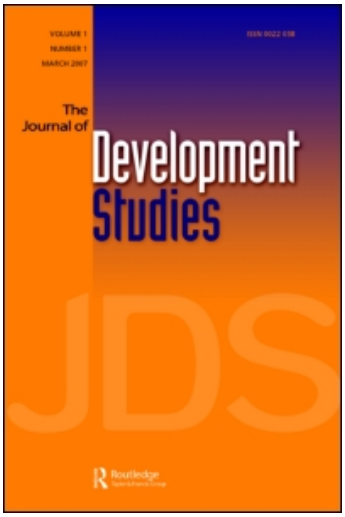

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Agricultural Land Use and Asset Accumulation in Migrant Households: the Case of El Salvador

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ABSTRACT *This paper examines the effect that international migration and remittances have on agricultural outcomes at the household level in El Salvador. Panel data are used to examine land use allocations, agricultural asset accumulation, and agricultural input use and returns. Findings suggest that migration and remittances cause a household to reallocate land away from commercial cash crops toward the production of subsistence food crops. There is weak evidence that migration and remittances contribute positively to agricultural asset accumulation in the form of land and livestock holdings. Further, results suggest that migration and remittance do not affect agricultural input use and may decrease the returns to land and labour on farm, as migrant households farm their land less intensively than non-migrant households.*

I. Introduction

Since the end of the civil war in 1992, El Salvador has become increasingly integrated into the international globalised economy. High levels of foreign direct investment, as well as international labour migration, define El Salvador's economic development trajectory. The civil war of the 1980s established a Salvadoran diaspora that, today, facilitates high rates of international migration. During the period between 1978 and 1987, El Salvador reported a net emigration of more than 650,000 people (Funkhouser, 1992). The 2000 US census reported that 13 per cent of the Salvadoran-born population (over 800,000 people) lives in the United States.[1] Salvadoran migrants typically settle in urban areas and are commonly urban, working age, married men who are better educated than non-migrants (Funkhouser, 1992). The money that flows back to families in El Salvador from migrants in the United States (remittances) is an important income source for Salvadoran households.

Migrant remittances have increased dramatically since the end of the civil war. Salvadorans living abroad sent $US858 million in remittances to El Salvador in

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1992.[2] Remittance levels steadily increased over the next 16 years, and in 2006 El Salvador received $US3.1 billion in remittances. At the same time, El Salvador's agricultural sector has been in decline in terms of relative importance in the overall economy (Figure 1). Beans, maize, and sugar all have falling relative shares of GDP. The share of coffee decreased most dramatically between 1991 and 2003 due to both a drop in production (150,000 tons to 88,000 tons) and a drop in coffee prices (from $US1049 per ton to $US413 in 1991 prices).

The decreasing relative importance of the agricultural sector has led many rural households to choose international migration as an alternative livelihood strategy. This change affects the agricultural sector, and agricultural households for two reasons. First, migration means losing a member of the family workforce, and second, migration enables a family to receive cash remittances. Given the importance of migration and remittances in rural households in El Salvador, this paper examines the effect that migration and remittances have on agricultural production activities. Specifically, this paper examines the effect of migration or remittances on land use allocations, land and livestock holdings, agricultural input use, and the return to agricultural land and labour.

This paper is structured as follows. First, section II presents a theory of migration and agricultural production decisions, section III describes the data used in the empirical analysis and section IV discusses the empirical strategy. Section V presents the empirical results and section VI provides concluding comments.

II. Theory of Agricultural Households' Productive Decisions

In general, the role of migration and remittances in a household's livelihood strategy is diverse. In this section three motivating factors for migration and remittances and their impacts on agriculture are considered: (1) remittances sent as a return on

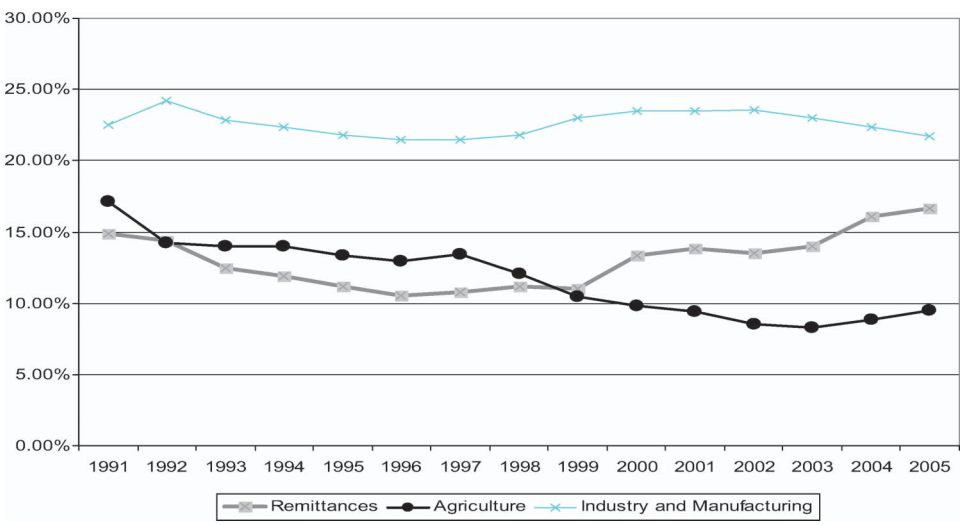

Figure 1. Remittances, agriculture, and industry share of GDP, 1991–2005. *Source*: Banco Central de Reserva de El Salvador (Central Reserve Bank of El Salvador), 2006.

a household's migration investment; (2) remittances sent to overcome a credit constraint; and (3) remittances sent to substitute for missing insurance markets.

