Does connectivity reduce gender gaps in off-farm employment? Evidence from 12 low- and middle-income countries

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Abstract

Gender gaps in labor force participation in developing countries have been shown to persist despite income growth or structural change. In this study, we assess the persistence of gender gaps across economic geographies within countries focusing on youth employment in off-farm wage jobs. We combine household survey data from 12 low- and middle-income countries with geo-spatial data on population density and estimate simultaneous probit models of different activity choices across the rural-urban gradient. We find that the gender gap increases from rural to peri-urban areas and disappears in high density urban areas. Child dependency does not constrain young women in non-rural areas, where also secondary educational attainment improves their access to off-farm jobs. The gender gap persists for married young women independent of connectivity improvements pointing at strong social norm constraints. These results highlight that economic development within countries alone might not reduce the gender gap.

JEL Classification: J16, J22, J21, O18, R23

Keywords: Gender gap, youth, off-farm employment, Ethiopia, Malawi, Niger, Nigeria, Uganda, Cambodia, Indonesia, Nepal, Mexico, Nicaragua, Peru, sub-Saharan Africa, Latin America, Asia

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1. INTRODUCTION

Young women's participation in the labor force, and especially in off-farm wage employment, has been associated with various positive outcomes for young women themselves, their families (in particular children) as well as the broader economy. Employment among young women directly contributes to economic growth and indirectly does so as participation delays their age of marriage and first child (Jensen, 2012; Heath and Mobarak, 2015), speeding up the demographic transformation (Stecklov and Menashe-Oren, 2019). Furthermore, evidence from different regions suggests that employment expansion to (young) women improves their children's health, nutrition and education outcomes (Perez-Alvarez and Favara, 2020; Chari et al., 2017; Quisumbing, 2003). Off-farm employment in specific is a significant predictor of women's decision-making power based on various studies (Annan et al., 2019, Buvinić and Furst-Nichols, 2014). Still, van den Broeck and Kilic (2019) estimate that around 7.8 million women are "missing" in off-farm employment in five African countries adding up to around 33 million in the 12 countries in Asia, Latin America and Africa studied in this paper.[3]

In this study, we aim to contribute to the literature on persisting gender gaps in female labor force participation (FLFP) in developing countries focusing specifically on off-farm wage employment of young people and economic geography. We assess the persistence of gender gaps across comparable geographies within countries. A location where a young woman lives can yield different levels of demand for her labor and provide different levels of networks to peers and other women who can help to gain access to jobs. For example, Ghani et al. (2012) tested the impact of improved infrastructure and agglomeration for female businesses in India and found that market entry of female-led businesses grew in response to both variables suggesting strong connectivity effects. Furthermore, urbanization or higher population density ease access to information and reduce uncertainty around FLFP (Fogli and Veldkamp, 2011). Population density might also reduce gaps that are caused by social norms, for example by more interactions with others, exposure to diversity, or better access to education and child care in urban areas. One reason why these hypotheses have not yet been empirically tested is that most surveys only provide administrative assignments of rural or urban, not comparable across countries and not accounting for livelihood portfolios in between, i.e. neither purely agricultural small-holder farming nor purely manufacturing and service jobs. Arslan et. al

[3] The number is the difference between men and women working in off-farm jobs in the 12 nationally representative household surveys of this study applying survey weights.

(2019) propose a new measure of a rural-urban gradient based on global population density data and document how this matches distinct livelihood profiles and levels of structural transformation of local economies. In this study, we employ this measure to test for the persistence of gender gaps in comparable geographies across countries.

The literature has so far tested the relationship between economic development, measured with income or structural change, and FLFP at country level and found that while there exists an inverse U-shaped relationship, a lot of cross-country variation remains unexplained (Gaddis and Klasen, 2014; Klasen and Pieters, 2014, Heath and Jayachandran, 2017). As the rural-urban gradient is associated with different levels of economic transformation we implicitly test the persistence of gender gaps along development levels within countries adding to the above literature. Most recently and most comparable to our study, Klasen et al. (2020) used individual data from eight countries to analyse the drivers of FLFP at the micro-level and found that country-specific factors explain most of the differences between countries, but rising educational attainment and fertility decline consistently increased FLFP over time within countries. However, their sample are only urban prime-age women whereas we focus on youth in all areas of the country. Youth is a transition period when many important decisions are taken at the same time (marriage, fertility, further education and labor supply) and young women might face additional constraints due to their younger age (Doss et al., 2019). Any gender gaps at this age might persist over the life course and even widen.

More specifically, we ask whether the youth gender gap in off-farm wage employment differs by connectivity. Population density serves as proxy measure for connectivity to markets and people and is comparable across countries. Secondly, we ask how individual and household characteristics previously associated with gender gaps contribute to the gender gap, specifically marital status, child care burden, education, household headship, wealth, time-saving assets and access to peer networks. And how does their contribution vary by connectivity? Lastly, controlling for these characteristics, does the bias against females persist across connectivity categories?

We estimate marginal effects from a simultaneous probit model of activity choices controlling for various observable individual, household and local characteristics as well as country fixed effects and compare the estimates across the rural, semi-rural, peri-urban and urban sample. Our results yield four main findings. First, social norms associated with marriage leave young married women worse off than their female or male counterparts independent of their connectivity. Second and in contrast to our first finding, child dependency is only a binding constraint in rural areas suggesting connectivity effects. Third, secondary education

improves young women's participation relative to their less educated counterparts, but more so in non-rural areas, and it eliminates the gender gap in off-farm wage employment. Fourth, controlling for other relevant characteristics of gender gaps, simply being female and unobservables associated with this still puts young women at significant disadvantage compared to young men. Furthermore, this gap increases from rural to peri-urban areas, but disappears in urban areas.

Our results align with previous studies that found strong persistence of social norms or context-specific factors independent of the level of structural change or income (Jayachandran, 2020; Alesina et al., 2013; Klasen et al. 2020, Klasen 2019; Gaddis and Klasen, 2014; Klasen and Pieters, 2014). We also show that some gender gap drivers reduce with greater connectivity. Our contribution lies in that we show how gender gaps persist or disappear across comparable geographic spaces within different country contexts.

The paper is structured as follows. In section 2, we review the literature to present a conceptual framework. Section 3 describes the data, section 4 introduces the estimation strategy. Section 5 summarizes the sample and variables of interest, followed by presentation and discussion of results in section 6. Section 7 then concludes with potential caveats and policy implications.

2. CONCEPTUAL FRAMEWORK

This paper focuses on the gender gap in off-farm wage employment (OFWE) among youth across different levels of connectivity. In the following, we motivate this focus.

With the structural transformation of an economy, people become more likely to earn their incomes outside of the agricultural sector by increasing the share from off-farm self-employment or wage labor (Davis et al., 2017). In the initial stages of the process, people shift from farm self-employment to non-farm self-employment. Then, as incomes rise and markets expand, those enterprises start hiring workers leading a shift towards wage employment (IFAD, 2016; Reardon and Timmer, 2014; Haggbalde et al., 2010; Reardon et al., 2007a; Gollin et al., 2002). At the same time, these changes in the labor market create local demand for agricultural products (Christiaensen and Todo, 2014; Christiaensen et al., 2013). It generates a rural transformation that implies the creation of off-farm jobs often linked to the agri-food system (e.g. medium-scale commercial farms or agricultural value chains) (Tschirley et al., 2017; Van den Broeck et al., 2017; Tschirley et al., 2015; Reardon et al., 2012; Reardon et al., 2007b;

Reardon et al., 2004; Reardon et al., 2003). These rural non-farm activities are also associated with improvements in welfare (Bezu et al. 2012).

This employment transformation has driven an urbanization process (Christiaensen et al., 2013), which has not only increased urban population but it has also produced a system of secondary cities and rural towns (Henderson, 2010; Henderson and Wang, 2005). Indeed, the rural transformation augmented linkages between rural and urban areas through the development of agricultural value chains, which have extended the reach of markets into new areas. In turn, the development of urban markets has contributed to the emergence of farming opportunities and strengthening of those value chains (Ingelaere et al., 2018; Vandercasteelen et al., 2018). These forward and backward linkages have led to two main facts. First, labor supply in off-farm employment has risen not only in urban, but also in rural areas. Second, the typical dichotomous classification of rural and urban can no longer capture all these transformations (Lerner and Eakin, 2011), requiring a more fluid spatial definition including the concept of intermediate areas (Simon, 2008; Simon et al., 2006).

Arslan et al. (2019) proposed a new measure of a rural-urban gradient defined by population density. They highlighted the importance of a spatially disaggregated approach in the analysis of labor policies by demonstrating that population density and household livelihoods are strictly related. Overall, connectivity to cities and markets increases commercial opportunities for rural areas (Arslan et al., 2019; Dolislager et al., 2019), while agglomeration generates localized external economies of scale, technological innovations, social networking and knowledge accumulation, which stimulate additional employment opportunities (Bloom et al., 2008).

In this transformative context, youth became an important cohort of the population. First, this is the period when individual decisions can affect future wellbeing. An unsuccessful transition to adulthood, among other in form of gender gaps, may lead to lifelong poverty and other long-term negative outcomes (Fox, 2019). Second, around 80 per cent of youth live in low- and middle-income countries, placing them at the heart of the debate for sustainable development (IFAD, 2019). Sub-Saharan Africa has the highest projected growth rate in youth population that if associated with lower per capita income growth might create political, social and economic consequences (Filmer and Fox, 2014). The youth working-age population in Asia has stabilized and youth population is declining (Stecklov and Mensashe-Oren, 2019). However, the share of youth neither employed, in education nor training (NEET) is a strategic challenge for this world region (World Bank, 2019). Similarly, in most Latin American

countries the population and workforce are ageing but youth unemployment remains high (Fox and Kaul, 2018).

In response to the need to create job opportunities for young people, the literature on youth labour economics has emerged (Fox and Kaul, 2018; Filmer and Fox, 2014; Mariara et al., 2019; Chakravarty et al., 2017). In this respect, the growing off-farm employment sector could present an important opportunity for the younger generations. In particular, as Arslan et al. (2019) observed, younger households depend more on commercial opportunities than on agricultural potential. Nevertheless, demographic factors strongly affect off-farm participation and differently drive male and female participation (Van de Broeck and Kilic, 2019; Fox and Sohnensen, 2016). Especially social norms associated with gender could reproduce preconceived notions of what activity may be acceptable or not for young women's occupation choices (Kabeer, 2016). For example, a wide literature discussed gender imbalances in agricultural activities (Lambrecht, 2016; Kilic et al., 2015; Oseni et al., 2015; Githinji et al., 2014; Peterman et al., 2014; Carr, 2008). Similar gender divisions prevail in non-farm businesses, where women are often more involved in food preparation and delivery jobs, while men focus on machinery and technological jobs (De de Pryck and Termine, 2014).

The labor force participation decision and occupation choice of women strongly depend on their marital status and parenthood. In most cultural contexts, marriage is associated with child birth and early school leaving. Social norms exert a strong influence on the age at which a woman has her first child, birth spacing and the total number of children desired, women's agency, family planning knowledge and availability, and the life expectancy of infants and children (e.g. Jensen, 2012; Heath and Mobarak, 2015; Perez-Alvarez and Favara, 2020; Chari et al., 2017; Quisumbing, 2003). On the other hand, early marriage implies lower levels of educational attainment while higher educational attainment increases the probability to work in high-skilled jobs (Dolislager et al., 2019; Filmer and Fox, 2014).

Another limitation for women's access to employment opportunities is the time constraint derived from child bearing and rearing and household chores, which are socially considered female responsibility in many societies. For example, there exists vast evidence that childcare availability increases female labor force participation (e.g. in Mexico (Talamas, 2019), in Rio de Janeiro (Barros et al. 2011), in Chile (Martínez and Perticará 2017), in Nicaragua (Hojman and Lopez Boo 2019), Nairobi (Clark et al. 2019) and Indonesia (Halim 2019)). Child bearing and rearing could force women to carry out income-generating activities that can be done close to home or mixed with home chores, yet are associated with lower profits (Maloney, 2003). Similarly, reducing the time burden of domestic work (e.g. access to

electricity and water, or adoption of time-saving technology at home) induces women to reallocate time from home to work, increasing female labor force participation. For example, in newly electrified communities in South Africa women decreased time in activities like collecting firewood (Dinkelman 2011), or in Indonesia the introduction of liquefied petroleum gas shift cooking fuel from wood to electric stoves (Bharati et al. 2019). In Nicaragua, electricity access increases the female propensity to work outside of home by about 23 per cent (Grogan and Sadanand, 2013). In the same way, house appliances like refrigerators and washing machine reduced housework and increased employment among rural Chinese women (Tewari and Wang, 2019).

Lastly, social networks are important for access to credit, insurance, jobs and attaining soft skills (Mani & Riley, 2019; Chakravarty et al., 2017; Field et al., 2015). Similarly, peers and role models shape aspirations influencing labor market outcomes (Ray, 2006; Beaman et al., 2012). However, young women might often have limited access to such networks due to social norms around their mobility outside their homes (Jayachandran, 2020) or preferences for males among other men (Beaman et al., 2013; Magruder, 2010).

