The Impact of Work Migration and Non-Work Migration on Household Welfare, Poverty and Inequality: New Evidence from Vietnam

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Abstract

This paper provides new empirical evidence on the impact of migration on migrant-sending households in Vietnam. Using data from the two most recent Vietnam Household and Living Standard Surveys, the paper estimates the impact of work migration and non-work migration on per capita income, per capita expenditures, poverty and inequality. It is found that both work migration and non-work migration have a positive impact on per capita expenditures of migrant-sending households. However, the channels through which work migration and non-work migration increase expenditures are different. Work migration increases income remarkably, mainly through remittances, thereby raising expenditures of migrant-sending households. Non-work migration does not lead to a significant increase in income, and the increase in expenditures might result from an increase in households' marginal propensity to consume due to household economies of scale. Because of the positive impact on expenditures, non-work migration significantly decreases the incidence, depth and severity of national poverty. The effect of work migration on poverty is much smaller. Still, while work migration does not lift people out of poverty, it makes their poverty less severe. In addition, both work migration and non-work migration decrease inequality, albeit only very slightly.

JEL Classification: O15, R23, I32

Key words: migration, impact evaluation, poverty, inequality, Vietnam.

1. Introduction

Migration potentially is an important strategy to fight poverty and decrease inequality. Remittances sent by migrants are remarkable capital flows. Nowadays, the amount of international remittances to developing countries is much higher than foreign assistance (DeWind and Holdaway, 2005). In 2005, the total flow of international remittances amounted to US$ 250 billion, and constituted 5-10% of total GDP in developing countries (World Bank, 2005a). It is even to be expected that remittance flows keep growing at a 7-8 percent annual rate (World Bank 2005b). International and internal remittances can help households increase income and consumption. Remittances can also help increase investment and production. The theory on exchange motives (Cox, 1987) argues that people give transfers to others because they want to get some return benefits. This implies that remittances can be invested in physical and social assets for the benefit of the migrant and the remittance recipients. In addition, productivity will increase if remittances help relax liquidity constraints and allow households to invest in high-return capital intensive activities (Stark, 1991; Taylor and Martin, 2001; Taylor and Lopez-Feldma, 2007). Through remittances, migration can thus directly and indirectly increase income and consumption in the home area and, if the poor receive at least some remittances, decrease poverty in the home area. If the poor even receive most remittances, not only poverty but also inequality will decrease.

Yet, migration does not necessarily lead to a significant increase in income or reduction in poverty and inequality in home areas. Remittances may not be sufficient to compensate for the loss of local income previously earned by the migrant. In extreme cases, they could even lower the earned income of the recipients if they provide disincentives to work effort (Farrington and Slater, 2006; Lloyd-Sherlock 2006; Sahn and Alderman, 1996). Migration could also result in labor shortages for migrant-sending households, and thus prevent these households from engaging in high-return but labor intensive activities (Taylor and Lopez-Feldma, 2007). Regarding inequality, migration can even harm inequality of the departure areas if remittances are mostly sent to the non-poor households.

Empirical findings do not settle the theoretical ambiguity of the impact of migration on home country welfare. For example, Acosta (2007) finds that for some countries remittances increase inequality, whereas the opposite happens in other countries. Adams (2006) suggests that international remittances reduce poverty in Guatamala and Mexico, since in these countries international migrants come from the poorest group of households, and remittances are sent to relatively poor households. However, Azam and Gubert (2006) find that in Mali and Senegal migrants mainly come from rich families, and that especially the rich families receive most remittances. Yang (2004) finds that migration reduced labor hours and income in the Philippines. Hence, the effect of out-migration on poverty and inequality remains an empirical question the answer to which depends on the specific nature of migration in an area.

Also the effect of migration on vulnerability is indefinite. According to insurance theory, migration is a strategy to cope with economic risks or shocks in the absence of complete risk and financial markets (Stark and Levhari, 1982, Stark and Bloom, 1985, Rosenzweig, 1988, Stark, 1991). Migrants will then remit more money when their family members who stayed behind

experience a decrease in income. On the other hand, recipients may become dependent on remittances, and fall into poverty when the migrant stops sending money.

In Vietnam, both internal and international migration has increased rapidly over the past decades. According to the 1999 Population and Housing Census, around 6.5 percent of the population over 5 years old changed their residence place during 1994-1999 (Dang et al., 2003). Between 1998 and 2006, the share of the population living in urban areas increased from 22 to 27 (1998 and 2006 Vietnam Household Living Standard Surveys). The annual number of international work migrants increased by 136 percent from 36 to 85 thousand during the period 2001-2007 (Labor Newspaper, 2008). In addition, an increasing number of women married foreigners. Until 2007, 177 thousand women left the country for marriage (Police Newspaper, 2008).

Most studies argue that the main reasons for economic migration in Vietnam are to find better employment and higher wages (e.g., Dang et al., 2003; Cu, 2005; Brauw and Harigaya, 2007). Industrialization and high economic growth in urban areas increasingly attract rural labors (Dang et al., 1997; Dang, 2001; Cu, 2005). Large flows of foreign direct investment move into industrial zones and companies that create employment for rural people. In addition, there are more landless or near landless households (Ravallion and van de Walle, 2006). The increased shortage of land could push farmers to go for non-farm employment in other areas (Cu, 2005).

There are many studies on migration in Vietnam. However, most of studies focus on the pattern and determinants of migration (e.g., Guest 1998; Djamba, 1999; Dang et al., 1997; Dang, 2001; Dang et al., 2003; GSO and UNFPA, 2005; Cu, 2005; Dang and Nguyen, 2006). Only two existing studies have assessed the quantitative impact of migration. The first study is Brauw and Harigaya (2007), who find that seasonal migration increases household expenditures using the Vietnam Living Standard Surveys (VLSS) 1993 and 1998. The second and most closest to this paper is *Nguyen et al.* (2008), who evaluate the impact of long-term migration on household expenditure and inequality using the Vietnam Household Living Standard Surveys (VHLSS) from 2002 and 2004. They find that migration increases expenditures but also inequality.

The main objective of this paper is to estimate the impact of long-term migration for both work and non-work reasons on several welfare indicators at household and country level in Vietnam. Compared to *Nguyen et al.*, we provide not only information on the impact of migration on expenditures and inequality, but also on remittances, work effort, income, and poverty. This results in a deeper understanding of the process in which migration affects expenditures. Also, we consider the relation between migration and vulnerability through the level of income diversification. Finally, we consider additional economy-wide welfare indicators besides inequality: we assess the impact of migration on three different poverty indicators. We do all this using the two most recent Living Standard Surveys: the VHLSSs 2004 and 2006.

By providing evidence on the impact of work migration and non-work in Vietnam, the paper is expected to make an empirical contribution to the migration literature. The findings are also policy relevant for not only Vietnam but also other developing countries. Vietnam is an interesting case to look at. Vietnam has been very successful in poverty reduction. The poverty incidence decreased by more than two-third from 58 percent in 1993 to 16 percent in 2006. In the

world, very few countries are able to have comparable achievements in poverty reduction (World Bank, 2004). In addition, Vietnam has achieved a remarkable decrease in poverty with a slight increase in inequality. The Gini index based on per capita expenditure increased from 0.33 in 1993 to 0.36 in 2006. Migration has been increased rapidly in Vietnam. Yet, little is known on the impact of migration on poverty and inequality.

The remainder of the paper is organized as follows. Section 2 presents the data used for the study with special attention on the definition of migration. Section 3 discusses patterns of migration and household welfare in Vietnam. Next, the methodology employed is discussed in Section 4. Sections 5 and 6 present the estimation results. Finally, we draw conclusions in Section 7.

2. Data set

We use data from VHLSSs in 2004 and 2006. The 2004 and 2006 VHLSSs covered 9188 and 9189 households, respectively. The samples are representative for the national, rural and urban, and regional levels. The 2004 and 2006 VHLSSs set up a panel of 4216 households, which are representative for the whole country, and for the urban and rural population. The surveys covered commune-level information on for example general economic conditions, infrastructure and facilities and household-level information such as basic demography, employment, education, health, housing, assets ownership, remittances, expenditures and income.

Expenditure and income were collected using very detailed questionnaires. Expenditure includes food and non-food expenditures. Food expenditure includes purchased food and foodstuff and self-produced products of households. Non-food expenditure comprises expenditure on education, healthcare, housing, power, water supply and garbage collection. Household income includes income from agricultural and non-agricultural production, salaries and wages, pensions, scholarship, interest and rental income, remittances and social transfers.

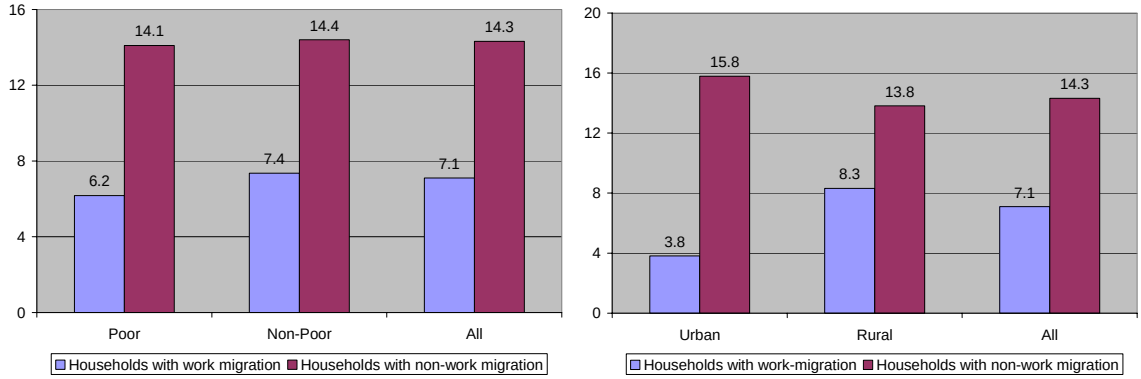
Although the surveys did not have explicit questions on migration, we could use special features of the panel of 4216 households to define migration. 1395 individuals who were part of these households in 2004 were not covered in the 2006 survey (these people do not include dead people). These people are considered migrants. Since a household's members in VHLSSs are defined as those who lived with the households for more than 5 months during the past year, the duration of the defined migration was at least 7 months. The 2006 VHLSS includes a question on the reasons why these people left the households: work, marriage/separate stay, and education/other reasons. The questionnaire did not distinguish between internal and international migration. Based on these data, we defined two types of migration: work migration and non-work migration. Households with work migration had someone leaving for work during the period 2004-2006. Households with so-called non-work migration had someone leaving for marriage, separate stay, education or other reasons. The number of households who sent out work migrants and non-work migrants are 295 and 608, respectively. Around 1 percent of households had both types of migration at the same time.

Our definition of migration has both disadvantages and advantages. The main disadvantage is that it probably underestimates total migration, as households may have migrants who left before 2004. On the other hand, the restriction of migration to a limited time period has an important advantage. Many studies define households with migration are those currently have migrating members, which may have migrated at any time before the survey, *e.g.* Hoddinott (1994), Barham and Boucher (1995), Niimi and Ozden (2006), and Mora and Taylor (2006). As the impact of migration on household welfare may change over time, merging migration over too long a time period may obscure the results of an impact study.

3. Migration and household welfare in Vietnam

Figure 1 presents the distribution of migrants over different groups of households. The percentage of households with work and non-work migration was 7.1 percent and 14.3 percent, respectively, with very similar shares for poor and non-poor households. As expected, rural areas had a higher proportion of households with work migration, 8.3 percent compared to 3.8 percent, since people tend to move from rural to urban areas for higher income employment. However, the share of households with non-work migration was somewhat higher in urban areas.

Figure 1: Distribution of migrants (% of all households)



Source: Authors' estimation from panel data of VHLSSs 2004-2006.

Households with people migrating between 2004 and 2006 could be expected to have experienced an increase in welfare over that period, especially when the migrants left for work. Table 1 shows averages of a number of welfare indicators for households with and without work-migration. The indicators include labor efforts, remittances, income, income diversification, consumption expenditure, and poverty indexes.

