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Migration, Agricultural Production and Diversification: A case study from Vietnam

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Abstract

The New Economics of Labor Migration (NELM) hypothesizes that migration is a strategy to reduce risks and financial liquidity constraints of rural households. This paper tests this hypothesis for the case of Vietnam. The impacts of migration on agricultural production and diversification are estimated in fixed effects regression models based on a panel data set of about 2,000 households in Vietnam. The findings suggest that rural households who receive remittances from their migrants reduce the share of their income from rice, increase their land productivity and become more specialized in labor allocation. However, migration also decreases labor productivity and crop diversification of rural households. Overall, the NELM hypothesis is only supported in cases migrant households receive remittances.

Keywords: Migration, Remittances, Agricultural Productivity, Diversification, Vietnam
JEL codes: *J62, D13, O13, Q12*

1. Introduction

As a consequence of the economic development process, rural to urban migration tends to commonly occur in developing countries. The effect of this trend on rural development is quite complex (de Brauw, 2007). On the one hand, migration is considered as a coping strategy to risks (Stark and Bloom, 1985). It supports income and expenditure of origin households, and alleviates poverty in rural areas (Nguyen et al., 2013; Amare, 2012, Taylor et al., 2003). On the other hand, migration may also have effects on agricultural production patterns of households depending on the broader agro-ecological, economic, and institutional context in rural regions (Lipton, 1980; Lucas, 2007). Although rural outmigration tends to reduce the pressure on agricultural labor, this could not reduce agricultural incomes because the loss of household labor may be, and often is, compensated by improvements in other factors, such as an increased access to capital due to remittances. However, in the context of missing or imperfect rural markets, such as labor, credit and insurance markets, migration becomes an important factor to overcome these imperfections affecting rural households' decisions on agricultural production, investment and labor allocation (Rozelle et al., 1999; Taylor et al., 2003). Moreover, migrants mainly come from relatively poor rural areas with fewer job opportunities although they may not be the poorest people in those places (Nguyen et al., 2013). Instead, migrants often are the more educated ones. Their outmigration results in brain drain in general but also in falling agricultural production (Connell, 1987).

Vietnam is an interesting place to study the relationship between migration and agricultural production. Although Vietnam's economy has grown rapidly since the late 1980s, agriculture is still an important part in its economic structure. It creates the largest number of jobs, and is a main income source for about 70 percent of its population (GSO, 2011a). However, agricultural production is challenged by several pressures, such as climate change, price volatility, and the outmigration of agricultural labor. The motivation of people moving to urban regions derives from the labor surplus and low productivity in the rural sector. About 50 percent of Vietnam's total labor force (population in working age) work in the agricultural sector, but produce only 20 percent of its Gross Domestic Product (GSO, 2011a). Moreover, the widening gap of living conditions between rural and urban areas "pull" rural residents to urban areas which are expected to provide better jobs and better education and public services. As a result, the rural to urban migration trend has strongly increased in the last decades. In contrast, rural market institutions are still underdeveloped in Vietnam. Farm households primarily depend on their own labor, and the land market is still controlled by the government. Also the credit and insurance markets are still lacking behind (van de Walle and Cratty, 2004; Deininger and Jin, 2008). Migration, therefore, has become a livelihood

strategy to solve these problems. These in turn affect household decisions on their labor force allocation and production portfolio.

The objective of this paper is to assess the effects of migration on agricultural production and labor allocation of rural households in Vietnam. It tests the hypothesis of the New Economics of Labor Migration (NELM) stating that migration is a strategy to cope with risks. Specifically, the paper explores the potential impact of rural-urban migration on land and labor productivity, agricultural diversification and labor diversification based on a panel data set from 2007-2010. The results of this paper are expected to provide evidence on how to improve the efficiency of agricultural production and contribute to rural development against the background of increasing rural outmigration.

The remainder of this paper is structured as follows: Section 2 summarizes the literature on migration, agricultural production and diversification. Section 3 introduces the data and research methodology. The results and their discussions are presented in Section 4, followed by Section 5, the conclusion.

2. Literature Review

Damon (2010), Rozelle et al. (1999) and Taylor et al. (2003) found that migration can be motivated by three reasons: (1) remittances are sent to enable households to invest; (2) remittances help to overcome credit constraints; and (3) they substitute for missing insurance markets.

The first motivation considers migration as an investment activity of rural households. The family expects to receive remittances in the future as a return on their initial investment cost. This cost includes both, the household's financial contribution to migration and the loss of household labor. Are remittances being transferred after migration, the households are enabled to invest into different farm and non-farm activities.

The second and third motivations are based on the theory of the NELM (Stark and Bloom, 1985). It hypothesizes that remittances play a role as financial intermediaries, enabling rural households to overcome credit constraints and risks to achieve the transition from small-scale to commercial production. It is assumed that a household face a binding credit constraint in cases of missing or incomplete credit markets. Migration can help a household relieve these constraints through remittances. Consequently, it is expected that there is an increasing investment in agricultural assets, agricultural technology, and agricultural commercialization activities. Migration and remittances are also considered as informal insurance mechanisms between the migrants and their rural households (Gubert, 2000 and Damon, 2010). Therefore, it provides a safety net for farm households to cope with the volatility of agricultural prices and production, and induce a modification in the agricultural production patterns.

These arguments are illustrated in Figure 1. Assume a household with two possible production activities, namely a high-return and a low-return activity. A household may invest fixed resources T (i.e. land or family labor) in either these activities. Let Qi for i=1,0 denote output of the two production activities. AA represents the production possibility frontier (PPF). At the relative price (p1/p0), the household specializes in the high-return activity Q1 and its output will be Q* = f(T,Z) with Z being a vector of household characteristics that shape the returns from investing in each activity.

Assume now that the household faces constraints on investing in the high-return activity, such that $c(.) \leq T1$, where c(.) denotes the barriers that limit the household to invest only T1 (T1<T) of fixed resources in the high-return activity. In case of credit or liquidity constraints, c(.) represents the sunk cost of adopting the high-return activity, and T1 denotes household's available credit and liquidity for investing in this activity. In case of facing risks, c(.) would be a measure of these (e.g., output variance) and T1 would be the maximum level of risk that a household would be willing to take in the high-return activity.