The question of how these factors affect female work participation in transforming economies within countries arises. Empowering young women by reducing the constraints on them and connecting them with peers, communities and markets is particularly important for three reasons. First, fully incorporating young women into the economy and raising their productivity can significantly speed up economic development. Second, young women working in OFWE are more likely to marry later and have fewer children, giving them a greater chance to obtain better health and economic outcomes for themselves and their children. Third, lower fertility speeds up the demographic transition and contributes to the realization of the demographic dividend (Stecklov and Menashe-Oren, 2019).

3. DATA

We answer the questions posed above using a dataset that combines nationally representative household surveys from 12 low- and middle-income countries with globally comparable geospatial data.

3.1. Household surveys

All household surveys are chosen based on three criteria. First, they should be nationally representative.[4] Second, they contain comparable information at the individual level about employment, hours worked, sector of work, as well as other personal and household characteristics. Third, availability of geo-referenced information allows us to combine the survey data with satellite data.

The countries included are Cambodia, Indonesia and Nepal in Asia; Mexico, Nicaragua and Peru in Latin America; Ethiopia, Malawi, Niger, Nigeria, Tanzania and Uganda in sub-Saharan Africa. For each country, we use the latest survey round available meeting above criteria. Thus, not all surveys were conducted in the same year, but we will control for this in the empirical methodology. Table A3 in the appendix provides the detailed list of all surveys, sample size and year.

Given the focus of our analysis, we limit the dataset to the youth population. In doing this, we use the United Nations definition of youth as individuals aged between 15 and 24 years to ensure comparability and account for the minimum age for admission to employment fixed by the International Labour Organization. We finally work with a cross-sectional sample of 121,476 individuals that represent 93.5 million young people in the countries included.

3.2. Geospatial data

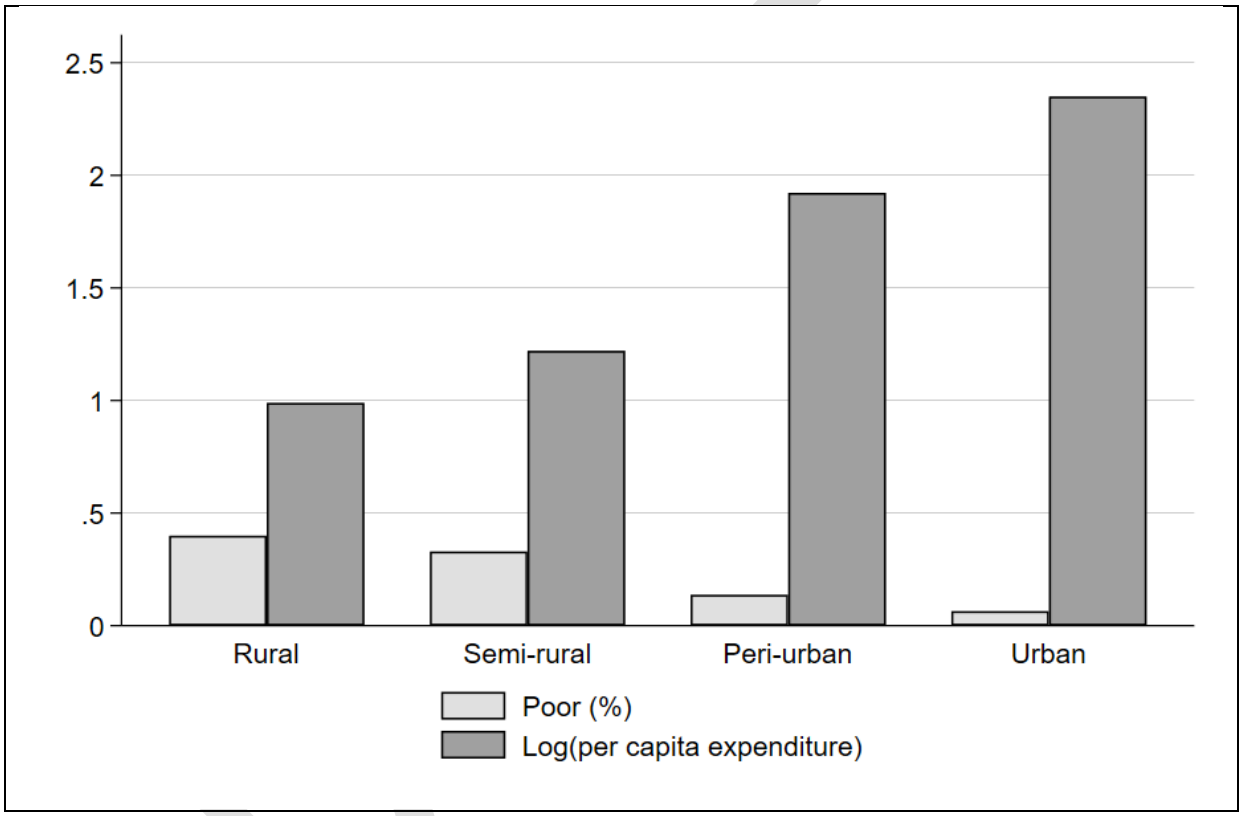
We use high-resolution geospatial databases to construct a variable to capture connectivity and one variable as a control for agro-ecological potential in the area. We merge these variables using available geospatial information of enumeration areas (EA) or other administrative sampling units with the household survey data.

We adopt the innovative approach introduced by Arslan et al. (2019), which groups the population of 85 low- and middle-income countries[5] into quartiles based on the population density of the areas in which they live. The population density data comes from the WorldPop project at a 250m x 250m resolution.[6] The least dense quartile represents rural areas, while the densest quartile represents the urban areas. In between are semi-rural (second quartile) and peri-urban (third quartile) areas.[7] This approach ensures comparability across regions and

[4] The survey of Indonesia is representative of 80 per cent of the total population.
[5] As defined by the World Bank in 2018.
[6] The production of the WorldPop datasets principally follows the methodologies outlined in Tatem et al. (2007), Gaughan et al. (2013), Alegna et al. (2015) and Stevens et al. (2015).
[7] Table C3 in the Appendix C shows the population density threshold to define each quartile and the average population density within each quartile.

countries and it creates a more precise spatial picture of the economic characteristics of areas than administrative definitions of rural or urban. Arslan et al. (2019) showed that each gradient presents different economic opportunities in terms of agricultural commercialization, off-farm diversification and market access. The rural-urban gradient is a proxy for connectivity to people, markets, and ideas and can be thought to correspond to economic or employment advantage especially beyond the farm sector. Indeed, figure 1 illustrates that poverty rates decline and expenditure levels increase as one moves from rural to urban areas in our sample.

Figure 1. Poverty rates and expenditure in all categories of the rural-urban gradient.



Notes: Poverty rates are based on household level consumption per capita at the international poverty line of international US$ 1.90 per day. Expenditure was calculated based on constant 2011 international US$ in purchasing power parity of local currencies. Population weights applied.

4. METHODOLOGY

4.1. ESTIMATION STRATEGY

We estimate the probability of off-farm wage employment participation testing differential effects for young women and men. We are specifically interested in the effect of being female and its interaction with individual characteristics (marital status, household headship, educational level), household characteristics (child dependency ratio, wealth, time-saving assets), connectivity and peer networks, using the following model:

$$P(Y_i = 1) = \alpha + \gamma_0 fem_i + \gamma_1 X_1 * fem_i + \gamma_2 X_2 * fem_i + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 W_l + C_c + \mu_i \quad (1)$$

Where Y_i is the dichotomous dependent variable that is equal to 1 if individual i has spent any work time in off-farm wage employment.[8] X_{1i} is a matrix of variables representing social constraints to female participation (individual and household) and X_{2i} is a matrix of variables for connectivity and peer networks. X_3 is the matrix of control variables (individual, household and context), W_l is the labor demand in off-farm wage employment varying at the administrative 1 level, and μ_i is the idiosyncratic error term. In addition, we include a country dummy, C_c, controlling for country-specific policy, institutions, social norms and the economic situation due to different years of survey collection.

We test whether young women are equally likely to access off-farm wage employment as young men, in which case γ_0, would be equal to 0, assuming all other variables capture observable drivers of the gender gap. We further test, whether γ_1 and γ_2 are equal to 0, which would be the case if social constraints as well as connectivity constraints are equally binding for young men as for young women. To assess whether spatial connectivity can alleviate gender gaps, we estimate the model for sub-samples separated by population density category (i.e. rural, semi-rural, peri-urban, and urban).

The estimation of equation (1) entails taking account of alternative activity options youth have, such as going to school, not working at all and working self-employed or on the family farm. We observe in the data that these options are not mutually exclusive, and we thus assume that these decisions are simultaneous rather than sequential. In fact, it is not a priori clear which decision comes first among them and it would not be possible to test for this. Therefore, the probability of participation in off-farm wage employment should be jointly estimated with the probability of the other three options. The model can be specified as a set of generalized structural equations with dichotomous dependent variables each representing the four options previously described and allowing correlation of the error terms without assuming any form. This can formally be written as:

$$P(Y_i^1 = 1) = \alpha + \gamma_0^1 fem_i + \gamma_1^1 X_1 * fem_i + \gamma_2^1 X_2 * fem_i + \beta_1^1 X_{1i} + \beta_2^1 X_{2i} + \beta_3^1 X_{3i} + \mu_i \quad (2a)$$

$$P(Y_i^2 = 1) = \alpha + \gamma_0^2 fem_i + \gamma_1^2 X_1 * fem_i + \gamma_2^2 X_2 * fem_i + \beta_1^2 X_{1i} + \beta_2^2 X_{2i} + \beta_3^2 X_{3i} + \mu_i \quad (2b)$$

$$P(Y_i^3 = 1) = \alpha + \gamma_0^3 fem_i + \gamma_1^3 X_1 * fem_i + \gamma_2^3 X_2 * fem_i + \beta_1^3 X_{1i} + \beta_2^3 X_{2i} + \beta_3^3 X_{3i} + \beta_4^3 W_l + \mu_i \quad (2c)$$

$$P(Y_i^4 = 1) = \alpha + \gamma_0^4 fem_i + \gamma_1^4 X_1 * fem_i + \gamma_2^4 X_2 * fem_i + \beta_1^4 X_{1i} + \beta_2^4 X_{2i} + \beta_3^4 X_{3i} + \beta_4^4 W_l + \mu_i \quad (2d)$$

[8] This definition is based on all activities, whether primary or secondary employment, and the hours worked reported. In some of the surveys this corresponds to the past 7 days as in standard labor force surveys, in others to the past 12 months, such as in the LSMS-ISA surveys.

Y^1, Y^2, Y^3, Y^4 are the four options, respectively no work activity, currently in school, working in off-farm wage employment and working in other employment. The other variables correspond to those specified in equation (1).

We focus our analysis on the equation (2c), participation in off-farm wage employment, and in particular on γ_0^3, γ_1^3, γ_2^3. Using these coefficients, we compute the marginal effect for a feasible interpretation of the results. We adjust for the fact that the marginal effect in a nonlinear model is not constant over its entire range (Karaca-Mandic et al., 2012) and the marginal effect of a change in interacted variables is not equal to the marginal effect of changing just the interaction term (Ai and Norton, 2003). Therefore, as illustrated by Ai and Norton (2003), the full interaction effect is the cross-partial derivate of the expected value of y:

$$\frac{\partial^2 \Phi(u)}{\partial fem \partial x_1} = \gamma_1 \Phi'(u) + (\gamma_0 + \gamma_1 x_1)(\beta_1 + \gamma_1 x_1)\Phi''(u) \quad (3)$$

This has four important implications. The interaction effect can be non-zero even if $\beta_{12} = 0$.[9] The statistical significance of the interaction effect cannot be tested with a simple t test on the coefficient of the interaction term β_{12}. Instead, the statistical significance of the entire cross-derivate must be calculated. The interaction effect is conditional on the independent variables, unlike the interaction effect in linear models. Because there are two additive terms, each of which can be positive or negative, the interaction effect may have different signs for different values of covariates. Therefore, the sign of β_{12} does not necessarily indicate the sign of the interaction effect (Karaca-Mandic et al., 2012).

We apply post-stratification weights by making surveys comparable to each other. We first adjust the sampling weights provided in the surveys from the household level to the individual level and then for the representativeness of age and gender population structure (Särndal, 2007; Deville et al., 1993; Deville and Särndal, 1992). Finally, we adjust the new weights for the sample size of cross-national surveys (Kaminska and Lynn, 2017; Lynn et al., 2007). This allows us to pool all individuals together and obtain population estimates without one country dominating due to its sample size.

Our empirical approach does not aim to establish causal relationships, but describe correlations accounting for the simultaneity of activity decisions and controlling for relevant observables. Omitted variable bias is a concern as we cannot control for unobservable

[9] In this case the interaction effect is:

$$\left.\frac{\partial^2 \Phi(u)}{\partial fem \partial x_1}\right|_{\gamma_1 = 0} = \gamma_0 \gamma_1 \Phi''(u)$$

characteristics which have been shown to be important for young women's wage employment participation, such as self-confidence (McKelway, 2020), beliefs (Bordalo et al., 2019), intra-household relationships (Bertrand et al., 2015) or community norms (Bernhardt et al., 2019). These could be captured with individual or household fixed effects, but this would require longitudinal data. Another way would be to use proxy variables, yet it is difficult to find comparable proxies in all twelve surveys at hand. Another concern arises from reverse causality. For example, marriage can influence employment decisions, but employment status might also influence the decision when and whom to marry, especially in the sample of young adults. Ideally, we would draw on quasi-experimental methods to resolve this, but such are challenging to apply to so many different countries in a comparable manner and for so many variables of interest. We thus present cautious interpretations with reference to the literature.