When a household engages in migration a significant cost is incurred by the household. This cost includes both the loss of a household labourer as well as the family's financial contribution toward the migrant's trip. Given these costs, the family expects to receive remittances in the future as a return on their initial migration investment in the form of regular remittance payments, or periodic remittance payments that come in the event of a negative economic shock. International migration of a family member also decreases the family labour supply. However, if separability holds in the agricultural household model, sending a migrant should have no effect on agricultural outcomes. If labour markets are functioning and hired labour is a reasonably good substitute for family labour, the loss of a family member should not affect a household's agricultural outcomes. If these conditions hold, a family can hire labour and maintain the current level of production and product mix. Remittances, in this case, would simply increase household consumption. If labour markets are missing or incomplete, or if family labour and hired labour are not substitutes, then we would expect international migration of a household member to result in a decrease in household agricultural production levels, a change away from labour-intensive crops, or an increase in the use of labour-saving technologies.

The second motivation for migration is to overcome a missing credit constraint. The new economics of labour migration (NELM) suggests that migration is a response to missing markets, namely missing credit and/or insurance markets. In the presence of missing markets separability in the agricultural household model no longer holds. Under these conditions, migration and remittance decisions will change agricultural outcomes. In this discussion, it is assumed that credit markets are missing or incomplete and a household faces a binding credit constraint. If remittances are sent to relieve a household's credit constraint we would expect remittances to increase investment in agricultural assets, agricultural technology, and agricultural commercialisation activities.

For comparison, first consider a household that is not credit constrained. In this case, the marginal product of capital is equal to the market rental rate of capital. The household's unconstrained Marshallian demand for capital, K_U^*, is a function of Salvadoran wages (w), existing capital stock (K_0), and the rental rate of capital (r) such that:

$$K_U^* = K(w, r, K_0) \tag{1}$$

Now, consider a credit constrained household. Given the credit constraint, there exists a shadow rate of capital equal to the Lagrange multiplier associated with the household's credit constraint, $\overline{B}$ The constrained Marshallian demand for capital, K_C^*, is now:

$$K_C^* = K_1(w, \rho(\cdot), K_0) \tag{2}$$

where ρ is the Lagrange multiplier associated with the household's credit constraint which takes the form $\rho = \rho(w, \overline{B})$. When a household is credit constrained, K_C^* will be below the level of K_U^*. However, if remittances relax $\bar{B}$, K_C^* would converge to the unconstrained level of K_U^*. Empirically, this suggests that if remittances relax a

household's credit constraint we would observe investment in agricultural assets like land and livestock with an increase in remittances.

The third motivation for migration is that migration and remittances serve to overcome missing insurance markets. Several studies have established the link between remittances and income variation and yet several other have identified a relationship between insurance and changes in agricultural production decisions. Stark and Lucas (1988) examine the relationship between remittances and agricultural variables. They show that families who experience a drought, risk losing cattle, and those who rely mostly on subsistence food crops receive more remittances during times of drought. Gubert (2002) examines how different measures of crop income shocks are buffered by remittances and finds that remittances act, at least partly, as a form of insurance in Mali. De la Briere and others (2002) show that the level of remittances in the Dominican Republic is directly related to the magnitude of the recipient household's income shock. A number of other studies have confirmed similar trends including Caldwell et al. (1986), Rosenzweig (1988), and Cox and Jimenez (1998).[3]

Many studies, primarily in the context of the United States, have examined the relationship between crop insurance payments, government commodity programmes, and agricultural outcomes. For example, Horowitz and Lichtenberg (1993) find that federal crop insurance increases fertilizer use by 10 per cent and pesticide expenditure by 21 per cent. However, other studies (Babcock and Hennessy, 1996; Smith and Goodwin, 1996;) found the opposite relationship – that multiple peril crop insurance and yield and revenue crop insurance programmes respectively decrease input use. Chavas and Holt (1990) examine how farmers allocate acreage to different crops under risk. They find that risk, measured by price and yield expectations, and wealth, measured by the farm equity, are important in corn–soybean acreage allocations. Wu and Adams (2001) examine the relationships between crop acreage decisions under three different revenue insurance programmes. They find that when insurance covers both corn and soybeans there is an increase in acreage for both, as land is pulled out of other crops and transitioned into corn and soybean production.

Considering the outcomes within these two bodies of literature, it is possible that remittances, as a form of household insurance, may alter the land use decisions at the household level. A theoretical model of agricultural land use decisions is presented in Chavas and Holt (1990). Building on this model, two cases are possible when remittances are received by the household. In Chavas and Holt (1990) acreage decisions are based on relative prices, crop yields, wealth, and risk preferences. If we consider remittances to be an income transfer, independent of yield or price fluctuations (that is not insurance), then remittances would have a pure wealth effect. If remittances increase wealth exclusively, acreage decisions would be unaffected if the remittance-receiving producer has constant absolute risk aversion, as detailed in the Chavas and Holt model.