(Insert Figure 1)

The NELM theory hypothesizes that $c(.)= \theta(M,R)$. The constrained resource allocation to the high-return activity is $T1c = \varphi c(.)$, where $\varphi c>0$. The constrained output under the high-return activity is Qc1 =f1(Tc1, Zy), and under the low-return activity, it is Qc0 =f0(T - Tc1, Zy). Constrained output, Qc, is given by

$$Q^C = Q_0^C + Q_1^C$$

where Qc < Q*, the unconstrained output.

Migration (M) and remittances (R) could contribute to production by relaxing the credit constraint through remittances or the implicit commitment to remit in case the household suffers an income loss. The potential effect of migration on these constraints, however, is not always positive. If rural households face a missing or imperfect labor and credit market, migration may further tighten the constraints on investing in a high-return activity since it increases the competition of scarce resources such as labor. In case these markets work well, the lack of migrant labor can be substituted by hired labor, if needed, and households can borrow money for buying production inputs. Then the effect of migration is minimal for production. It just helps rural households increase their total income. Therefore, the influences of migration on liquidity, risk and labor constraints are unknown, or $\theta(M)$ and $\theta(R)$ are ambiguous.

These motivations have been investigated in several empirical studies. Rozelle et al. (1999) and Taylor et al. (2003) explored the links between migration, remittances, and crop and self-employment incomes in rural China based on a three stage least squares model with cross-sectional data. The results supported the NELM hypothesis that remittances loosen constraints in production on imperfect markets which are prevalent in rural areas in developing countries. The authors found that migration has a negative impact on crop income but it does not affect crop yields, and remittances could partially compensate for the presumed lost labor effect. They also provided evidence that migration supports self-employment activities of rural households. The results are also confirmed by Li et al. (2013) who tested the relationship between migration, remittances and agricultural productivity in small farming systems in Northwest China. Also Taylor and Lopez-Feldman (2010) confirmed that rural households' access to U.S. migrant labor markets could increase income and raise land productivity in migrant-sending households in Mexico.

Wouterse (2010) distinguished between two types of migration in Burkina Faso: continental migration (migration in the continent) and intercontinental migration (migration to Europe). He found that only continental migration improved technical efficiency, due to shifted labor time of male adults away from cereal production. The intercontinental migration could not improve the efficiency because of the distortion of the gender balance in the household when the females become the prominent provider of labor in cereal production. In contrast, Mendola (2008) found that international migration resulted in increased investments in new agricultural technologies by rural migrant household, while internal migration did not. This has been explained by the fact that the migrant households involved in international migration are generally better off in comparison with those involved only in domestic migration.

Lucas (1987) examined the impact of temporary labor migration in Southern Africa to work in the mining sector. He found that temporary migration leads to diminished agricultural production in the short run, but it enhances both crop productivity and cattle accumulation through invested remittances in the long run.

Damon (2010) used panel data and a two stage least squares model with instrumental variables to measure the effect of migration and remittances on agricultural land use and asset accumulation in El Salvador. He found that migration and remittances cause a household to reallocate land away from commercial cash crops toward the production of subsistence food crops. These do not affect agricultural input use and may decrease the returns to land and labor.

McCarthy et al. (2009) explored the effect of migration on the re-allocation of resources in agriculture among migrant families in Albania. The authors argued that migration exerts a strong downward pressure on agricultural labor and crop diversification. However, the loss in household

labor in agriculture is compensated by increased access to capital, leading to overall improvements in both agricultural and total incomes.

Literature on the effect of migration on agriculture production in Viet Nam is still scarce. A recent estimation was conducted by Brennan et al. (2012) who ran a dynamic macro model, namely Vietnam's agricultural sector (VAST) programing model, to estimate the impact of migration on agriculture production. The results showed that under assumption of full employment, migration slightly increases meat production and decreases feed output. Producers in rural areas may be better off because any decrease in production is offset to some extent by an increase in prices.

A unique econometric approach evaluating the impact of migration on agricultural production in Vietnam is conducted by de Brauw (2007, 2010). The author used data from the Vietnam Living Standard Survey (VLSS) from the periods 1992-93 and 1997-98 and a two stage least squares model with instrumental variables to measure the impact of migration on agricultural production. The results revealed that migration does not change agricultural productivity, but it does modify cropping patterns from labor-intensive to land-intensive crops. However, his studies only refer to migration for employment, but not to migration for education or any other purposes such as marriage. Migration for employment often occurs together with remittance flows from these migrants to their original households. Consequently, the loss of labor due to migration could be compensated by remittances. Therefore its impact on labor allocation and production might be different to other types of migration, such as migration for education that often does not imply any remittances flows to rural households. Moreover, there is a concern that migration is not reflected accurately in the VLSS data set (Pincus and Sender, 2008). The temporary and unregistered migrants are excluded in this data set (GSO, 2011b, Dang et al., 2003).

This paper is motivated by these shortcomings of earlier research in this field. By using a different panel data set, we are able to separate migration into two types depending on the status of remittances transfer. In cases of migration with remittances transfers to rural households, it is assumed that the loss of household labor can be compensated by remittances. Households can also use remittances to overcome the constraints of risks on production. Therefore, agricultural production could be maintained or increased. On the other hand, in cases of migration without remittances transfers, rural households cannot reduce the constraints of credit and risks, so that decreased agricultural production is expected. However, both types of migration are expected to increase labor productivity.

3. Data and Methodology

3.1. Data

This paper uses a panel data set under the project 'Impact of shocks on vulnerability to poverty: Consequences for development of emerging Southeast Asian economies' (hereafter DFG FOR 756).[1] The household survey includes 2,200 households that were randomly selected from the three provinces DakLak, ThuaThien Hue, and Ha Tinh in Vietnam in 2007, 2008, and 2010. The survey collected a broad set of information regarding the socio-demographic and economic conditions of the sampled households with the composition of the income source portfolio, production activities, borrowing, lending and expenditure patterns, and the exposure to shocks and risks. Migration activities include information about the migration duration period, the place of destination, the reasons of migration and the remittances sent to and received from rural households. In this paper, migrants are defined as household members who migrate to urban areas for at least one month a year for any purposes. A similar definition has been used by de Brauw (2007, 2010) and de Brauw and Harigaya (2007) in their studies on seasonal migration, rural household welfare and agricultural production in Vietnam. However, they only focused on migration for employment, while our definition captures all types of migration including migration for employment, migration for education as well as for other purposes.