4.2. VARIABLE DEFINITIONS

As mentioned above, participation in the four main activities is not mutually exclusive. We identify such pluri-activity in the data by computing the full-time equivalent (FTE)[10] of each work activity for each individual 15 years and older. This allows us to capture even those who work for a few hours on the family farm while also working in a full-time wage job, primary or secondary occupation alike. In this respect, the first dependent variable represents the participation in the labor force that is 1 if the young person did not carry out any work activity. The second variable is 1 whenever the individual is enrolled in the school system. The third variable represents the participation in off-farm wage employment and is 1 if the individual FTE of off-farm wage work is greater than 0. Off-farm wage employment is defined as any wage work activity that is neither helping out in the households' own business/farm[11] nor her/his own business/farm. The fourth variable is 1 if a young person has spent any other FTE unit in a miscellaneous activity, such as farm work or self-employment.

Being female is our core variable according to which the other characteristics differently influence the activity choices. In the conceptual framework in section 2, we review literature motivating the focus on marital status, household headship, secondary education attainment, child dependency, wealth, time saving assets and peer networks. Marital status, household head status and secondary education attainment are defined as dummy variables

[10] FTE measures the number of working hours spend in all types of employment relative to a standard benchmark of 40 hours per week (FTE=1) and ranges between 0 and 2, allowing for a maximum work of 80 hours per week (Dolislager et al., 2019).

[11] If an individual works for remuneration in the family business, it is considered wage employment.

taking the value 1 respectively if the individual is married, the household head and has concluded secondary education. Child dependency ratio is a proxy of childcare within the household, typically a household chore fulfilled by women, whether the older sisters or young mothers. The variable is defined as the number of household members below age 10 over the number of members aged 10 and above (Van den Broeck and Kilic, 2019). Further, we construct a wealth index following the procedure of the international wealth index (Smits and Steendijk, 2015).[12,13] In the construction of the wealth index, we specifically consider three dimensions, of which some are relevant for gender gaps: Communication equipment, which control for access to information; means of transport that may reduce travelling time; and quality of housing characteristics. Then we also construct a time-saving asset index applying the international wealth index methodology. This index includes household appliances and facilities that affect domestic workloads primarily done by women.[14] Peer-network variables are created for each of the four activity outcomes, distinguished by gender. It is calculated as the share of young females or males in the specific activity over the total young female or male population within the highest level of administrative unit in each country, excluding the person for which the share is calculated. With this variable, we aim to capture network effects related to access to information, role models and social interaction, which can improve access to jobs (Vogli and Veldkamp, 2011; Mani and Riley, 2019; Ray, 2006; Chakravarty et al., 2017; Field et al., 2015; Beaman et al., 2012).[15]

We also include a set of variables controlling for individual, household and context characteristics. At the individual level, we consider a dummy that accounts for different cohorts of age to control for differences between teenagers potentially still in school and more likely to live with their parents and young adults more likely to start their own lives in terms of work and family. At the household level, we take account of the household size and its demographic composition, i.e., the share of women, the share of elderly (above 64 years old) and the share

[12] A separate wealth index constructed on the assets available in the survey data would make comparability difficult. Thus, the international wealth index is the most appropriate procedure for the construction of a comparable index among countries and time points (Smits and Steendijk, 2015; Gwatkin et al., 2007; Mc Kenzie, 2005).

[13] We computed the index using polychoric principal component analysis (Kolenikov and Angeles, 2009) and we rescaled it to a range from 0 to 100 (Smits and Steendijk, 2015). We also include the squared term as Goldin (1995) documents an inverse U-shaped relationship between female labor force participation and wealth or income across countries.

[14] Table C2 in Appendix C presents a detailed list of the classification of each variable.

[15] The data does not allow to control, for example, for individual access to information via mobile phones, internet or similar sources as this information is only available at household level.

of working-age adults. We further control for remittance receipt that can affect the incentive to work as remittances increase non-labor income (Chami et al., 2018; Acosta et al., 2009)

As we model a labor supply decision, we control for local labor demand as well as specifically the sector size for both off-farm wage employment and other employments. Local labor demand is calculated as the working share in the total population (15 – 64 years) within the administrative unit at the highest level (admin 1), excluding the person for which the share is calculated. We proxy the size of the off-farm wage employment sector with the median of the non-farm income share in total income (excluding other sources of income like remittances) at the admin 1 level. We use the respective value as a proxy for the sector size of other employment.

The last control variable is the local enhanced vegetation index (EVI) that is a proxy for the agro-ecological potential. A high agricultural potential can positively affect labor force participation, especially in the on- and off-farm segments of the agriculture and food sector (Arslan et al., 2019; Liverlpool-Tasie et al., 2016; Haggblade et al., 2010; Reardon et al. 2007a). Based on MODIS remote sensing data[16] (Chivasa et al., 2017; Jaafar and Ahmad, 2015), we use the procedure adopted by Arslan et al. (2019), which calculate the 3-year average for the period 2013-2015 in the enumeration area to minimize the impact of seasonality and annual agro-climatic variation

5. AN OVERVIEW OF YOUTH ACTIVITIES

Table 1 summarizes the complete list of variables used in the estimation. Summary statistics for the four sub-samples of the rural-urban gradient are presented in appendix table A6. In terms of youth activities, the majority of youth do not report a work activity, but a similar share is currently in school. Thus, many young people go to school and do not work in our sample. Yet, 38% of youth work in some form of employment other than wage jobs. With 18% off-farm wage employment might seem relatively small, but not negligible. Off-farm wages contribute meaningfully to household income. Households in which a youth works in off-farm wage, this type of income contributes to almost half of household income in rural areas, increasing over the rural-urban gradient up to 75 percent.

[16] EVI data covering all developing countries at 250m x 250m resolution that allow the aggregation to 1 km level to match the resolution of population data for all non-built and non-forested land. EVI measures the influence of geography on the potential for productivity in farming. It is an improvement over the most common NDVI, which utilizes only the red and infrared bands and is subject to noise caused by underlying soil reflectance, especially in low-density vegetation canopies, and to noise from atmospheric absorption. EVI utilizes the blue band for correcting for atmospheric aerosols (Jaafar and Ahmax, 2015).

Table 1. Summary statistics of all variables for each sample, mean (standard deviation).

	Global sample
Dependent variable:	
No work activity (1=yes)	0.48
	(0.50)
In school (1=yes)	0.43
	(0.50)
Off-farm wage employment (1=yes)	0.18
	(0.38)
Other employment (1=yes)	0.38
	(0.48)
Individual characteristics:	
Female (1=yes)	0.47
	(0.50)
Marital status (1=married)	0.17
	(0.38)
Household head (1=yes)	0.13
	(0.33)
Secondary education (1=yes)	0.53
	(0.50)
Age cohort 15-17 (1=yes)	0.33
	(0.47)
Age cohort 18-24 (1=yes)	0.67
	(0.47)
Household characteristics:	
Household size	4.76
	(2.73)
Child dependency ratio	0.20
	(0.31)
Share of women in household	0.49
	(0.25)
Share of elderly in household	0.04
	(0.11)
Share of workers in household	0.63
	(0.34)
Remittances received (1=yes)	0.33
	(0.47)
Wealth index (pPCA standardize 0-100)	59.66
	(27.11)
Time-saving asset index (pPCA standardize 0-100)	50.01
	(32.12)
Context variables:	
Enhanced Vegetation Index (3-year average)	0.28
	(0.13)
Local labor demand	0.67
	(0.11)
Off-farm labor demand	0.72
	(0.36)
Labor demand for other employment	0.28
	(0.36)
Connectivity:	
Location: Rural	0.22
	(0.42)
Location: Semirural	0.17
	(0.38)
Location: Peri-urban	0.25
	(0.43)
Location: Urban	0.35
	(0.48)
Peer network:	
Female peer network in no work activities	0.56
	(0.17)
Male peer network in no work activities	0.44
	(0.17)
Female peer network in school	0.45
	(0.13)
Male peer network in school	0.46
	(0.11)
Female peer network in off-farm wage employment	0.13
	(0.09)
Male peer network in off-farm wage employment	0.19
	(0.13)
Female peer network in other employment	0.32

	Global sample
	(0.22)
Male peer network in other employment	0.40
	(0.24)
No. of observations	121,476
Population size	93,489,569

Note. All values are weighted means and standard deviations are in parentheses.

In table 2, we present the factors expected to influence gender gaps in off-farm wage employment across the rural-urban gradient and we test the difference between young men and women in the sample. Relatively more young women are already married compared to their male peers with a large difference of between 23 percentage points in peri-urban to 28 percentage points in rural areas. Only in urban areas are much fewer youth married and the gap between the sexes is only 6 percentage points. Young women tend to get married at a younger age and to men who are older than them (Doss et al. 2019) resulting in such large differences. In many contexts, with marriage come children. Consequently, young women live in households with relatively higher child dependency ratio, which decreases from rural to urban areas in line with findings from other studies showing lower fertility in urban areas (Stecklov and Menashe-Oren, 2019). Household headship is on average more common among young men in rural and peri-urban areas, but with 13 percent relatively few young people are already considered a head. Secondary education achievement is above 60 percent in peri-urban and urban areas with young women outperforming young men. Relatively more young women also concluded secondary schooling in semi-rural areas, but at an overall lower rate. As one might expect, in rural areas only around a third of youth in our sample attained secondary education without a gender gap. The size of the peer network in off-farm wage work increases along the rural-urban gradient, pointing at a higher number of opportunities in this sector for young people in more densely populated areas. However, on average young men are surrounded by relatively more young men in this activity compared to young women and their female peer network.

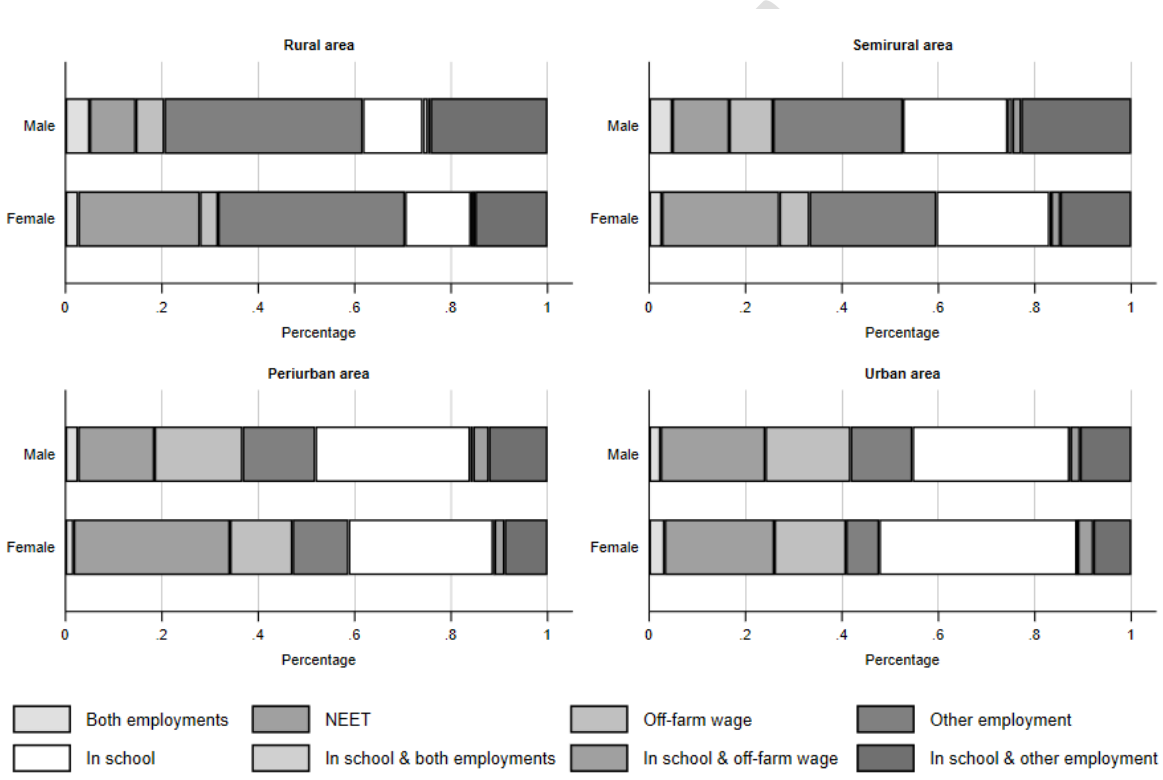
Table 2. Summary statistics of the gender variables for all samples in every location of the rural-urban gradient

	Rural		
	Female	Male	Difference
Marital status (1=married)	0.39	0.11	0.28***
Household head (1=yes)	0.06	0.10	-0.04***
Secondary education (1=yes)	0.32	0.32	0.00
Child dependency ratio	0.37	0.22	0.14***
Wealth index	42.97	43.76	-0.79
Time-saving asset index	29.32	27.82	1.49
Female peer network in off-farm wage	0.10	0.09	0.01*
Male peer network in off-farm wage	0.16	0.14	0.01***
	Semi-rural		
	Female	Male	Difference
Marital status (1=married)	0.33	0.09	0.23***
Household head (1=yes)	0.10	0.14	-0.04
Secondary education (1=yes)	0.41	0.34	0.07***
Child dependency ratio	0.27	0.17	0.10***
Wealth index	50.51	48.11	2.40*
Time-saving asset index	39.10	34.85	4.25***
Female peer network in off-farm wage	0.11	0.10	0.01**
Male peer network in off-farm wage	0.17	0.15	0.02***
	Peri-urban		
	Female	Male	Difference
Marital status (1=married)	0.33	0.10	0.23***
Household head (1=yes)	0.14	0.18	-0.04**
Secondary education (1=yes)	0.68	0.64	0.04**
Child dependency ratio	0.22	0.13	0.09***
Wealth index	70.01	68.47	1.54
Time-saving asset index	61.56	57.20	4.36***
Female peer network in off-farm wage	0.16	0.15	0.01***
Male peer network in off-farm wage	0.25	0.23	0.02***
	Urban		
	Female	Male	Difference
Marital status (1=married)	0.12	0.06	0.06**
Household head (1=yes)	0.14	0.14	-0.00
Secondary education (1=yes)	0.67	0.61	0.06
Child dependency ratio	0.18	0.12	0.05***
Wealth index	69.94	67.24	2.70***
Time-saving asset index	65.71	61.86	3.85**
Female peer network in off-farm wage	0.15	0.14	0.01***
Male peer network in off-farm wage	0.22	0.19	0.03***

Note: Difference reports the difference in means and asterisks indicate the level of statistical significance from a simple t-test: *<0.10; **<0.05; ***<0.01.