However, if migration or remittances act as an informal insurance mechanism, the risk structure of the agricultural household will change. Suppose the expected normalised profits per acre for crop i is $\bar{\pi}_i$. Further, suppose remittances act as an insurance mechanism such that an agricultural producer will receive remittances (R_i) if $\bar{\pi}_i$ is below a certain profit floor $\alpha\bar{\pi}_i$ (Hennessy et al., 1997). The insurance level is

determined by the implicit contract between the migrant and the household and the ability of the migrant to pay, which is determined by wages and unemployment rates in the United States and the migrant's level of consumption. If $\bar{\pi}_i \geq \alpha\bar{\pi}_i$ no remittances are sent. However, if $\bar{\pi}_i < \alpha\bar{\pi}_i$, the household then engages with the migrant in an insurance transfer. Remittances that fluctuate with crop prices and yields will change the profit distribution of crops by providing a safety net for farmers' revenues, and may induce a change in the mix of crops a farmer chooses to undertake. The agricultural response to the remittance transfer depends on the risk preference of the household. If the household has a constant absolute risk aversion, the transfer will not affect the acreage allocation. If the household has decreasing absolute risk aversion, they will allocate land to riskier crops as remittances increase their wealth. Conversely, if the household has an increasing absolute risk aversion, we would expect to see a move into less risky crops as their wealth increases.

These three theoretical possibilities result in a number of possible relationships between agricultural production, migration, and remittances. Firstly, if labour, insurance, and credit markets are complete and functioning and hired labour is a substitute for family labour we would expect migration and remittances to have no effect on agricultural production. However, if credit, insurance, or labour markets are not functioning there will be a relationship between agricultural production, migration, and remittances. The direction of this effect depends on the market imperfection and household conditions. In the case of missing labour markets, or imperfect substitutability of labour, we would expect migration and remittances to decrease agricultural production levels, or an increase in the use of on-farm labour saving technology. If however, credit markets are not functioning, and migration and remittances relieve this constraint, we would expect to see investment in agricultural investments. Further, if migration and remittances overcome a missing insurance market, we would expect to see households re-allocate acreage and production resources depending on their risk preferences. Finally, if the effect of the loss of a labourer (assuming missing labour markets) is larger than the potential benefits of remittances like relieving credit and insurance constraints, then the overall effect of migration and remittances on agricultural production will be negative.

There have been several studies that have empirically examined the relationship between agriculture and migration which provide some evidence of the relationships theoretically established above. Taylor and Wyatt (1996) study the effectiveness of remittances in relieving credit and risk constraints in the farm-household economy in Mexico. They find that the effect of remittances depends on the farm-household's initial asset holdings, and that initial production constraints are important in determining the impact on rural income inequality. Rozelle et al. (1999) investigate the effect of remittances on farm productivity in the case of China. They find that migration significantly decreases corn yields which they attribute to an absence of on-farm labour markets in this area of China. They find that reduced yields from labour losses are partly mitigated by the increased access to capital facilitated by migrant remittances.

Two recent papers (McCarthy et al., 2006; Miluka et al., 2007) have examined the explicit relationship between remittances and agricultural production, using data from Albania. McCarthy et al. (2006) find that permanent international migration has a negative impact on staple cereal production and fruit production, but a positive impact on land allocated to forest and pasture, as well as livestock holdings.

Miluka et al. (2007), find that migration is primarily used as a strategy for households to pull out of crop agriculture. Their results suggest that remittance-receiving households do not invest in productivity-enhancing and time-saving farm technologies in crop production and that households shift their agricultural investments from crop production to livestock production.

III. Data

The data used for the empirical analysis in this paper are a four-year panel dataset collected in El Salvador in 1996, 1998, 2000, and 2002 by the Salvadoran Foundation for Economic and Social Development[4] (FUSADES) and Ohio State University (OSU) under the Broadening Access and Strengthening Input Markets System (BASIS) programme in El Salvador (Pleitez Chavez, 2004) (Table 1).

Table 1. Description of variables used in empirical analysis

Variable	Description	Units
Coefficient of variation (CV)	The standard deviation of total agricultural revenue divided by the mean of agricultural revenue for each household.	CV
House area	Area dedicated to the household's house and immediate living area	Hectares
Forest area	Area dedicated to forest	Hectares
Pasture area	Area dedicated to pasture	Hectares
Fallow area	Area dedicated to being fallow.	Hectares
Unoccupied area	Area that is unoccupied	Hectares
Cultivated area	Area that is cultivated with any crop except pasture.	Hectares
Basic grains area	Area dedicated to the production of basic grains	Hectares
Coffee area	Area dedicated to coffee production	Hectares
Other cash crops area	Area dedicated to other cash crops	Hectares
Age of HH head	Age of the person reported as the household head.	Years
Dependency ratio	Number of people over 65 years and under 16 years divided by the members between 16 years and 65 years.	Ratio
Senior citizen present in HH	Household members over 65 years old	Number
Female headed HH	Household head is female	Dummy Variable (= 1 if yes)
Number of HH members	Number of household members excluding migrants	Number
Number of children present in HH	Number of people in the household less than 16 years old.	Number
Land area in HA	Land holdings, including rented, owned, borrowed land.	Hectares
Value of livestock holdings	Reported value of all livestock owned by the household at the beginning for the survey year divided by 1000.	US Dollars
Ha rented in	Area rented in by the household.	Hectares
Ha rented out	Area rented out by the household.	Hectares

The 1996 survey was design as a stratified random sample to represent all rural areas in El Salvador. In 1996 the sample consisted of 738 households. The 738 households consist of 302 land holding, agriculture producing households[5] and 436 agricultural worker households. These households represent all 14 departments (states) in El Salvador and 165 out of 262 municipalities. The 1998 sample resurveyed 494 households (314 agricultural landholding households) from the original primary sample. The attrition rate between 1996 and 1998 was 24 per cent. In 2000, 470 households were interviewed from the original survey, of which 365 were agricultural landholding households. The attrition rate between 1998 and 2000 was 4.8 per cent. In 2002, 451 households were resurveyed including 346 agricultural landholding households. The attrition rate between 2000 and 2002 was 4 per cent.[6]

Two other datasets that provide instrumental variables for estimation purposes are also used. Wage and unemployment rates in US cities are calculated from the US Current Population Survey using only non-resident Latino workers in the migrant's destination city. In addition, the Salvadoran national household survey collected by the Salvadoran National Census office (DIGESTyC) for 1996, 1998, 2000, and 2002 is used to calculate the per cent of households and individuals in each municipality[7] that received remittances in that year.