The questionnaire includes a detailed section on agricultural production. This information is collected for each crop that was cultivated by a household in one year. It covers cultivated land, production, the selling price, and cash cost for seeds or seedlings, hired labor, fertilizers, pesticides, insecticides, weeding, and the rental of machinery or service fees (mostly irrigation fee). The information on family labor is not directly taken from the questionnaire. Only information about household members who were engaged mainly or partly in agriculture is available. In this study, therefore, the family labor for crop production is estimated by detracting labor working days for other activities such as self-employment, off-farm employment, or else from the total labor working days.

3.2. Methodology

In this paper, we use fixed effects regression models. The village-level fixed effects help to deal with the potential selection bias and the bias of unobserved factors that may influence the migration and dependent variables (agriculture production and diversification outcomes). They adequately capture the inter-village differences, such as quality of land, education attributes, local infrastructural development, geo-environmental attributes, and other village-level factors. A main assumption of the method is that unobserved variables are correlated with both, the outcomes and

[1] See Hardeweg and Waibel (2009) for details on the data collection procedure.

migration status, and unchanged in the period 2007 – 2010, thus controlling for endogeneity problems (Duncan et al., 2004). We also tested instrumental variables such as the education level of the most educated household member, share of migrants in village population, number of current friends and relatives in urban areas, but the results turned out to be biased. We thus followed the suggestion by Nguyen and Mont (2012), Duncan et al., (2004) and Vartanian and Buck (2005) to exclude instrumental variables since invalid instruments can result in an even larger bias in impact estimates.

Additionally, similar to Damon (2010), we also use a lagged migration status variable, in which the migration status of rural households in 2007 explains outcomes of agricultural production only in 2008, and the migration status of rural households in 2008 explains outcomes in 2010. Specifically, the empirical model is specified as:

$$Y_{jit} = f(M_{i,t-1}, R_{i,t-1}, X_{it}) + e_{ijt} \quad (1)$$

$$Y_{jit} = \alpha_{ij} + \beta_1 M_{i,t-1} + \beta_2 R_{i,t-1} + \beta_3 X_{it} + \varepsilon_{ijt} \quad (2)$$

where Y_{jit} is the agricultural outcome j of household i in the time period t. Further, α_{ij} is the village-level fixed effects estimator; $M_{i,t-1}$ is the dummy variable referring to a migrant household without remittances transfer in the previous period ($M_{i,t-1}$ =1,0). Similarly, $R_{i,t-1}$ is the dummy variable referring to a migrant household, who received remittances transfer in the previous period ($R_{i,t-1}$ =1,0) in comparison to the non-migrant household ($M_{i,t-1}$ =0,0 and $R_{i,t-1}$ =0,0). X_{it} is a vector of household characteristic control variables including age of household head, number of years in school of household head, total household members, squared of total household members, share of total household members younger than 15 years, share of total household members older than 65 years, irrigated land as a share of totally owned land, household engaged in self-employed activities, household engaged in livestock activities and participating in political or social organizations. Finally, ε_{ijt} is an independently distributed error term.

+ Outcomes:

Two groups of outcomes are used in this study. The first group includes indicators directly related to crop production; those are share of rice income of total crop income, the growth of land productivity and labor productivity.

Vietnam primarily has a rice-based agricultural economy. Rice is cultivated on about 80 percent of the arable land and is the main income source of rural residents. Rice cultivation is considered as labor-intensive, so that migration affects rice production by creating a shortage of labor in rural areas. However, migration could also improve rice production technology through remittances and increased labor productivity.

Regarding the effect of migration on the efficiency of crop production, the indicators of the growth of land productivity and labor productivity are used. Land productivity is calculated as the ratio of crop income on total land used for crop production, and labor productivity is the ratio of crop income of total family working labor days for crop production activities (Fan and Chan-Kang, 2005). The growth of these ratios is calculated as the change between two years 2010 to 2008, and 2008 to 2007 (Butzer et al., 2002).

The second outcome group includes several diversification indicators. Empirically, several studies confirmed that rural households diversify their livelihoods to cope with risks (Dercon, 2002, Tongruksawattana et al., 2010). Among others, migration is considered as one of these strategies (Stark and Bloom, 1985). In this paper, we try to identify the effect of migration on rural household diversification through three diversification indicators including crop diversification, land diversification and labor diversification.

To measure diversification, the Simpson Index of Diversification (SID), as adopted by Minot et al. (2006), is used as follows:

$$SID = 1 - \sum P_i^2 \quad (3)$$

where Pi is the proportion of organisms that are classified in species i.

With respect to crop diversification, P_i is the proportion of income from crop i in total crop income, while in case of land diversification, it is the proportion of land used for cultivating crop i in total cultivated land of a household. The value of SID falls between 0 and 1. If a household grows only one crop, or has one land parcel, then $P_i = 1$ and SID = 0. As the number of those proportions increase, the shares (P_i) decline, as does the sum of squared shares, so that SID approaches 1. The larger SID means the more diversification.

Similarly with respect to the labor diversification index, P_i is measured as the proportion of number of laborers from production activity i in total laborers involved in all production activities of a household (Phung and Waibel, 2009). We estimate two labor diversification indexes: the first one includes the migrant members in the cities, and the second index excludes them.

Regarding the controlled independent variables, the household characteristics include a set of variables on demographical characteristics such as age of household head, education of household head, household size, and proportion of people below fifteen and older than sixty five years. The dummy variable of a household who participated in political or social organizations indicates the social capital of a household. The share of irrigated land is expected to support agricultural production, while households engaged in livestock activity and households engaged in non-farm activities can be considered as competitive activities to agricultural production.

