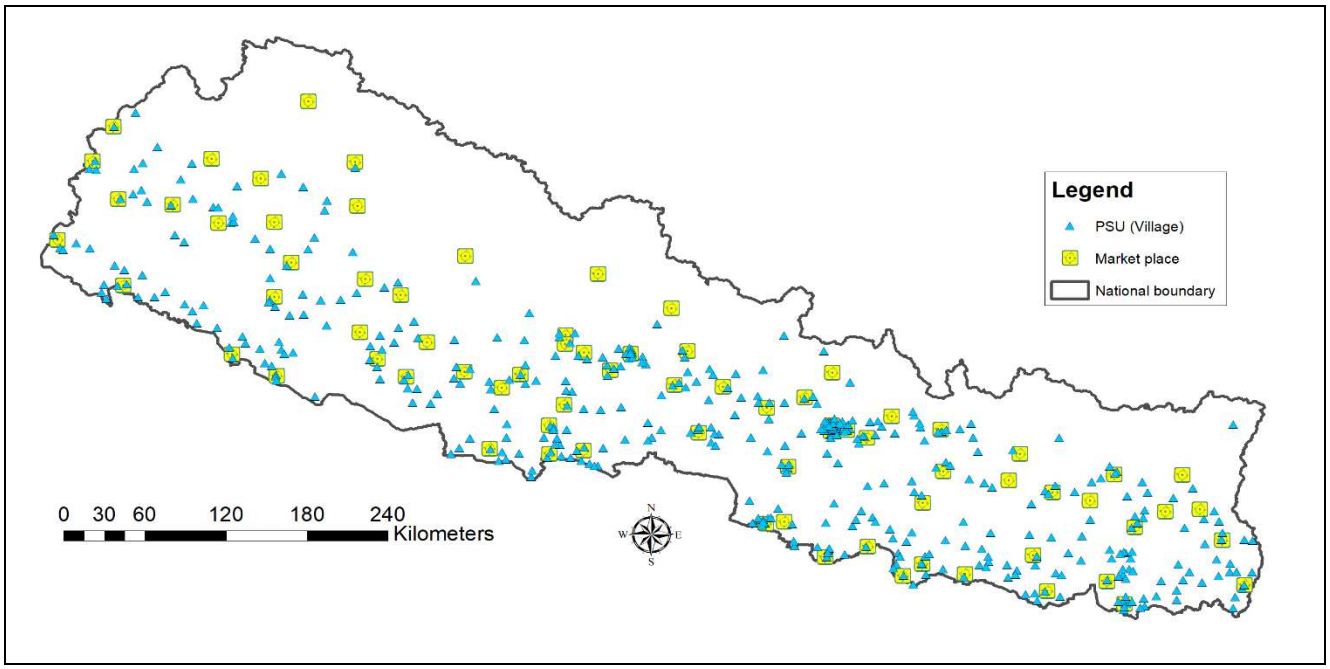

Table 1: Descriptive Statistics (N=499)

	NLFS 2008		NLSS 2010	
	Mean	Std. Dev	Mean	Std. Dev
Labour force participation rate (In percentage)	83.90	14.68	85.96	12.29
Labour force participation rate-Male (In percentage)	89.96	10.29	89.72	10.63
Labour force participation rate-Female (In percentage)	78.29	21.49	82.73	17.20
Labour force participation rate-Agriculture sector (In percentage)	55.57	35.07	58.80	34.83
Labour force participation rate-Non agriculture sector (In percentage)	58.63	17.73	62.72	16.43
Emigration rate to India (number of emigrants per 1,000 population)	32.68	43.11	33.09	46.46
Emigration rate to MEOA (number of emigrants per 1,000 population)	24.56	25.95	29.01	30.69
Average remittance received per household (In NPR)	3705	5993	4471	6703
Agriculture land owned by households (in Acres)	1.075	0.828	1.171	0.894
Average number of members per household	5.124	0.96	5.209	1.084
Share of working age (15-60) in the population	0.537	0.091	0.529	0.098
Share of emigrants with schooling to grade ≥ 8	0.556	0.317	0.628	0.322
Share population aged 15-60 with schooling to grade ≥ 8	0.381	0.227	0.402	0.219
Literacy rate (share of individual in locality who are literate)	0.690	0.158	0.657	0.18
Unemployment rate for adult aged 17-65	0.024	0.037	0.019	0.031
Higher Secondary level (grade 11-12) Gross Enrolment Rate for children of all age	1.307	1.874	0.935	1.038
Domestic migration rate (local migrants per 1,000 population)	61.76	59.72	93.05	85.21
Average remittance received from domestic migrants (In 1,000 NPR)	2.54	3.72	0.06	0.12

Source: Authors own calculation from NLFS 2008 and NLSS 2010. *Note:* MEOA is a MENA (Middle East and North Africa) and Other Asia

Table 2: The first stage model for locality emigration rate

	Emigration Rate
Predicted migration to India	-1.017
	(3.311)***
Predicted migration to MEOA	0.825
	(5.054)***
Agriculture land owned	2.838
	(1.185)
Average household size	2.144
	(0.958)
Share of working age (15-60)	-2.870
	(8.696)***
Share of Migrants with grade ≥ 8	6.831
	(1.426)
Share of 15-60 with grade ≥ 8	-19.027
	(0.886)
Literacy rate aged ≥ 17	42.416
	(1.917)*
Higher secondary Gross Enrolment Rate	3.002
	(2.551)**
Internal migration rate	-0.180
	(5.950)***
Average size of domestic remittance	-0.425
	(0.694)
F-Statistic (for excluding the two instruments)	13.77
R-Squared	0.263
Observations	998

This table shows first-stage results for migration rate instrumented with predicted migration to India and to MEOA using time and village fixed effects. The t-statistics in ( ) are derived from cluster-robust standard errors (clustered at 499 villages), ***, **, * denote 1%, 5%, 10% statistically significance.