As explained in the methodology section, youth activities are not fully mutually exclusive resulting in a diverse set of combinations. Figure 2 presents the share of youth by sex in each of the possible activity combinations along the rural-urban gradient. The rural-urban gradient reflects the structural transformation levels of the economies, which in turn determine the availability of the different activities (IFAD, 2019). Gender differences in activity portfolios might be related to social norms (Jayachandran, 2019).

Figure 1. Share of youth in different activities along the rural-urban gradient by gender.



From left to right, we observe that only very few youth work in both, off-farm wage employment and other employment. When we look at hours worked, we find that those young people who work in off-farm wage employment spent on average at least 80 percent of their total work hours in these jobs, increasing over the rural-urban gradient. This indicates that such jobs are full-time and rarely combined with other main activities. Similarly small is the share of youth working in such off-farm jobs while also attending school (second last bar component). The second group from the left are those neither employed, in education nor training (NEET). This share increases over the rural-urban gradient for young men. There are relatively more young women in this category with almost 25 percent in rural areas, and the highest share in peri-urban areas. As the previous literature asserts, family farming is an easy

entry activity in rural areas, thus rural youth tend to be involved in some work activities with low rates of inactivity (Dolislager et al., 2019) and most youth start working on the farm at an early age, usually while going to school (Fox, 2019). In contrast, although urban areas may offer more job opportunities in general, the lack of an easy entry activity for youth increases the share of young NEETs (Bloom et al., 2008; Henderson, 2010).

As observed in the summary statistics, relatively few youth work in off-farm wage employment compared to being in school or working in other employments. The share of youth engagement in these jobs increases along the rural-urban gradient and there are relatively more young men than women in such jobs. The next two categories, only working in other employment or only being in school, take up the largest shares in all areas. However, in rural areas, other employment dominates, while in urban areas education is more common. Other employment includes working on one's own or the family farm, on a farm for wage, or self-employed. In rural areas, the former two activities dominate, while in peri-urban and urban areas self-employment or running a business are more common (IFAD, 2019). Here we note that such self-employment is less common than wage employment among youth, for men and women alike. While the share of youth who are in school and work in both types of employment or in wage jobs off the farm is almost negligible, there are up to around 20 percent of youth who work in another employment aside their school attendance. Thus, such work might either be in form of helping out on the family farm or having a small self-employment on the side that allows flexibility to work after school.

In terms of gender differences, two findings stand out. First, young women seem more likely than young men to be NEET independent of their connectivity. Second, they appear less likely than their male counterparts to work in off-farm wage jobs, but might have much better chances in (peri-)urban areas. None of these observations accounts for individual, household, local or country characteristics nor for the simultaneous decision to participate in these various activities. We will thus now turn to the simultaneous estimation of off-farm wage participation.

6. RESULTS

The results of the Simultaneous Equation Probit Model are presented in table A2 in the appendix. The table reports the estimates of the four outcome equations (i.e. no work activity, in school, off-farm wage employment, other employment). The first column presents the estimates of the full sample, while columns 2, 3, 4, and 5 report the results for the rural-urban gradient categories, i.e. rural, semirural, peri-urban and urban, respectively. The corresponding marginal effects of the main variables

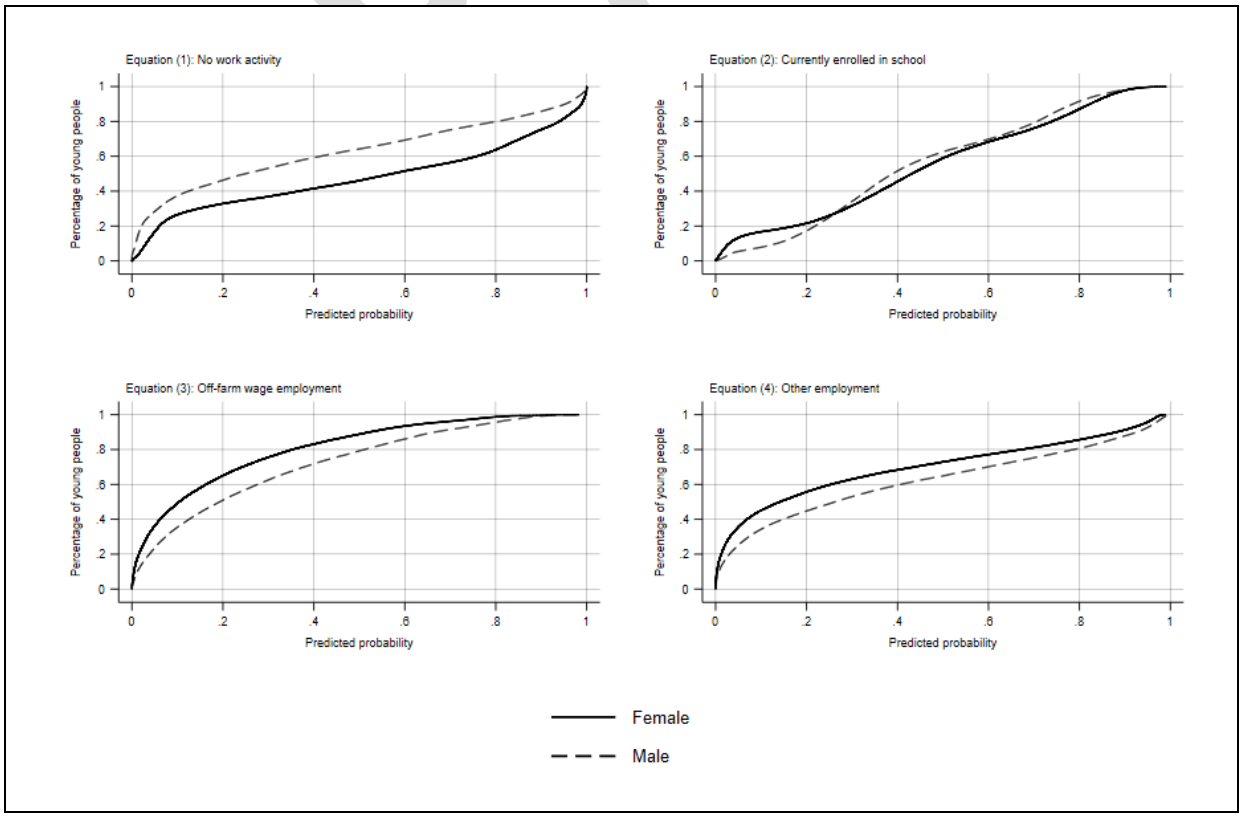
in the off-farm wage employment equation are presented in table A1, again in columns for the full sample and each rural-urban gradient category.

6.1. PREDICTED PROBABILITY FOR DIFFERENT ACTIVITIES

Figure 3 shows the cumulative predicted probabilities of the four equations that are estimated in the simultaneous equation model. We observe a gender gap in all outcomes, aside from school attendance. A high percentage of young women are excluded from the labor market demonstrating that equal access to work is yet far. For example, comparing the 60 per cent of both sexes, young women have a cumulative probability of around 80 per cent to not be working, while young men have a cumulative probability of only around 40 per cent.

Even though the gender gap seems smaller within the labor force, young women are less likely to participated in both off-farm wage employment and in other types of work. In off-farm wage employment, for instance, looking at the 80th percentile of the population, young females are 40 percent likely to be in off-farm wage employment, whereas young males have a likelihood of 50 percent. By contrast, a higher percentage of young females and males have equal probabilities to be in education confirming the efforts to equalize access in education over the past decades.

Figure 2. Cumulative predicted probabilities of the four outcome equations in the Simultaneous Equation Probit Model of the global sample, separated by gender.

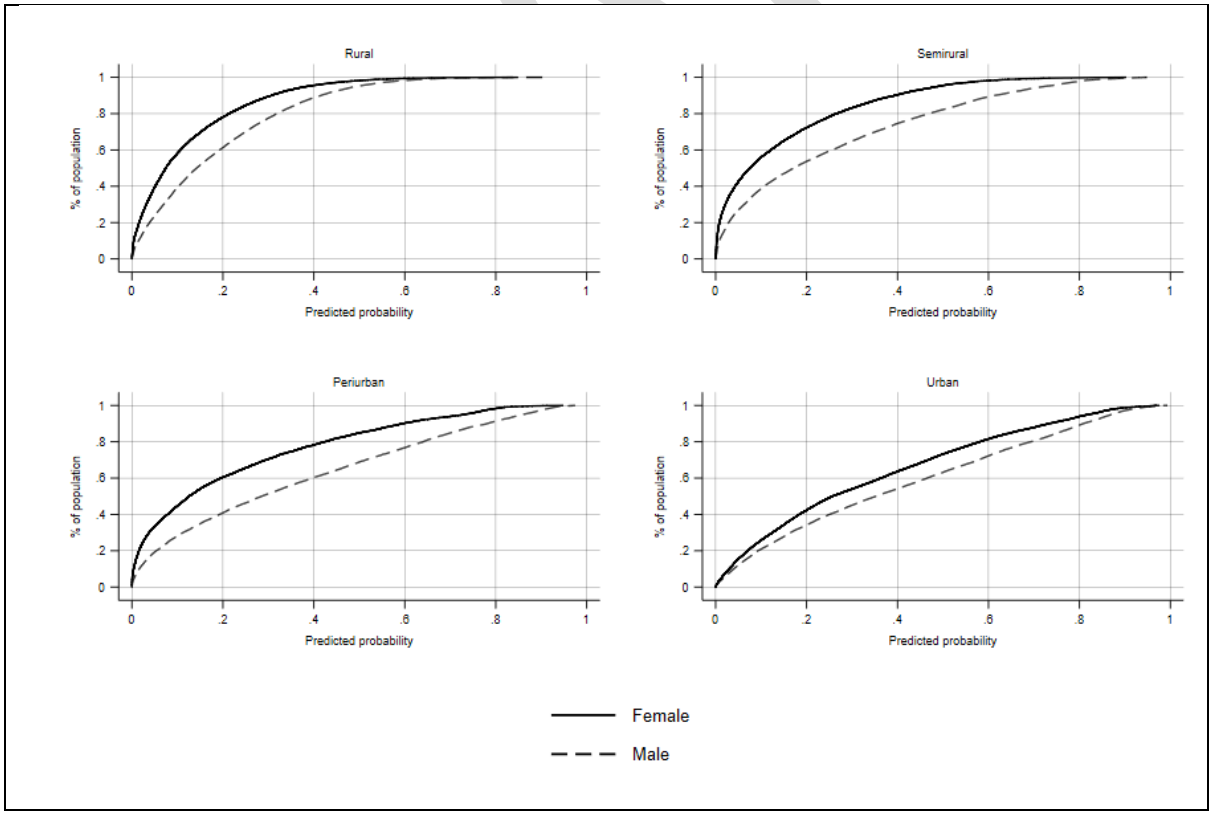


Note. Cumulative predicted probabilities refer to the four outcomes (no work, student, off-farm wage employment, other employment) in the full-sample (column 1) of the global sample estimates in Table A1 of equations 2a to 2d.

6.2. PROBABILITY TO WORK IN OFF-FARM WAGE EMPLOYMENT ALONG THE RURAL-URBAN GRADIENT

Figure 4 shows the cumulative predicted probabilities of off-farm wage employment separated by female and male participation in the four different locations (rural, semirural, peri-urban and urban). Overall, young men are more likely to be employed in off-farm wage employment controlling for individual, household and context characteristics as well as the simultaneous activity choice. Even though the gap is observable in all locations of the rural-urban gradient, it is greater in semi-rural and peri-urban areas. For example, in peri-urban areas, 60 percent of young women have a 20 percent cumulative probability to participate in off-farm wage employment compared to 40 percent cumulative probability for the 60 percent of young men. In urban areas, off-farm wage employment rates are overall higher, and the difference between young men's and women's likelihood to work in such jobs is relatively small.