4.Results and Discussion

This section presents first the descriptive and then the econometric results on the impacts of migration on household's agricultural production and diversification.

4.1. Descriptive analysis

Table 1 shows some descriptive statistical results of some indicators related to agricultural production and diversification of rural households in 2007, 2008 and 2010. The total income from crop production reached its highest level in 2008, the year of the food crisis, and then it decreased. In contrast, the share of income from rice production slightly fell from 2007 to 2008 and increased to 47 percent of total crop income in 2010. Accordingly, the land use for crop production and agricultural working days of family labor also increased from 2007 to 2008 and slightly decreased from 2008 to 2010. The Simpson index of crop and land diversification developed into the same direction. However, while the labor diversification of migrant households including migrant members remained the same over the three years, this index slightly increased over the years in case migrant members were excluded. These results indicate that agricultural diversification requires labor intensification, but it maintains a higher income than in case of specialization. The labor diversification strategy seems to be more important for rural households than the strategy of agricultural diversification.

(Insert Table 1)

Table 2 describes migration and remittances. The total number of migrant households in the sample increased from 690 in 2007 to 802 and 890 in 2008 and 2010. However, the share of migrant households who received remittances from their members in the cities decreased from 30 percent in 2007 to 25 percent in 2008 and increased to 34 percent in 2010. The total remittance income of an average household has decreased from 202 US$ in 2007 to 182 US$ in 2008 and increased to 301 US$ in 2010.

(Insert Table 2)

The relationship between migration and agricultural production and diversification is described in Table 3. The share of income from rice production is significantly higher for migrant households with remittances than for non-migrant households and migrant household without remittances, while there is no statistically significant difference between the last two groups. The results from the T-test also show that land productivity and labor productivity of migrant households with

remittances is higher than of migrant households without remittances and of non-migrant households. However, the indicators of land and labor productivity do not differ statistically significantly between the non-migrant households and migrant households without remittances.

(Insert Table 3)

Migrant households with remittances and non-migrant households diversify more in terms of income from different crops and land use for cropping. The labor diversification index of migrant households is higher than for non-migrant households. However, excluding migrant members, migrant households seem to be more specialized, especially in case they had received remittances.

The comparative analysis confirms that migrant households are more efficient in crop production when remittances transfer took place. It also shows that migration is a diversification strategy in terms of labor allocation. However, the results could not explain the effect of migration on household production and resource allocation. The reason may be that migrant households are different from the non-migrant ones in terms of their inherent characteristics, such as being financially better off, having higher social capita or assets in comparison to non-migrant households. In the following, the fixed effects approach is used to further explain those effects of migration.

4.2. Econometric estimation results

+ Migration and Crop production

Table 4 presents the estimation results of the effect of migration on the share of rice income in total crop income, the growth of land productivity and labor productivity. Migration tends to decrease the share of rice income and the growth of labor productivity of rural households. However, while this effect on the share of rice income is statistically significant for migrant households with remittances, the effect on labor productivity is only statistically significant for migrant households without remittances. With respect to land productivity, the effect turns positive and statistically significant for migrant households with remittances, while it is negative and statistically insignificant for migrant households without remittances. These results suggest that migrant households tend to shift from rice production to other crops, especially when they receive remittances. This is consistent with the finding of de Brauw (2007, 2009).

Migrants are normally young people, and their absence decreases labor productivity. This effect becomes more prevalent in cases absence cannot be substituted by remittances. Remittances transfers help not only to reduce the decrease in labor productivity of migrant households, but they

also increase land productivity by supporting the production of other crops than labor-intensive rice crop.

(Insert Table 4)

Considering the household characteristics, similar to Damon (2010), the higher the age of the household head, the lower are the share of rice income as well as the land and labor productivities. The education level of the household head is negative and statistically significant in model (1) and it becomes negative but statistically insignificant in model (2) and positive and statistically insignificant in model (3). This could be explained by the fact that better educated household heads might be less likely to focus on crop production, especially rice, but it could help to improve the labor productivity to some extent.

The number of household members has a positive and statistically significant effect in model (1), but it becomes positive and statistically insignificant in model (2) and negative and statistically insignificant in model (3). The higher the number of household members, the higher the share of rice income in total crop production income, because rice production is a labor intensive activity. However, the squared household size is negative and statistically significant indicating that a household tends to move to other crops or non-farm activities when this number increases further.

The share of household members younger than 15 years and the share of household members older than 65 years show a negative effect on the share of rice income, and a positive one on land productivity and labor productivity. Nevertheless, it is only statistically significant with respect to the share of rice income. Therefore, households with higher shares of old members are more likely to cultivate other crops than rice, since rice production is very labour-intensive requiring more laborers than other crops.

With regards to the production conditions, the share of irrigated land in total agricultural land has a positive and statistically significant effect on the estimated models (1) and (2). This indicates that irrigation is very important for rice production, improving its efficiency.

Also factors related to substitutable or complementary aspects of crop production have been found to have an influence. On the one hand, the more the households are engaged in self-employed activities, such as small businesses or services, the lower the share of rice production and the less efficient is crop production in terms of land productivity and labor productivity. On the other hand, a household engaged in livestock activities seems to complement crop production. It helps to increase rice production and labor productivity.

Finally, the participation of households in political or social organizations does not seem to support rice production and the efficiency of crop production. It is negative and statistically insignificant in all three estimated models.

+Migration and Crop diversification

The following part describes the effect of migration on crop diversification. The estimated results are presented in Table 5.

(Insert Table 5)

Migrant households with remittances seem to support crop diversification, indicated by the positive sign. Unfortunately, this variable is statistically insignificant in both models. At the same time, migration without remittances transfers is negative and statistically significant in both, crop and land diversification. This means that on the one hand, production shifts to other crops than rice and land productivity increases but the diversification of their crop production has not increased. On the other hand, migrant households without remittances specialize more in crop production and reduce their labor productivity. Therefore, the latter tend to be more risk loving in crop production.

The control variables age and education level of the household head are statistically insignificant in the two estimated models. However, those characteristics affect the diversification indexes in different directions. While the age of household head somehow supports crop diversification, the education level reduces it.

