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## The Effect of Remittances on Labour Supply in the Republic of Haiti

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## ABSTRACT

### The Effect of Remittances on Labour Supply in the Republic of Haiti\*

We examine the labour supply effect of remittances in the Republic of Haiti, the prime international remittances recipient country in the Latin American and Caribbean (LAC) region relative to its GDP. Unlike previous empirical literature we address three econometric issues that may bias the estimates. We account for endogeneity of the remittances with respect to labour supply, for the zero-inflated nature of our dependent variable, hours of work, and for the self-selection of the migrant sample. Our results are in line with previous literature, and point to a decline of labour supply in the presence of remittances. However, contrary to previous findings, the labour market response to remittances of female household heads is not as sensitive as male's.

JEL Classification: C39, F22, F24, J22

Keywords: international migration, remittances, labour supply, Republic of Haiti

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## 1. Introduction

Remittances affect the labour market behaviour of recipients in different manners.<sup>1</sup> Remittances are likely to increase the reservation wage, through an income effect, and thus reduce the supply of formal labour. Additionally, the labour scarcity that emigration creates could drive upward wages and thus the supply of labour.<sup>2</sup> However, since migrants tend to be young, labour could fall if those left behind are in general in the dependent groups (i.e. under 18 and over 65 years old), at least in remittances recipient households. The overall impact on total labour will depend on which of these effects dominates. Recent empirical evidence for developing countries mostly finds a net negative effect of remittances on the labour supply of recipients —section 3 provides more details.

Using the Haiti Living Conditions Survey 2001 (ECVH-2001), we provide new evidence on the effect of remittances on the labour supply of recipients, for men and women separately, in the Republic of Haiti (hereafter, Haiti), the prime international remittances recipient country in the Latin American and Caribbean (LAC) region relative to its GDP. Our empirical strategy addresses two important econometric issues. First, since migrants are a self-selected sample, following Taylor, Rozelle, and de Brauw (2003), we estimate a first-stage model and use the predicted number of migrants per household as instrument in the remittances equation. Second, remittances are likely to be an endogenous regressor in the labour supply equation, as the labour supply of non-immigrants may affect the decision of emigrants to send remittances. We use an instrumental variable approach to address this issue. Finally, since our dependent variable, hours worked, is a zero-inflated variable, we use a Tobit model.

Our findings are in line with theoretical predictions and previous evidence, and show a decline in labour market participation and number of hours worked in the presence of remittances, i.e. dominance of the income effect over the substitution of this non-labour income. However, contrary to what previous empirical literature finds for other countries, the effect is larger among male household heads than among their female counterparts. The presence of a spouse in the household reduces to half the effect for male heads, suggesting that wives' labour supply does also respond to

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<sup>1</sup> Of course this is only one of the many implications of remittances, for they typically improve the living standards of recipient households and allow some households to escape poverty, increase investment in education and health, or permit small entrepreneurs to engage in riskier and more profitable activities when credit markets are highly imperfect and restricted to a few.

<sup>2</sup> In the context of the Haitian economy, where it is plausible to assume an elastic labour supply, the effect of emigration on wage increases may not be forthcoming.

remittances. The fall in labour supply is also halved for female heads living in rural areas.

This paper's contribution is twofold. From a substantive point of view, we provide evidence for first time of the labour supply effect of remittances in Haiti, by gender. From a methodological perspective, unlike previous studies, we address a more comprehensive set of issues, which may bias our estimates, than previous empirical studies. In particular, we address the following four econometric issues, which may bias our estimates: a zero-inflated dependent variable, reverse causality, omitted variable bias, and immigrants being a self-selected sample.

The remaining of the paper is structured as follows. In Section 2 we provide basic information on international migration in Haiti. Section 3 presents a survey of the empirical literature, while in Section 4 we describe the methodology used for the analysis and discuss the relevant econometric issues; the data are also described in this section. Section 5 lays out the results and discussion, and in Section 6 we present some concluding remarks.

## **2. International migration in Haiti**

Emigration of workers has been a constant in the relatively short history of Haiti as a republic. The first wave of emigration, dating back to the early 20<sup>th</sup> century, saw hundreds of thousands of Haitians, pushed by economic hardship, migrating to Cuba and the neighbouring Dominican Republic (DR) to work on cane plantations. The second wave of important Haitian emigration is to be found at the beginning of the Duvalier era in the early 1960s. In contrast to the first wave, the second important wave, starting in the early 1960s with the Duvalier era, was primarily motivated by political reasons. Most of those migrants came from the middle and upper-middle class and were in general very well-educated.<sup>3</sup> Destination countries also changed from Cuba and the DR to Canada, the United States of America, France, and the newly independent African nations. Emigration of Haitians persists to date; it has become more widespread and the motive is chiefly economic. Destination countries have not changed much, except in the case of Cuba and the African countries. In order to capture the idiosyncrasies of different destination countries, we include country dummy variables in our migration and remittance regressions.

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<sup>3</sup> See for instance Jadotte (1977) for an early research on Haitian immigrants in Quebec-Canada.

The corollary of the migration outflows sketched above is that Haiti is the fourth (82%) tertiary education migrant sender in the world after Surinam (90%), Guyana (86%), and Jamaica (83%) (Docquier and Marfouk, 2006). By population size,<sup>4</sup> the country would be the world first exporter of skilled migrants (Ratha and Shaw, 2007).<sup>5</sup>

Remittances flows that follow from such large migration outflows are an important income source for the country. This non labour income flow has also infused the country's economy with much needed foreign-exchange reserves. Remittance flows to Haiti have been growing steadily, although its slope is less steep after 2008. This may be reflecting the beginning of the global economic meltdown, that started in the housing market in the USA, and which probably hampered the ability of Haitian migrant workers to send remittances. Since 2000, remittances outpace foreign direct investment (FDI) and the country's export of goods and services. Remittances were also above official development assistance (ODA) until 2009.<sup>6</sup>

By origin, nearly 90 per cent of all remittances come from North America, with the majority of these flows stemming from the USA. The rest come from the Latin America and the Caribbean (LAC) region (6%) and Europe (4%).

Despite the large size of remittances flows, both in absolute and relative terms, research on their microeconomic impacts is scant and largely descriptive. Remittances have been found to have important distributive effects in Haiti. They allow some households to escape poverty (Lamaute-Brisson, 2003) and are a vehicle for social inclusion, as they allow participation in the market process through the higher demand capacity that remittances bestow upon the deprived recipient households (Orozco, 2006). Notwithstanding this, they do not necessarily reduce inequality, as remittances accrue more to the top deciles of the income distribution (Lamaute-Brisson, 2003; Jadotte, 2006).

As outlined in the Introduction, remittances are likely to have important effects on individual recipient's labour supply, and as the next section discusses, they have been found to have a negative impact on labour supply. There is however no evidence for Haiti, and this paper bridges this gap.

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<sup>4</sup> Size here makes reference to countries with population above 5 million.

<sup>5</sup> Although no official statistics exist, it is estimated that the brain drain situation has aggravated after the January 2010 seism in Haiti where about one third of civil servants perished and an additional one third of skilled Haitians has supposedly left in the aftermath of temblor.

<sup>6</sup> This pattern was reversed in 2010 as a result of the international community financial help to Haiti after the January 2010 earthquake, which is of course a transitory flow.