Figure 3. Cumulative predicted probabilities of off-farm wage employment equation by gender, separated by the rural-urban gradient (overall sample).



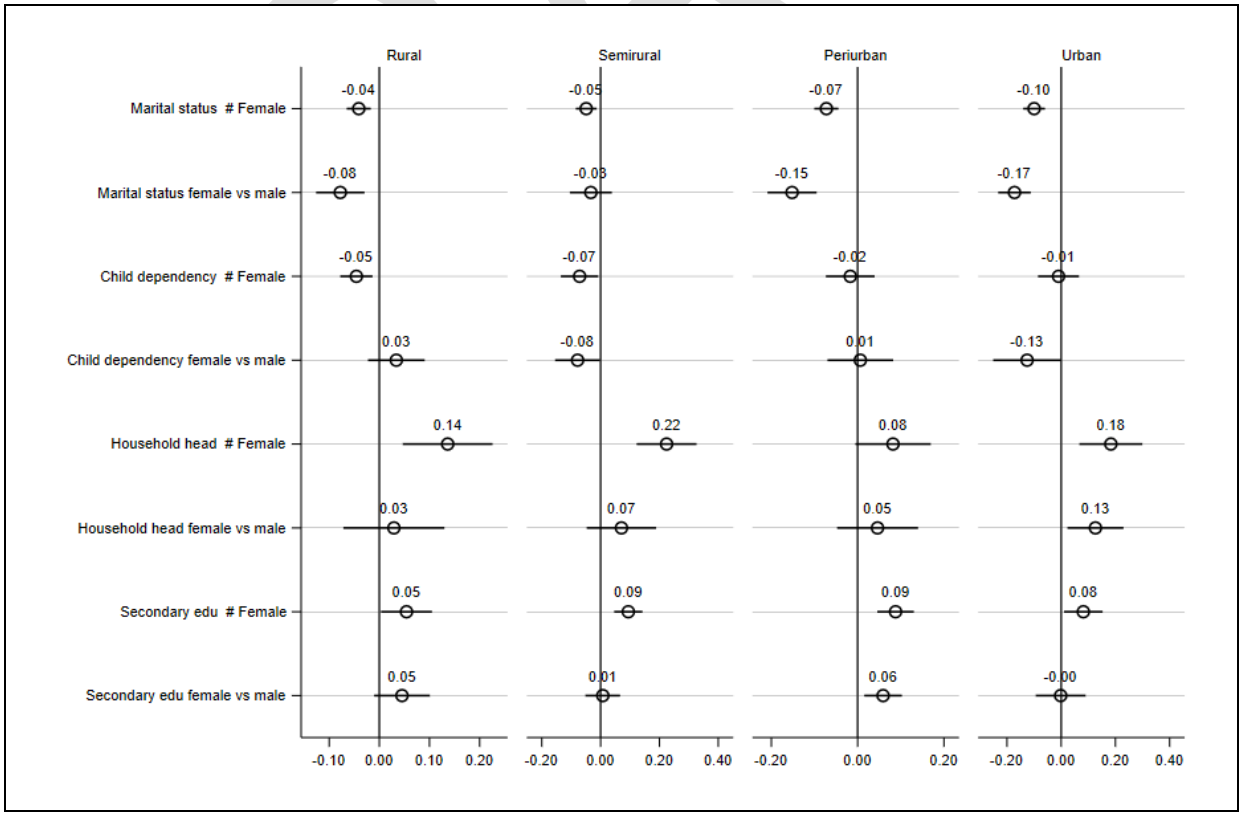
Note. Cumulative predicted probabilities refer to equation (3), off-farm wage employment, in the rural-urban gradient sample (columns 2, 3, 4 and 5) of the global sample estimates in Table A1.

6.3. DRIVERS OF THE GENDER GAP ALONG THE RURAL-URBAN GRADIENT

For the purpose of the discussion, we graphically present the marginal effects of being a young woman interacted with different potential drivers of the gender gap on the participation in off-farm wage employment. For each variable of interest, we present two marginal effects. The first marginal effect compares the effect of an increase in the respective variable on a young woman's participation to that of a young woman for whom the variable remains constant. The second marginal effect compares a young woman to a young man with respect to the same level of the variable of interest.

Figure 5 graphs these marginal effects for four potential drivers of the gender gap: being married, child dependency ratio, being the household head and having completed secondary education. The effects were separately estimated for each category of the rural-urban gradient. Based on the weights applied, these can be read as weighted population average of the full rual, semi-rural, peri-urban or urban sample across all countries.

Figure 5. Marginal effects of marital status, child dependency ratio, household headship and secondary education in every category of the rural-urban gradient.



Notes: Each panel presents the marginal effects of being married, child dependency ratio, being the household head and having concluded secondary education in every category of the rural-urban gradient (rural, semirural, peri-urban and urban). Estimates come from Table A1 in columns 1 (rural), 2 (semirural), 3 (peri-urban) and 4 (urban) in the appendix. The base category is

young women at a lower level of the given variable, i.e. unmarried young women for the marital status, young women with the average child dependency ratio, young women that are not household head, and young women with an educational level below secondary. The female vs male rows are the difference of the marginal effect between young women and men at the same level of the corresponding variable. Confidence levels are set at 90 per cent.

Marriage is associated with opposite probabilities for OFWE for young women and men. Married young women are significantly less likely to participate in OFWE compared to unmarried young women. Married women reduce their participation compared to unmarried young women by 4, 5, 7 and 10 percentage points respectively in rural, semirural, peri-urban and urban areas. At the same time, married young men are more likely to work in such jobs resulting in an even larger gap between the sexes. Young married women have a participation compared to young married men by 8, 15 and 15 percentage points respectively in rural, peri-urban and urban areas. The gender difference between married youth is insignificant in semi-rural areas. Marital status thus significantly limits young women's participation in off-farm jobs which are characterized by full-time work outside of the household. Higher connectivity is not associated with a reduction in this constraint, but rather with a stronger division. This could be partially explained by the observations made in other studies that in more developed contexts, in this case peri-urban and urban areas, married women can afford to stay home and not work, while in rural and less developed areas every household member contributes to household income (Jayachandran, 2020; Field et al., 2010). However, as we control for household wealth and we model other activity choices, this result points at persistent norms around young women's roles when married.

Similar to marital status, childcare in the household differently affects young women and men. In this case, an increase in child dependency ratio is associated with lower female off-farm wage participation, particularly in rural and semirural rural areas (5 and 7 percentage points) compared to young women with average child dependency ratio. Peri-urban and urban areas might offer more options for child care to reduce this constraint. Not shown in this figure but observed in table A1, the marginal effect of child dependency ratio is positive for young men in urban areas (12 percentage points). As a result, a higher child dependency puts young women at a weakly significant disadvantage compared to young men in semi-rural and urban areas. In semi-rural areas, this gap is driven by young women's constraint possibly due to lack of child care options, while in urban areas it appears to be driven by young men's stronger labor force participation pressure with increasing child dependency – and relatively more off-farm jobs available in such areas.

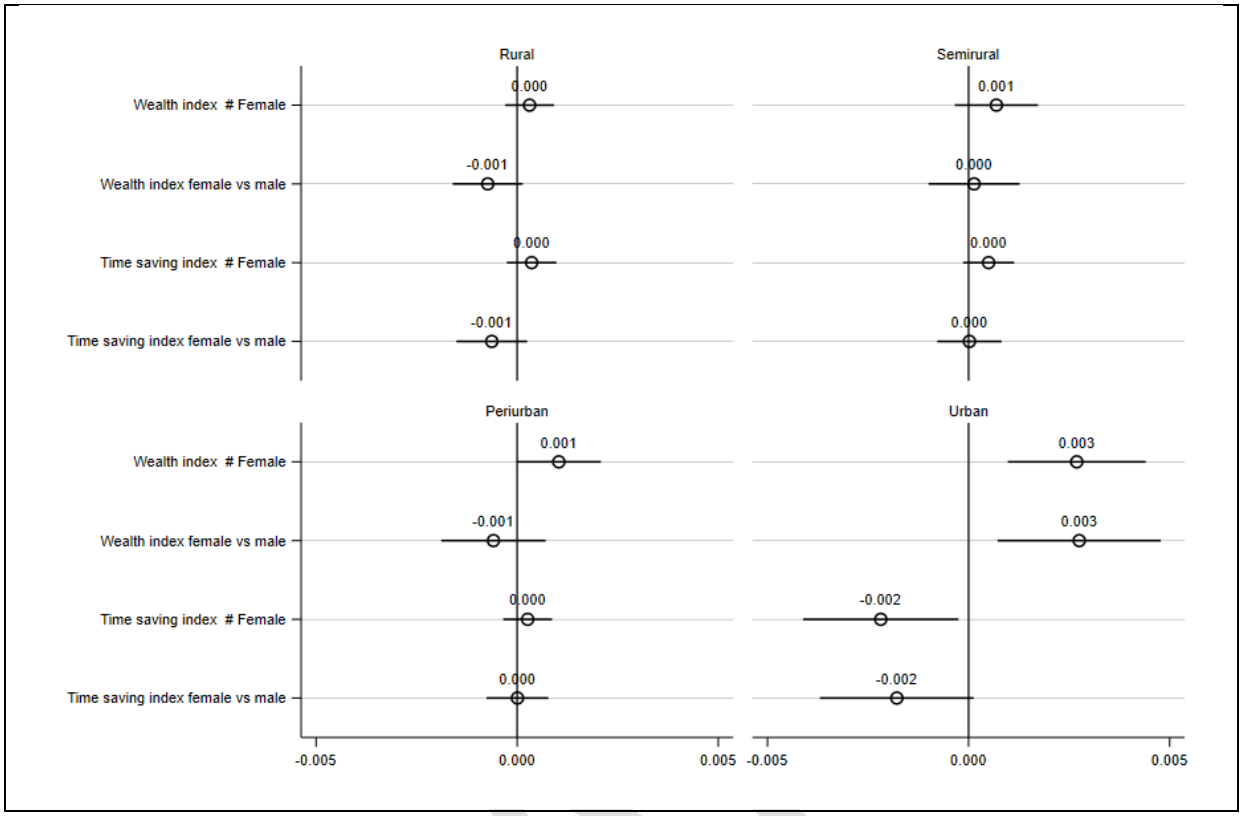
Young women who are the household head in rural, semirural, peri-urban and urban areas are respectively 14, 22, 8 and 18 percentage points more likely to work for wage off the

farm compared to young women who are not the household head. It should be noted that on average only between six and 14 percent of young women in rural and urban areas respectively are household heads. There are two possible directions of influence at work here. One way is that with headship comes decision-making power. This could simply be due to absence of a male partner or dominant older female in the household, thus enabling the young woman to access jobs outside her home. At the same time, Annan et al. (2019) documented that off-farm wage employment is associated with stronger decision-making power and headship could thus be a result of this type of employment. As noted earlier, our method documents correlations and cannot disentangle such endogenous relationships. This pattern consistently appears across connectivity categories, or stated differently, it seems to hold independent of population density. In comparison to young men, young women's headship is not associated with a disadvantage. In urban areas, young female household heads are even significantly more likely than young men to work in off-farm jobs. This could again be related to the two possible explanations from above.

The marginal effect of secondary education on female participation is positive and statistically significant in rural, semirural, peri-urban and urban areas, of 5, 9, 9 and 8 percentage points respectively. As expected and documented in the literature, secondary education aides access to off-farm jobs (Dolislager et al., 2019; Essers, 2016; Van den Broeck and Kilic, 2019). While this is the case for all youth, young women are even more likely than young men to access off-farm jobs in peri-urban areas when they attained secondary education, by six percentage points.

Figure 6 shows the marginal effects of household wealth and time-saving asset wealth on participation in off-farm wage jobs. All estimates are reported in the appendix table A1.

Figure 6. Marginal effects of wealth index and time saving asset index in every category of the rural-urban gradient.