Similarly, the higher the number of household members, the more likely are households to diversify their crops and the higher the rice income. However, when this number further increases, a household would reduce its land diversification. This indicates that rural households tend to shift to non-farm activities.

The share of household members younger than 15 years has a negative effect on the diversification indexes, while the share of household members older than 65 years is positive. This could be explained by the fact that the higher number of household members below 15 years is associated with a lower number of household laborers which again decreases the crop diversification of a household.

Irrigation is also very important for the diversification strategy. The higher the share of irrigated land, the less likely a household diversifies its land. When an irrigation system is implemented, the households tend to become more specialized.

Households who are engaged in self-employed activities are less likely to diversify their crop production, while they are more likely to diversify their crops when they engaged in livestock

activities. Those results are consistent with previous results from Table 4. Therefore, self-employed activities are substitutes to crop production, while livestock activities are complementary activities. Finally, similarly to previous estimations, the participation of households in political or social organizations does clearly not promote their diversification in crop production activities.

+ Migration and Labor diversification

Table 6 presents the estimated results of the impact of migration on the labor diversification of rural households. The estimated model (6) shows the effect of migration on household labor allocation as a whole (including migrant members), and model (7) presents the effect of migration on the allocation of only household labor members who did not migrate (excluding migrant members).

Migration is considered as a diversification strategy to cope with risks (Stark and Bloom, 1985). This is confirmed by the estimated model (6) by positive and statistically significant results. However, the effect of migration on labor diversification becomes negative as if their migrant members are excluded. It is statistically significant in case migrant households received remittances transfers. In other words, migration is considered as a labor diversification strategy of rural households as a whole, but the remaining household members who did not migrate, specialize on employment at origin places, especially, when remittance transfers have taken place.

(Insert Table 6)

Considering to the control variables, the age of household head is negative and statistically significant in model (7). When the household head becomes older, the household would be more specialized in their production activities in case of missing migrant members.

Similar as in the case of crop diversification, households with more members are more likely to diversify their labor allocation. However, these labor allocations become more specialized, when the number of household members becomes abundant. The share of household members older than 65 years is negative and statistically significant. It is clear that labor diversification depends on the number of labor members in a household.

The condition of the irrigation system is also very important for diversifying labor allocation. Water availability is a very important resource in rural places, not only for crop production, but also supporting production activities such as fishing, husbandry, or transportation.

Finally, a household who engages in self-employment, husbandry or participates in political or social organizations increases the propensity of labor diversification.

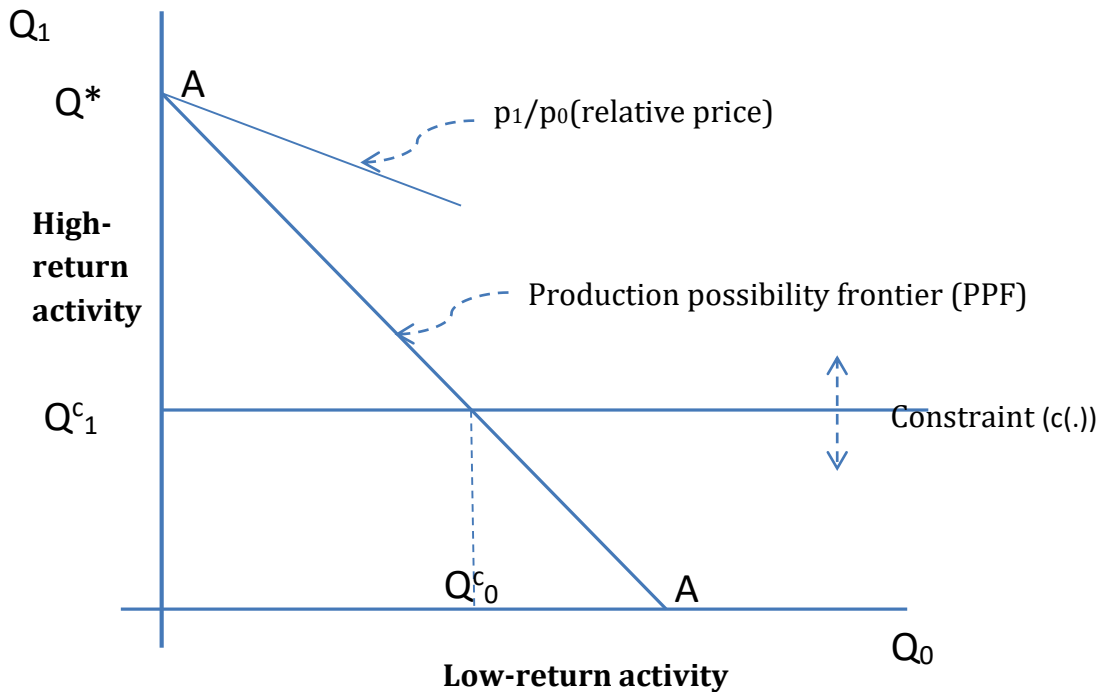
5. Conclusions

This paper investigates the interaction of agricultural production, diversification strategies and rural-urban migration in Vietnam. Migration is hypothesized to be a strategy to reduce risks and financial liquidity constraints of rural households; as a result, it may affect the re-allocation of resources in several ways depending on the institutions and the market conditions. To avoid selection bias and endogeneity problems, a fixed effects estimation approach is applied to panel data of a stratified sample of about 2,000 households.

The results suggest that migration is a diversification strategy of rural households. However, the effect of migration on agricultural production and diversification depends on the remittance transfers of migrants to their rural households. If remittance transfers take place, migrant households in rural areas of origin shift from rice production to other crops, and increase their land productivity. It also increases migrant households' specialization rather than diversification at rural places. In case of missing remittances, migration leads rural households to decrease their labor productivity and crop diversification.

Therefore, the hypothesis of the NELM is only supported in case of available remittances. These help rural households to compensate for the lack of labor and to specialize in more efficient income generating activities.

Tables and Figures



Source: Rozelle et al. (1999).