To examine how the labor efforts of household members change with migration, the labor variables of migration households in 2004 are constructed for only non-migrating members. As can be seen, the ratio of working members in households was quite similar between households

with and without work migration. However, annual working hours per laborer for households with migration were slightly lower for households without migration.

Households with work migration experienced a large increase in both internal and international remittances. Internal and international remittances per capita increased by around 78 percent and 561 percent, respectively. Remittances of households without work migration increased only slightly.

The growth rate of income of households with work migration was a higher than that of households without migration: 50 percent compared to 20 percent. Migration household income excluding remittances also increased at a higher rate than that of households without migration.

Table 1: Welfare of households with and without work migrants during 2004-2006

Welfare indicators	Households with work migrants		Households without work migrants	
	2004	2006	2004	2006
Ratio of members engaged in productive activities to total household members older than 14 years (%)	81.7	79.9	81.3	78.6
	[1.4]	[1.5]	[0.5]	[0.4]
Annual working hours per capita	1023.7	1073.7	1026.9	1060.7
	[29.6]	[29.2]	[10.7]	[10.6]
Annual working hours per working member	1592.1	1693.1	1828.1	1868.6
	[39.4]	[39.2]	[16.1]	[14.6]
Per capita internal remittances	472.0	851.0	423.1	435.8
	[76.9]	[69.2]	[19.1]	[20.8]
Per capita international remittances	123.3	911.9	251.9	302.1
	[71.5]	[388.3]	[46.7]	[64.5]
Per capita income	4733.4	7088.5	5790.0	6902.0
	[194.5]	[455.7]	[129.0]	[146.2]
Household income divided by the number of working members (above 14 years old)	8111.2	13100.0	11215.1	13188.0
	[364.8]	[1414.3]	[310.7]	[372.9]
Household income excluding remittances divided by the number of working members (above 14 years old)	7028.9	8917.7	9773.2	11540.5
	[283.2]	[404.3]	[233.2]	[261.9]
Simpson index 1 (all income sources)	0.5630	0.5561	0.4852	0.4719
	[0.0090]	[0.0100]	[0.0042]	[0.0042]
Simpson index 2 (income sources excluding remittances)	0.5120	0.4670	0.4230	0.4108
	[0.0110]	[0.0122]	[0.0048]	[0.0048]
Per capita consumption expenditure	3608.9	4612.5	4329.1	4848.0
	[129.8]	[148.4]	[87.8]	[90.5]
Poverty incidence (P0 (%))	17.3	10.7	20.6	16.2
	[2.6]	[2.2]	[1.0]	[0.9]
Poverty gap index (P1)	0.0463	0.0222	0.0522	0.0405
	[0.0100]	[0.0084]	[0.0033]	[0.0030]
Poverty severity index (P2)	0.0181	0.0097	0.0195	0.0147
	[0.0055]	[0.0053]	[0.0016]	[0.0015]
Number of observations	295	295	3921	3921

Standard errors in brackets (corrected for sampling weight and cluster correlation).
Source: Authors' estimation from panel data of VHLSSs 2004-2006.

Migration could imply increased income diversification and thus a reduction of risk. To measure income diversification, we use the Simpson index (SI). A larger SI means more income diversification: SI ranges between 0 if there is only one source of income and $(1 - 1/k)$ if a household earns income equally from all k possible income sources (see appendix 2). We define seven mutually exclusive income sources: crops, livestock, fishery/forestry/other agricultural activities, non-farm self employment, wages, remittances, transfers, and other income. Since migration can lead to increased remittances, we estimate the SI for total income and income without remittances.

Households with work migrants had a higher average SI than other households, even before migration. This could be because a large share of these households came from rural areas. The SI was slightly reduced over time for both groups of households. Moreover, the SI for income without remittances decreased remarkably from 0.512 to 0.467 for the households with migration.

Per capita expenditure increased by around 28 percent and 12 percent for households with and without migration during the period 2004-2006, respectively. Poverty, which is measured by three Foster-Greer-Thorbecke poverty indexes, reduced for groups of households (the formulas of these poverty indexes are presented in section 4.2). Migration households experienced a larger decrease in poverty than other households did.

Table 2: Welfare of households with and without non-work migrants during 2004-2006

Welfare indicators	Households with non-work migrants		Households without non-work migrants	
	2004	2006	2004	2006
Ratio of members engaged in productive activities to the total household members older than 14 years old (%)	77.6	79.0	82.0	78.7
	[1.2]	[0.9]	[0.5]	[0.4]
Annual working hours per capita	1066.1	1152.3	1021.1	1047.1
	[29.3]	[22.4]	[10.4]	[10.8]
Annual working hours per working member	1726.3	1873.1	1829.2	1855.6
	[34.7]	[30.3]	[16.1]	[14.7]
Per capita internal remittances	396.1	802.8	428.9	405.4
	[40.4]	[76.0]	[19.9]	[18.9]
Per capita international remittances	217.2	219.2	249.6	358.2
	[49.1]	[53.8]	[50.5]	[74.8]
Per capita remittances (both international and internal)	613.3	1021.9	678.5	763.6
	[67.2]	[89.4]	[55.2]	[77.4]
Per capita income (Household income divided by household size)	5520.7	7093.7	5754.2	6884.3
	[208.8]	[266.7]	[132.5]	[152.2]
Household income divided by the number of working members (above 14 years old)	10000.0	12500.0	11138.9	13292.1
	[533.1]	[617.9]	[315.2]	[403.0]
Household income excluding remittances divided by the number of working members (above 14 years old)	8924.2	10700.0	9703.9	11497.4
	[468.3]	[568.9]	[232.1]	[268.0]
Simpson index 1 (all income sources)	0.5020	0.4975	0.4889	0.4749
	[0.0080]	[0.0079]	[0.0043]	[0.0043]
Simpson index 2 (income sources excluding remittances)	0.4450	0.4206	0.4268	0.4147
	[0.0090]	[0.0091]	[0.0049]	[0.0049]

Welfare indicators	Households with non-work migrants		Households without non-work migrants	
	2004	2006	2004	2006
Per capita consumption expenditure	4260.8	5387.5	4284.2	4746.2
	[163.4]	[170.1]	[86.3]	[88.6]
Poverty incidence (P0 (%))	20.7	12.8	20.4	16.4
	[2.0]	[1.6]	[1.0]	[0.9]
Poverty gap index (P1)	0.0550	0.0293	0.0514	0.0409
	[0.0071]	[0.0045]	[0.0033]	[0.0031]
Poverty severity index (P2)	0.0220	0.0100	0.0190	0.0151
	[0.0036]	[0.0019]	[0.0016]	[0.0016]
Number of observations	608	608	3608	3608

Standard errors in brackets (corrected for sampling weight and cluster correlation).
Source: Authors' estimation from panel data of VHLSSs 2004-2006.

Similarly, Table 2 presents the welfare indicators of households with and without non-work migration. In general, households with non-work migration experienced a higher increase in per capita remittances and income than those without non-work migration. Per capita expenditure also increased at a higher rate for the migrant-sending households: 26 percent compared to 11 percent for the period 2004-2006. As a result, poverty of the non-work migration households decreased more quickly than poverty of the households without non-work migration.

4. Methodology of impact evaluation

It is not possible to ascribe the differences between migrant-sending households and other households to the migration, as the two groups are likely to differ in other respects. To address the causal effects of migration on household welfare, poverty and inequality, we used the methodology of difference-in-indifferences with propensity score matching. In the following section, we discuss this method and the indicators used.

4.1. Impact of migration on household welfare indicators

Let *D* be a binary variable indicating whether a household has migrants: *D*=1 if a household has migrants, *D*=0 otherwise. In addition, denote *Y* as the variable of interest, with $Y_i = Y_{i1}$ if household *i* has migrants and $Y_i = Y_{i0}$ if the same household *i* had not had migrants. The impact of migration on household *i* is then measured by:

$$\Delta_i = Y_{i1} - Y_{i0} \quad (1)$$

Following the evaluation literature, the *average* impact of migration on households with migrants is defined by

$$ATT = E(Y_1 - Y_0 \mid D = 1) = E(Y_1 \mid D = 1) - E(Y_0 \mid D = 1) \quad (2)$$

where ATT denotes the Average Treatment Effect on the Treated, or in this case the average effect of migration on households with migrants (Heckman et. al., 1999).

Estimation of ATT is not straightforward, since $E(Y_0 \mid D=1)$ is unobservable. $E(Y_0 \mid D=1)$ is the counterfactual which would give the expected outcome of households with migration if nobody had migrated. A possible solution would be to estimate $E(Y_0 \mid D=1)$ by the expected value of the variable of interest for those households that do not have migrants, $E(Y_0 \mid D=0)$, which is observable. Obviously, this approach is only valid if households with and without migrants are similar in all respects but migration, put differently if the decision to migrate is not correlated with other variables that are not controlled for in the analysis. In practice, this requires selection of a valid control group (the counterfactual).

We use a matching methodology to derive such a control group, which comes down to pairing households with and without migrants on the basis of some observable variables such that both groups become comparable. Such matching is preferable to randomly choosing a control group, since it suffers less from selection bias. The main advantage of matching compared to regression-based methods is that it is a non-parametric method, which avoids specifying the relationship between characteristics and outcome. A second advantage is that matching methods emphasize the common support problem, which implies that they only compare household performance between households with and without migrants when the two groups of households have otherwise similar characteristics.

We use the method of propensity score matching (Rosenbaum and Rubin, 1983). We start by estimating the probability of being a household with migrants at time *t* by using a logit or probit model, $P(D_{it}=1)=F(X_{it-1})$, where *X* is a vector of observed variables before migration. Let's divide the sample into two groups: a group of households with migrants (say group M) and a group of households without migrants (say group C). The matching methodology pairs each family with migrants to some group of "comparable" households without migrants and then associates to the outcomes of the treated families the (weighted) outcomes of their neighbors in the comparison group. The matching estimator is defined by $\mu = \sum_{i \in M}\left[y_i - \sum_{j \in C} g\left(p_i, p_j\right) y_j \right]$, where *p* is the probability of having migrants and *g(.)* gives the weights on control family *j* in forming a comparison with migrant family *i*. The function *g(.)* differs for the different matching estimators proposed in the literature.

Since we have longitudinal data on the migration and non-migration households, we can estimate the impact of migration by using the method of difference-in-differences with matching. The main advantage of the difference-in differences method compared to the standard matching estimator in levels is that the former eliminates differences in the variable of interest due to unobserved time-invariant effects. This implies that the difference-in differences method controls for selection on both observables and time-invariant unobservables, while the standard matching method controls for selection on observables only. Let Δy be the differences between the variable of interest before and after migration. Then the difference-in-differences estimator is given by:

$$\delta = \sum_{i \in M} \left[\Delta y_i - \sum_{j \in C} g(p_i, p_j) \Delta y_j \right]. \quad (3)$$

Different matching estimators can be used. In this paper, we use nearest-neighbors, kernel matching, and local linear regression matching to examine the sensitivity the impact estimates. We calculate standard errors using bootstrap techniques. This is common practice in empirical studies, although Abadie and Imbens (2006) show that bootstrap can give invalid standard errors for the nearest neighbor matching estimator, and there is no evidence on the validity of bootstrap standard errors for other matching estimators. We implement the bootstrap by repeatedly drawing samples from the original sample of the VHLSS panel data. Since the VHLSSs sample selection follows stratified random cluster sampling, communes instead of households are bootstrapped in each stratum (Deaton, 1997). In other words, the bootstrap is made of communes (i.e., clusters) within strata. The number of replications is 500. We also tried to bootstrap households instead of communes, and the results of both possibilities are very similar.