Table 2 presents descriptive statistics for all four panel years. Descriptive statistics are limited to the 451 households that remained in the panel for all four years, since these are the observations that are employed in the subsequent empirical analysis. Descriptive analysis suggests that the average number of senior citizens in the household has increased over the panel years as has the average age of the household head. The average number of children in each household as well as the dependency ratio both decreased. The per cent of households headed by a female in the sample

Table 2. Household demographic characteristics

	1996	1998	2000	2002
Number of households in sample	451	451	451	451
Number of household members (in El Salvador)	7.08	6.22	6.71	6.32
	(2.83)	(2.68)	(2.96)	(2.80)
Average number of adults 65+ in household	1.01	0.27	0.36	0.39
	(1.53)	(0.58)	(0.75)	(0.68)
Average number of children 0 to 16 in household	2.83	2.60	2.71	2.41
	(2.56)	(2.24)	(2.36)	(2.17)
Average age of household head	47.04	50.05	51.69	53.87
	(14.86)	(14.26)	(14.44)	(14.16)
Percent of female headed households in the sample	0.08	0.11	0.14	0.17
	(0.27)	(0.31)	(0.35)	(0.37)
Dependency ratio	1.35	0.88	0.88	0.79
	(1.20)	(0.74)	(0.85)	(0.71)
Average education level of household head	2.70	2.63	2.48	3.00
	(1.71)	(2.74)	(2.73)	(3.18)

Note: Standard deviations are reported below each statistic in parentheses. Education is measured in levels completed: 1 = pre-school education; 2 = primary school education; 3 = high school education; 4 = vocational school; 5 = Bachelor's education.

increased from 8 per cent to 17 per cent over the same time period. The average education level of the household head has also increased slightly over the sample period.

Table 3 describes migration and remittance variables. The total number of migrants in the sample increased from 316 to 423 between 1996 and 2002, similarly the number of migrants per household also increased from .70 in 1996 to .94 in 2002. The per cent of households engaging in migration also increased from 35 per cent to 41 per cent, while the percentage of household that receive remittances increased from 18 to 35 per cent. The average level of remittances also increased from $US160 in 1996 per year to $US613 in 2002.

Table 4 presents a set of descriptive statistics for selected agricultural variables in the survey. The number of agricultural land holders increased over the sample period from 167 to 346. Agricultural land holders are defined as households that hold more than 0.1 hectares of agricultural land (excluding land area dedicated to the housing lot).[8] Size of landholdings remained relatively constant over the period, as did the area of cultivated land. Changes in land use can be seen in the decrease in average land area dedicated to forest and fallow and further an increase in average area dedicated to pasture. The value of livestock decreased between 1996 and 1998, but then remained relatively constant, around $US450 for the remaining survey rounds. The value of agricultural inputs varied significantly between years. This variation is a likely contributor to the variation observed in returns to labour and land.

IV. Empirical Approach

The objective of this empirical analysis is to examine whether migration and remittances change agricultural production decisions at the household level, either because migration and remittances result in the loss of a household labourer, relieve a liquidity constraint, or overcome missing insurance markets. A number of agricultural outcome variables are considered in the empirical analysis in addition to land use allocations, including total land area, livestock holdings, agricultural input levels, and returns to agricultural land and labour. To fully exploit the panel nature

Table 3. Migration and remittance descriptive statistics

	1996	1998	2000	2002
Total number of migrants in the sample	316	300	403	423
Number of HH that received remittances	83	96	128	158
Average number of migrants per household	0.70	0.67	0.94	0.94
	(1.23)	(1.60)	(1.53)	(1.75)
Percentage of households with migrants	0.35	0.32	0.43	0.41
	(0.48)	(0.47)	(0.50)	(0.49)
Percentage of households that received remittances	0.18	0.21	0.28	0.35
	(0.39)	(0.41)	(0.45)	(0.48)
Average remittances received for remittance receiving household	160.87	201.96	388.47	613.54
	(507.95)	(839.85)	(1069.03)	(1458.00)

Note: Standard deviations are reported below each statistic in parentheses.