Figure 1. Potential Migration Effects on Rural Household's Production

Table 1. Descriptive statistics for agricultural production

	2007	2008	2010
Total crop income ($US-PPP, 2005)	3,026	3,463	2,729
Share of income from rice production	0.46	0.44	0.47
Crop land (ha)	0.82	0.89	0.88
Annual agricultural working days (days)	435.11	470.48	463.41
Crop diversification	0.21	0.30	0.24
Land diversification	0.27	0.30	0.27
Labor diversification	0.38	0.38	0.38
Labor diversification excl. migration	0.29	0.31	0.32
Total observations	2,068	2,048	2,005

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Table 2. Migration and remittances

	2007	2008	2010
Migrant households	692	802	890
Migrant households who received remittances	204	203	310
Remittance income per annum ($US-PPP, 2005)	202	182	301
Total observations	2,068	2,048	2,005

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Table 3. Migration[1] and agricultural production

	Non-migrant HH (1)	Migrant HH with remittances (2)	Migrant HH without remittances (3)	T-test (1 - 2)	(1 - 3)	(2 - 3)
Share of rice income	0.45	0.50	0.45	***	ns	**
Land productivity ($US/ha/year)	2,719	3,470	2,737	**	ns	**
Labor productivity ($US/working day)	3.95	5.02	3.65	*	ns	*
Crop diversification	0.25	0.27	0.23	*	*	**
Land diversification	0.29	0.29	0.27	ns	*	*
Labor diversification	0.34	0.43	0.42	***	***	*
Labor diversification excl. migration	0.34	0.27	0.32	**	*	***
Number of households	2,432	405	1,087			

Note: *significant at 10%, ** significant at 5%, *** significant at 1%, ns- not significant. These numbers are calculated for the pooled data set of year 2007, 2008, and 2010. All values are changed to PPP $ 2005.

[1] Migration is defined as lagged migration.

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Table 4. Migration, share of rice income, land and labor productivity growth

Variables	Share of rice income (1)	Growth of land productivity (2)	Growth of labor productivity (3)
	coef/se	coef/se	coef/se
Lag of migrant HH with remittances (1-Yes, 0-No)	-0.026**	0.265**	-0.090
	(0.013)	(0.122)	(0.066)
Lag of migrant HH without remittances (1-Yes, 0-No)	-0.008	-0.051	-0.133**
	(0.011)	(0.105)	(0.059)
Age of household head	-0.001**	-0.007*	-0.004**
	(0.001)	(0.004)	(0.002)
Years in school of household head	-0.005***	-0.015	0.006
	(0.002)	(0.012)	(0.005)
Total household members	0.026**	0.149	-0.021
	(0.011)	(0.093)	(0.041)
Squared of total household members	-0.002*	-0.012	0.001
	(0.001)	(0.009)	(0.004)
Share of household members younger than 15 years old	-0.014	0.048	0.114
	(0.030)	(0.270)	(0.116)
Share of household members >= 65 years old	-0.103***	0.317	0.018
	(0.035)	(0.267)	(0.117)
Share of irrigated land on total own land	0.241***	1.112***	0.101
	(0.027)	(0.162)	(0.072)
Household engaged in self-employed activities (1-Yes, 0-No)	-0.035***	-0.295***	-0.196***
	(0.012)	(0.101)	(0.047)
Household engaged in livestock activities (1-Yes, 0-No)	0.041**	0.224	0.151**
	(0.018)	(0.165)	(0.068)
HH participated in political or social organizations (1-Yes, 0-No)	-0.006	-0.155	-0.094
	(0.018)	(0.149)	(0.079)
Constant	0.357***	-0.463	0.362**
	(0.055)	(0.338)	(0.158)
Number of observations		3,924	

Note: *, **, *** indicate statistically significant levels at 10%, 5% and 1%.

All standard deviations of the estimators are robust at village level.

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Table 5. Migration and crop diversification strategy

Variables	Crop diversification (4)	Land diversification (5)
	coef/se	coef/se
Lag of migrant HH with remittances (1-Yes, 0-No)	0.011	0.014
	(0.009)	(0.009)
Lag of migrant HH without remittances (1-Yes, 0-No)	-0.017**	-0.016*
	(0.008)	(0.009)
Age of household head	0.000	0.000
	(0.000)	(0.000)
Years in school of household head	-0.001	-0.000
	(0.001)	(0.001)
Total household members	0.024***	0.025***
	(0.007)	(0.008)
Squared of total household members	-0.001	-0.001*
	(0.001)	(0.001)
Share of household members younger than 15 years old	-0.058***	-0.056**
	(0.021)	(0.023)
Share of household members ≥ 65 years old	0.019	0.024
	(0.023)	(0.026)
Share of irrigated land in total own land	0.003	-0.025*
	(0.012)	(0.013)
Household engaged in self-employed activities (1-Yes, 0-No)	-0.034***	-0.039***
	(0.009)	(0.009)
Household engaged in livestock activities (1-Yes, 0-No)	0.060***	0.063***
	(0.010)	(0.012)
HH participated in political or social organizations (1-Yes, 0-No)	0.013	0.002
	(0.011)	(0.010)
Constant	0.114***	0.166***
	(0.032)	(0.035)
Number of observations	3,924	

Note: *, **, *** indicate statistically significant levels at 10%, 5% and 1%.
All standard deviations of the estimators are robust at village level.

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Table 6. Migration, income and labor diversification strategy

Variables	SID_labor (including migration) (6)	SID_labor (excluding migration) (7)
	coef/se	coef/se
Lag of migrant HH with remittances (1-Yes, 0-No)	0.081***	-0.019*
	(0.011)	(0.011)
Lag of migrant HH without remittances (1-Yes, 0-No)	0.058***	-0.004
	(0.009)	(0.010)
Age of household head	0.000	-0.001***
	(0.001)	(0.000)
Years in school of household head	-0.002	0.001
	(0.001)	(0.001)
Total household members	0.034***	0.046***
	(0.009)	(0.009)
Squared of total household members	-0.003***	-0.004***
	(0.001)	(0.001)
Share of household members younger than 15 years old	0.008	-0.008
	(0.030)	(0.026)
Share of household members ≥ 65 years old	-0.249***	-0.134***
	(0.031)	(0.026)
Share of irrigated land on total own land	0.051***	0.075***
	(0.013)	(0.012)
Household engaged in self-employed activities (1-Yes, 0-No)	0.096***	0.154***
	(0.010)	(0.010)
Household engaged in livestock activities (1-Yes, 0-No)	0.025*	0.024*
	(0.014)	(0.013)
HH participated in political or social organizations (1-Yes, 0-No)	0.024*	0.044***
	(0.013)	(0.013)
Constant	0.181***	0.119***
	(0.042)	(0.041)
Number of observations	3,924	

Note: *, **, *** indicate statistically significant levels at 10%, 5% and 1%.