### **3. Brief review of previous empirical literature**

Following the pioneering works of Stark and Bloom (1985), and Stark and Levhari (1982), which gave rise to the so called “New Economics of Labour Migration” (NELM), a load full of researchers have attempted to unravel the economic implications of international migration in developing countries. One such implication refers to the labour supply response to remittances. Empirical evidence for developing countries of the region, typically find a negative effect of remittances on labour supply of women. The effect on men’s labour supply is usually either smaller or negligible, with the exception of Acosta (2011) for El Salvador.

Acosta (2011) study for El Salvador is the closest to ours, as they also account for selection into migration and endogeneity of remittances. Unlike us, he only examines the extensive margin, and finds that labour participation remains unaffected for men while women’s participation declines as remittances rise.

Amuedo-Dorantes and Pozo (2006a) study for Mexico is the only other empirical analysis that account for endogeneity of remittances, but does not address the self-selection of migrants. They find that remittances do affect the labour response of both women and men. For men, they find that a 16 per cent increase in monthly per capita remittance income is associated with a 15 per cent decline of the amount of monthly hours worked in the formal sector for both urban and rural areas. In order words, for each additional 100 Mexican pesos of remittance income, 32 hours less of work are employed in the formal sector. They also find that a similar expansion of remittance income causes a rise in informal sector employment of similar magnitude of the above decline in the formal sector. Their results, thus, clearly suggest a reallocation of labour induced by remittance income among men. For women, remittance accretion triggers a decline of hours worked for all types of employment. This suggests that for remittance income there is an income effect that dominates the substitution effect among Mexican women, who may be buying time away from certain types of work and possibly substituting home production for it. Hanson (2007) concludes that women from high migration Mexican states are less likely to work outside their home compared to men.

That same negative association of labour market participation and hours worked with remittances is unveiled by Rodriguez and Tiongson (2001) for the Philippines. Previous to our paper, this is the only instance in the empirical literature, where effects for men are found to be stronger than for women.



Kim (2007) examines the labour supply effect of remittances in Jamaica for men and women together, and concludes that remittances have some impact on the extensive margin (labour participation) but little or none on the intensive margin (working hours of employees). Bussolo and Medvedev (2008), using a general equilibrium model for Jamaica, also find a negative effect.

A related empirical literature examines the relationship between remittances and self-employment. Funkhouser (1992) finds for Nicaragua that remittances have entrepreneurial activities (self-employment) for men, and reduce women's labour supply. Woodruff and Zenteno's (2004) results for Mexico also suggest that remittances help relax wealth and capital constraints that inhibit the development of small enterprises in this country by increasing small scale self-employment. Amuedo-Dorantes and Pozo (2006b) conclude the contrary for the Dominican Republic. The authors find that remittances are associated with a reduction in the likelihood of entrepreneurial activities among recipient households.

Brown and Leever (2007) try to unravel the impact of remittance inflows on the different income sources of recipient households in Fiji and Tonga. By extrapolation, their results may be interpreted in the same sense if we construe more income from a given source as more work (i.e. assuming no change in individuals' productivity level). The authors observe on average a decline of subsistence agriculture and wage income while farm income and own business income boost on account of remittances. This would be suggesting a reallocation of labour from the former two to the latter two kinds of activities, which may be implying a remittances-induced realignment of these two small islands' economic structure.

To our knowledge, no previous study has addressed the international migration and remittances issue in Haiti. The objective of this paper is to further our understating on that matter and to provide some brech to the lacunae in this research field for Haiti. The methodology used here builds on the ideas of Taylor, Rozelle, and de Brauw (2003), and Amuedo-Dorantes and Pozo (2006a). Contrary to the Poisson model used by Taylor, Rozelle, and de Brauw for the migration decision, we estimate a zero-inflated (logit) negative binomial model for reasons discussed below.

#### 4. Methodology and econometric issues

In order to estimate the impact of remittances on individual labour supply, two econometric issues have to be addressed: the self-selection of the migrant population and the potential endogeneity problem, which results from reverse causality, as the labour supply of recipients may influence the decision of emigrants to send remittances.

If there are systematic differences between migrant and non-migrant households, the possibility of self-selection in migration exists and therefore the sample of migrants and remittance senders are not random. In order to gain a first insight, Figure 1 shows kernel density estimates for migrant households (i.e. households with relatives abroad) and non migrant households, with the counterfactual of *ex ante* remittance per equivalent adult income; then the same assessment is done including remittance income. The results show migrant households to fare better than their non-migrant counterparts, and the difference between the two groups to widen after remittance income is accounted for. The robustness of this finding is ascertained with the Kolmogorov-Smirnov (K-S) tests displayed in Table 1.

**Table 1. Kolmogorov-Smirnov (K-S) test of equality of distributions.**

Including Remittances			
Smaller group	D	P-value	Corrected
Non migrant:	0.0957	0.000	
Migrant:	-0.0007	0.999	
Combined K-S:	0.0957	0.000	0.000

Excluding Remittances			
Smaller group	D	P-value	Corrected
Non migrant:	0.2041	0.000	
Migrant:	-0.0005	0.999	
Combined K-S:	0.2041	0.000	0.000

*Source:* Author's own calculations based on the ECVH-2001

**Figure 1. Kernel density estimates of log incomes for migrant and non-migrant households**

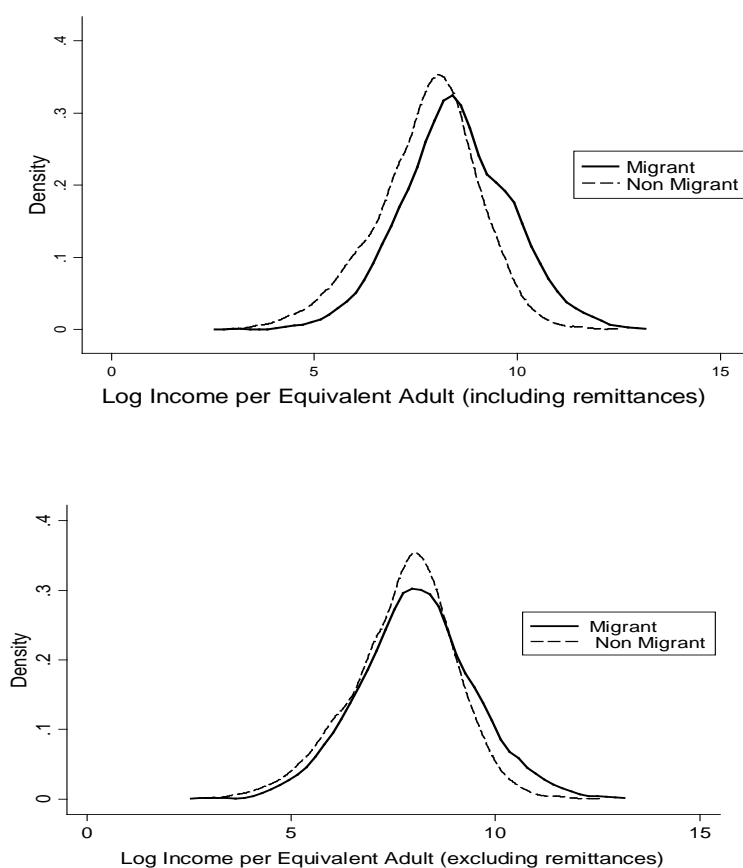


Table A1 in the appendix provides further evidence on the systematic difference between migrant and non-migrant households in two key observables, namely education and wealth. Migrant households have stock of education and wealth well above national average, while non-migrant are well below average in these two indicators.