It should be noted that we are able to construct so-called baseline data before migration since the migration is defined for the period 2004-2006. It is possible that before 2004 both migration and non-migration households already had migrating members. However, through controlling for a large number of household and village variables including receipt of internal and international remittances in 2004, we expect to be able to construct a control group with observed characteristics similar to the migrant group. The main difference between the migrant and control group is that the migrant group had migrating members between 2004 and 2006, while the control group did not. We therefore interpret the estimated differences as the impact of migration during the period 2004-2006.

4.2 Impact of migration on poverty and inequality

We measure expenditure poverty by three Foster-Greer-Thorbecke poverty indexes, which can all be calculated using the following formula (Foster, Greer and Thorbecke, 1984):

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left[\frac{z - Y_i}{z} \right]^\alpha , \quad (4)$$

where Y_i consumption expenditure per capita for person i, z is the expenditure poverty line, n is the total number of people in the sample population, q is the number of poor people, and α can be interpreted as a measure of inequality aversion. When $\alpha = 0$, we have the headcount index H, which measures the proportion of people below the poverty line. When $\alpha = 1$ and $\alpha = 2$, we obtain the poverty gap PG, which measures the depth of poverty, and the squared poverty gap P_2 which measures the severity of poverty, respectively.

We use three common measures to measure inequality: the Gini coefficient, Theil's L index, and Theil's T index of inequality. The Gini index can be calculated from the individual expenditures of the population as follows:

$$G = \frac{n+1}{n-1} - \frac{2}{n(n-1)\bar{Y}} \sum_{i=1}^{n} \rho_i Y_i \,, \tag{5}$$

where $\bar{Y}$ is the average per capita expenditure, and ρ_i is the rank of person *i* in the *Y*-distribution, counting from the richest so that the richest has the rank of 1. The Gini coefficient varies from zero to one. The closer to one, the more unequal is the distribution.

The Theil L index of inequality is calculated as follows:

$$Theil\_L = \frac{1}{n} \sum_{i=1}^{n} \ln\left(\frac{\bar{Y}}{Y_i}\right), \tag{6}$$

and ranges from zero to infinity with higher values indicating more inequality.

The Theil T index of inequality equals:

$$Theil\_T = \frac{1}{n} \sum_{i=1}^{n} \frac{Y_i}{\bar{Y}} \ln\left(\frac{Y_i}{\bar{Y}}\right), \tag{7}$$

and ranges from zero (lowest inequality) to ln(N) (highest inequality).

The impact of migration on the poverty indexes of migrant households is calculated as follows:

$$\Delta P_\alpha = P_\alpha(Y_1^A \mid D = 1) - P_\alpha(Y_0^A \mid D = 1), \tag{8}$$

where the first term on the right-hand side is the poverty measure of households with migration given this migration. This term is observed and can be computed directly from the sample data. The second term on the right-hand side is the counterfactual measure of poverty, *i.e.*, poverty indexes of the migration households had they not had migration. This term is not observed directly. To estimate this term, we estimate Y_0^A for each household as follows:

$$\hat{Y}_{0i}^A = Y_{1i}^A - \hat{\Delta}_i \,, \tag{9}$$

where Y_{1i}^A is observed per capita expenditure of migration household *i*. $\hat{\Delta}_i$ is the impact estimate of migration on household *i* estimated using the difference-in-differences with matching method described in the previous section. It should be noted that we measure the impact of migration in 2006, i.e., after households sent migrants (and the superscript "A" means "after" migration).

We also measure the impact of migration on total poverty:

$$\Delta P_\alpha = P_\alpha(Y^A) - P_\alpha(Y_0^A) \,, \tag{10}$$

where $P_\alpha(Y^A)$ is the observed poverty index of the entire population and $P_\alpha(Y_0^A)$ is the poverty index of the entire population if there had been no migration at all.

For inequality, we only measure the impact of migration on the entire population:

$$\Delta I = I(Y^A) - I(Y_0^A), \tag{11}$$

where $I(Y^A)$ is the index for observed inequality and $I(Y_0^A)$ the inequality index in the absence of migration, which is estimated using the predicted counterfactual expenditure. The standard errors of the estimates of impacts on poverty and inequality are estimated using the bootstrap technique described in the previous section.

5. Propensity score estimation and determinants of migration

The first step in measuring impact is to predict the propensity score, which is the probability that a household had at least one migrating member during 2004-2006. Since the dependent variable is binary, we used logit regression. The main problem we faced was how to select the set of explanatory variables. Two requirements need to be taken into account. First, the explanatory variables should be exogenous to migration (Heckman et al., 1999; Ravallion, 2001). Therefore, we use variables before migration during the 2004-2006 period, *i.e.*, variables in the 2004 VHLSS. Second, the explanatory variables should affect both the outcome variable we are interested in and migration (Ravallion, 2001). Variables which affect the outcome variable but not migration should not be included in the logit regressions. Similarly, variables affecting migration but not the outcome variables should be ignored.

Economic theories of migration suggest that people primarily migrate in order to improve income, or to reduce risk (Harris and Todaro, 1970; Stark, 1980; Katz and Stark, 1986; Stark and Taylor, 1991; Stark, 1991). The new economics of labor migration assumes that migration decisions are determined both by individual and household characteristics, including human and physical assets of the households (Stark, 1991; Mora and Taylor, 2006). In line with the recent literature on determinants of migration (e.g., Hoddinott, 1994; Morra and Taylor, 2006; Sienaert, 2007), our set of explanatory variables includes household income, receipt of remittances, education of household head and head's spouse, age, sex and marriage of the head, household composition, household education, housing and land, village characteristics, regions and urbanity. Several control variables such as household income and remittances are also outcome variables. However, these variables were measured in 2004, i.e., before migration during the 2004-2006 period, and pre-treatment outcome can be used as control in the regression of the propensity score (Dehejia and Wahba, 1998; Smith and Todd, 2005).

It should be noted that households with and without migration during the 2004-2006 period may have had migrating members before 2004. Moreover, households who had migrating members before 2004 may be less likely to have had members migrating between 2004 and 2006. Therefore, migration before 2004 should be controlled for. Since the VHLSSs do not present information on migration before 2004, we use receipts of remittances in 2004 as a proxy for pre 2004 migration.

Table A1 in the Appendix presents the entire set of explanatory variables, and their means and standard errors of the means. Table A2 in the Appendix presents the logit regressions regarding the determinants of work and non-work migration. We start (models 1a and 1b) by including all explanatory variables that are expected to affect migration. Next, we re-estimate the

model by only including variables that are statistically significant at the 10% level (models 2a and 2b). We use models 2a and 2b to estimate the propensity scores for work and non-work migration, respectively.

To examine the common support, we present Figures 3 and 4 of the propensity scores. The bars above the horizontal line represent the density distribution of the propensity score of the migration households, while the bars below the horizontal line represent the density distribution of the propensity score of the non-migration households. The figures show that the common support is large. This means that for each migration household we will be able to find non-migration households with similar propensity scores.

According to Model 2a, households with non-work migrants were less likely to have work migrants. As expected, households with lower per capita income tended to send out work migrants. Households with international remittances in 2004 were less likely to send work migrants during the period 2004-2006, since international remittances in 2004 imply that these households sent migrants already before 2004. On the contrary, households with internal remittances were more likely to have work migrants. It should be noted that internal remittances as defined in the VHLSSs include all internal private transfers received by households. These can be given to households not only by relatives but also by friends, neighbors, etc. Thus, the receipt of internal remittances of a household can be a indicator not only for migrants but also for relationship with other households. Households with a larger network could have a higher probability of migration. Ethnic minorities were less likely to sent out migrating members compared to Kinh/Chinese households. Large living areas and annual crop lands were associated with a small probability of work migration.

Non-work migration was not significantly correlated with economic factors such as income and land. Households with a large number of members and higher ratio of members between 15 and 60 years olds were more likely have non-work migration. Smaller living areas tended to increase the probability of non-work migration.

It should be noted that the main aim of the predicted propensity score is to overcome the multidimensionality problem of matching by covariates. The quality of a constructed comparison group should be assessed by testing whether the distribution of the covariates is similar between the comparison and treatment groups given the predicted propensity score. We test the equality of means of covariates between migrant and non-migrant households using t-tests. To examine the sensitivity of the impact estimates to different matching schemes, we will use four matching estimators including 1 nearest neighbor, 5 nearest neighbors, kernel matching with bandwidth of 0.05, and local linear regression matching with bandwidth of 0.05. The results of the balancing test for these estimators are presented in Tables A3 to A10 in Appendix I. It can be seen that we cannot reject equality of the means of the covariates between migrant and non-migrant households for any of the matching estimators.[1] All estimators achieve similar bias reduction

[1] We relied on the STATA command called "psmatch2" to perform the matching estimators. However, we do not use the original command for the estimation, since the command does not allow sampling weights. We revised the command to allow for sampling weights. We also tried to estimate the migration impacts without sampling weights. The results are very similar to those using the sampling weights.

percentages of *X*. Yet, the matched group from kernel matching is most similar to the migrant group. So we will use the results from the kernel matching scheme in the remainder of this paper the interpretation. Results from other matching estimators are very similar and presented in Appendix 1.

6. Impact of migration

Below, we will analyze the impacts of migration on welfare at the household and country level. At household level, we assess the ultimate effects on income and expenditures and the underlying factors work efforts of non-migrating members, remittances, and income diversification. At the national level, we consider poverty of both migrant households and the overall population and total inequality.

6.1. Impact of migration on income and expenditure

Work migration had a significant impact on per capita income, household income per working household member, as well as per capita consumption expenditures (Table 3). Migration for work purposes resulted in an average increase in per capita income by 897 thousand VND between 2004 and 2006: an increase of 19 percent. Income per working member even increased by one third. This was solely due to an increase in remittances: non-remittances income did not significantly change due to migration. Per capita consumption increased by 8 percent only, suggesting a high propensity to save out of remittances.

Migration for non-work purposes only significantly affected average per capita consumption expenditures and not income (Table 3). The latter is not surprising given our previous finding that work migration affects per capita income through remittances alone. Between 2004 and 2006, per capita consumption increased by 525 thousand VND, or 12 percent, due to migration. Perhaps surprisingly, this indicates that consumption effect of non-work migrants was higher than the consumption effect on work migrants, even though it did not lead to an increase in per capita income. A possible explanation is that households with non-work migrants had on average higher per capita expenditures than households with work migrants. Richer households may experience more household economies of scale and thus decrease total consumption less as a result of a reduction in household size (Deaton and Paxson, 1998).

Table 3: Impact of migration on income and expenditure in 2006 (kernel matching with bandwidth of 0.05)

Welfare indicators (outcome)	2004			2006			Diff-in-diff
	Treatment	Matched control	Difference	Treatment	Matched control	Difference	
Impact of work migration							
Per capita income (Household income divided by household size)	4733.4***	4941.9***	-208.5**	7088.5***	6399.7***	688.9*	897.4**
	[194.5]	[185.0]	[86.6]	[455.7]	[169.5]	[445.4]	[424.6]
Household income divided by the number of working members (above 14 years old)	8111.2***	8208.0***	-96.9	13100.0***	10500.0***	2614.2*	2711.0**
	[364.8]	[302.2]	[249.1]	[1414.3]	[284.5]	[1406.9]	[1398.2]
Household income excluding remittances divided by the number of working members (above 14 years old)	7028.9***	7466.4***	-437.5*	8917.7***	9527.0***	-609.3*	-171.8
	[283.2]	[264.7]	[236.3]	[404.3]	[263.3]	[379.3]	[347.2]
Per capita consumption expenditure	3608.9***	3786.5***	-177.5*	4612.5***	4487.5***	125.0	302.6***
	[129.8]	[108.6]	[96.8]	[148.4]	[106.6]	[119.7]	[117.0]
Impact of non-work migration							
Per capita income (Household income divided by household size)	5520.7***	5433.8***	87.0	7093.7***	6748.0***	345.7***	258.8
	[208.8]	[158.3]	[234.0]	[266.7]	[189.5]	[311.7]	[240.1]
Household income divided by the number of working members (above 14 years old)	10000***	10100***	141.8	12500.0***	12000.0***	492.6	350.8
	[533.1]	[344.2]	[597.9]	[617.9]	[332.1]	[679.2]	[554.0]
Household income excluding remittances divided by the number of working members (above 14 years old)	8924.2***	8857.7***	66.5	10700.0***	10700.0***	-79.1	-145.7
	[468.3]	[249.0]	[503.1]	[568.9]	[287.3]	[621.7]	[474.9]
Per capita consumption expenditure	4260.8***	4153.2***	107.6	5387.5***	4754.5***	633.0***	525.4***
	[163.4]	[121.0]	[188.1]	[170.1]	[112.9]	[193.0]	[144.0]

* significant at 10%; ** significant at 5%; *** significant at 1%.
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

6.2. Impact of migration on work efforts of non-migrating household members

Table 4 presents the impact of migration on work efforts. The table suggests that work migration did not have a statistically significant impact on the labor efforts of the non-migrating members. Non-work migration, on the other hand, resulted in an increase in annual working hours per working member (older than 14) by around 7 percent. This suggests that there was a need to compensate a loss in income due to non-work migration by means of an increase in working hours of the remaining household members. The results of the previous section suggest that this increase was sufficient to compensate the per capita income loss.