Table 4. Descriptive statistics for agricultural variables

	1996	1998	2000	2002
Total number of agricultural land holders in the sample	167	290	351	346
Average size of land holdings (in hectares)	1.60 (5.11)	1.59 (4.11)	2.16 (4.33)	1.79 (3.64)
Average land holdings dedicated to pasture	0.29 (2.51)	0.51 (2.75)	0.49 (1.95)	0.53 (2.28)
Average land holdings dedicated to fallow/forest	0.65 (3.38)	0.04 (0.24)	0.11 (0.51)	0.07 (0.37)
Average land holdings dedicated to crop cultivation	0.73 (1.47)	0.63 (1.18)	0.76 (1.17)	0.67 (1.13)
Average land holdings dedicated to basic grains production	0.32 (0.72)	0.10 (0.30)	0.48 (0.74)	0.43 (0.63)
Average land holdings dedicated to coffee production	0.06 (0.33)	0.04 (0.20)	0.04 (0.33)	0.07 (0.42)
Value of livestock (in US$)	636.72 (2142.59)	422.83 (1255.94)	454.03 (1255.48)	479.73 (1551.71)
Value of agricultural inputs (in US$)	824.61 (11435.53)	252.56 (741.33)	265.92 (435.63)	675.19 (3813.27)
Returns to labour and land (in US$)	1,047.23 (3574.26)	1,283.03 (2780.80)	1,518.11 (2937.95)	1,091.07 (2193.64)

Note: Standard deviation is reported below each statistic in parentheses. (1) Agricultural producers are defined as households holding more than 0.1 hectares of agricultural land (excluding land area dedicated to the housing lot), with the exception of 1996, in which case agricultural household are defined as households that hold 0.1 hectares of land including the housing lot.

of the dataset, this study examines the effect of the previous period's migration and remittance decisions on current period agricultural outcomes. The empirical model is:

$$A_{jit} = \alpha_i + X_{it}\gamma_1 + \gamma_3 Y_{it} + \gamma_4 R_{i,t-1} + \varepsilon_t \tag{3}$$

where A_{jit} is the agricultural outcome for household i, crop j, in time period t. Further, α_i is the household fixed effect, X_{it} is a vector of household demographic control variables, Y_{it} is total land area including net rented land and livestock values,[9] $R_{i,t-1}$ is the standard deviation of remittances in the previous time period (replaced by the dichotomous variable, $M_{i,t-1}$, in the migration version of this regression, which take a value of 1 if the household has any migrants in the current period, and 0 if the household has no migrants, and ε_t is an independently distributed error term).

One of the challenges when examining the effect of migration and remittances on household outcomes is that while the migration decision is observed for all households, remittance levels are only observed for households that have migrants. Therefore, given that migrant households may be somehow different than non-migrant households, there is an inherent selection problem when remittances are used to explain a household outcome. The panel dataset helps in this regard since we are able to control for household level unobserved characteristics using a household fixed effects approach.

Another challenge in migration research is that unobservable factors that influence the migration decision and remittance levels may also influence household agricultural outcomes. This joint determination causes explanatory variables measuring migration and remittance to be correlated with the error term using a standard ordinary least squared (OLS) approach. Other studies have addressed this problem using two staged least squares instrumental variable models. Good instruments, those that are correlated with migration and remittances, but uncorrelated with agricultural outcomes, are difficult to find. Instruments that have been used in the past to explain migration or remittances include: per capita Western Union offices interacted with education at the household level (Amuedo-Dorantes and Pozo, 2006); village migrant networks measured by the proportion of families that have a member abroad (Acosta, 2006); and number of international migrants who have returned two or more years ago[10] (Acosta, 2006).

This paper uses the percentage of households in a community that receive remittances to instrument for migration, drawing on the Acosta (2006) approach. The justification for using this variable as an instrumental variable is that it is a good proxy for the network of migrants from a community. Migrant networks lower the cost of migration for future migrants by helping with adjustment costs (for example previous migrants in the network provide housing and job search information for new migrants) and therefore increase the probability of migration from a given community. Further, while this network variable is a good predictor of migration, it is unlikely to be strongly correlated with household level agricultural outcomes, and therefore is a good candidate for an instrumental variable. The community level variables on remittances are calculated using the Salvadoran national household dataset (EHPM). Additionally, the wage rate and unemployment rate of non-resident Latino workers in the US migrant destination city, both from the US Current Population Survey (CPS), are used to instrument for remittances. Both of these variables are likely correlated with the level of remittances sent because they characterise the labour market conditions in the migrant's destination city. It is highly unlikely that these variables affect any agricultural outcomes in El Salvador. It is likely that US wage and unemployment are also good instruments to predict migration. However, we only observe US wage and unemployment levels for households that have migrants and it is therefore impossible to predict migration status with these variables given these missing data.

To estimate the effect of migration and remittances on agricultural outcomes a two-staged instrumental variable approach is used and compared against OLS and fixed effects estimates. All standard errors are clustered at the municipal level to control for municipal level unobserved effects. The first stage of the model predicts either the probability of migration at the household level, or the standard deviation of remittances the household receives each year. The first stage equation for remittances associated with (10) used to predict R_i is:

$$R_{i,t-1} = \alpha_1 w_{us_i,t-1} + \alpha_2 N_{us_i,t-1} + \rho X_{it} + \eta Y_{it} + u_i \tag{4}$$

where $w_{us_i,t-1}$ is the US wage rate of non-resident Latino workers in the migrant destination city in the previous period and $N_{us_i,t-1}$ is the US unemployment rate in the previous period and u_i is the household specific first stage error term. Both

$w_{us_i,t-1}$ and $N_{us_i,t-1}$ are the excluded instruments used to identify the first stage equation and X_{it} is vector of demographic characteristics. In the case where migration is used to explain agricultural outcomes the first stage equation used to predict migration is:

$$M_{i,t-1} = \theta_1 Z_{i,t-1} + \rho X_{it} + \eta Y_{it} + u_i \tag{5}$$

where $Z_{i,t-1}$ is the percentage of households in a community that receive remittances, X_{it} is a vector of household demographic control variables. The strength of the instrumental variables is examined in the first stage regression by testing the significance of the excluded variable(s) using an F-test as well as examining the r-squared between regressions excluding and including the instruments. Further, in the second stage regression the Hansen-J statistics is used to test for overidentification in the case of remittances, however it is not used in the migration regressions since the migration first stage regression is perfectly identified. The exogeneity of migration and remittances is tested by comparing the Sargan-Hansen statistic between the instrumental variable regression where migration and remittances are treated as endogenous, and the OLS regression where both are treated as exogenous.[11] The null hypothesis is that the variables in question are exogenous.