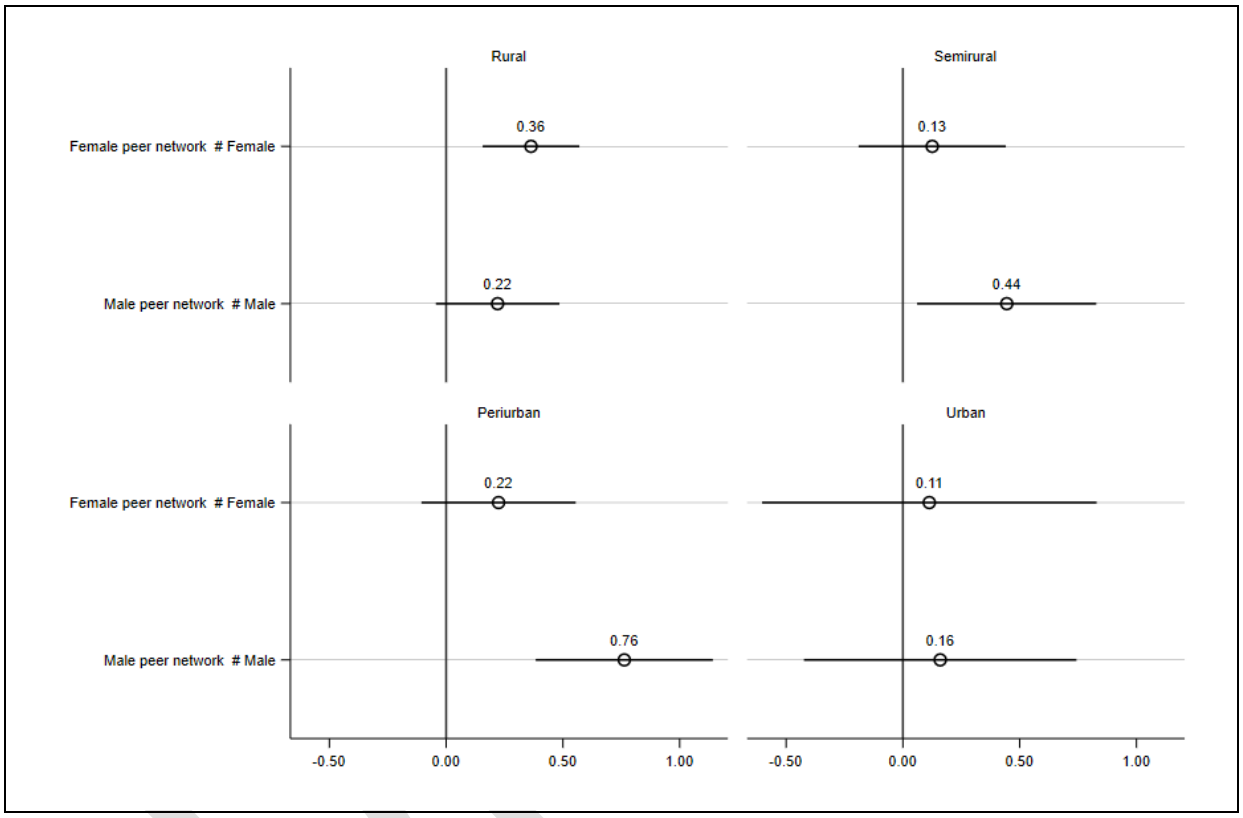


Notes: Each panel presents the marginal effects of the wealth index or the time saving asset index in every category of the rural-urban gradient (rural, semirural, peri-urban and urban). Estimates come from table A1 in columns 1 (rural), 2 (semirural), 3 (peri-urban) and 4 (urban) in the appendix. The base category is young women at the average level of the variable. The female vs male estimates are the difference of the marginal effect between young women and men at the same level of the corresponding variable. For peer network, we do not have a female vs male comparison, therefore we report marginal effects of both female and male peer network which can be compared to assess the different effect of peer network on female and male participation. Confidence level are set at 90 per cent.

The only significant marginal effect in this figure are those of a household wealth index for young women's OFWE. Young women in wealthier households are significantly more likely to work in off-farm wage jobs than young women from less wealthy households in peri-urban and more so in urban areas. In urban areas, this results in an advantage for young women compared to young men in wealthier households driven by the fact that for young men, household wealth does not appear to make a significant difference for their OFWE participation. Contrary to what we would expect, ownership of time-saving assets does not significantly interact with young women's OFWE participation, or even have a negative marginal effect in urban areas. This could be explained by the fact that the index is on average 90 in urban households, so that almost every household owns almost all time-saving assets we can measure in the surveys. At the same time, education opportunities are higher in urban areas so that young women with high time-saving assets might rather pursue more education than wage employment. Indeed, the estimation results of outcome "currently in school" show a positive coefficient of the time-saving asset index for peri-urban areas.

Lastly, we investigate the role of peer networks in the off-farm wage employment sector. Figure 7 presents the marginal effects of the network size once for young women and then for young men along the rural-urban gradient. We do not compute the gender difference of the marginal effect here as we focus on gender-specific network size so that we rather directly compare the respective marginal effects. It should be noted that we separately control for the overall and sector-specific labor demand, so that our measure does not capture those.

Figure 7. Marginal effects of peer networks in every category of the rural-urban gradient.



Notes: Each panel presents the marginal effects of the female and male peer network in every category of the rural-urban gradient (rural, semirural, peri-urban and urban). Estimates come from table A1 in columns 1 (rural), 2 (semirural), 3 (peri-urban) and 4 (urban) in the appendix. The base category is young women or young men at the average level of the peer network variable. We do not have a female vs male comparison; therefore, we report marginal effects of both female and male peer network which can be compared to assess the different effect of peer networks on female and male participation. Confidence level are set at 90 per cent.

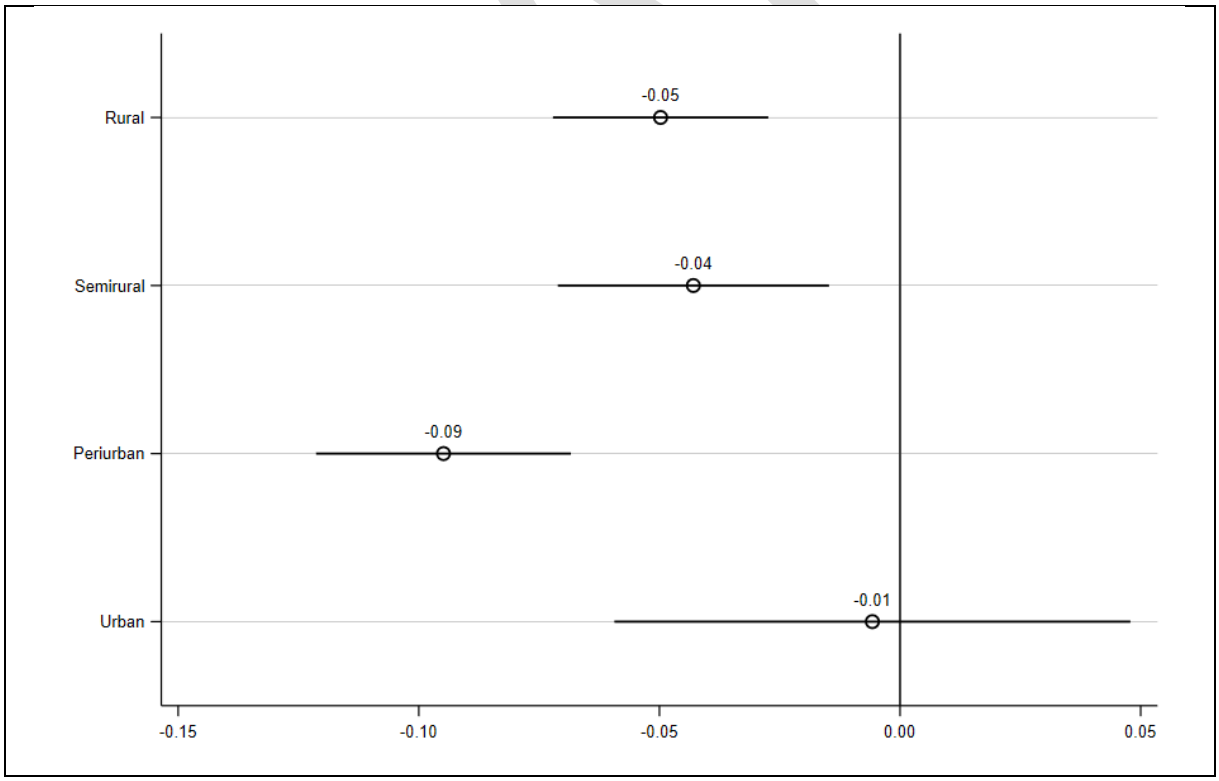
The peer network size has a positive marginal effect for both sexes, but the magnitude is greater for young men and it is significant for young women only in rural areas. The likelihood to work in off-farm wage employment in a rural area increases by 36 percentage points for a young woman in a rural area if her peer network increases by one unit. Yet, this points at the importance of such agglomeration effects in relatively less connected areas, while for young men the marginal effect is largest in the areas between rural and urban, namely semi-rural and peri-urban. In urban areas, peer network size does not seem to influence participation.

6.4. The innate gender bias

Figure 8 reports the marginal effect of the female dummy in each gradient (rural, semirural, peri-urban and urban). Assuming the interaction terms capture all possible heterogeneities between young men and women due to observed characteristics (i.e. marital status, childcare, household head status, secondary education, wealth, time-saving assets and peer network), we can refer to this partial effect as the "innate gender bias", which is not related to observable characteristics.

The coefficient increases along the rural-urban gradient and it disappears in urban areas approaching an inverse U-shape relationship. On the one hand, the lack of off-farm wage opportunities in rural areas might reduce the access of young men to such jobs and through that decrease the gender gap. On the other hand, as opportunities in off-farm wage employment increase along the rural-urban gradient, the gender gap increases and only shrinks in densely populated areas possibly due to greater connectivity and lower biases associated with social norms.

Figure 4. The marginal effect of being female in every category of the rural-urban gradient.



Notes: The figure presents the marginal effect of the female dummy. Estimates come from four sub-sample regressions of the the rural-urban gradient categories, i.e. rural (column 1), semirural (column 2), peri-urban (column 3) and urban (column 4) of Table A1. The base category is male. Confidence level are set at 90 per cent.

7. CONCLUSION

In this study, we use micro-data from twelve low- and middle-income countries merged with geo-spatial data on population density to assess the persistence of gender gaps in wage employment across globally comparable geographies. The analysis focuses on youth and off-farm wage employment as important demographic and livelihood. We find the largest and most persistent gender gaps for married youth independent of their connectivity explained largely by the negative effect of marital status on young women's participation and simultaneous positive effect on young men's participation pointing at persistent social norms around roles and responsibilities within marriage. Also, child dependency reveals a gender gap, which is, however, largely explained by a positive marginal effect on male participation. Secondary education improves young women's participation rates more so in non-rural areas. Overall, there is no consistent improvement of the gender gap over the rural-urban gradient related to observable characteristics. Being female by itself is associated with an increase in the gender gap over the rural-urban gradient, but then disappears in urban areas pointing at potential positive connectivity effects.

While our analysis adds to the literature on gender gaps in employment in developing countries, it cannot address all questions that arise. Especially for youth, the transition into the labor market is important, and we only conduct a cross-sectional analysis instead of a dynamic one. This also implies that we cannot control for unobservable characteristics which have been shown to be important for young women's wage employment participation, such as self-confidence (McKelway, 2020), beliefs (Bordalo et al., 2019), intra-household relationships (Bertrand et al., 2015) or community norms (Bernhardt et al., 2019). Another important question is whether the participation gender gap also reflects qualitative differences, such as in wages, formality and job conditions (Borrowman and Klasen, 2020), and how these might vary along the rural-urban gradient.

Despite these caveats, we provide evidence that investments related to improve connectivity, for example in form of rural road expansion, might contribute to economic development (e.g. Aggarwal, 2018), but they are no magic bullet to overcome gender gaps. Instead, our analysis confirms what other papers have shown, that social norms around gender roles are persistent and thus require interventions that address these and should do so at a young age.

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APPENDIX

Table A1. Marginal effects for off-farm wage employment participation, sub-samples of each category of the rural-urban gradient.

	Rural	Semirural	Periurban	Urban
Female	-0.05***	-0.04**	-0.09***	-0.01
	(0.01)	(0.02)	(0.02)	(0.03)
Marital status (Married = 1)	-0.00	-0.03	0.00	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Child dependency ratio	-0.06***	-0.03	-0.02	0.06
	(0.02)	(0.03)	(0.02)	(0.04)
Household headship	0.12***	0.18***	0.06*	0.11***
	(0.03)	(0.04)	(0.03)	(0.04)
Secondary education	0.03*	0.09***	0.06***	0.08***
	(0.02)	(0.02)	(0.02)	(0.03)
Female peer network	0.00**	0.00	0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Male peer network	0.00**	0.00	0.00	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)
Wealth index	0.24***	0.16	-0.07	0.37
	(0.09)	(0.15)	(0.16)	(0.26)
Time-saving assets	0.10	0.27**	0.45***	0.25
	(0.09)	(0.13)	(0.15)	(0.25)
Marital status # Male	0.04	-0.02	0.08**	0.07**
	(0.03)	(0.04)	(0.03)	(0.03)
Marital status # Female	-0.04***	-0.05***	-0.07***	-0.10***
	(0.01)	(0.02)	(0.01)	(0.02)
Marital status female vs male	-0.08***	-0.03	-0.15***	-0.17***
	(0.03)	(0.04)	(0.03)	(0.04)
Child dependency ratio # Male	-0.08**	0.01	-0.02	0.12*
	(0.03)	(0.04)	(0.04)	(0.06)
Child dependency ratio # Female	-0.05***	-0.07**	-0.02	-0.01
	(0.02)	(0.03)	(0.03)	(0.04)
Child dependency ratio female vs male	0.03	-0.08*	0.01	-0.13*
	(0.03)	(0.05)	(0.05)	(0.08)
Household headship # Male	0.11***	0.15***	0.04	0.06
	(0.04)	(0.05)	(0.04)	(0.04)
Household headship # Female	0.14***	0.22***	0.08*	0.18***
	(0.05)	(0.05)	(0.04)	(0.06)
Household headship female vs male	0.03	0.07	0.05	0.13**
	(0.06)	(0.07)	(0.06)	(0.06)
Secondary education # Male	0.01	0.09***	0.03	0.08**
	(0.02)	(0.03)	(0.02)	(0.04)
Secondary education # Female	0.05**	0.09***	0.09***	0.08**
	(0.03)	(0.02)	(0.02)	(0.04)
Secondary education female vs male	0.05	0.01	0.06**	-0.00
	(0.03)	(0.04)	(0.03)	(0.06)
Wealth index # Male	0.00**	0.00	0.00**	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Wealth index # Female	0.00	0.00	0.00*	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Wealth index female vs male	-0.00	0.00	-0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Time saving index # Male	0.00**	0.00	0.00	-0.00

	(0.00)	(0.00)	(0.00)	(0.00)
Time saving index # Female	0.00	0.00	0.00	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Time saving index female vs male	-0.00	0.00	0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Female peer network # Female	0.36***	0.13	0.22	0.11
	(0.11)	(0.16)	(0.17)	(0.37)
Male peer network # Male	0.22	0.44**	0.76***	0.16
	(0.13)	(0.20)	(0.19)	(0.30)
Observations	38,730	29,351	22,691	30,704
Population size	21,021,894	16,232,220	23,107,226	33,128,229

Note: Standard errors in parentheses. Statistical significance: *<0.10; **<0.05; ***<0.01. Marginal effects control for all variables specified in the Simultaneous Equation Model in Table A2.