Table 4: Impact of work and non-work migration on household work efforts in 2006 (kernel matching with bandwidth of 0.05)

Indicators (outcome)	2004			2006			Diff-in-diff
	Treatment	Matched control	Difference	Treatment	Matched control	Difference	
Impact of work migration							
Ratio of members engaged in productive activities to the total household members older than 14 years old (%)	81.7***	79.5***	2.2*	79.9***	78.1***	1.8	-0.5
	[1.4]	[0.7]	[1.5]	[1.5]	[0.7]	[1.5]	[1.6]
Annual working hours per capita	1023.7***	1091.2***	-67.5**	1073.7***	1144.2***	-70.5**	-2.9
	[29.6]	[18.3]	[28.1]	[29.2]	[17.7]	[29.0]	[31.2]
Annual working hours per working member	1592.1***	1693.4***	-101.3***	1693.1***	1765.6***	-72.5*	28.8
	[39.4]	[21.4]	[39.7]	[39.2]	[19.2]	[40.9]	[48.9]
Impact of non-work migration							
Ratio of members engaged in productive activities to the total household members older than 14 years old (%)	77.6***	75.6***	2.0	79.0***	75.1***	3.8***	1.8
	[1.2]	[0.7]	[1.3]	[0.9]	[0.6]	[1.1]	[1.4]
Annual working hours per capita	1066.1***	1087.5***	-21.5	1152.3***	1113.5***	38.8	60.3**
	[29.3]	[17.3]	[31.0]	[22.4]	[19.5]	[26.7]	[29.5]
Annual working hours per working member	1726.3***	1812.5***	-86.2**	1873.1***	1835.0***	38.1	124.3***
	[34.7]	[21.0]	[40.3]	[30.3]	[21.9]	[35.8]	[40.8]

* significant at 10%; ** significant at 5%; *** significant at 1%.
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

6.3. Impact of migration on remittances

Table 5 shows that both work and non-work migration lead to an increase in remittances. However, remittances from non-work migrants were relatively low. This could explain why in case of non-work migration there was a higher need to compensate possible income losses with increasing working hours (see above). The table also shows that non-work migration increased internal remittances but not international remittances. This is in accordance with the observation that most non-work migrants left for marriage or separate stay, which mainly involve internal migration.

Table 5: Impact of migration on remittances in 2006 (kernel matching with bandwidth of 0.05)

Welfare indicators (outcome)	2004			2006			Diff-in-diff
	Treatment	Matched control	Difference	Treatment	Matched control	Difference	
Impact of work migration							
Per capita internal remittances	472.0***	377.4***	94.6	851.0***	417.4***	433.6***	339.0***
	[76.9]	[26.3]	[72.0]	[69.2]	[31.4]	[74.6]	[95.1]
Per capita international remittances	123.3***	63.6***	59.8	911.9***	166.3***	745.6*	685.8*
	[71.5]	[18.0]	[62.9]	[388.3]	[33.4]	[389.0]	[379.6]
Per capita remittances (both international and internal)	595.3***	441.0***	154.3	1762.9***	583.7***	1179.2**	1024.9***
	[103.8]	[34.6]	[90.5]	[398.7]	[45.3]	[400.1]	[401.6]

Welfare indicators (outcome)	2004			2006			Diff-in-diff
	Treatment	Matched control	Difference	Treatment	Matched control	Difference	
Impact of non-work migration							
Per capita internal remittances	396.1***	368.2***	27.9	802.8***	391.9***	410.9***	383.0***
	[40.4]	[24.3]	[45.3]	[76.0]	[27.6]	[81.6]	[85.2]
Per capita international remittances	217.2***	223.4***	-6.2	219.2***	255.9***	-36.7	-30.5
	[49.1]	[71.2]	[84.4]	[53.8]	[49.7]	[73.1]	[96.2]
Per capita remittances (both international and internal)	613.3***	591.6***	21.7	1021.9***	647.7***	374.2***	352.5***
	[67.2]	[77.0]	[98.6]	[89.4]	[55.3]	[107.8]	[124.5]

* significant at 10%; ** significant at 5%; *** significant at 1%.
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

6.4. Impact of migration of income diversification

Migration did not increase the overall Simpson index of income diversification. However, work migration resulted in a decrease of 3 percentage points in the Simpson diversification index of non-remittances income. This suggests that some work migrants were before involved in different activities than their household members, so that when they left local income became less diversified. This could increase their vulnerability to shocks if the migrant stops sending remittances. We do not find this effect for non-work migrants.

Table 6: Impact of migration on income diversification in 2006 (kernel matching with bandwidth of 0.05)

Welfare indicators (outcome)	2004			2006			Diff-in-diff
	Treatment	Matched control	Difference	Treatment	Matched control	Difference	
Impact of work migration							
Simpson index 1 (all income sources)	0.5630***	0.5280***	0.0354***	0.5561***	0.5080***	0.0481***	0.0128
	[0.0090]	[0.0064]	[0.0098]	[0.0100]	[0.0061]	[0.0108]	[0.0113]
Simpson index 2 (income sources excluding remittances)	0.5120***	0.4804***	0.0313***	0.4670***	0.4640***	0.0029**	-0.0284***
	[0.0110]	[0.0066]	[0.0106]	[0.0122]	[0.0066]	[0.0124]	[0.0122]
Impact of non-work migration							
Simpson index 1 (all income sources)	0.5020***	0.5051***	-0.0031	0.4975***	0.4922***	0.0053	0.0084
	[0.0080]	[0.0054]	[0.0095]	[0.0079]	[0.0050]	[0.0092]	[0.0093]
Simpson index 2 (income sources excluding remittances)	0.4450***	0.4522***	-0.0073	0.4206***	0.4422***	-0.0216**	-0.0143
	[0.0090]	[0.0060]	[0.0104]	[0.0091]	[0.0053]	[0.0101]	[0.0100]
	[163.4]	[121.0]	[188.1]	[170.1]	[112.9]	[193.0]	[144.0]

* significant at 10%; ** significant at 5%; *** significant at 1%
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

6.5. Impact of migration on poverty and inequality

Table 7 presents the impact of work and non-work migration on expenditure poverty and inequality. Although work migration did not have statistically significant effects on the incidence of poverty, it did significantly change the poverty gap and severity for the work migration households. Hence, work migration did not lift people out of poverty but it did make their poverty less harsh.

The effects of non-work migration on expenditure poverty were larger, which could be expected given that non-work migration was more widely spread and on average resulted in a larger increase in per capita expenditures (although not per capita income). Non-work migration helped reduce the poverty incidence of migration households by around 9 percentage points and in addition reduced their poverty gap and severity indexes by 57 percent and 67 percent, respectively. These numbers translate into an reduction of the overall poverty incidence by 1.2 percentage points and a reduction of the overall poverty gap and severity indexes by 12 percent and 17 percent.

Table 7: Impact of work and non-work migration on poverty and inequality in 2006 (kernel matching with bandwidth of 0.05)

	Households with "work" migration			Households with "non-work" migration		
	With migration	Without migration	Impact	With migration	Without migration	Impact
Poverty of households with migration						
Poverty incidence (P0 (%))	10.7***	13.5***	-2.7	12.8***	21.7***	-8.9***
	[2.2]	[3.1]	[2.5]	[1.6]	[3.2]	[3.1]
Poverty gap index (P1)	0.0222**	0.0384***	-0.0162**	0.0293***	0.0701***	-0.0407**
	[0.0084]	[0.0120]	[0.0074]	[0.0045]	[0.0151]	[0.0141]
Poverty severity index (P2)	0.0097**	0.0179**	-0.0082**	0.0100***	0.0327***	-0.0228**
	[0.0053]	[0.0081]	[0.0044]	[0.0019]	[0.0096]	[0.0091]
All poverty						
Poverty incidence (P0 (%))	15.9***	16.0***	-0.2	15.9***	17.1***	-1.2***
	[0.7]	[0.7]	[0.2]	[0.7]	[0.9]	[0.4]
Poverty gap index (P1)	0.0392***	0.0402***	-0.0010**	0.0392***	0.0448***	-0.0056***
	[0.0025]	[0.0026]	[0.0004]	[0.0025]	[0.0033]	[0.0019]
Poverty severity index (P2)	0.0144***	0.0149***	-0.0005	0.0144***	0.0175***	-0.0031***
	[0.0012]	[0.0013]	[0.0003]	[0.0012]	[0.0019]	[0.0013]
All inequality						
Gini	0.3464***	0.3477***	-0.0013**	0.3464***	0.3510***	-0.0046***
	[0.0050]	[0.0051]	[0.0005]	[0.0050]	[0.0053]	[0.0015]
Theil L	0.1984***	0.2002***	-0.0019**	0.1984***	0.2055***	-0.0071***
	[0.0058]	[0.0060]	[0.0009]	[0.0058]	[0.0065]	[0.0026]
Theil T	0.2080***	0.2096***	-0.0016***	0.2080***	0.2135***	-0.0056***
	[0.0073]	[0.0074]	[0.0006]	[0.0073]	[0.0077]	[0.0018]

* significant at 10%; ** significant at 5%; *** significant at 1%
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

Nguyen *et al.* (2008) found that total migration between 2002 and 2004 resulted in an increase in inequality in 2004: the actual Gini coefficient was 0.42, compared to the counterfactual (no migration) of 0.38. On the contrary, we find that both work and non-work migration slightly decreased expenditure inequality in 2006. The effects we find are, however, extremely small compared to the 0.04 points observed by Nguyen *et al.*. The difference could lie in the slightly different time period covered in the two studies or in methodological differences. Nguyen *et al.* use least-squares regression to determine the impact of migration on expenditures to compute inequality, whereas we use difference-in-differences with propensity score matching, which has the advantages that it controls for time-invariant unobservable differences between households with and without migrants in addition to observable differences, and that it does not impose a functional form on the relationship between migration, the covariates, and expenditures.

7. Conclusions

While migration is an increasingly important phenomenon in Vietnam, there are surprisingly few studies analyzing its effects quantitatively. In this study, we therefore estimate the impact of long-term migration on welfare at household and country level in Vietnam using the VHLSSs of 2004 and 2006. Compared to Nguyen *et al.*(2008), the only other existing study on the impact of long-term migration in Vietnam, we provide not only information on expenditures and inequality, but also on remittances, work effort, income and poverty. Also, we look at income diversification as an indicator of vulnerability.

Work migration resulted in an increase of income per capita by 19 percent and of income per working member by one third. This was purely due to an increase in remittances: migration did not significantly affect non-remittances income per working member, nor did it change the work efforts of the remaining household members. Per capita consumption increased by 8 percent, less than half of the percentage increase in per capita income, suggesting a high propensity to save out of remittances.