To address the selectivity bias problem, a migration process model is estimated in a first stage and the predicted number of migrants per household is used as an instrument in the remittances equation.<sup>7</sup> Since a non negligible percentage of households have more than one migrant, the migration equation is estimated via a count model.

Traditionally, count regression models have appealed to Poisson, which assumes equidispersion of the first and second moments (i.e. the conditional mean and the conditional variance are equal). A Poisson process for the migration (M) equation could be represented as in Equation [1] below:

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<sup>7</sup> See Taylor, Rozelle, and de Brauw (2003) for a similar application of this procedure.

$$[1] \quad \Pr(M_i = m_i) = \frac{e^{-\lambda} \lambda^m}{m_i!}, m = 0, 1, 2, \dots, (E(M) = \lambda \text{ and } \text{Var}(M) = \lambda) \Rightarrow \text{Equidispersion}$$

We carried out a first test of mean and variance comparison and found some evidence of overdispersion, which casted doubt on a true Poisson data generating process of the outcomes.<sup>8</sup> In fact, many households have more than one migrant. The number of households participating in migration amounts to 1,060, sending between 1 and 12 close relatives abroad with the counts (0, 1, 2, 3, 4, 5) representing almost 99 per cent of the probability mass of the outcome variable.<sup>9</sup> This represents about one third migration participation rate. Moreover, of those households participating in migration approximately 44 per cent of them send more than one migrant and some 21 per cent have more than 2 relatives living abroad —Table A2 in the appendix shows the distribution of number of migrants across households. To account for the fact that certain households have higher counts than others, unobserved heterogeneity can be introduced in Equation [1] via a multiplicative randomness to give more variability to  $m_i$ . This can be done in the following way: let  $\zeta$  be a mixing random (or heterogeneity) variable with mean 1 and homogenous variance, i.e.  $E(\zeta) = 1$  and  $\text{Var}(\zeta) = \sigma^2$ . By substituting  $\lambda\zeta$  for  $\lambda$ , this gives rise to  $M \sim \text{Poisson}(M / \lambda\zeta)$ . Then it can be shown that the conditional mean and variance are now, respectively:

$$[2] \quad E(M | \lambda, \alpha) = \lambda$$

$$[3] \quad \text{Var}(M | \lambda, \alpha) = E(M) \left[ 1 + E(M) \sigma^2 \right] = \lambda \left[ 1 + \lambda \sigma^2 \right],$$

which captures the idea of overdispersion (*i.e.*  $\text{Var}(M) > E(M)$ ). Under the assumption that  $\zeta$  follows a Gamma distribution,  $\zeta \sim \text{Gamma}(1, \alpha)$ , where  $\alpha$  is the variance (dispersion) parameter of the Gamma distribution, the model can be estimated via a Gamma-Poisson mixture model, which gives rise to a type II negative binomial model,  $NB(\lambda, \alpha)$ .<sup>10</sup> Thus, under the negative binomial distribution we can posit the probability

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<sup>8</sup> The overdispersion test (see Cameron and Trivedi, 2005: 670-671) strongly rejects the equidispersion hypothesis with an F-stat (1, 6069) = 6,662.19 and  $\text{Pr} > F = 0.0000$ .

<sup>9</sup> We report figures for our sample of households whose head is between 15 and 64 years old. Nonetheless, the structure of the data of all households (irrespective of the age of the household head) is very similar.

<sup>10</sup> The type II negative binomial model arises because of the quadratic variance function as given in Equation [3]. The

of observing a number  $m$  of migrants in household  $i$  in the following manner:

$$[4] \quad \Pr(M_i = m_i | \lambda, \alpha) = \frac{\Gamma\left(\frac{1 + \alpha m}{\alpha}\right)}{\Gamma(\alpha^{-1}) m!} \left[ \frac{\alpha}{\alpha(1 + \alpha\lambda)} \right]^{\frac{1}{\alpha}} \left( \frac{\alpha\lambda}{1 + \alpha\lambda} \right)^m \quad m = 0, 1, 2, \dots$$

where  $\Gamma(\cdot)$  is the gamma integral, with  $\ln \lambda = X' \beta$  and  $X$  a vector of covariates capturing individual, household, and regional characteristics. As can be deduced from Equation [4], when the dispersion parameter  $\alpha$  equals zero (or  $\ln \alpha = -\infty$ ) the model boils down to a standard Poisson. The preference of the negative binomial model over the Poisson was ascertained with a likelihood ratio test (see Table A3 in the appendix).

While a considerable percentage of households that participate in migration have more than one relative abroad, many households do not send migrants. This results in a large amount of zeros in the outcome variable, and these account for about two thirds of the probability mass. So, to account for the (potential) excess zero counts we estimate a zero-altered negative binomial model and contrasted with the standard negative binomial model.

To avoid cluttering notation we can drop the covariates, and now let  $f_2(\cdot)$  be the density function of the migration process posited in [4], and let  $f_1(\cdot)$  be the density of a binary process, 0 and 1, which will supplement  $f_2(\cdot)$ . Then, migration  $m_i = 0$  if the binary process takes on the value 0, while if the latter takes on the value 1  $m_i = 0, 1, 2, 3, \dots$  from the migration process density  $f_2(\cdot)$ . So, the occurrence of zeros is both in the binary and the count process, (in the latter case it is conditional on the binary taking on the value of 1,<sup>11</sup> which gives rise to a hurdle type model. Thus, the density of the zero-inflated negative binomial can be represented as follows:

$$[5] \quad f(m_i) = \begin{cases} f_1(0) + [1 - f_1(0)] f_2(0) & \text{if } m_i = 0 \\ [1 - f_1(0)] f_2(m_i) & \text{if } m_i \geq 1 \end{cases}$$

Here a logit model is used to parameterize  $f_1(0)$ . The variables in  $f_1(\cdot)$  and  $f_2(\cdot)$

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quadratic variance function is just one case among many that can give rise to the type II negative binomial model (see Cameron and Trivedi, 1998 & 2005).

<sup>11</sup> In the latter case it is conditional on the binary taking on the value of 1.

do not overlap and  $\dim(f_1(\cdot)) < \dim(f_2(\cdot))$ .<sup>12</sup> A Vuong test favoured the zero-inflated negative binomial (ZINB) model over the standard one.<sup>13</sup>

A key issue in estimating Equation [5] is the identification of the migration process. As it has been established by previous studies, networks development reduces settlement costs (i.e. the expenses associated with migration are less onerous) and therefore makes financing the travel abroad less constraining —see, for instance, Massey and Lindstrom (1994), Pedersen, Pytlikova, and Smith (2004). Moreover, contact with individuals with a certain experience abroad provides useful information to potential migrants, resulting in lowering the risk and uncertainty that migration involves. Both regional migration rates and the presence of returned migrants in a household are used as regional and household levels network variables for identification of the migration equation.<sup>14</sup> The regional migration rate is derived by finding the ratio of the total number of migrants to the population of a particular region, while for household network we take into consideration individuals that have spent more than three months abroad and have returned. We interact the regional migration rate with household size so as to assure its variability across households. Finally, the validity of the model's specification to predict the probability of migration was also assessed using Pregibon's (1980) goodness of link test.