V. Results

Table 5 presents results on the determinants of migration and remittances. These results are the first stage results used in the later IV analysis explaining land use decisions. Similar first stage results are used in the regressions explaining land holdings, livestock value, agricultural inputs, and agricultural returns to land and labour, however land area and livestock value are excluded. Results explaining a household's migration status are presented in model (1), which excludes the per cent of households at the community level that receive remittances in the previous time period, and model (2) which includes this variable. The inclusion of this variable helps to explain the migration decision of a household, as it significantly increases the probability of migration. An F-test used to test the hypothesis that the per cent of households at the community level that receive remittances equals zero is strongly rejected. While the r-squared in both regressions is low, the addition of this instrument does improve the overall explanatory power of the regression.

The first stage remittance equation also indicates that the lagged US wage significantly increases the lagged standard deviation of the remittances received by the household. However, the other excluded variable, lagged US unemployment rate, is not significant. An F-test testing the joint significance of these variables is significant however, and takes a higher value than if only the lagged US wage rate was included. Further, the addition of the excluded instruments increases the r-squared from .05 to .14, suggesting that the addition of these two variables lends significant power to explaining the lagged standard deviation of remittances. The US wage and unemployment rates are exogenous to Salvadoran household agricultural decision, however, the fact that groups of migrants in the same cities in the United States means that each migrant in that city will face the same wage rate.

Table 5. First stage regressions for migration status and remittances levels

	International migrant family member in previous period		Standard deviation of remittances in previous period	
	(1)	(2)	(3)	(4)
Land area (in HA)	0.011**	0.010*	−0.014	−0.027**
	(0.005)	(0.005)	(0.009)	(0.013)
Number of adults 65+ years old	0.023	0.015	−0.025	−0.113
	(0.031)	(0.031)	(0.052)	(0.106)
Female (HH head)	0.111**	0.098**	0.221***	0.207
	(0.049)	(0.049)	(0.082)	(0.154)
Level of education (HH head)	0.002	0.004	−0.012	−0.015
	(0.008)	(0.008)	(0.013)	(0.025)
Age (HH head)	0.004**	0.004**	0.006**	0.007
	(0.001)	(0.001)	(0.002)	(0.005)
Number of household members (in El salvador)	−0.008	−0.008	−0.012	−0.013
	(0.009)	(0.009)	(0.016)	(0.034)
Number of children 0 to 16 years old	0.011	0.011	0.019	0.024
	(0.012)	(0.012)	(0.020)	(0.048)
Value of livestock (divided by 1000)	−0.002	−0.006	0.103***	0.215***
	(0.011)	(0.011)	(0.018)	(0.036)
Salvadoran wage rate	−0.001	−0.003	0.005	−0.006
	(0.008)	(0.008)	(0.013)	(0.026)
Percent of HH that receive remittances at community level (lagged)		0.570***		
		(0.206)		
US wage (lagged)				0.005***
				(0.001)
US unemployment rate (lagged)				−1.339
				(4.594)
Constant	0.180**	0.084	−0.385**	−1.482**
	(0.091)	(0.097)	(0.152)	(0.615)
Observations	856	856	856	379
R-squared	0.03	0.04	0.05	0.14
F-test on excluded instruments		8.84		7.19
p-value		0.003		0.0009

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Models (1) – (4) are estimated using OLS. Model (1) estimates if the household has a migrant excluding percent of households that receive remittances at the community level, and model (2) includes this variable. A similar strategy is used to estimate remittances in models (3) and (4), where model (4) include US wage and unemployment variables and model (3) excludes these variables. Model (4) restricts the sample to only households that have migrants. Data from 1996, 1998, 2000, and 2002 are used.

The variation in this variable comes from between city variations and between time period variations in wage rates.[12]

Agricultural outcome variables are explained by both migration status of the household and the standard deviation of remittances. Households where US wage and unemployment rates are observed are limited to migrant households exclusively, as discussed in the previous section. Self-selection into migration is a concern,

especially when interpreting the OLS results. These concerns are somewhat minimised in the panel data models where unobserved characteristics at the household level are controlled for using a household level fixed effect.

Land Allocation Results

Table 6 presents results on the determinants of agricultural land dedicated to pastures. Tests for the exogeneity of both remittances and migration suggest that we fail to reject the null hypothesis of exogeneity. OLS results, in (model 1), suggest that a household having an international migrant in the previous period reduces the land area dedicated to pasture by $-.209$ hectares. The point estimate associated with migration in the fixed effects model (model 3), and the IV-fixed effects model, (model 5), are also both negative, however when household level fixed effects are taken into account these coefficients are not significant. It is possible that agricultural households that engage in migration use some of their capital (for example livestock) to pay for migration and therefore reduce their use of pastures. Remittances in the previous year also have a negative effect on pasture area in both the OLS (model 2) and fixed effects models (model 4). However, this finding is no longer significant when remittances are instrumented (model 6).