Migration for non-work purposes did not significantly affect per capita and per worker income. Remittances were low and per capita working hours increased. This suggests that there was a need to compensate a loss in per capita income due to the departure of a productive household member. Surprisingly, we found this effect for non-work migrants only. Despite the absence of an effect of non-work migration on per capita income, per capita consumption increased by 12 percent, *i.e.* more than for work migration, which did significantly increase income. Possibly, households with non-work migrants, which had on average higher per capita expenditures than households with work migrants, experienced more household economies of scale and thus decreased total consumption less as a result of a reduction in household size.

Migration potentially affects the vulnerability of households to shocks. While neither work nor non-work migration affected overall income diversification as measured by the Simpson index, we could postulate that the covariance between local income sources is higher than the covariance between local income and remittances. Remittances could even be negatively

correlated with earned income if migrants remit more when needs are higher. If so, especially work migration, which resulted in most remittances, would have decreased vulnerability.

On the other hand, work migration resulted in a decrease of diversification of non-remittances income. Apparently, before migration some migrants engaged in different activities than their household members, so that when they left local income became less diversified. This could increase the vulnerability of these households to shocks if the migrant would stop sending remittances in the future. Possibly, this prospect affects the limited increase in per capita consumption compared to per capita income. We did not find these effects for non-work migration, which was associated with low levels of remittances and did not affect non-remittance income diversification levels.

The household-level effects translated into changes in poverty and inequality at the country level. Due to its even distribution over poor and non-poor households and its relatively large effect on expenditures, non-work migration significantly decreased the incidence, depth and severity of national poverty. The effects of work migration on poverty were much smaller, mainly due to the lower expenditure effects. Still, while work migration did not lift people out of poverty, it did make their poverty less severe.

In addition, we found that migration decreased inequality, although only very slightly. This conflicts with the results of Nguyen *et al.* (2008) who found that total migration resulted in a substantial increase in inequality. Both the two-years difference between the data used for the two studies and methodological differences could explain these results. While we used difference-in-differences with propensity score matching, Nguyen *et al.* applied least-squares regression to determine the impact of migration on expenditures. Our method has the advantages that it controls for time-invariant unobservable differences between households with and without migrants in addition to observable differences, and that it does not impose a functional form on the relationship between migration, the covariates, and expenditures. Yet more research is needed to test the robustness of these contradictory results.

Overall, our analysis suggests that work migration and non-work migration are an important tool to increase household consumption expenditures and to reduce poverty and inequality in Vietnam. Also for other developing countries, especially for some Asian developing countries, such as the Philippines, Indonesia, Lao, and Cambodia, with a similar economic structure as Vietnam, migration may play an important role in terms of poverty and inequality reduction. There are several measures and policies to increase migration. Improvement of transportation and road can promote not only local market but also the probability of migration from rural to urban areas. Vocational training programs can provide rural people with production and business skills, and rural people are more likely to find employment in urban areas. The government can support migrants by social security programs and protective policies.

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Appendix 1. Descriptive statistics and regression results

Table A1: Descriptive information on the 2004 variables for households with and without migration

Variable	Description	Type	Household with work migrants	Household without work migrants	Household with non-work migrants	Household without non-work migrants
migration1	Households with work migration (yes = 1)	Binary	1	0	0.0773	0.0687
			[0]	[0]	[0.0108]	[0.0042
migration2	Households with non-work migration (yes = 1)	Binary	0.1593	0.1431	1	0
			[0.0213]	[0.0056]	[0]	[0]
incomepc04	Per capita income (million VND)	Continuous	4.9542	5.8202	5.4337	5.8145
			[0.1898]	[0.0880]	[0.1624]	[0.0930]
dforemit04	Receipt of international remittances	Binary	0.0271	0.0607	0.0691	0.0565
			[0.0095]	[0.0038]	[0.0103]	[0.0038]
ddoremit04	Receipt of internal remittances	Binary	0.8983	0.8452	0.8257	0.8528
			[0.0176]	[0.0058]	[0.0154]	[0.0059]
dagri04	Household involved in agricultural activities (yes = 1)	Binary	0.8780	0.7819	0.7895	0.7885
			[0.0191]	[0.0066]	[0.0165]	[0.0068]
ragri_oc04	Ratio of members involved in agricultural production to total household members	Continuous	0.3839	0.3357	0.3516	0.3370
			[0.0157]	[0.0048]	[0.0119]	[0.0050]
runsk_oc04	Ratio of unskilled workers to total household members	Continuous	0.1313	0.1194	0.1220	0.1199
			[0.0119]	[0.0032]	[0.0081]	[0.0034]
ethnic04	Ethnic minorities (yes = 1)	Binary	0.0983	0.1597	0.1760	0.1519
			[0.0174]	[0.0059]	[0.0155]	[0.0060]
hhsize04	Household size	Discrete	4.9797	4.3532	5.5197	4.2079
			[0.0917]	[0.0274]	[0.0821]	[0.0263]
pchild04	Ratio of members younger than 16 to total household members	Continuous	0.1577	0.2518	0.1803	0.2561
			[0.0103]	[0.0035]	[0.0070]	[0.0037]
pelderly04	Ratio of members older than 60 to total household members	Continuous	0.0709	0.1247	0.0990	0.1247
			[0.0082]	[0.0040]	[0.0068]	[0.0043]
pfemale04	Ratio of female members to total household members	Continuous	0.4582	0.5158	0.5291	0.5088
			[0.0106]	[0.0031]	[0.0070]	[0.0033]
agehead04	Age of household head	Discrete	51.7	48.8	53.0	48.4
			[0.6157]	[0.2252]	[0.4936]	[0.2342]
sexhead04	Gender of household head (male = 1, female = 0)	Binary	0.7898	0.7554	0.7368	0.7614
			[0.0238]	[0.0069]	[0.0179]	[0.0071]
married04	Head lives with spouse (yes = 1)	Binary	0.8305	0.8113	0.7829	0.8176
			[0.0219]	[0.0062]	[0.0167]	[0.0064]
hhedu04	Head completed technical degree or post-secondary degrees	Binary	0.1051	0.1421	0.1250	0.1419
			[0.0179]	[0.0056]	[0.0134]	[0.0058]
hsedu04	Head's spouse completed technical degrees or post-secondary degrees	Binary	0.1017	0.0808	0.0691	0.0845
			[0.0176]	[0.0044]	[0.0103]	[0.0046]
rtechnical04	Ratio of members with technical degrees to total household members	Continuous	0.0630	0.0645	0.0625	0.0648

Variable	Description	Type	Household with work migrants	Household without work migrants	Household with non-work migrants	Household without non-work migrants
			[0.0083]	[0.0025]	[0.0055]	[0.0027]
rposecond04	Ratio of members with post-secondary degrees to total household members	Continuous	0.0244	0.0283	0.0321	0.0274
			[0.0053]	[0.0018]	[0.0045]	[0.0018]
livingarea04	House area per capita (m2)	Continuous	13.18	15.80	13.05	16.05
			[0.39]	[0.19]	[0.33]	[0.20]
housetype1	House made of permanent materials	Binary	0.1593	0.1900	0.1743	0.1901
			[0.0213]	[0.0063]	[0.0154]	[0.0065]
housetype2	House made of semi-permanent materials	Binary	0.6169	0.5800	0.6217	0.5759
			[0.0284]	[0.0079]	[0.0197]	[0.0082]
housetype3	House of temporary materials	Binary	0.2237	0.2300	0.2039	0.2339
			[0.0243]	[0.0067]	[0.0164]	[0.0070]
anualand04	Area of annual crop land per capita (thousand m2)	Continuous	0.5906	0.7631	0.7796	0.7462
			[0.0444]	[0.0243]	[0.0568]	[0.0249]
pereland04	Area of perennial crop land per capita (thousand m2)	Continuous	0.1899	0.2469	0.2675	0.2388
			[0.0405]	[0.0211]	[0.0462]	[0.0218]
forland04	Forestry land per capita (thousand m2)	Continuous	0.3691	0.2323	0.3799	0.2186
			[0.1261]	[0.0326]	[0.1246]	[0.0303]
aqualand04	Aquaculture water surface per capita (thousand m2)	Continuous	0.0309	0.0613	0.0727	0.0568
			[0.0138]	[0.0079]	[0.0241]	[0.0077]
roadv04	Road to village (yes = 1)	Binary	0.8780	0.9095	0.8980	0.9088
			[0.0191]	[0.0046]	[0.0123]	[0.0048]
dmarket104	Distance from village to nearest market (km)	Continuous	2.2102	2.3387	2.1995	2.3517
			[0.2385]	[0.0884]	[0.2010]	[0.0920]
region1	Household in Red River Delta	Binary	0.2203	0.2056	0.1891	0.2095
			[0.0242]	[0.0065]	[0.0159]	[0.0068]
region2	Household in North East	Binary	0.1559	0.1469	0.1414	0.1486
			[0.0212]	[0.0057]	[0.0141]	[0.0059]
region3	Household in North West	Binary	0.0034	0.0487	0.0493	0.0449
			[0.0034]	[0.0034]	[0.0088]	[0.0034]
region4	Household in North Central Coast	Binary	0.2000	0.1109	0.0905	0.1217
			[0.0233]	[0.0050]	[0.0116	[0.0054]
region5	Household in South Central Coast	Binary	0.0983	0.0951	0.0872	0.0967
			[0.0174]	[0.0047]	[0.0114]	[0.0049]
region6	Household in Central Highlands	Binary	0.0305	0.0640	0.0576	0.0624
			[0.0100]	[0.0039]	[0.0095]	[0.0040]
region7	Household in North East South	Binary	0.0508	0.1270	0.1645	0.1145
			[0.0128]	[0.0053]	[0.0150]	[0.0053]
region8	Household in Mekong River Delta	Binary	0.2407	0.2017	0.2204	0.2018
			[0.0249]	[0.0064]	[0.0168]	[0.0067]
Urban04	Household in urban areas (yes = 1)	Binary	0.1492	0.2400	0.2467	0.2314
			[0.0208]	[0.0068]	[0.0175]	[0.0070]
	Number of observations		295	3921	608	3608

Figures in brackets are standard errors. Standard errors are corrected for sampling weights and cluster correlation.
Source: Authors' estimation from VHLSSs 2004-2006.

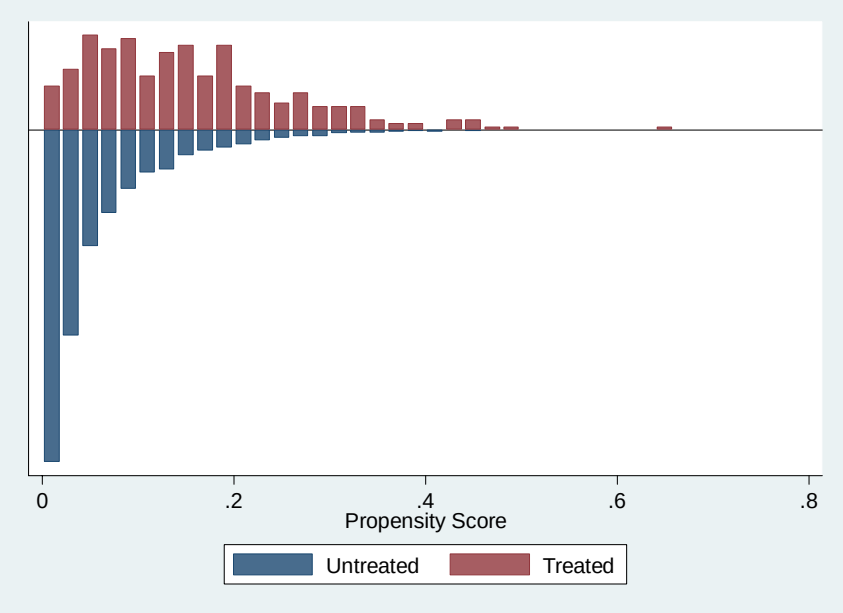
Table A2: Logit regressions of migration probability