Table A2. Simultaneous Equation Model for the global sample.

	Rural	Semirural	Peri-urban	Urban
	b/se	b/se	b/se	b/se
Equation (1): no work activity (=1)				
Female#Female peer network in no-work	1.80***	0.95**	2.27***	2.08**
	(0.45)	(0.47)	(0.52)	(0.85)
Female	0.05	0.27	0.04	0.38
	(0.20)	(0.21)	(0.29)	(0.63)
Marital status (1=married)	-0.55**	-0.84***	-1.01***	-0.60***
	(0.22)	(0.21)	(0.18)	(0.18)
Child dependency ratio	-0.22	0.21	0.06	0.25
	(0.18)	(0.17)	(0.22)	(0.35)
Household head (1=yes)	-1.40***	-1.38***	-0.99***	-1.07**
	(0.33)	(0.35)	(0.24)	(0.42)
Secondary school completed (1=yes)	-0.38**	-0.08	-0.12	-0.26
	(0.16)	(0.15)	(0.11)	(0.23)
Wealth index	0.01*	0	0	0.01***
	(0.00)	(0.00)	(0.00)	(0.00)
Time-saving asset index	0	0.00**	0	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)
Female # married	0.74***	0.95***	1.33***	0.64**
	(0.23)	(0.26)	(0.21)	(0.25)
Female # Child dependency ratio	0.07	-0.24	-0.16	0.37
	(0.20)	(0.24)	(0.26)	(0.44)
Female # Household head	0.38	0.2	-0.36	0.01
	(0.59)	(0.47)	(0.29)	(0.43)
Female # Secondary school completed	0.34*	-0.1	-0.11	0.4
	(0.19)	(0.18)	(0.17)	(0.28)
Female # Wealth index	0	0.01	0	-0.02***
	(0.00)	(0.00)	(0.00)	(0.01)
Female # Time-saving asset index	0	0	0	0
	(0.00)	(0.00)	(0.00)	(0.01)
Age 18-24 (compared to 15-17)	-0.55***	-0.63***	-0.82***	-0.69***
	(0.08)	(0.07)	(0.09)	(0.13)
Household size	0.01	-0.02	-0.04***	-0.05**
	(0.01)	(0.01)	(0.01)	(0.02)
Share of females in the household	-0.30*	-0.54***	-0.54***	-0.42
	(0.18)	(0.17)	(0.17)	(0.29)
Share of elderly in the household	-1.36***	-1.22***	-0.36	-1.07**
	(0.42)	(0.30)	(0.32)	(0.50)
Share of workers among working-aged household members	-6.16***	-5.74***	-5.49***	-4.50***
	(0.18)	(0.17)	(0.17)	(0.23)
Remittances received (yes=1)	0.11	0.05	-0.01	0.15

	(0.11)	(0.07)	(0.08)	(0.10)
Local labor demand	3.43***	2.36***	2.39***	2.83**
	(0.77)	(0.70)	(0.88)	(1.10)
EVI	-0.09	-0.32	-0.14	0.47
	(0.33)	(0.30)	(0.32)	(0.53)
Cambodia	-0.09	-0.18**	0.05	-0.45**
	(0.11)	(0.09)	(0.15)	(0.22)
Ethiopia	-0.18	-0.07	0	-0.13
	(0.12)	(0.09)	(0.19)	(0.21)
Indonesia	-0.05	-0.19	-0.13	-0.62**
	(0.21)	(0.16)	(0.23)	(0.28)
Malawi	-0.22**	-0.31***	0.08	-0.06
	(0.11)	(0.09)	(0.16)	(0.20)
Mexico	-0.07	-0.23	-0.02	-0.54*
	(0.19)	(0.14)	(0.23)	(0.29)
Nepal	-0.24**	-0.16*	0	-0.13
	(0.12)	(0.10)	(0.17)	(0.20)
Nicaragua	0.03	-0.24	0.02	-0.51*
	(0.18)	(0.18)	(0.21)	(0.30)
Niger	-0.05	-0.22	-0.06	0.04
	(0.16)	(0.19)	(0.19)	(0.22)
Nigeria	0.08	-0.17	-0.01	0
	(0.13)	(0.11)	(0.17)	(0.21)
Peru	-0.16	-0.22*	0.05	-0.45*
	(0.15)	(0.13)	(0.20)	(0.25)
Tanzania	-0.08	-0.17*	0.21	-0.25
	(0.11)	(0.10)	(0.17)	(0.21)
Constant	1.06	2.11***	1.84**	0.05
	(0.74)	(0.67)	(0.88)	(0.99)
Equation (2): student (=1)				
Female#Female peer network in no-work	0.89	-0.11	1.33*	-1.09
	(0.64)	(0.41)	(0.71)	(0.96)
Female	0.21	-0.27	-0.19	0.24
	(0.23)	(0.27)	(0.47)	(0.93)
Marital status (1=married)	-1.34***	-1.28***	-1.74***	-1.48**
	(0.18)	(0.18)	(0.20)	(0.61)
Child dependency ratio	0.04	-0.33***	0.25	-0.09
	(0.13)	(0.13)	(0.17)	(0.31)
Household head (1=yes)	-0.44*	-0.18	-0.01	0.12
	(0.24)	(0.20)	(0.19)	(0.24)
Secondary school completed (1=yes)	-0.51***	-0.22**	-0.46***	-0.86***
	(0.11)	(0.10)	(0.11)	(0.18)
Wealth index	0.01***	0.01***	0	0
	(0.00)	(0.00)	(0.00)	(0.00)
Time-saving asset index	0.00**	0	0.01**	0
	(0.00)	(0.00)	(0.00)	(0.00)
Female # married	-0.40**	-0.09	0.04	0.25
	(0.18)	(0.42)	(0.26)	(0.66)
Female # Child dependency ratio	-0.38**	-0.3	-0.33	-0.22
	(0.19)	(0.22)	(0.27)	(0.40)
Female # Household head	0.18	-0.31	-0.31	0.02
	(0.37)	(0.33)	(0.27)	(0.29)
Female # Secondary school completed	0.17	0.04	0.05	0.48*
	(0.15)	(0.19)	(0.17)	(0.28)
Female # Wealth index	0	0	0	0
	(0.00)	(0.00)	(0.00)	(0.01)
Female # Time-saving asset index	0	0	0	0
	(0.00)	(0.00)	(0.00)	(0.00)
Age 18-24 (compared to 15-17)	-0.91***	-1.01***	-1.15***	-0.87***
	(0.06)	(0.06)	(0.07)	(0.10)
Household size	0.03***	0.02	-0.01	0.02

	(0.01)	(0.01)	(0.01)	(0.02)
Share of females in the household	0.15	0.42**	-0.13	-0.21
	(0.15)	(0.17)	(0.18)	(0.29)
Share of elderly in the household	0.13	-0.77**	-0.57*	-0.53
	(0.32)	(0.32)	(0.29)	(0.72)
Share of workers among working-aged household members	-0.23*	-0.41***	-0.69***	-0.88***
	(0.12)	(0.14)	(0.11)	(0.19)
Remittances received (yes=1)	0.11	0.24**	0.14*	0.43***
	(0.09)	(0.09)	(0.09)	(0.14)
Local labor demand	0.59	1.04***	1.11**	0.87
	(0.52)	(0.40)	(0.48)	(0.66)
EVI	0.97***	0.55	0.90***	-0.2
	(0.37)	(0.35)	(0.30)	(0.45)
Cambodia	-0.21	-0.61***	-0.22	-0.21
	(0.16)	(0.12)	(0.21)	(0.30)
Ethiopia	0.17	0.14	0.03	-0.08
	(0.13)	(0.11)	(0.21)	(0.25)
Indonesia	-0.11	-0.47***	-0.23	-0.16
	(0.20)	(0.17)	(0.20)	(0.30)
Malawi	0.48***	0.05	0.1	-0.23
	(0.14)	(0.12)	(0.17)	(0.21)
Mexico	-0.14	-0.47***	-0.1	0.32
	(0.16)	(0.15)	(0.18)	(0.28)
Nepal	0.64***	0.27*	0.29*	0.33
	(0.16)	(0.14)	(0.17)	(0.24)
Nicaragua	0.11	-0.21	-0.06	0.18
	(0.16)	(0.16)	(0.16)	(0.27)
Niger	-0.38*	-0.55***	0.21	-0.39
	(0.20)	(0.18)	(0.26)	(0.31)
Nigeria	0.32**	-0.01	0.05	0.19
	(0.15)	(0.11)	(0.15)	(0.31)
Peru	-0.06	-0.36**	-0.12	-0.13
	(0.13)	(0.17)	(0.18)	(0.32)
Tanzania	-0.42***	-0.53***	-0.40*	-1.07***
	(0.15)	(0.13)	(0.23)	(0.30)
Constant	-1.41***	-0.74*	-0.69	0.22
	(0.48)	(0.43)	(0.47)	(0.73)
Equation (3): Off-farm wage employment (1=yes)				
Sector size of off-farm employment	-0.14	0.24	0.05	0.02
	(0.20)	(0.19)	(0.28)	(0.47)
Female#Female peer network in no-work	3.17***	0.87	1.45	0.63
	(0.88)	(1.11)	(1.08)	(2.05)
Female	-0.13	-0.03	-0.41	-0.23
	(0.17)	(0.17)	(0.25)	(0.47)
Marital status (1=married)	0.21	-0.09	0.39**	0.37**
	(0.15)	(0.22)	(0.15)	(0.15)
Child dependency ratio	-0.48**	0.04	-0.12	0.63*
	(0.20)	(0.20)	(0.20)	(0.36)
Household head (1=yes)	0.54***	0.67***	0.18	0.29
	(0.18)	(0.20)	(0.19)	(0.21)
Secondary school completed (1=yes)	0.05	0.44***	0.15	0.46**
	(0.14)	(0.13)	(0.12)	(0.21)
Wealth index	0.01**	0	0.01**	0
	(0.00)	(0.00)	(0.00)	(0.01)
Time-saving asset index	0.01**	0	0	0
	(0.00)	(0.00)	(0.00)	(0.00)
Female # married	-0.61***	-0.28	-0.88***	-1.02***
	(0.18)	(0.26)	(0.17)	(0.20)
Female # Child dependency ratio	0.08	-0.53*	0.01	-0.69
	(0.23)	(0.28)	(0.26)	(0.43)
Female # Household head	0.29	0.4	0.29	0.57**