Table 3: Second stage regression model for labour force participation (LFP) rates

	OLS	IV model				
	1	2	3	4	5	6
	LFP	LFP	LFP-Male	LFP-Female	LFP-Agri	LFP-NonAgri
Emigration	-0.003	0.128	0.011	0.265	-0.110	0.011
	(0.342)	(1.970)**	(0.188)	(2.820)***	(2.444)**	(0.162)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Time and Village Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-Squared (within)	0.154					
Wald test		34919	29948	13443	8482	4707

These outcome variables are labour force participation rates for adult aged 17-65. The IV results have locality emigration rates instrumented with (destination-trend-based) predicted migration to India and to MEOA. The t-statistics in ( ) are derived from cluster-robust standard errors (clustered at 499 villages), ***, **, * denote 1%, 5%, 10% statistically significance. Emigration impacts are in percentage form. Agri stands for agriculture and NonAgri stands for non-agriculture. *N=998*. Full results are available from the author.

Table 4: Spillover effects on labour force participation rate: neighbours based on closest geographical proximity

	Labour Force Participation Rate				
	1st Neighbour	2nd Neighbour	3rd Neighbour	4th Neighbour	5th Neighbour
Emigration	0.1208	0.1113	0.0223	0.0828	0.1010
	(2.481)**	(2.824)***	(0.541)	(1.770)*	(2.400)**
Control Variables	Yes	Yes	Yes	Yes	Yes
Time and Village Fixed Effects	Yes	Yes	Yes	Yes	Yes
Wald test	46454	42348	53153	42435	39402
Weak IV test statistics	18.14	27.41	21.66	20.26	25.43

Notes; The columns correspond to models where the definition of an interconnected village extends from the closest nearest neighbour up to fifth neighbour. Other notes, see Table 3.

Table 5: Spillover effects on labour force participation rates in urban and rural localities: neighbours based on geographical proximity

	Labour Force Participation Rate					
	Urban localities			Rural localities		
	1st Neighbour	2nd Neighbour	3rd Neighbour	1st Neighbour	2nd Neighbour	3rd Neighbour
Emigration	0.0511 (0.723)	0.0641 (1.084)	-0.0221 (0.392)	0.1278 (2.412)**	0.0925 (2.081)**	-0.0589 (1.049)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Time and Village Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Wald test	583	1041	1017	34494	38471	34926
Weak IV test statistics	8.33	17.22	15.30	4.40	8.28	6.21
Observations	348	348	348	650	650	650

Notes: See Table 4

Table 6: Spillover effects on labour force participation rate: neighbours based on road network

	1st Neighbour	2nd Neighbour
Emigration	0.1161 (2.66)***	0.112 (2.94)***
Control Variables	Yes	Yes
Time and Village Fixed Effects	Yes	Yes
Wald test	51688	51664
Weak IV test statistics	30.21	46.56

Notes: The closest neighbours are based on geographic proximity and road links, as explained in the text. Other notes, see Table 4.

Table 7: Spillover effects on labour force participation rate: neighbours based on shortest geographical distance to the market

	IV regression	Spatial Durbin Model (Impacts)		
	Model 1	Direct	Indirect	Total
Emigration	0.1182	-0.008	0.059	0.0513
	(2.478)**	(0.83)	(2.22)**	(1.61)
Control Variables	Yes		Yes	
Time and Village Fixed Effects	Yes		Yes	
R-Squared (within)			0.1671	
Wald test	47327			
Weak IV test statistics	26.76			

Notes: Model 1 is a FE-IV model, similar to those in Table 6 but using the closest neighbour that has access to a market (as close as 15 km from the locality). The Spatial Durbin Model (SDM) provides local and global spillover estimates of emigration with a weight matrix constructed from the five nearest neighbours (KNN5). In SDM, emigration estimate is weighted average of first five neighbours. Other notes, see Table 3.

Appendix

Table A.1: Effects of emigration on male and female rural agriculture wages (Instrumental variables estimates)[12]

	Male log wage	Female log wage		
	Task-1	Task-2	Task-3	Task-4
Emigration	0.0037	0.0022	0.0028	0.0029
	(3.943)***	(1.625)	(2.449)**	(2.415)**
Agriculture land owned	-0.0262	-0.0404	-0.0362	0.0167
	(-0.642)	(-1.152)	(-1.169)	(0.580)
Share of working age (15-60)	0.0281	0.0196	0.0227	0.0223
	(5.080)***	(2.853)***	(3.722)***	(3.695)***
Internal migration rate	0.0019	0.0005	0.0009	0.0010
	(4.865)***	(0.954)	(1.894)*	(2.207)**
Average domestic remittance	-0.2008	0.2962	0.2093	0.1063
	(-0.724)	(1.146)	(1.037)	(0.502)
Higher secondary GER	0.0837	0.0593	0.0529	0.0703
	(2.748)***	(1.850)*	(1.992)**	(2.485)**
R-Squared	0.046	0.075	0.070	0.056
Observation	277	288	265	259

Estimates are from a cross sectional instrumental variable model (for 2010), with emigration rate at locality level instrumented with predicted migration to India and MEOA. Wages are in logs. The t-statistics in ( ) are derived from robust standard errors. Task 1-4 are agriculture related tasks, Task-1 is for males and Tasks 2-4 are female specific.

[12] Wage rates are taken from NLSS 2010 community questionnaire, which provides information about the agricultural wage rate in the community for different agricultural tasks. Thus, the wage rates are only available from agriculture sector from rural locality.