Explanatory variables	Households with work migration (yes = 1)		Households with non-work migration (yes = 1)	
	Model 1a	Model 2a	Model 1b	Model 2b
Households with work migration (yes = 1)			-0.4371**	-0.4582**
			[0.1980]	[0.1960]
Households with non-work migration (yes = 1)	-0.5537***	-0.5435***		
	[0.2011]	[0.2022]		
Per capita income (million VND)	-0.0288	-0.0406*	-0.0103	
	[0.0252]	[0.0243]	[0.0142]	
Receipt of international remittances	-0.6058*	-0.6020*	0.1462	
	[0.3633]	[0.3626]	[0.2321]	
Receipt of internal remittances	0.4124*	0.4179*	-0.23	
	[0.2177]	[0.2152]	[0.1441]	
Household involved in agricultural activities (yes = 1)	0.6223**	0.5335**	0.0268	
	[0.2534]	[0.2485]	[0.1739]	
Ratio of members involved in agricultural production to total household members	-0.0525		0.022	
	[0.3012]		[0.2706]	
Ratio of unskilled workers to total household members	0.126		-0.0184	
	[0.3676]		[0.2977]	
Ethnic minorities (yes = 1)	-0.7113***	-0.6177***	-0.1073	
	[0.2749]	[0.2336]	[0.2000]	
Household size	0.3200***	0.3053***	0.5408***	0.5376***
	[0.0457]	[0.0431]	[0.0442]	[0.0414]
Ratio of members younger than 16 to total household members	-3.7832***	-3.7498***	-3.8269***	-3.8170***
	[0.4598]	[0.4328]	[0.3466]	[0.3241]
Ratio of members older than 60 to total household members	-2.8967***	-2.9113***	-0.9504***	-0.9939***
	[0.5389]	[0.5168]	[0.3570]	[0.3523]
Ratio of female members to total household members	-1.3120***	-1.2700***	1.1137***	1.1032***
	[0.4052]	[0.3927]	[0.3004]	[0.2907]
Age of household head	0.0245***	0.0257***	0.0118*	0.0121**
	[0.0073]	[0.0066]	[0.0063]	[0.0060]
Gender of household head (male = 1, female = 0)	-0.0664		-0.004	
	[0.1951]		[0.1941]	
Head lives with spouse (yes = 1)	-0.0746		-0.4128*	-0.4218***
	[0.2450]		[0.2262]	[0.1627]
Head completed technical degree or post-secondary degrees	-0.3968	-0.5539**	-0.1683	
	[0.2883]	[0.2360]	[0.2253]	
Head's spouse completed technical degrees or post-secondary degrees	0.8121**	0.6959***	0.0582	
	[0.3195]	[0.2512]	[0.2595]	
Ratio of members with technical degrees to total household members	-0.5179		0.1513	
	[0.6802]		[0.5436]	
Ratio of members with post-secondary degrees to total household members	-0.4071		0.5876	
	[0.8533]		[0.6973]	
House area per capita (m2)	-0.0167*	-0.0154*	-0.0151**	-0.0147**
	[0.0096]	[0.0092]	[0.0072]	[0.0067]
House made of permanent materials	Omitted			

Explanatory variables	Households with work migration (yes = 1)		Households with non-work migration (yes = 1)	
	Model 1a	Model 2a	Model 1b	Model 2b
House made of semi-permanent materials	0.0307		0.1172	
	[0.1905]		[0.1595]	
House of temporary materials	0.0578		0.068	
	[0.2559]		[0.1999]	
Area of annual crop land per capita (thousand m2)	-0.2037**	-0.1918**	0.0527	
	[0.0841]	[0.0796]	[0.0338]	
Area of perennial crop land per capita (thousand m2)	0.0095		0.0299	
	[0.0429]		[0.0322]	
Forestry land per capita (thousand m2)	0.0583***	0.0600***	0.0328	
	[0.0216]	[0.0209]	[0.0201]	
Aquaculture water surface per capita (thousand m2)	-0.4079		0.0675	
	[0.2870]		[0.0992]	
Road to village (yes = 1)	-0.0824		0.1445	
	[0.2416]		[0.1814]	
Distance from village to nearest market (km)	0.0138		-0.0091	
	[0.0193]		[0.0117]	
Household in Red River Delta	Omitted			
Household in North East	0.2446		-0.0669	
	[0.2473]		[0.1892]	
Household in North West	-2.7590*	-2.7510**	-0.2998	
	[1.4406]	[1.3894]	[0.2985]	
Household in North Central Coast	0.6327***	0.5626***	-0.3865**	-0.2929*
	[0.2289]	[0.1820]	[0.1903]	[0.1660]
Household in South Central Coast	0.1375		-0.1572	
	[0.2562]		[0.1914]	
Household in Central Highlands	-0.6128		-0.5495**	-0.4662*
	[0.4879]		[0.2720]	[0.2457]
Household in North East South	-0.8441**	-0.8861***	0.0813	
	[0.3307]	[0.3003]	[0.1929]	
Household in Mekong River Delta	0.1286		-0.1342	
	[0.2384]		[0.1755]	
Household in urban areas	-0.6107***	-0.6583***	-0.0583	
	[0.2254]	[0.2184]	[0.1482]	
Constant	-3.6128***	-3.6164***	-3.9384***	-3.9728***
	[0.6452]	[0.5062]	[0.5325]	[0.4179]
Observations	4216	4216	4216	4216
R-squared	0.16	0.16	0.16	0.16

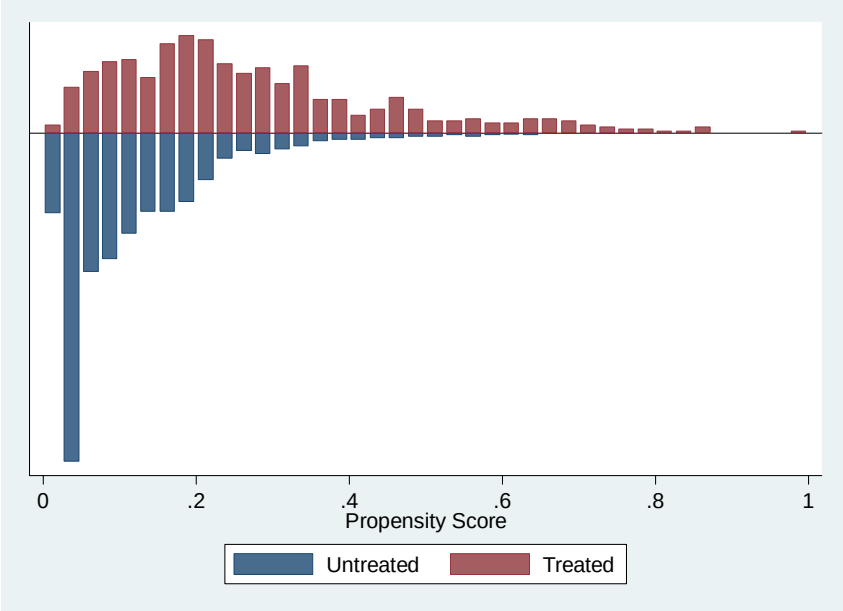
* significant at 10%; ** significant at 5%; *** significant at 1%.
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and cluster correlation.
Source: Authors' estimation from VHLSSs 2004-2006.

Figure A1: Predicted propensity score of households with and without work migration (Model 2a)



Source: Authors' estimation from VHLSSs 2004-2006.

Figure A2: Predicted propensity score of households with and without non-work migration (Model 2b)



Source: Authors' estimation from VHLSSs 2004-2006.

Table A3: Testing balance of the conditioning variables for households with work migrants: 1 nearest neighbor matching (Model 2a)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration2	Unmatched	0.1593	0.1431	4.5		0.77	0.444
	Matched	0.1593	0.1525	1.9	58.3	0.23	0.821
dforemit04	Unmatched	0.0271	0.0607	-16.4		-2.37	0.018
	Matched	0.0271	0.0271	0.0	100.0	0.00	1.000
ddoremit04	Unmatched	0.8983	0.8452	15.9		2.46	0.014
	Matched	0.8983	0.9288	-9.1	42.6	-1.32	0.188
incomepc04	Unmatched	4954.2	5820.2	-19.1		-2.67	0.008
	Matched	4954.2	4917.0	0.8	95.7	0.14	0.892
living04	Unmatched	13.2	15.8	-27.0		-3.74	0.000
	Matched	13.2	12.6	5.5	79.7	0.88	0.381
dagri04	Unmatched	0.8780	0.7819	25.8		3.90	0.000
	Matched	0.8780	0.9017	-6.4	75.3	-0.92	0.358
ethnic04	Unmatched	0.0983	0.1597	-18.4		-2.81	0.005
	Matched	0.0983	0.1017	-1.0	94.5	-0.14	0.891
hhsize04	Unmatched	4.9797	4.3532	38.0		6.07	0.000
	Matched	4.9797	5.0271	-2.9	92.4	-0.30	0.761
pchild04	Unmatched	0.1577	0.2518	-47.6		-7.29	0.000
	Matched	0.1577	0.1630	-2.7	94.3	-0.36	0.717
pelderly04	Unmatched	0.0709	0.1247	-26.4		-3.63	0.000
	Matched	0.0709	0.0831	-6.0	77.4	-0.92	0.356
pfemale04	Unmatched	0.4582	0.5158	-30.5		-4.90	0.000
	Matched	0.4582	0.4710	-6.8	77.7	-0.90	0.370
agehead04	Unmatched	51.7	48.8	23.3		3.46	0.001
	Matched	51.7	51.9	-1.6	93.2	-0.21	0.832
hhedu04	Unmatched	0.1051	0.1421	-11.2		-1.77	0.077
	Matched	0.1051	0.0780	8.2	26.6	1.14	0.254
hsedu04	Unmatched	0.1017	0.0809	7.2		1.26	0.209
	Matched	0.1017	0.0780	8.2	-13.8	1.01	0.314
anualand04	Unmatched	0.5906	0.7631	-14.3		-1.93	0.054
	Matched	0.5906	0.5036	7.2	49.6	1.55	0.122
forland04	Unmatched	0.3691	0.2323	6.5		1.10	0.269
	Matched	0.3691	0.2339	6.4	1.2	0.84	0.403
region3	Unmatched	0.0034	0.0487	-28.7		-3.61	0.000
	Matched	0.0034	0.0102	-4.3	85.0	-1.00	0.316
region4	Unmatched	0.2000	0.1109	24.7		4.60	0.000
	Matched	0.2000	0.2068	-1.9	92.4	-0.20	0.838
region7	Unmatched	0.0509	0.1270	-27.0		-3.86	0.000
	Matched	0.0509	0.0441	2.4	91.1	0.39	0.699
urban0404	Unmatched	0.1492	0.2400	-23.1		-3.56	0.000
	Matched	0.1492	0.1220	6.9	70.1	0.96	0.337

Source: Authors' estimation from VHLSSs 2004-2006.