	(0.27)	(0.26)	(0.29)	(0.27)
Female # Secondary school completed	0.38*	0.17	0.45***	0.01
	(0.23)	(0.20)	(0.17)	(0.30)
Female # Wealth index	0	0	0	0.02**
	(0.00)	(0.00)	(0.00)	(0.01)
Female # Time-saving asset index	0	0	0	-0.01
	(0.00)	(0.00)	(0.00)	(0.01)
Age 18-24 (compared to 15-17)	0.58***	0.70***	1.00***	1.00***
	(0.08)	(0.09)	(0.09)	(0.14)
Household size	0.01	-0.03	0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.03)
Share of females in the household	0.32	-0.18	0.22	-0.22
	(0.20)	(0.26)	(0.21)	(0.29)
Share of elderly in the household	0.14	0.59	-0.28	0.42
	(0.35)	(0.36)	(0.36)	(0.78)
Share of workers among working-aged household members	1.38***	1.62***	2.58***	2.45***
	(0.16)	(0.17)	(0.13)	(0.19)
Remittances received (yes=1)	0.01	0.21**	0.03	0.01
	(0.10)	(0.10)	(0.08)	(0.11)
Local labor demand	0.34	0.02	-1.07	-0.65
	(0.70)	(0.68)	(0.71)	(0.88)
EVI	-0.27	-0.01	0.66**	-1.16***
	(0.42)	(0.46)	(0.33)	(0.43)
Cambodia	0.1	0.21	0.62**	-0.57
	(0.26)	(0.29)	(0.32)	(0.41)
Ethiopia	0.40**	0.44**	0.89***	-0.05
	(0.20)	(0.19)	(0.33)	(0.26)
Indonesia	0	-0.65***	-0.02	-0.28
	(0.28)	(0.23)	(0.26)	(0.31)
Malawi	-0.66***	-0.52***	0.1	-0.31
	(0.24)	(0.19)	(0.27)	(0.25)
Mexico	0.04	-0.22	0.11	-0.24
	(0.32)	(0.27)	(0.24)	(0.40)
Nepal	0.24	-0.03	0.11	-0.08
	(0.23)	(0.18)	(0.21)	(0.26)
Nicaragua	0.29	-0.3	0.06	-0.12
	(0.25)	(0.24)	(0.31)	(0.40)
Niger	0.11	0.04	0.47*	0.04
	(0.25)	(0.31)	(0.26)	(0.23)
Nigeria	-0.77***	-0.32*	-0.35	-0.59**
	(0.23)	(0.18)	(0.28)	(0.25)
Peru	0.08	-0.23	0.25	-0.51*
	(0.22)	(0.21)	(0.25)	(0.31)
Tanzania	0.07	0.41**	0.34	0.13
	(0.19)	(0.17)	(0.26)	(0.27)
Constant	-3.88***	-3.72***	-4.33***	-3.11***
	(0.62)	(0.67)	(0.71)	(0.99)
Equation (4): Other work activities (1=yes)				
Sector size of other employment	-0.07	0.06	0.05	-0.21
	(0.14)	(0.13)	(0.16)	(0.49)
Female#Female peer network in no-work	1.21***	1.69***	2.13***	0.15
	(0.45)	(0.41)	(0.52)	(0.84)
Female	-0.07	0.08	-0.33	-0.63
	(0.32)	(0.31)	(0.35)	(0.71)
Marital status (1=married)	0.88***	1.42***	0.50***	0.25
	(0.24)	(0.24)	(0.17)	(0.28)
Child dependency ratio	0.47***	-0.29**	0.26	-0.87***
	(0.18)	(0.14)	(0.20)	(0.31)
Household head (1=yes)	-0.09	-0.55**	-0.13	0.21
	(0.28)	(0.24)	(0.20)	(0.39)
Secondary school completed (1=yes)	0.37***	-0.27*	0.01	0.03

	(0.13)	(0.14)	(0.11)	(0.23)
Wealth index	-0.01***	0	-0.01***	-0.01**
	(0.00)	(0.00)	(0.00)	(0.01)
Time-saving asset index	-0.01***	-0.01***	0	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)
Female # married	-0.82***	-1.28***	-0.29	0.3
	(0.23)	(0.32)	(0.20)	(0.35)
Female # Child dependency ratio	-0.14	0.56***	-0.14	0.02
	(0.21)	(0.21)	(0.21)	(0.37)
Female # Household head	-0.86**	-0.47	-0.14	-0.51
	(0.37)	(0.38)	(0.38)	(0.40)
Female # Secondary school completed	-0.55***	0.27	-0.05	-0.33
	(0.18)	(0.19)	(0.17)	(0.25)
Female # Wealth index	0.01*	-0.01	0	0.01
	(0.00)	(0.00)	(0.00)	(0.01)
Female # Time-saving asset index	0	0	0	0
	(0.00)	(0.00)	(0.00)	(0.01)
Age 18-24 (compared to 15-17)	0.13*	0.17***	0.03	0.15
	(0.07)	(0.06)	(0.07)	(0.15)
Household size	0.01	0.06***	0.05***	0.06***
	(0.01)	(0.01)	(0.01)	(0.02)
Share of females in the household	0.01	0.81***	0.36*	0.24
	(0.18)	(0.24)	(0.20)	(0.39)
Share of elderly in the household	0.82**	0.36	0.69**	0.43
	(0.39)	(0.32)	(0.28)	(0.55)
Share of workers among working-aged household members	4.72***	4.34***	3.47***	2.75***
	(0.17)	(0.16)	(0.18)	(0.28)
Remittances received (yes=1)	-0.05	-0.38***	0.01	-0.18*
	(0.10)	(0.14)	(0.10)	(0.11)
Local labor demand	-1.21	-2.89***	-1.04	-1.18
	(0.82)	(0.78)	(0.84)	(1.18)
EVI	0.15	-0.16	-0.53	1
	(0.42)	(0.36)	(0.37)	(0.62)
Cambodia	-0.65***	-0.41***	-0.35	-0.08
	(0.19)	(0.16)	(0.22)	(0.39)
Ethiopia	-0.17	-0.33***	-0.53***	0.07
	(0.12)	(0.12)	(0.20)	(0.30)
Indonesia	-0.27	0.48**	0.06	0.04
	(0.22)	(0.21)	(0.25)	(0.35)
Malawi	0.17	0.24**	0.02	0.31
	(0.12)	(0.12)	(0.16)	(0.24)
Mexico	-0.3	0.01	-0.26	-0.48
	(0.23)	(0.21)	(0.25)	(0.35)
Nepal	0.09	0.08	-0.02	-0.17
	(0.13)	(0.11)	(0.17)	(0.25)
Nicaragua	-0.54***	0.19	0.22	-0.05
	(0.20)	(0.25)	(0.40)	(0.33)
Niger	-0.22	-0.05	-0.21	-0.07
	(0.15)	(0.19)	(0.23)	(0.25)
Nigeria	-0.15	0.03	0.31*	0.35
	(0.12)	(0.13)	(0.17)	(0.25)
Peru	-0.28*	0.15	-0.1	0.41
	(0.16)	(0.17)	(0.21)	(0.36)
Tanzania	-0.16	0.12	-0.14	-0.06
	(0.12)	(0.14)	(0.19)	(0.30)
Constant	-2.46***	-2.30***	-2.67***	-1.87**
	(0.47)	(0.58)	(0.58)	(0.75)
N	38730	29351	22691	30704
Sub-population size	21021894	16232220	23107226	33128229

Note: Standard errors in parentheses. Statistical significance: *<0.10; **<0.05; ***<0.01.

Table A3. List of surveys used for the dataset

Country	Survey Name	Year	Sample Size (individuals)	Geolocations
	Asia			
Cambodia	Cambodia Socio-Economic Survey	2014	53,968	Village geocodes identified
Indonesia	Indonesian Family Life Survey (Strauss, Witoelar and Sikoki, 2016)	2014	58,300	EAs geocoded
Nepal	Nepal Living Standards Survey	2010	28,670	Village geocodes identified
	Latin America			
Mexico	Encuesta nacional de ingresos y gastos de los hogares	2016	256,448	EAs geocoded
Nicaragua	Encuesta nacional de hogares sobre medición de nivel de vida	2014	29,381	Municipality geocodes identified
Peru	Encuesta nacional de hogares 2016 (Anual) – Condiciones de vida y pobreza	2016	134,235	EAs geocoded
	Sub-Saharan Africa			
Ethiopia	Ethiopian Socioeconomic Survey	2015/2016	23,393	Enumeration Areas (EA) geocoded
Malawi	Fourth Integrated Household Survey	2016/2017	53,885	EAs geocoded
Niger	National Survey on Household Living Conditions on Agriculture - Panel	2014	22,671	EAs geocoded
Nigeria	General Household Survey- Panel	2015/2016	24,807	EAs geocoded
Tanzania	National Panel Survey	2014/2015	16,285	EAs geocoded
Uganda	The Uganda National Panel Survey	2013/2014	9,376	EAs geocoded

Note: RAND Cooperation provided geolocations of enumeration areas of IFLS-5.

Table A4. Variables used for the wealth index

Variable	Description
Communication equipment	
Radio	Yes/no
Television	Yes/no
Phone (landline and mobile)	Yes/no
Means of transport	
Bicycle	Yes/no
Motorbike	Yes/no
Car (including van or camion)	Yes/no
Reduction of domestic workloads	
Refrigerator	Yes/no
Washing machine	Yes/no
Iron	Yes/no
Quality of drinking water	1 – Low [unprotected well, spring, surface water, etc.] 2 – Middle [public tap, protected well, tanker truck, etc.] 3 – high [bottle water or water piped into dwelling or premises]
Quality of cooking fuel	1 – Low [No access to fuel. The household must go in forest/bush to looking for fuelwood, crop residue and others collected fuel] 2- Middle [Indirect access to fuel. The household must go to buy it in the market or produce it by itself - charcoal, kerosene and other purchased fuel] 3 – High [Direct access to fuel. The household accesses to fuel directly in the house - electricity, gas or solar energy]
Quality of the house	
Number of sleeping rooms	1 – low [between 0 and 1] 2- middle [2 rooms] 3 – high [3 rooms and above]
Quality of floor material	1 – Low [None, earth, dung, etc.] 2 – Middle [Cement, concrete, raw wood, etc.] 3 – High [Finished floor with parquet, carpet, tiles, ceramic, etc.]
Quality of toilet facility	1 – low [traditional pit latrine, hanging toilet, or no toilet facility] 2 – Middle [public toilet, improved pit latrine, etc.] 3 – high [any kind of private flush toilet]
Quality of lighting facility (access to electricity)	Yes/no

Table A5. Population density thresholds and resulting average population density to define the categories of the rural-urban gradient from global WorldPop data.

	Pop. Density Threshold (1,000 people per sqkm)	Average population density
Rural	<=0.16	0.05
Semi-rural	>0.16 & <=0.58	0.32
Peri-Urban	>0.58 & <=2.39	1.20
Urban	>2.39	7.56

Table A6. Mean and standard deviation of the complete list of variables for each category of the rural-urban gradient.

	Rural	Semi-rural	Peri-urban	Urban
Dependent variable:				
No work activity (1=yes)	0.30	0.41	0.55	0.58
	(0.55)	(0.58)	(0.43)	(0.42)
Student (1=yes)	0.34	0.44	0.45	0.48
	(0.56)	(0.59)	(0.43)	(0.42)
Off-farm wage employment (1=yes)	0.10	0.14	0.21	0.22
	(0.36)	(0.41)	(0.35)	(0.35)
Other employment (1=yes)	0.64	0.50	0.27	0.23
	(0.57)	(0.59)	(0.38)	(0.35)
Individual characteristics:				
Gender (1=yes)	0.50	0.50	0.49	0.43
	(0.60)	(0.59)	(0.43)	(0.42)
Marital status (1=married)	0.25	0.21	0.21	0.09
	(0.51)	(0.48)	(0.35)	(0.24)
Household head (1=yes)	0.08	0.12	0.16	0.14
	(0.33)	(0.38)	(0.32)	(0.29)
Secondary education (1=yes)	0.32	0.38	0.66	0.63
	(0.56)	(0.57)	(0.41)	(0.41)
Age cohort 15-17 (1=yes)	0.35	0.37	0.35	0.29
	(0.57)	(0.57)	(0.41)	(0.38)
Age cohort 18-24 (1=yes)	0.65	0.63	0.65	0.71
	(0.57)	(0.57)	(0.41)	(0.38)
Household characteristics				
Household size	5.47	4.95	4.41	4.47
	(3.47)	(3.20)	(2.38)	(2.13)
Child dependency ratio	0.30	0.22	0.17	0.15
	(0.44)	(0.37)	(0.24)	(0.23)
Share of women in HH	0.49	0.51	0.50	0.48
	(0.26)	(0.28)	(0.23)	(0.23)
Share of elderly in HH	0.04	0.04	0.04	0.04
	(0.12)	(0.13)	(0.09)	(0.10)
Share of workers in HH	0.77	0.70	0.57	0.54
	(0.35)	(0.38)	(0.31)	(0.28)
Remittances received (1=yes)	0.27	0.33	0.46	0.27
	(0.53)	(0.55)	(0.43)	(0.38)
Wealth index (pPCA standardize 0-100)	39.06	46.00	66.96	68.38
	(32.38)	(31.98)	(22.12)	(16.33)
Context variables:				
Enhanced Vegetation Index (3 years average)	0.32	0.33	0.33	0.21
	(0.15)	(0.15)	(0.09)	(0.09)
Employment density	0.74	0.73	0.67	0.61
	(0.12)	(0.11)	(0.08)	(0.08)
Off-farm labor demand	0.44	0.50	0.81	0.93
	(0.42)	(0.46)	(0.27)	(0.12)
Labor demand for other employment	0.56	0.50	0.19	0.07
	(0.42)	(0.46)	(0.27)	(0.12)
Spatial connectivity:				
Travel time to cities (minutes)	58.76	47.57	53.96	63.49
	(61.54)	(48.04)	(42.63)	(48.57)
Peer network:				
Female peer network in no work activities	0.47	0.49	0.58	0.65
	(0.21)	(0.20)	(0.13)	(0.11)
Male peer network in no work activities	0.33	0.36	0.45	0.53
	(0.17)	(0.18)	(0.11)	(0.12)
Female peer network in studying	0.38	0.43	0.43	0.50
	(0.16)	(0.15)	(0.11)	(0.10)
Male peer network in studying	0.43	0.49	0.47	0.46
	(0.14)	(0.13)	(0.09)	(0.09)
Female peer network in off-farm wage employment	0.10	0.10	0.16	0.14
	(0.09)	(0.10)	(0.08)	(0.08)
Male peer network in off-farm wage employment	0.15	0.16	0.24	0.20
	(0.14)	(0.14)	(0.12)	(0.11)
Female peer network in other employment	0.45	0.42	0.28	0.22
	(0.25)	(0.26)	(0.19)	(0.13)
Male peer network in other employment	0.57	0.51	0.34	0.29
	(0.26)	(0.27)	(0.19)	(0.16)
No. of observations	38,730	29,351	22,691	30,704

Note. All value are means and standard deviation in parentheses.