All the standard deviations of the estimators are robust at village level.

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

References

Amare, M., Hohfeld, L., Waibel, H., 2012. Rural-Urban Migration and Employment Quality: A Case Study from Thailand. *Asian Development Review*, 29(1), 58–80. Asian Development Bank.

Brennan, D., Petersen, E. H., Nguyen, N. Q., Vanzetti, D., 2012. Rural Urban Migration and Agriculture Production. No 124405. Conference (56th). *Freemantle, Australia from Australian Agricultural and Resource Economics Society.*

Butzer, R., Mundlak, Y., Larson, D.F., 2002. Determinants of Agricultural Growth in Indonesia, the Philippines, and Thailand. *World Bank Policy Research Working Paper No. 2803*. Available at SSRN: http://ssrn.com/abstract=636086.

Connell, J., 1987 Migration, Rural Development and Policy Formation in the South Pacific. *Journal of Rural Studies,* 3, 105-121.

Damon, A. L., 2010. Agricultural Land Use and Asset Accumulation in Migrant Households: The Case of El Salvador. *Journal of Development Studies,* 46, 162–189.

Dang, N.A., Tacoli, C., Hoang, X. T., 2003. Migration in Vietnam: a Review of Information on Current Trends and Patterns, and their Policy Implications. Paper presented at the Regional Conference on Migration, *Development and Pro-Poor Policy Choices in Asia,* on June 22-24, 2003 in Dhaka, Bangladesh.

Deininger, K., Jin, S., 2008. Land Sales and Rental Markets in Transition: Evidence from Rural Vietnam. *Oxford Bulletin of Economics and Statistics*. Department of Economics, University of Oxford, 70, 67–101.

de Brauw, A., Harigaya, T., 2007. Seasonal migration and improving living standards in Vietnam. *American Journal of Agricultural Economics*, 89, 430–447.

de Brauw, A., 2007. Seasonal Migration and Agriculture in Vietnam. Working Papers 07–04, Agricultural and Development Economics Division of the Food and Agriculture Organization of the United Nations (FAO - ESA).

de Brauw, A., 2010. Seasonal migration and agriculture production in Vietnam. *Journal of Development Studies*, 46, 114–139.

Dercon, S. (2002). Income risk, coping strategies and safety nets. Discussion paper, 22. World Institute for Development Economics Research, United Nations University (UNU-WIDER), Helsinki.

Duncan, G.J., Magnuson, K.A., Ludwig, J., 2004. The Endogeneity Problem in Developmental Studies. *Research in Human Development*, 1, 59–80.

Fan, S., Cha, K. C., 2005. Is small beautiful? Farm size, productivity, and poverty in Asian agriculture. *Agricultural Economics*, 32, 135–146. doi: 10.1111/j.0169-5150.2004.00019.x.

Government Statistical Office (GSO)., 2011a. Vietnam Household Living Standards Survey 2010 Report. http://www.gso.gov.vn/default.aspx?tabid=512&idmid=5&ItemID=12425.

General Statistics Office (GSO)., 2011b. Vietnam Population and housing Census 2009, Migration and Urbanization in Vietnam: Patterns, Trends and Differentials. Internet: URL http://vietnam.unfpa.org/webdav/site/vietnam/shared/Census%20publications/7_Monograph-Migration-Urbanization.pdf .

Gubert, F., 2000. Migration, Remittances and Moral Hazard. Evidence from the Kayes Area (Western Mali). Working Papers 2000-17, CERDI.

Li, L., Wang, C., Segarra, E., Nan, Z., 2013. Migration, remittances, and agricultural productivity in small farming systems in Northwest China. *China Agricultural Economic Review*, 5, 5–23.

Lipton, M., 1980. Migration from rural areas of poor countries: The impact on rural productivity and income distribution. *World Development*, Elsevier, 8, 1–24.

Lucas, R., 1987. Emigration to South Africa's Mines. *American Economic Review*, 77 , 313–330.

Lucas, R., 2007. Migration and rural development. *The Electronic Journal of Agricultural and Development Economics*. Food and Agriculture Organization of the United Nations, 4, 99–122.

McCarthy, N., Carletto, C., Kilic, T., Davis, B., 2009. Assessing the Impact of Massive Out-Migration on Albanian Agriculture. *European Journal of Development Research*. 21, 448–470.

Mendola, M., 2008. Migration and technological change in rural households: Complements or substitutes? *Journal of Development Economics*, Elsevier, 85(1-2), 150–175.

Minot, N., Michael, E., Tran, A.T. T., Le, T. Q., 2006. Income diversification and poverty in the Northern Uplands of Vietnam. *International Food Policy Research Institute. Research Paper No. 145*.

Nguyen, L. D., Raabe, K., Grote, U., 2013. Rural–Urban Migration, Household Vulnerability, and Welfare in Vietnam, *World Development*, http://dx.doi.org/10.1016/j.worlddev.2013.11.002.

Nguyen, V. C. Mont, D., 2012. Economic impacts of international migration and remittances on household welfare in Vietnam. *International Journal of Development*, 11(2), 144–163.

Pincus, J., Sender, J., 2008. Quantifying poverty in Vietnam: Who counts? *Journal of Vietnamese Studies*, 3, 114–150.

Phung, D. T., Waibel, H., 2009. Diversification, risk management and risk coping strategies: Evidence from rural households in three Provinces in Vietnam. Paper No. 25 in Proceedings of the German Development Economics Conference, Frankfurt, Germany.

Rozelle, S., Taylor, J. E., de Brauw, A., 1999. Migration, Remittances, and Agricultural Productivity in China. *American Economic Review*, 89.