Table A4: Testing balance of the conditioning variables for households with work migrants: 5 nearest neighbors matching (Model 2a)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration2	Unmatched	0.1593	0.1431	4.5		0.77	0.444
	Matched	0.1593	0.1742	-4.2	8.2	-0.48	0.628
dforemit04	Unmatched	0.0271	0.0607	-16.4		-2.37	0.018
	Matched	0.0271	0.0285	-0.7	96.0	-0.10	0.920
ddoremit04	Unmatched	0.8983	0.8452	15.9		2.46	0.014
	Matched	0.8983	0.9085	-3.0	80.9	-0.42	0.677
incomepc04	Unmatched	4954.2	5820.2	-19.1		-2.67	0.008
	Matched	4954.2	4993.5	-0.9	95.5	-0.14	0.885
living04	Unmatched	13.2	15.8	-27.0		-3.74	0.000
	Matched	13.2	12.8	4.0	85.3	0.66	0.510
dagri04	Unmatched	0.8780	0.7819	25.8		3.90	0.000
	Matched	0.8780	0.8922	-3.8	85.2	-0.54	0.589
ethnic04	Unmatched	0.0983	0.1597	-18.4		-2.81	0.005
	Matched	0.0983	0.1146	-4.9	73.5	-0.64	0.523
hhsize04	Unmatched	4.9797	4.3532	38.0		6.07	0.000
	Matched	4.9797	5.0102	-1.9	95.1	-0.21	0.837
pchild04	Unmatched	0.1577	0.2518	-47.6		-7.29	0.000
	Matched	0.1577	0.1545	1.6	96.7	0.21	0.830
pelderly04	Unmatched	0.0709	0.1247	-26.4		-3.63	0.000
	Matched	0.0709	0.0746	-1.8	93.1	-0.30	0.765
pfemale04	Unmatched	0.4582	0.5158	-30.5		-4.90	0.000
	Matched	0.4582	0.4559	1.2	96.0	0.16	0.873
agehead04	Unmatched	51.7	48.8	23.3		3.46	0.001
	Matched	51.7	51.9	-1.0	95.7	-0.14	0.888
hhedu04	Unmatched	0.1051	0.1421	-11.2		-1.77	0.077
	Matched	0.1051	0.0936	3.5	68.8	0.47	0.641
hsedu04	Unmatched	0.1017	0.0809	7.2		1.26	0.209
	Matched	0.1017	0.0983	1.2	83.7	0.14	0.891
anualand04	Unmatched	0.5906	0.7631	-14.3		-1.93	0.054
	Matched	0.5906	0.5890	0.1	99.1	0.02	0.981
forland04	Unmatched	0.3691	0.2323	6.5		1.10	0.269
	Matched	0.3691	0.4877	-5.6	13.2	-0.45	0.652
region3	Unmatched	0.0034	0.0487	-28.7		-3.61	0.000
	Matched	0.0034	0.0088	-3.4	88.0	-0.84	0.399
region4	Unmatched	0.2000	0.1109	24.7		4.60	0.000
	Matched	0.2000	0.1803	5.5	77.9	0.61	0.544
region7	Unmatched	0.0509	0.1270	-27.0		-3.86	0.000
	Matched	0.0509	0.0549	-1.4	94.7	-0.22	0.826
urban0404	Unmatched	0.1492	0.2400	-23.1		-3.56	0.000
	Matched	0.1492	0.1451	1.0	95.5	0.14	0.889

Source: Authors' estimation from VHLSSs 2004-2006.

Table A5: Testing balance of the conditioning variables for households with work migrants: kernel matching with bandwidth of 0.05 (Model 2a)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration2	Unmatched	0.1593	0.1431	4.5		0.77	0.444
	Matched	0.1593	0.1612	-0.5	88.3	-0.06	0.950
dforemit04	Unmatched	0.0271	0.0607	-16.4		-2.37	0.018
	Matched	0.0271	0.0308	-1.8	89.2	-0.26	0.793
ddoremit04	Unmatched	0.8983	0.8452	15.9		2.46	0.014
	Matched	0.8983	0.8952	0.9	94.2	0.12	0.902
incomepc04	Unmatched	4954.2	5820.2	-19.1		-2.67	0.008
	Matched	4954.2	5007.5	-1.2	93.8	-0.19	0.851
living04	Unmatched	13.2	15.8	-27.0		-3.74	0.000
	Matched	13.2	13.5	-3.0	89.0	-0.46	0.645
dagri04	Unmatched	0.8780	0.7819	25.8		3.90	0.000
	Matched	0.8780	0.8862	-2.2	91.4	-0.31	0.757
ethnic04	Unmatched	0.0983	0.1597	-18.4		-2.81	0.005
	Matched	0.10	0.12	-5.1	72.3	-0.67	0.505
hhsize04	Unmatched	4.9797	4.3532	38.0		6.07	0.000
	Matched	4.9797	4.9483	1.9	95.0	0.22	0.828
pchild04	Unmatched	0.1577	0.2518	-47.6		-7.29	0.000
	Matched	0.1577	0.1670	-4.7	90.1	-0.62	0.534
pelderly04	Unmatched	0.0709	0.1247	-26.4		-3.63	0.000
	Matched	0.0709	0.0735	-1.3	95.2	-0.21	0.834
pfemale04	Unmatched	0.4582	0.5158	-30.5		-4.90	0.000
	Matched	0.4582	0.4654	-3.9	87.4	-0.50	0.620
agehead04	Unmatched	51.7	48.8	23.3		3.46	0.001
	Matched	51.7	51.3	3.5	85.1	0.47	0.641
hhedu04	Unmatched	0.1051	0.1421	-11.2		-1.77	0.077
	Matched	0.1051	0.1027	0.7	93.6	0.09	0.925
hsedu04	Unmatched	0.1017	0.0809	7.2		1.26	0.209
	Matched	0.1017	0.0933	2.9	59.7	0.34	0.732
anualand04	Unmatched	0.5906	0.7631	-14.3		-1.93	0.054
	Matched	0.5906	0.6324	-3.5	75.8	-0.60	0.550
forland04	Unmatched	0.3691	0.2323	6.5		1.10	0.269
	Matched	0.3691	0.3944	-1.2	81.5	-0.11	0.913
region3	Unmatched	0.0034	0.0487	-28.7		-3.61	0.000
	Matched	0.0034	0.0108	-4.7	83.7	-1.07	0.286
region4	Unmatched	0.2000	0.1109	24.7		4.60	0.000
	Matched	0.2000	0.1854	4.1	83.5	0.45	0.653
region7	Unmatched	0.0509	0.1270	-27.0		-3.86	0.000
	Matched	0.0509	0.0529	-0.7	97.3	-0.11	0.910
urban0404	Unmatched	0.1492	0.2400	-23.1		-3.56	0.000
	Matched	0.1492	0.1402	2.3	90.2	0.31	0.759

Source: Authors' estimation from VHLSSs 2004-2006.

Table A6: Testing balance of the conditioning variables for households with work migrants: local linear regression matching with bandwidth of 0.05 (Model 2a)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration2	Unmatched	0.1593	0.1431	4.5		0.77	0.444
	Matched	0.1593	0.1525	1.9	58.3	0.23	0.821
dforemit04	Unmatched	0.0271	0.0607	-16.4		-2.37	0.018
	Matched	0.0271	0.0271	0.0	100.0	0.00	1.000
ddoremit04	Unmatched	0.8983	0.8452	15.9		2.46	0.014
	Matched	0.8983	0.9288	-9.1	42.6	-1.32	0.188
incomepc04	Unmatched	4954.2	5820.2	-19.1		-2.67	0.008
	Matched	4954.2	4917.0	0.8	95.7	0.14	0.892
living04	Unmatched	13.2	15.8	-27.0		-3.74	0.000
	Matched	13.2	12.6	5.5	79.7	0.88	0.381
dagri04	Unmatched	0.8780	0.7819	25.8		3.90	0.000
	Matched	0.8780	0.9017	-6.4	75.3	-0.92	0.358
ethnic04	Unmatched	0.0983	0.1597	-18.4		-2.81	0.005
	Matched	0.10	0.1017	-1.0	94.5	-0.14	0.891
hhsize04	Unmatched	4.9797	4.3532	38.0		6.07	0.000
	Matched	4.9797	5.0271	-2.9	92.4	-0.30	0.761
pchild04	Unmatched	0.1577	0.2518	-47.6		-7.29	0.000
	Matched	0.1577	0.1630	-2.7	94.3	-0.36	0.717
pelderly04	Unmatched	0.0709	0.1247	-26.4		-3.63	0.000
	Matched	0.0709	0.0831	-6.0	77.4	-0.92	0.356
pfemale04	Unmatched	0.4582	0.5158	-30.5		-4.90	0.000
	Matched	0.4582	0.4710	-6.8	77.7	-0.90	0.370
agehead04	Unmatched	51.7	48.8	23.3		3.46	0.001
	Matched	51.7	51.9	-1.6	93.2	-0.21	0.832
hhedu04	Unmatched	0.1051	0.1421	-11.2		-1.77	0.077
	Matched	0.1051	0.0780	8.2	26.6	1.14	0.254
hsedu04	Unmatched	0.1017	0.0809	7.2		1.26	0.209
	Matched	0.1017	0.0780	8.2	-13.8	1.01	0.314
anualand04	Unmatched	0.5906	0.7631	-14.3		-1.93	0.054
	Matched	0.5906	0.5036	7.2	49.6	1.55	0.122
forland04	Unmatched	0.3691	0.2323	6.5		1.10	0.269
	Matched	0.3691	0.2339	6.4	1.2	0.84	0.403
region3	Unmatched	0.0034	0.0487	-28.7		-3.61	0.000
	Matched	0.0034	0.0102	-4.3	85.0	-1.00	0.316
region4	Unmatched	0.2000	0.1109	24.7		4.60	0.000
	Matched	0.2000	0.2068	-1.9	92.4	-0.20	0.838
region7	Unmatched	0.0509	0.1270	-27.0		-3.86	0.000
	Matched	0.0509	0.0441	2.4	91.1	0.39	0.699
urban0404	Unmatched	0.1492	0.2400	-23.1		-3.56	0.000
	Matched	0.1492	0.1220	6.9	70.1	0.96	0.337

Source: Authors' estimation from VHLSSs 2004-2006.

Table A7: Testing balance of the conditioning variables for households with non-work migrants: 1 nearest neighbor matching (Model 2b)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration	Unmatched	0.0773	0.0687	3.3		0.77	0.444
	Matched	0.0773	0.0822	-1.9	42.4	-0.32	0.751
hhsize04	Unmatched	5.5197	4.2079	72.2		18.10	0.000
	Matched	5.5197	5.3553	9.1	87.5	1.44	0.150
pchild04	Unmatched	0.1803	0.2561	-38.5		-8.10	0.000
	Matched	0.1803	0.1565	12.0	68.7	2.40	0.017
pelderly04	Unmatched	0.10	0.12	-11.8		-2.38	0.017
	Matched	0.10	0.09	1.9	83.8	0.44	0.661
pfemale04	Unmatched	0.53	0.51	10.9		2.37	0.018
	Matched	0.5291	0.5275	0.8	92.4	0.15	0.882
agehead04	Unmatched	53.0	48.4	35.3		7.66	0.000
	Matched	53.0	53.1	-0.8	97.7	-0.15	0.880
married04	Unmatched	0.7829	0.8176	-8.7		-2.03	0.042
	Matched	0.7829	0.7944	-2.9	66.9	-0.49	0.623
living04	Unmatched	13.0	16.0	-29.4		-5.95	0.000
	Matched	13.0	13.8	-7.6	74.3	-1.62	0.106
region4	Unmatched	0.0905	0.1217	-10.1		-2.21	0.027
	Matched	0.0905	0.0872	1.1	89.5	0.20	0.840
region6	Unmatched	0.0576	0.0624	-2.0		-0.45	0.649
	Matched	0.0576	0.0395	7.6	-277.3	1.47	0.142

Source: Authors' estimation from VHLSSs 2004-2006.

Table A8: Testing balance of the conditioning variables for households with non-work migrants: 5 nearest neighbor matching (Model 2b)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration	Unmatched	0.0773	0.0687	3.3		0.77	0.444
	Matched	0.0773	0.0799	-1.0	69.3	-0.17	0.865
hhsize04	Unmatched	5.5197	4.2079	72.2		18.10	0.000
	Matched	5.5197	5.4036	6.4	91.1	1.02	0.306
pchild04	Unmatched	0.1803	0.2561	-38.5		-8.10	0.000
	Matched	0.1803	0.1665	7.0	81.8	1.39	0.163
pelderly04	Unmatched	0.0990	0.1247	-11.8		-2.38	0.017
	Matched	0.0990	0.0962	1.3	89.2	0.29	0.769
pfemale04	Unmatched	0.5291	0.5088	10.9		2.37	0.018
	Matched	0.5291	0.5275	0.8	92.4	0.15	0.879
agehead04	Unmatched	53.0	48.4	35.3		7.66	0.000
	Matched	53.0	53.4	-3.3	90.7	-0.61	0.544
married04	Unmatched	0.7829	0.8176	-8.7		-2.03	0.042
	Matched	0.7829	0.7829	0.0	100.0	0.00	1.000
living04	Unmatched	13.0	16.0	-29.4		-5.95	0.000
	Matched	13.0	13.3	-3.1	89.3	-0.68	0.497
region4	Unmatched	0.0905	0.1217	-10.1		-2.21	0.027
	Matched	0.0905	0.0901	0.1	98.9	0.02	0.984
region6	Unmatched	0.0576	0.0624	-2.0		-0.45	0.649
	Matched	0.0576	0.0510	2.8	-37.2	0.51	0.613

Source: Authors' estimation from VHLSSs 2004-2006.