The labour market response of remittance income recipient households, which is the focus of the analysis, is represented by the following structural model:

$$[6] \quad L_i = \phi_0 + \phi_1 R_i + \phi_2 \Omega_i' + \eta_i ,$$

where  $L$  is the number of hours worked,  $R$  is the monthly adult equivalent remittances received,  $\Omega'$  is a vector of individual and household characteristics, and  $\eta$  is the error term. It is worth noting that  $L$  includes overall labour supply, that is, wage labour (formal and informal) but also self-employed and subsistence agriculture activities.<sup>15</sup>

The estimation of equation [6] raises two issues. First, the dependent variable has both a

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<sup>12</sup> This exposition is adapted from Cameron and Trivedi (2009: 586-587).

<sup>13</sup> See Table A3 in the appendix for the result of the likelihood ratio test and the Vuong test favouring the negative binomial model over Poisson (this is additional to the previous test) and the ZINB over the standard Negbin. For further discussion on count data models see Greene (1994) and Cameron and Trivedi (1998).

<sup>14</sup> Correlation between these two network variables is low (0.0864) and the null that it is equal to zero could not be rejected at the 1 per cent level, avoiding therefore potential risk of collinearity between them.

<sup>15</sup> Unfortunately, the data set does not contain information on hours devoted to income-generating activities other than the main activity, and thus we cannot perform a separate analysis for each type of activity or examine the substitution effects that may result from the received remittances.

discrete and continuous nature and can also be zero-inflated since many individuals report zero hours of work. So, to account for the structure of the dependent variable, a Tobit model is estimated to assess the behaviour of remittance recipient households in the labour market.<sup>16</sup>

Endogeneity is a second problem we have to address. As stated earlier, remittances can be endogenously determined and, as rightly pointed by Amuedo-Dorantes and Pozo (2006a), a reverse causality may arise since the number of hours worked (or the mere participation in the labour market) may influence the decision of remittance senders. To address this endogeneity issue we use an IV approach. We instrument the variable remittances with three variables: the interaction between the regional migration rate variable and the percentage of non-migrant household members with secondary and tertiary education,<sup>17</sup> and the predicted number of migrants (from equation [4] above).<sup>18</sup> Thus, we have a model with two overidentifying restrictions. Exogeneity condition compliance of these instruments to the labour equation is assessed first by regressing per adult equivalent remittances on these three instruments. They yield a joint significance F-statistic = 104.72 ( $\text{Pr} > F = 0.000$ ) for men, while their correlation with hours worked are, respectively, -0.008, 0.045, 0.046. For women these values are, in the same order, 84.35, -0.018, 0.021, and 0.003. Secondly, a standard Tobit model is estimated regressing monthly hours on these three instruments. The results suggest that these variables can effectively be removed from the structural model [6] since they are not significant at the 5 per cent level for both men and women labour supply<sup>19</sup> (for more on this see for instance Angrist and Pischke, 2009: Chapter 4). Gross individual correlations among these instruments and the endogenous variable are acceptable. So, this precludes any loss of efficiency from using the IV method. Besides, the high values of the F-statistics above are indicative of the instruments' strength,<sup>20</sup> and

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<sup>16</sup> In the case of a Probit estimation  $L$  would be a dichotomous variable taking on the value of 1 if the household participates in the labour market and 0 otherwise. So, an IV-Probit model is later estimated to assess the robustness of the results —see Table A6 in the appendix.

<sup>17</sup> More educated individuals in Haiti have a greater probability to migrate. We assume moreover that remittance money is used partly to finance schooling of household members left behind. So, the interaction above can help control for this factor but also guarantees the variability of migration rates across households. A somewhat similar strategy is adopted by Hanson and Woodruff (2003), and Amuedo-Dorantes and Pozo (2006a).

<sup>18</sup> The second instrument (namely, the regional network interaction with percentage of household members with tertiary education) is potentially weak, particularly for women. This is possibly due to the low percentage of highly skilled individuals in the survey (and the country), about 1 per cent, and that households headed by women have even less educational input.

<sup>19</sup> See Table A4 in the appendix for results both of hours worked and the instruments and remittances (the endogenous regressor) and the instruments.

<sup>20</sup> See Staiger and Stock (1997) for more on this issue. The authors suggest a critical value for F-stat equal to 10 when the overidentifying restrictions are at least two (i.e. three instruments for one endogenous regressor, which is our case). Anything below that critical value would be a flag for a weak instrument situation. This a rule of thumb and

all individual t-statistics for each of these instruments show significance at the 1 per cent level, except the interaction regional migration rate and tertiary education on the women equation that is significant at the 10 per cent level only.<sup>21</sup> So, their predictive power for remittances is very high.

As outlined above, the costs associated with migration may inhibit certain households to undertake such an enterprise, particularly in a context of imperfect credit markets which permeate developing countries like Haiti. Accordingly, household wealth and its square are considered to control for the fact that wealthier households are less liquidity-constrained to finance migration costs and therefore migration probabilities will increase with wealth. However, after a certain threshold wealthy households may face higher opportunity costs of migration and therefore will be less likely to migrate.

Cognizant of the potential endogeneity problem with this variable, since wealth may be positively correlated with contemporaneous remittances flows, we approximate wealth using households' durable goods and access to amenities (e.g. refrigerator, vehicle, running water and access to electrical network, quality of wall, floor and roof of the house, etc.) that can more likely represent a household long term economic status. The approach adopted to construct the wealth index is the principal components analysis (PCA).<sup>22</sup>

Now, a robust appraisal of a household long term economic status based on this index would require that information on wealth before migration takes place is used since the self-selectiveness of migration and the remittances that ensue could lead one to envisage the possibility of remittance income being used to purchase such assets (Acosta, 2011). Table A5 in the appendix compares household income, wealth (using the proxy above), migration participation rate, and remittances receipts as a ratio of income per adult equivalent. Indeed, the wealth index increases monotonically with income quintiles but as can be observed the share of remittances as a percentage income follows an almost opposite pattern, despite the fact that low quintile households are less

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quite an ad hoc test. More formal tests of weak instruments can be found in Stock and Yogo (2005). In this case however, homoskedasticity of the errors is a key assumption.

<sup>21</sup> As suggested in footnote 19 above, this finding is quite reasonable.