In the case of land area dedicated to basic grains, having a migrant in the previous time period increases the land area dedicated to basic grains in the current period (Table 7). Point estimates associated with all three specifications (models 1, 3, and 5) are positive and significant. The endogeneity test for migration and remittances is strongly rejected, suggesting that the instrumental variable model estimates are less biased than those from the OLS model. Having a migrant in the previous period increases the land area dedicated to basic grains by 2.489 hectares (model 5), and further a one standard deviation increase in remittances in the previous period increases basic grains land area by .659 hectares (model 6). This result suggests that migration and remittance-receiving households are responding by putting more of their land into subsistence food crops. This is likely due to a strong food security motive by the remaining household members. Since migration is in itself a risky process that requires large capital investment, households may be ensuring their food security by expanding their food crops given the uncertainty of remittances and the debt incurred to pay for migration.

In Table 8, the reallocation of land area away from cash crops[13] is further confirmed. Results testing the exogeneity of migration and remittances reject the null of exogeneity, indicating that the IV-fixed effect results are less biased. The IV-fixed effect results in model 5 suggest that having an international migrant in the previous period leads to a decrease in area dedicated to cash crops by 3.119 hectares. Remittances in the previous period also decrease the land area in cash crops (model 6) by .705 hectares. This result suggests that migrant households are pulling out of cash crop production, likely because of their anticipation of remittances as a source of supplementary income.

Asset Holdings

Empirical results suggest that remittances and migration have a varied impact on the agricultural asset holdings and outcomes at the household level. Results in Table 9

Table 6. Determinants of land area dedicated to the pasture (in hectares)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	−0.209**	–	−0.125	–	−1.761	–
	(0.097)	–	(0.119)	–	(1.180)	–
Standard deviation of remittances last period	–	−0.157***	–	−0.217**	–	−0.304
	–	(0.058)	–	(0.098)	–	(0.455)
Land area (in HA)	0.511***	0.507***	0.587***	0.583***	0.574***	0.602***
	(0.014)	(0.014)	(0.131)	(0.130)	(0.126)	(0.167)
Number of adults 65+ Years Old	0.077	0.069	−0.098	−0.085	−0.178	−0.004
	(0.088)	(0.088)	(0.102)	(0.099)	(0.177)	(0.260)
Female (HH head)	0.385***	0.397***	0.009	0.078	0.314	0.155
	(0.138)	(0.138)	(0.258)	(0.257)	(0.377)	(0.688)
Level of education (HH head)	−0.027	−0.029	0.004	0	0.009	0.044
	(0.021)	(0.021)	(0.033)	(0.031)	(0.036)	(0.075)
Age (HH head)	−0.010**	−0.010**	−0.002	0.001	0.006	0.021
	(0.004)	(0.004)	(0.014)	(0.014)	(0.014)	(0.031)
Number of household members (in El salvador)	−0.006	−0.006	−0.012	−0.016	0.022	0.026
	(0.026)	(0.026)	(0.059)	(0.058)	(0.067)	(0.236)
Number of children 0 to 16 years old	0.022	0.023	0.022	0.025	0.03	0.01
	(0.033)	(0.033)	(0.081)	(0.079)	(0.089)	(0.441)
Value of livestock (divided by 1000)	0.170***	0.186***	0.204	0.24	0.193	0.269
	(0.031)	(0.032)	(0.174)	(0.178)	(0.172)	(0.265)
Salvadoran wage rate	0.040*	0.042*	0.015	0.013	−0.009	0.065
	(0.022)	(0.022)	(0.028)	(0.028)	(0.033)	(0.071)

(*continued*)

Table 6. (*Continued*)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.058	−0.156	−0.492	−0.692		
	(0.257)	(0.257)	(0.704)	(0.718)		
Observations	856	856	856	856	814	250
R-squared	0.72	0.72	0.64	0.64		
Number of households			449	449	407	125
Endogeneity test for migration variable					2.345	0.078
p-value					0.1257	0.7807
Overidentification test (Hansen J statistic)						1.162
P-value						0.2811

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used.

Table 7. Determinants of land area dedicated to the basic grains (in hectares)

	Basic grains area					
	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	0.057*	–	0.113**	–	2.489***	–
	(0.034)	–	(0.057)	–	(0.903)	–
Standard deviation of remittances last period	–	0.051**	–	0.059	–	0.659***
	–	(0.020)	–	(0.038)	–	(0.244)
Land area (in HA)	0.030***	0.032***	0.014	0.015	0.034**	0.01
	(0.005)	(0.005)	(0.018)	(0.018)	(0.016)	(0.017)
Number of adults 65+ years old	−0.031	−0.028	0.098	0.09	0.213	−0.138
	(0.031)	(0.031)	(0.061)	(0.061)	(0.192)	(0.210)
Female (HH head)	−0.112**	−0.117**	−0.02	−0.024	−0.463	−0.745***
	(0.048)	(0.048)	(0.094)	(0.099)	(0.320)	(0.287)
Level of education (HH head)	−0.003	−0.002	0.007	0.008	0.001	0.021
	(0.008)	(0.008)	(0.009)	(0.009)	(0.026)	(0.035)
Age (HH head)	0.002	0.002	0.017***	0.017***	0.007	−0.005
	(0.001)	(0.001)	(0.005)	(0.005)	(0.011)	(0.010)
Number of household members (in El salvador)	0.020**	0.020**	0.054**	0.057***	0.004	0.163
	(0.009)	(0.009)	(0.021)	(0.021)	(0.049)	(0.106)
Number of children 0 to 16 years old	−0.005	−0.005	−0.065***	−0.066**	−0.076	−0.265**
	(0.012)	(0.012)	(0.025)	(0.025)	(0.066)	(0.135)
Value of livestock (divided by 1000)	0.057***	0.052***	0.049	0.038	0.064	−0.105
	(0.011)	(0.011)	(0.041)	(0.043)	(0.049)	(0.131)