Table A9: Testing balance of the conditioning variables for households with non-work migrants: kernel matching with bandwidth of 0.05 (Model 2b)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration	Unmatched	0.0773	0.0687	3.3		0.77	0.444
	Matched	0.0773	0.0815	-1.6	51.6	-0.27	0.789
hhsize04	Unmatched	5.5197	4.2079	72.2		18.10	0.000
	Matched	5.5197	5.3886	7.2	90.0	1.14	0.254
pchild04	Unmatched	0.1803	0.2561	-38.5		-8.10	0.000
	Matched	0.1803	0.1753	2.5	93.4	0.50	0.620
pelderly04	Unmatched	0.0990	0.1247	-11.8		-2.38	0.017
	Matched	0.0990	0.0983	0.3	97.1	0.08	0.939
pfemale04	Unmatched	0.5291	0.5088	10.9		2.37	0.018
	Matched	0.5291	0.5319	-1.5	86.2	-0.27	0.784
agehead04	Unmatched	53.0	48.4	35.3		7.66	0.000
	Matched	53.0	53.1	-1.1	96.8	-0.21	0.834
married04	Unmatched	0.7829	0.8176	-8.7		-2.03	0.042
	Matched	0.7829	0.7759	1.7	80.0	0.29	0.770
living04	Unmatched	13.0	16.0	-29.4		-5.95	0.000
	Matched	13.0	13.3	-2.4	91.8	-0.53	0.599
region4	Unmatched	0.0905	0.1217	-10.1		-2.21	0.027
	Matched	0.0905	0.0866	1.3	87.6	0.24	0.812
region6	Unmatched	0.0576	0.0624	-2.0		-0.45	0.649
	Matched	0.0576	0.0515	2.5	-25.7	0.46	0.644

Source: Authors' estimation from VHLSSs 2004-2006.

Table A10: Testing balance of the conditioning variables for households with non-work migrants: local linear regression with bandwidth of 0.05 (Model 2b)

Variable	Sample	Treated	Control	% bias	% bias reduction	T-statistic	P-value
migration	Unmatched	0.0773	0.0687	3.3		0.77	0.444
	Matched	0.0773	0.0822	-1.9	42.4	-0.32	0.751
hhsize04	Unmatched	5.5197	4.2079	72.2		18.10	0.000
	Matched	5.5197	5.3553	9.1	87.5	1.44	0.150
pchild04	Unmatched	0.1803	0.2561	-38.5		-8.10	0.000
	Matched	0.1803	0.1565	12.0	68.7	2.40	0.017
pelderly04	Unmatched	0.0990	0.1247	-11.8		-2.38	0.017
	Matched	0.0990	0.0949	1.9	83.8	0.44	0.661
pfemale04	Unmatched	0.5291	0.5088	10.9		2.37	0.018
	Matched	0.5291	0.5275	0.8	92.4	0.15	0.882
agehead04	Unmatched	53.0	48.4	35.3		7.66	0.000
	Matched	53.0	53.1	-0.8	97.7	-0.15	0.880
married04	Unmatched	0.7829	0.8176	-8.7		-2.03	0.042
	Matched	0.7829	0.7944	-2.9	66.9	-0.49	0.623
living04	Unmatched	13.0	16.0	-29.4		-5.95	0.000
	Matched	13.0	13.8	-7.6	74.3	-1.62	0.106
region4	Unmatched	0.0905	0.1217	-10.1		-2.21	0.027
	Matched	0.0905	0.0872	1.1	89.5	0.20	0.840
region6	Unmatched	0.0576	0.0624	-2.0		-0.45	0.649
	Matched	0.0576	0.0395	7.6	-277.3	1.47	0.142

Source: Authors' estimation from VHLSSs 2004-2006.

Table A11: Impacts of work migration on household welfare in 2006

	Impact of work migration (Propensity score estimated from Model 2)			Impact of non-work migration (Propensity score estimated from Model 4		
	1 nearest neighbor matching	5 nearest neighbors matching	Local linear regression matching with bandwidth of 0.05	1 nearest neighbor matching	5 nearest neighbors matching	Local linear regression matching with bandwidth of 0.05
Ratio of members engaged in productive activities to the total household members older than 14 years old (%)	1.0	0.2	-0.9	1.7	1.5	1.6
	[2.4]	[1.9]	[1.6]	[1.9]	[1.6]	[1.4]
Annual working hours per capita	30.8	5.9	-8.4	46.1	43.2	47.4
	[53.1]	[40.0]	[31.7]	[44.1]	[34.5]	[29.3]
Annual working hours per working member	92.1	41.2	27.3	115.1*	118.1**	121.5***
	[76.9]	[60.7]	[49.4]	[61.8]	[48.0]	[42.2]
Per capita internal remittances	548.3***	344.5***	340.6***	388.4***	387.8***	390.8***
	[143.6]	[108.4]	[95.3]	[110.5]	[95.6]	[85.5]
Per capita international remittances	668.5*	721.7*	683.1*	-38.9	-34.0	-23.6
	[392.7]	[380.9]	[379.4]	[186.2]	[134.1]	[100.7]
Per capita remittances (both international and internal)	1216.8***	1066.2***	1023.7***	349.4*	353.7***	367.1***
	[426.5]	[405.2]	[401.1]	[211.9]	[160.0]	[128.5]
Per capita income (Household income divided by household size)	1136.0**	1005.1**	885.2**	211.7	213.2	262.7
	[548.6]	[476.5]	[420.4]	[395.8]	[292.2]	[246.8]
Household income divided by the number of working members (above 14 years old)	2756.4*	2569.8*	2746.1**	289.3	305.8	402.6
	[1519.9]	[1439.3]	[1389.4]	[898.0]	[664.3]	[558.8]
Household income excluding remittances divided by the number of working members (above 14 years old)	-342.6	-194.8	-153.1	-201.3	-176.0	-127.2
	[674.1]	[483.3]	[348.7]	[698.6]	[542.3]	[479.7]
Ratio of non-farm income to total income (%)	0.9	0.0	-0.2	-1.7	-1.6	-1.4
	[2.3]	[1.8]	[1.5]	[1.6]	[1.3]	[1.1]
Ratio of non-farm income (excluding remittances) to total income (%)	-6.0***	-7.0***	-6.8***	-3.3*	-3.3**	-3.0***
	[2.7]	[2.2]	[1.9]	[1.7]	[1.4]	[1.2]
Simpson index 1 (all income sources)	0.0415**	0.0218	0.0130	0.0062	0.0062	0.0062
	[0.0202]	[0.0154]	[0.0115]	[0.0146]	[0.0113]	[0.0094]
Simpson index 2 (income sources excluding remittances)	-0.0139	-0.0166	-0.0282**	-0.0174	-0.0171	-0.0177*
	[0.0203]	[0.0161]	[0.0125]	[0.0156]	[0.0120]	[0.0100]
Per capita consumption expenditure	257.0	259.9*	311.8**	511.1**	522.2***	530.8***
	[220.0]	[160.2]	[116.4]	[220.0]	[173.3]	[151.7]
Difference between impact on per capita income and impact on per capita expenditure	878.9*	745.2*	573.4	-299.4	-309.0	-268.1
	[494.3]	[439.6]	[394.8]	[335.7]	[242.9]	[194.9]
Difference between impact on per capita income and impact on total remittances per capita	-80.8	-61.1	-138.5	-137.8	-140.6	-104.4
	[359.3]	[268.2]	[188.7]	[341.3]	[262.4]	[222.1]

Note: Because of limited space, this Table reports only the difference-in-differences estimates (similar to the figures in the last column of Table 3). For the observed outcomes of the treated group, see Table 3.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Figures in brackets are standard errors. Standard errors are corrected for sampling weights and estimated using bootstrap (non-parametric) with 500 replications.
Source: Authors' estimation from panel data of VHLSSs 2004 and 2006.

Table A12: Impacts of work migration on poverty and inequality in 2006

	Impact of work migration (Propensity score estimated from Model 2)			Impact of non-work migration (Propensity score estimated from Model 4)		
	1 nearest neighbor matching	5 nearest neighbors matching	Local linear regression matching with bandwidth of 0.05	1 nearest neighbor matching	5 nearest neighbors matching	Local linear regression matching with bandwidth of 0.05
Poverty of households with migration						
P0 (%)	-3.6	-3.4	-3.3	-9.0**	-9.1***	-9.3***
	[4.1]	[3.1]	[2.5]	[4.3]	[3.6]	[3.2]
P1	-0.0168	-0.0162*	-0.0161**	-0.0412**	-0.0415**	-0.0421**
	[0.0147]	[0.0085]	[0.0074]	[0.0215]	[0.0173]	[0.0152]
P2	-0.0088	-0.0083*	-0.0082*	-0.0238**	-0.0237**	-0.0240**
	[0.0085]	[0.0045]	[0.0044]	[0.0143]	[0.0113]	[0.0100]
All poverty						
P0 (%)	-0.2	-0.2	-0.2	-1.2**	-1.3**	-1.3***
	[0.3]	[0.2]	[0.2]	[0.6]	[0.5]	[0.4]
P1	-0.0010	-0.0010*	-0.0010**	-0.0056*	-0.0057**	-0.0058**
	[0.0009]	[0.0006]	[0.0004]	[0.0030]	[0.0024]	[0.0021]
P2	-0.0005	-0.0005	-0.0005	-0.0033*	-0.0033**	-0.0033**
	[0.0005]	[0.0004]	[0.0003]	[0.0020]	[0.0016]	[0.0014]
All inequality						
Gini	-0.0013	-0.0013*	-0.0013**	-0.0045**	-0.0046***	-0.0047***
	[0.0011]	[0.0007]	[0.0005]	[0.0022]	[0.0018]	[0.0016]
Theil L	-0.0017	-0.0017*	-0.0018**	-0.0073*	-0.0073**	-0.0074***
	[0.0015]	[0.0011]	[0.0009]	[0.0041]	[0.0032]	[0.0029]
Theil T	-0.0016	-0.0016*	-0.0016**	-0.0056**	-0.0056**	-0.0057***
	[0.0013]	[0.0009]	[0.0007]	[0.0028]	[0.0022]	[0.0019]

Appendix 2. Simpson index

Simpson's diversity index (also known as Species diversity index) is an index which is often used to measure the biodiversity of a habitat in ecology. It takes into account the number of species present, as well as the relative abundance of each species. In economics, it can be widely used to measure the income diversification. It takes into account both the number of source and the relative amounts of sources. In this chapter, the Simpson index (SI) of income diversity is defined as:

$$SI = 1 - \sum_{i=1}^{k} R_i^2 \qquad \text{(A.1)}$$

where R_i is the ratio of income from source i to the total income, and k is the number of all possible income sources. SI is calculated for all households in the sample data. SI varies between 0 and $(1 - 1/k)$, and larger SI means more income diversification. SI will be equal to 0 if there is only one source of income. On the contrary, SI will be highest at $(1 - 1/k)$ if there are k equal sources of income. In this chapter, k is equal to 7, thus SI will be from 0 to 0.857.[2]

[2] Other diversity indexes can be Shannon-Weaver Index and Herfindahl index. Discussion and application can be found in several studies such as Barrett et al. (2000), Barrett and Reardon (2000), Joshi et al. (2003), Minot et al. (2006).