<sup>22</sup> Lubotsky and Wittenberg (2006) contend that the PCA approach may bewilder the lines between wealth differences and taste differences when the full set of proxy variables is not used. Using the full set of proxies did not improve much our measure of sampling adequacy. Moreover, an MCA (multiple correspondence analysis) approach may be more suitable to build wealth index on discrete data, but results did not change qualitatively when applying an MCA to the data.



likely to participate in migration and receive remittances compared to their high quintile counterparts.<sup>23</sup>

#### 4.1 Data source

The data used for this research come from the “*Enquête sur les Conditions de Vie en Haïti*” (Haiti Living Condition Survey, ECVH-2001). The ECVH-2001 is a multi-topic household survey with nationally representative cross-section data and was conducted on 7,800 households by the “*Institut Haïtien de Statistique et d’Informatique*”. Satisfactory responses to the household questionnaire, the main file from which information is derived, were found for 7,186 households—a response rate of 93%. Such good response rate certifies the reliability of the ECVH-2001, especially when compared with the response rate of Living Standard Measurement Surveys (LSMS) for similar countries of the region (e.g. Jamaica – LSMS1999, 74%; Guatemala – LSMS2000, 84.5%; Nicaragua – LSMS1999, 96.3%). The ECVH-2001 includes information on income (including self-consumption and barter<sup>24</sup>), education, demography, labour force, migration (both internal and international), remittances, health, domesticity and servitude, aspects of public life, distance to facilities, community infrastructure, housing amenities, agriculture, and fishery. The structure of the population appears to be well reflected by the ECVH-2001 as far as gender, education, age, and other key variables are concerned.

We select only household heads aged between 15 and 64 years old, which sum up to 6,070 observations. The data reveal that about one third of Haitian households have at least one member living in a foreign country while approximately two thirds of them receive remittances that make up more than 40 per cent of their income.<sup>25</sup> On average more than 25 per cent of households receive remittances either from a relative or a friend abroad,<sup>26</sup> representing slightly more than 17 per cent of total income. This figure is above the 15.32 per cent of GDP reported by the IMF balance of payment statistics for the same period. The difference may be attributable to our definition of remittances, as we included cash, in-kind transfers, and gifts from relatives and friends

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<sup>23</sup> For similar application to El Salvador see Acosta (2011).

<sup>24</sup> Given the productive structure of the Haitian economy these two are particularly important in the rural area, and to some extent the other urban area.

<sup>25</sup> In fact, 2 per cent households only have remittances as their sole income source.

<sup>26</sup> About one-third of female-headed households receive remittances from relatives or friends from abroad, while about 20 per cent of their male counterparts do.

abroad. In that sense we believe there is no risk of important downward biases in the coefficients capturing the impact of remittances on labour market outcomes. However, it is worth pointing that informal channels can be used to transfer quite an amount of remittances and that household members are more likely to remember whether they have received remittances or not than the exact amount of transfer received from family or friends abroad. Table 2 below presents summary statistics of the relevant variables.

While average remittances across all households are just at about HTG 3,400 (about HTG 4,400 and HTG 2,600 for female-headed and male-headed households, respectively), among recipient households, average monthly remittances amount to approximately, HTG 14,653 and HTG 12,750 for female-headed and male-headed households, respectively.<sup>27</sup> Remittances flows are highly unequal with a Gini index among recipient households of 0.72, compared to a country income inequality of 0.65. Average years of schooling reproduce very well what is observed at national level; nonetheless, using just the remittances recipient sub-sample (852 for female-headed and 652 for male-headed households), as should be expected from the above discussion schooling years substantially increases. They are above 6 years and about 4.6 years for men and women, respectively.<sup>28</sup> As we also conjectured, the maximum wealth index also declines among migrant senders and recipient. While this index is about 23 and 22 for men and women, recipient households have an index that reaches its maximum level at 18 and 19 for men and women, respectively. This can be considered a prima facie evidence for the non linear relationship between wealth and migration we hypothesized above. Land holding and livestock do not present significant statistical difference between recipient households and national averages.

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<sup>27</sup> The average exchange rate during the survey data collection period (May-August 2001) is HTG 24.03/USD1. Source: *Banque de la République d'Haïti*, <http://www.brh.net>.

<sup>28</sup> Normally, it would make sense to truncate the maximum schooling years at 18 but doing so did not really change the results, neither quantitatively nor qualitatively.

**Table 2: Summary statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
<b>Men</b>					
Monthly equivalent remittances	3,256	2,553.08	14,896.75	0	594,000
Years of schooling	3,256	3.72	5.12	0	36
Wealth index	3,256	0.03	2.89	-1.84	23.29
Age	3,256	40.69	11.35	15	64
Married (1 if married or lives in common-law union)	3,256	0.34	0.47	0	1
Returned migrant (1 if present)	3,256	0.06	0.23	0	1
Home (1 if property is owned <i>de jure</i> )	3,256	0.70	0.46	0	1
Household size	3,256	4.81	2.52	1	15
Hardship (1 if household lives in this area)	3,256	0.12	0.32	0	1
Livestock (number of large animals)	3,256	6.31	10.51	0	210
Hectare (land holding in hectares)	3,256	1.12	3.32	0	96.75
<b>Women</b>					
Monthly equivalent remittances	2,814	4,436.44	17,248.50	0	272,030
Years of schooling	2,814	3.05	4.72	0	28
Wealth index	2,814	0.18	2.81	-1.84	22.47
Age	2,814	41.16	12.08	15	64
Married (1 if married or lives in common-law union)	2,814	0.28	0.45	0	1
Returned migrant (1 if present)	2,814	0.05	0.22	0	1
Home (1 if property is owned <i>de jure</i> )	2,814	0.66	0.47	0	1
Household size	2,814	4.83	2.40	1	17
Hardship(1 if household lives in this area)	2,814	0.17	0.37	0	1
Livestock (number of large animals)	2,814	5.00	8.20	0	105
Hectare (land holding in hectares)	2,814	0.80	2.15	0	32.90

## 5. Results and discussion

We first discuss the estimates of the migration equation, presented in Table A3 in the appendix. Different specifications were explored and our criterion for selecting the ZINB model has been based mainly on the lowest values of Akaike and Bayes information. As mentioned in Section 4 above, the data support the negative binomial over a Poisson model with a likelihood ratio test for  $\ln \alpha = -\infty$  that is equal to 438 and significant at the 1 per cent level. Furthermore, a Vuong test ( $z = 3.82$ ,  $\Pr > \chi^2 = 0.000$ ) established preference for a zero-inflated negative binomial over a standard negative binomial model.

As to the covariates, all the variables kept in the model have the expected signs and are significant at either 5 or 1 per cent level. The level of schooling, albeit positively correlated with migration, does not to have an important impact on the

migration probability; an additional year of education is associated with a 1 per cent higher probability of migration while a one unit increase in the wealth level of a family increases this probability by almost 11 per cent. For this last variable the inflexion point occurs at a wealth level approximately equal to 14. Interestingly, with the exception of three observations found in the second richest quintile, all households beyond this threshold belong to the first quintile of the income distribution. Both network variables have, as expected, a positive impact on the probability of migration and are highly significant. The strongest effect however is found in the presence of a returned migrant in the household, which is consistent with the theoretical prediction in the literature. Households in the semi-urban and rural areas have a higher emigration probability compared to the metropolitan area of Port-au-Prince (MAPaP). Livestock and landholding, which we entered as substitute for perfect credit markets, show positive effect on emigration probability. As can be observed from Table A3 (appendix), the impact of livestock is almost seven-fold compared to land. This may be depicting the fact that the former is a more marketable, liquid, and fungible asset than the latter.<sup>29</sup> Consistent with the previous observation, households dedicated to agricultural activities and fisheries have a lower emigration probability. The same applies to nuclear family.