Stark, O., Bloom, D. E., 1985. The new economics of labor migration. *American Economic Review*, 75, 173–178.

Taylor, J. E., Lopez-Feldman, A., 2010. Does Migration Make Rural Households More Productive? Evidence from Mexico. *Journal of Development Studies*, 46, 68–90.

Taylor, E., Rozelle, S., de Brauw, A., 2003. Migration and Income in Source Communities: A new economics of migration perspective from China. *Economic Development and Cultural Change*, 52, 75–101.

Tongruksawattana, S., Schmidt, E., Waibel, H., 2010. Shocks and coping actions of rural households: Empirical evidence from Northeast Thailand. Paper prepared for the CPRC International Conference 2010: Ten Years of War against Poverty hosted by the Brooks World Poverty Institute, University of Manchester, UK.

Vartanian, T. P., Buck, P. W., 2005. Childhood and Adolescent Neighborhood Effects on Adult Income: Using Siblings to Examine Differences in Ordinary Least Squares and Fixed-Effect Models. *Social Service Review*, 79, 60–94.

van de Walle, D., Cratty, D., 2004. Is the emerging non-farm market economy the route out of poverty in Vietnam? *The Economics of Transition*. The European Bank for Reconstruction and Development, 12, 237–274.

Wouterse, F., 2010. Migration and technical efficiency in cereal production: evidence from Burkina Faso. *Agricultural Economics*. International Association of Agricultural Economists, 41, 385–395.

Appendices

Appendix 1. Summary statistics of dependent variables

Variables		Mean	Std. Dev.	Min	Max	Observations
Share of rice income	overall	0.46	0.41	0.00	1.00	N = 3924
	between		0.38	0.00	1.00	n = 1986
	within		0.14	-0.04	0.96	T-bar = 1.98
Growth of land	overall	0.09	2.58	-13.99	11.60	N = 3924
productivity	between		1.65	-6.99	9.56	n = 1986
	within		2.07	-10.46	10.64	T-bar = 1.98
Growth of labor	overall	0.15	1.34	-8.09	6.40	N = 3924
productivity	between		0.67	-3.42	3.42	n = 1986
	within		1.17	-4.59	4.88	T-bar = 1.98
Crop diversification	overall	0.25	0.24	0.00	0.81	N = 3924
index	between		0.21	0.00	0.75	n = 1986
	within		0.13	-0.16	0.65	T-bar = 1.98
Land diversification	overall	0.29	0.26	0.00	0.83	N = 3924
index	between		0.23	0.00	0.81	n = 1986
	within		0.11	-0.09	0.66	T-bar = 1.98
Labor	overall	0.37	0.23	0.00	0.80	N = 3924
diversification index	between		0.23	0.00	0.80	n = 1986
	within		0.03	0.06	0.69	T-bar = 1.98
Labor	overall	0.31	0.25	0.00	0.75	N = 3924
diversification index	between		0.21	0.00	0.74	n = 1986
excluding migrants	within		0.13	-0.05	0.67	T-bar = 1.98

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.

Appendix 2. Summary statistics of independent variables

Variables		Mean	Std. Dev.	Min	Max	Observations
Lag of migrant HH (1-Yes, 0-No)	overall	0.38	0.49	0.00	1.00	N = 3924
	between		0.43	0.00	1.00	n = 1986
	within		0.23	-0.12	0.88	T-bar = 1.98
Lag of migrant HH with remittances (1-Yes, 0-No)	overall	0.10	0.37	0.00	1.00	N = 3924
	between		0.29	0.00	1.00	n = 1986
	within		0.23	-0.34	0.66	T-bar = 1.98
Lag of migrant HH without remittances (1-Yes, 0-No)	overall	0.28	0.42	0.00	1.00	N = 3924
	between		0.32	0.00	1.00	n = 1986
	within		0.27	-0.27	0.73	T-bar = 1.98
Age of household head	overall	49.09	13.00	20.00	94.00	N = 3924
	between		12.92	23.00	93.00	n = 1986
	within		1.69	26.09	72.09	T-bar = 1.98
Years in school of household head	overall	6.78	4.06	0.00	20.00	N = 3924
	between		3.99	0.00	19.00	n = 1986
	within		0.81	-2.22	15.78	T-bar = 1.98
Total household members	overall	4.39	1.72	1.00	14.00	N = 3924
	between		1.61	1.00	12.50	n = 1986
	within		0.60	1.39	7.39	T-bar = 1.98
Squared of total household members	overall	22.20	17.39	1.00	196.00	N = 3924
	between		16.24	1.00	156.50	n = 1986
	within		6.19	-35.30	79.70	T-bar = 1.98
Share of children younger than 15 years old	between	0.18	0.19	0.00	0.75	N = 3924
	within		0.19	0.00	0.69	n = 1986
	between		0.05	-0.07	0.43	T-bar = 1.98
Share of old people ≥ 65 years old	overall	0.08	0.19	0.00	1.00	N = 3924
	between		0.18	0.00	1.00	n = 1986
	within		0.03	-0.42	0.58	T-bar = 1.98
Share of irrigated land	overall	0.53	0.44	0.00	1.00	N = 3924
	between		0.40	0.00	1.00	n = 1986
	within		0.20	0.03	1.03	T-bar = 1.98
Household engaged in self-employed activities (1-Yes,	overall	0.28	0.45	0.00	1.00	N = 3924
	between		0.42	0.00	1.00	n = 1986

0-No)	within		0.18	-0.22	0.78	T-bar = 1.98
Household engaged in	overall	0.86	0.35	0.00	1.00	N = 3924
livestock activities (1-Yes, 0-	between		0.31	0.00	1.00	n = 1986
No)	within		0.16	0.36	1.36	T-bar = 1.98
HH participated in political	overall	0.88	0.33	0.00	1.00	N = 3924
or social organizations (1-	between		0.26	0.00	1.00	n = 1986
Yes, 0-No)	within		0.20	0.38	1.38	T-bar = 1.98

Source: Own calculations based on the DFG Rural Household Surveys 2007, 2008 and 2010.