The results for the instrumental variable Tobit model are displayed in Table 3 below, with the number of monthly hours worked censored below and above at 40 and 288 hours, respectively.<sup>30</sup> Separate estimations are implemented for working-age men and women. The Wald exogeneity tests (for both IV-Tobit and IV-probit) indicate rejection of the exogeneity of the instrumented variable, remittances, granting therefore consistency to the point estimates.<sup>31</sup> Per contra, this rejection is not very strong in the case of women. The coefficients for both sexes on remittances show a negative sign and are statistically significant at the 1 and 5 per cent level, respectively. The (negative) effect of remittances, though, is quite small.

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<sup>29</sup> In not so well integrated markets small livestock (e.g. pigs, goats) tend to be more marketable and fungible than large livestock or cattle (e.g. cows, buffalos). We do not consider small livestock as an explanatory variable here since households do not possess large quantities of them (at least in the survey), which means that, even though they can be determinant in helping households cope with risks, they would not capture well the means to defray migration expenditures.

<sup>30</sup> 40 hours is chosen as minimum of 10 hours per week worked, while 288 hours is the maximum assuming that 12 hours are worked during 6 days of the week for 4 weeks. Recall that hours worked include overall labour supply, that is, wage labour (formal and informal) but also self-employed and subsistence agriculture activities.

<sup>31</sup> Besides, in the diagnostic of the first stage model goodness-of-fit measures (see Tables below for the IV-Tobit and the IV-probit) strongly support these instruments (for more on this issue see Bound, Jaeger, and Baker (1995)).

**Table 3. IV-Tobit model of labour supply (hours worked) by headship (working age 15-64). Marginal effects**

	Men	z-Stat	Women	z-Stat
	$\partial y/\partial x$		$\partial y/\partial x$	
Monthly equivalent remittances	-0.066***	-4.46	-0.046**	-2.37
Years of schooling	3.288***	4.59	1.736*	1.79
Wealth index	8.470***	4.35	10.727***	2.56
Experience	-0.335	-0.28	6.576***	6.12
Experience squared	0.015	0.88	-0.088***	-5.58
Married (1 if married or lives in common-law union)	-0.711	-0.13	-7.943	-1.16
Returned migrant	21.991*	1.83	3.184	0.23
Home (1 if property is owned <i>de jure</i> )	7.604	1.24	15.483**	2.18
Household size	2.572**	2.41	3.466**	2.36
Hardship	-29.397***	-3.69	-11.962	-1.45
Livestock (number of large animals)	-12.184**	-1.90	-12.291	-1.44
Hectare (land holding in hectares)	1.079	1.46	1.881	1.38
<b>Reference: MAPaP</b>				
Semi-urban	30.400***	2.99	-9.036	-0.80
Rural	25.120***	2.60	-8.336	-0.75
Male (1 if at least one migrant is male)	35.816**	2.24	2.393	0.15
Female (1 if at least one migrant is female)	24.433*	1.70	1.666	0.12
Destination country of migrants				
US/Canada	-9.780	-0.61	18.142	1.04
Dominican Republic	-14.395	-0.69	18.224	0.94
US/Canada and Dominican Republic	-16.850	-0.39	37.948	0.97
Other countries	-11.525	-0.57	-3.664	-0.18
Constant	33.619*	1.66	-60.984***	-2.97
Number of obs.	3,256		2,814	
Wald $\chi^2(20)$	110.95 (Pr > $\chi^2$ = 0.000)		77.37 (Pr > $\chi^2$ = 0.000)	
Exogeneity test: Wald $\chi^2(1)$	23.09 (Pr > $\chi^2$ = 0.000)		3.39 (Pr > $\chi^2$ = 0.065)	
<b>First stage diagnostic:</b>	F(22, 3233) = 35.60 Prob > F = 0.0000 R <sup>2</sup> = 0.1950		F( 22, 2791) = 50.05 Prob > F = 0.0000 R <sup>2</sup> = 0.2829	

\*, \*\*, \*\*\*, mean significance at 10%, 5%, and 1%, respectively.

The marginal effects displayed in Table 3 show that remittances reduce the hours worked of non-migrants, and that this effect is larger for male household heads than for female household heads.<sup>32</sup> A HTG 100 increase in the adult equivalent monthly remittances drives men monthly hours worked down by almost 7 hours. In other words, an almost 50 per cent increase in the monthly equivalent adult remittance income only causes, *caeteris paribus*, a 7 per cent decline in the average monthly hours worked for male household heads.

<sup>32</sup> The differential effect of remittances by gender is statistically significant, as a test of difference-of-means shows ( $t$ -statistic = 41.84; Prob >  $t$  = 0.000).

The same nominal increment is associated with an almost 5 hour decline for female household heads. In relative terms however the same nominal increase of remittance income<sup>33</sup> would represent a 6 per cent fall of labour hours worked for female household heads.

The larger (income) effect for men head of household may reflect their traditionally higher involvement in paid work. Men's labour supply is more responsive to changes in income than to changes in wages when their labour supply is close to its potential. Our results are also consistent with some empirical studies that conclude that men's labour supply is more responsive to income, while women's is more responsive to wages (Mincer, 1985; Killingsworth, 1983). The smaller response of female household heads may also be related to the fewer income-generating opportunities they face in developing countries, especially in rural areas (de Janvry and Sadoulet, 2001; Lanjow and Lanjow, 2001), and to them being more likely to participate in low-income activities (Davis et al., 2010).

The interpretation of this effect, however, should be taken with caution, as we are not controlling for the possible reaction to remittances of the spouse and other household members. We explore this issue in Section 5.1 by looking at the differential effect of remittances by marital status of the head and household size.

What does this labour supply reduction mean in terms of foregone earnings? If we adopt a conservative stance and assume that workers in migrant households earn twice the official 2001 minimum wage,<sup>34</sup> the impact of a HTG 100 increase in remittance money would represent almost HTG 59.5 per month forgone for men and about HTG 44 per month for women. The labour supply effect of remittances is sensibly lower in Haiti than in other developing countries. For instance, Amuedo-Dorantes and Pozo (2006a), find forgone earnings for women to be 63% in Mexico.

Some of the other variables considered in the estimation require some attention. Hours worked tend to increase with experience for female household heads, up to a certain threshold. Years of schooling of individuals and household wealth also increase the number of hours worked, while being married or living in common law union has no effect on labour.<sup>35</sup> Male headed households with returned migrants offer more labour

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<sup>33</sup> Which in fact would represent a 27 per cent average increase in remittance receipts to women.

<sup>34</sup> Official minimum wage as of 2001, established by the May 4th 1995 bill, was at HTG 36/day. See *Le Nouvelliste*, 2003.

<sup>35</sup> The coefficient of being married is not significant when the variable is included only in levels. The high variance of this effect, however, —which renders the coefficient insignificant at standard confidence levels— is due to the heterogeneity of the effect by remittances. In other words, we are misspecifying our equation. As soon as we let the

hours. Since we do not have information to know what member of the household is the returnee and whether she works, it is difficult to provide a clear interpretation of this effect. We can however suggest reasonable scenarios that are consistent with this finding. A positive effect of returned migrants, for instance, would be consistent with returned migrants being mostly the heads of the household, something that, as pointed out above, we cannot check. Such positive effect, however, could also be explained by returnees not being active in the labour market, as long as this could induce higher labour supply by the head of household to cover the costs of having one additional member in the household. As we do not have information on the labour market status of household members other than the head, we cannot know either whether this is the case. Notice also that having at least one male migrant is related to larger labour supply in households headed by men. This effect cannot be driven by the possible differential remitting behaviour of males and females, as this is already captured by the remittance variable. It may however be related to the increased participation rates of non-migrant men, relative to non-migrant women. That is, household heads may react to the possible decreased income due to the absence of male household members (i.e. the migrants) by increasing participation both at the intensive and extensive margins (see Table A6).

Both households whose property is owned *de jure*<sup>36</sup> and the ones with greater size supply more work hours, but their effect is only significant for women. A variable (hardship) to control for the presence of households in regions under harsher conditions in Haiti is included, namely the regions with the highest vulnerability and poverty prevalence, highest unemployment rate, and highest inequality level. The two regions that meet the above conditions are *Département du Nord-Est* (Northeast) and *Département du Nord-Ouest* (Northwest). Total hours supplied by households in these two regions are inferior compared to households in other regions of the country.

Finally, the lack of statistical significance of the dummy variables that indicate the destination country of migration suggest that having migrants in different countries does not seem to have a differential effect on the labour supply in the source country, despite the idiosyncrasies related to the destination country of migration.

To check the robustness of the main findings from the instrumental variable Tobit estimation above, an instrumental variable probit model is estimated where the

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effect of being married to vary by remittances (by means of and interaction term, see Section 5.1), the level effect of being married proves to be significant for male household heads and to have a similar size as in Table 3.

<sup>36</sup> The reference category includes households with no property or households with no legal property rights (i.e. squatters).

dependent variable is 1 if the household is employed and 0 otherwise. The results are reported in Table A6 in the appendix. The same behavioural pattern is observed on account of remittance income, whereby this causes a decline in the probability of labour market participation for both men and women. The size of such effect is also quite small.

### **5.1. Heterogeneous effects**

As pointed out above, the labour supply reaction of household heads to remittances may be influenced by the behaviour of the spouse and other household members. Because of the remittances spouses may change their labour supply decision and this may condition the labour supply response of the household head. We do not have information on the labour supply of household members other than the head, but we do know whether the household head has a spouse and how many members are there in the household. We thus examine such source of heterogeneity in the remittance effect by interacting our variable of interest (i.e. monthly equivalent remittances) with being married (or living in common-law union) and with household size —here we assume that the likelihood of having a household member other than the spouse working increases with the household size. Table 4 shows that the presence of a spouse mitigates the negative effect of remittances for male household heads, but not for female heads. The effect is sizeable, as it reduces the negative effect of remittances by 40%. This finding suggests that female spouses may be also reducing her participation in income-generating activities, as a reaction to remittances. The nil influence of male spouses on the labour reaction of female household heads may be explained by having spouses that have a marginal or nil participation in income generating-activities. This situation where male headed households usually have two income generating spouses while female headed households normally have a single income generating spouse is consistent with a story of assortative mating (Smits, 2003). Other members of the household appear not to have much effect on the labour response of the household head —we should, however, bear in mind that we can only approximate the influence of other household members in a rather coarse manner.



**Table 4. Heterogeneous Effects. IV-Tobit model of labour supply (hours worked) by headship (working age 15-64). Marginal effects**

	Men	z-Stat	Women	z-Stat
	$\partial y / \partial x$		$\partial y / \partial x$	
Monthly equivalent remittances (MER)	-0.100***	-4.78	-0.061**	-2.27
MER*Married	0.046***	4.76	0.002	0.27
MER*Household size	-0.000	-0.18	-0.001	-0.82
MER*Semi-urban	-0.020	-1.63	0.006	0.48
MER*Rural	-0.021*	-1.92	0.032***	2.91
Number of obs.	3,256		2,814	

\*, \*\*, \*\*\*, mean significance at 10%, 5%, and 1%, respectively. Only interaction effects are displayed. The complete set of estimates can be obtained from the authors, on request.

We have argued above that the smaller response of female household heads may be related to the fewer income-generating opportunities they face in developing countries. Such reduced opportunities are especially relevant in rural areas (de Janvry and Sadoulet, 2001; Lanjow and Lanjow, 2001). This would predict a smaller effect in rural areas than in urban or semi-urban areas for female household heads. We examine this by interacting remittances with the two regional dummies, and find results that support this prediction: the labour supply effect of female household heads falls to half for households in rural areas. Contrary to this, the effect is homogeneous across type of areas for male household heads.<sup>37</sup>

## 6. Concluding remarks

Accounting for selectivity bias in household migration decision and endogeneity in the determination of remittances and labour supply, this paper provides new evidence on the effect of remittances on labour supply (both in the intensive and extensive margin) in the Republic of Haiti. Different econometric methods are used to model the migration probability, the decision to remit, and labour market participation of remittance recipient households. We use a count model using a zero-altered negative binomial with logit inflation to estimate migration probability, while a two-step estimation methodology is adopted for investigating the decision to remit and their effects on labour supply.

<sup>37</sup> If we want to trust the weakly significant (only at 10%) estimate of the interaction effect between remittances and rural, we should speak of a reinforcing effect for households headed by a men and located in a rural area. Notice that this finding is consistent with the female spouses of those male heads facing fewer income-generating opportunities in rural areas and thus having less room to react to receiving remittances.

In line with standard economic theory predictions and previous evidence, we find a negative effect of remittances on labour supply of recipients (both labour participation and hours worked). Contrary to previous evidence for developing countries, though, our findings suggest that the effect of remittances is larger for male household heads than for female heads. This finding may be related to the fewer income-generating opportunities women face in developing countries, especially in rural areas, and to them being more likely to participate in low-income activities.

Unlike previous studies, we examine the heterogeneity of the remittance effect. In particular, we first investigate whether the behaviour of other household members, and especially of the spouse, has an influence on the labour supply response to remittances of the head. Since our data set only does not contain information on the labour market status of household members other than the head, we investigate this by using information on the marital status of the head and of the household size. We find that in male headed households with a spouse, the labour supply response of the head is substantially lower than in male headed households without a spouse. Our conjecture is that this may be explained by female spouses also reacting to remittances.

Given the significant amount of literature showing that women face fewer and poorer income-generating opportunities in rural areas, we also investigate whether the remittance effect is lower in rural areas. Our findings suggest that the reduction in labour supply of female heads in rural areas brought about by remittances is half the size of the reduction in urban and semi-urban areas.

The data limitations mentioned above preclude an analysis of the effects of remittances on spouses and other household members. Finally, another limitation of the data set is that it does not contain the amount of hours devoted to different income-generating activities, and thus we cannot investigate the possible substitution of one activity for another that may result from receiving remittances.

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## Appendix

**Table A1. Migration and remittance recipient status, education, wealth, and income**

Household Status	%Household members with secondary education	%Household members with superior education	Wealth index	Percentage of recipients	Ratio remittance/income
<b>Migrant</b>	22	1.9	1.3	66	28
<b>Non-migrant</b>	11	0.3	-0.55	8	3
<b>Recipient</b>	25	1.7	1.56	100	41
<b>Non-recipient</b>	11	0.4	-0.53	NA	NA

*Source:* Author's own calculations based on the ECVH-2001 (note: unweighted)

**Table A2. Distribution of number of migrants**

# migrants	% households with <i>n</i> migrants	Cumulative percentage
<b>None</b>	82.54	82.54
<b>Some</b>	17.46	100.00
<b>1</b>	56.70	56.70
<b>2</b>	22.45	79.15
<b>3</b>	11.60	90.75
<b>4</b>	5.28	96.04
<b>5</b>	2.45	98.94
<b>6</b>	0.94	99.43
<b>7</b>	0.28	99.72
<b>8</b>	0.09	99.81
<b>10</b>	0.09	99.91
<b>12</b>	0.09	100.00

*Source:* Author's own calculations based on the ECVH-2001 (note: unweighted)

**Table A3. Zero-altered negative binomial-Logit inflation model of migration (working age 15-64)**

	Coef	z-Stat	$\partial P(y > 0)/\partial x$	z-Stat	
Years of schooling	0.025***	4.60	0.012***	4.60	
Wealth index	0.222***	12.32	0.109***	12.29	
Wealth index squared	-0.008***	-6.73	-0.004***	-6.77	
Age	-0.035**	-2.40	-0.017**	-2.41	
Age squared	0.001***	3.14	2.7E-04***	3.14	
Married (1 if married, or lives in common-law union = <i>Plase</i> in Haitian Creole)	0.235***	4.17	0.122***	3.96	
Presence of returned migrant	0.897***	9.90	0.684***	6.73	
Interaction Migration rate and Household size	0.175***	5.80	0.086***	5.79	
Livestock (number of large animals)	0.191**	2.76	0.094**	2.77	
Hectare (land holding in hectares)	0.028**	2.29	0.014**	2.28	
Semi-urban	0.361***	4.03	0.199***	3.60	
Rural	0.382***	4.38	0.180***	4.54	
Intercept	-0.931***	-3.17			
<b>Logit inflation model</b>					
Log likelihood: -5742.47					
Farming and fisheries	1.600***	4.430	-0.102***	-3.700	
Nuclear family	1.470***	4.190	-0.094***	-3.590	
Intercept	-3.156***	-6.480			
Number of obs:	6,070				
Nonzero obs:	1,790				
Zero obs:	4,280				
Wald $\chi^2(12)$ :	665, (Pr > $\chi^2 = 0.000$ )				
LR test, Ho: $\ln \alpha = -\infty$ :	$\bar{\chi}^2(01) = 438$ , (Pr > $\bar{\chi}^2 = 0.000$ )				
Vuong test:	$z = 3.82$ , (Pr > $z = 0.000$ )				
NBRM	BIC=-41208.685	AIC= 1.907	Prefer	Over	Evidence
vs ZINB	BIC=-41340.255	dif= 131.569	ZINB	NBRM	Very strong
	AIC= 1.871	dif= 0.036	ZINB	NBRM	
	Vuong= 8.169	prob= 0.000	ZINB	NBRM	p = 0.000

\*, \*\*, \*\*\*, mean significance at 10%, 5%, and 1%, respectively.

**Table A4. Exogeneity of the instruments and their correlation with the endogenous regressor**

Depvar.: Hours worked	Men	t	Women	t
Migrant_hat	6.284*	1.920	-1.173	-0.250
Neteduc_sec	-47.727*	-1.710	-54.267	-1.430
Neteduc_sup	134.187	1.530	214.206	1.220
Intercept	82.081***	27.970	57.571***	13.880
$\sigma$ (standard error in parentheses)	116.849 (2.123)		137.293 (2.994)	
	F(3,3253) = 3.43 Prob > F = 0.0164		F(3,2811) = 1.25 Prob > F = 0.2910	

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Depvar.: Remittances	Men	t	Women	t
Migrant_hat	1,020.968***	8.280	2,039.270***	11.020
Neteduc_sec	9,646.828***	9.310	8,305.704***	5.500
Neteduc_sup	18,100.670***	5.430	12,608.010*	1.740
Intercept	-250.478**	-2.310	-297.381*	-1.850
Number of observations	3,256		2,814	
	F( 3, 3252) = 104.72 Prob > F = 0.0000		F( 3, 2810) = 84.35 Prob > F = 0.0000	

\*, \*\*, \*\*\*, mean significance at 10%, 5%, and 1%, respectively.

**Table A5. Income quintiles, education, migration, and international remittances**

Quintile (from poorest to richest)	%Household members with secondary education	%Household members with superior education	Wealth index	Migration participation	Percentage of recipients	Ratio remittance/ income
1	7	0.07	-1.2	0.16	11	0.53
2	9	0.2	-0.79	0.25	20	0.44
3	12	0.3	-0.59	0.27	24	0.38
4	17	0.4	0.10	0.34	31	0.37
5	32	0.4	3.04	0.52	48	0.39

Source: Author's own calculations based on the ECVH-2001 (note: unweighted)



**Table A6. IV-Probit model of labour market participation by headship (working age 15-64).**

**Marginal effects**

	Men	z-Stat	Women	z-Stat
	$\partial y/\partial x$		$\partial y/\partial x$	
Monthly equivalent remittances	-0.001***	-5.54	-0.0004***	-2.32
Years of schooling	0.025**	2.69	0.028***	3.33
Wealth index	0.145***	5.38	0.073***	1.98
Experience	0.003	0.24	0.071***	7.73
Experience squared	-0.0008	-0.37	-0.001***	-7.33
Married (1 if married or lives in common-law union)	-0.170**	-2.26	-0.116*	-1.92
Returned migrant	0.601***	3.37	0.248**	1.92
Home (1 if property is owned <i>de jure</i> )	0.080	1.00	0.134***	2.17
Household size	0.050***	3.52	0.044***	3.36
Hardship	-0.738***	-7.67	-0.347***	-4.92
Livestock (number of large animals)	-0.289***	-3.54	-0.202***	-2.74
Hectare (land holding in hectares)	0.125***	5.58	0.097***	5.13
Semi-urban	0.532***	4.08	0.111	1.15
Rural	0.447***	3.64	0.059	0.62
Male (1 if at least one migrant is male)	0.433***	2.07	0.023	-0.16
Female (1 if at least one migrant is female)	0.237	1.26	0.076	0.62
Destination country of migrants				
US/Canada	-0.035	-0.17	0.153	0.99
Dominican Republic	-0.281	-1.00	0.123	0.71
US/Canada and Dominican Republic	0.119	0.19	1.016***	2.30
Other countries	-0.287	-1.10	0.008	0.04
Constant	0.274	1.05	-1.090***	-6.32
Number of observations	3,256		2,814	
Wald $\chi^2(20)$	181.54 (Pr > $\chi^2 = 0.000$ )		164.94 (Pr > $\chi^2 = 0.000$ )	
Exogeneity test: Wald $\chi^2(1)$	35.60 (Pr > $\chi^2 = 0.000$ )		2.96 (Pr > $\chi^2 = 0.085$ )	
<i>First stage diagnostic:</i>	F(22, 3233) = 35.15 Prob > F = 0.0000 R <sup>2</sup> = 0.1950		F( 22, 2791) = 50.05 Prob > F = 0.0000 R <sup>2</sup> = 0.2829	

\*, \*\*, \*\*\*, mean significance at 10%, 5%, and 1%, respectively.