(*continued*)

Table 7. (*Continued*)

	Basic grains area					
	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Salvadoran wage rate	−0.001	−0.001	0.017	0.016	0.051*	0.014
	(0.008)	(0.008)	(0.011)	(0.012)	(0.029)	(0.040)
Constant	−0.024	0.005	−1.047***	−0.986***		
	(0.090)	(0.090)	(0.279)	(0.273)		
Observations	856	856	856	856	814	250
R-squared	0.17	0.17	0.13	0.13		
Number of households			449	449	407	125
Endogeneity test for migration variable					15.588	16.335
p-value					0.0001	0.0001
Overidentification test (Hansen J statistic)						0.206
P-value						0.65

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used. Basic grains include corn, beans and sorghum.

Table 8. Determinants of land area dedicated to the other cash crops (in hectares)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	−0.024	–	−0.156**	–	−3.119***	–
	(0.064)	–	(0.070)	–	(1.153)	–
Standard deviation of remittances last period	–	−0.015	–	−0.045	–	−0.795***
	–	(0.038)	–	(0.069)	–	(0.308)
Land area (in HA)	0.111***	0.111***	0.044**	0.044*	0.019	0.024
	(0.009)	(0.009)	(0.022)	(0.023)	(0.030)	(0.027)
Number of adults 65+ years old	−0.138**	−0.138**	−0.196**	−0.187**	−0.34	0.034
	(0.058)	(0.058)	(0.093)	(0.094)	(0.231)	(0.300)
Female (HH head)	−0.228**	−0.227**	−0.563***	−0.573***	−0.01	0.101
	(0.091)	(0.091)	(0.182)	(0.191)	(0.413)	(0.321)
Level of education (HH head)	0.019	0.018	−0.012	−0.013	−0.004	−0.043
	(0.014)	(0.014)	(0.016)	(0.016)	(0.034)	(0.043)
Age (HH head)	0.004	0.004	−0.003	−0.003	0.01	0.025
	(0.003)	(0.003)	(0.009)	(0.009)	(0.014)	(0.019)
Number of household members (in El salvador)	0.022	0.022	−0.014	−0.018	0.048	−0.126
	(0.017)	(0.017)	(0.026)	(0.026)	(0.061)	(0.130)
Number of children 0 to 16 years old	−0.028	−0.028	0.035	0.035	0.048	0.153
	(0.022)	(0.022)	(0.026)	(0.026)	(0.078)	(0.143)
Value of livestock (divided by 1000)	0.011	0.013	−0.156	−0.148	−0.175	0.157
	(0.020)	(0.021)	(0.144)	(0.152)	(0.145)	(0.128)
Salvadoran wage rate	−0.017	−0.017	−0.006	−0.005	−0.049	−0.008
	(0.014)	(0.014)	(0.014)	(0.013)	(0.040)	(0.036)

(*continued*)

Table 8. (*Continued*)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0.012	−0.022	0.788	0.736		
	(0.169)	(0.170)	(0.492)	(0.503)		
Observations	856	856	856	856	814	250
R-squared	0.22	0.22	0.11	0.1		
Number of households			449	449	407	125
Endogeneity test for migration variable					19.622	5.203
p-value					0	0.0226
Overidentification test (Hansen J statistic)						2.968
P-value						0.0849

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used. Other cash crops include fruits, vegetables, timber, cacao, and sugar.

Table 9. Determinants of total land holdings (in hectares)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	0.668**	–	−0.391	–	1.119	–
	(0.27)	–	(0.36)	–	(2.94)	–
Standard deviation of remittances last period	–	0.266	–	−0.079	–	−2.057
	–	(0.16)	–	(0.19)	–	(1.87)
Number of adults 65+ years old	−0.16	−0.138	0.117	0.14	0.192	0.737
	(0.25)	(0.25)	(0.22)	(0.22)	(0.28)	(1.06)
Female (HH head)	−0.537	−0.518	−0.968	−1.015	−1.266**	−1.575
	(0.39)	(0.39)	(0.70)	(0.72)	(0.57)	(1.33)
Level of education (HH head)	−0.012	−0.008	−0.032	−0.034	−0.036	−0.001
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.13)
Age (HH head)	0.034***	0.036***	0.062	0.062	0.056	0.195*
	(0.01)	(0.01)	(0.04)	(0.04)	(0.05)	(0.12)
Number of household members (in El salvador)	−0.047	−0.051	0.05	0.042	0.019	−0.417
	(0.07)	(0.08)	(0.10)	(0.10)	(0.13)	(0.45)
Number of children 0 to 16 years old	−0.006	−0.002	−0.066	−0.067	−0.074	0.29
	(0.10)	(0.10)	(0.12)	(0.12)	(0.13)	(0.76)
Salvadoran wage rate	0.146**	0.145**	0.223**	0.228**	0.248**	0.277
	(0.06)	(0.06)	(0.10)	(0.10)	(0.10)	(0.22)
Constant	−0.596	−0.378	−2.43	−2.546		
	(0.73)	(0.74)	(2.09)	(2.14)		

(*continued*)

Table 9. (*Continued*)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Observations	856	856	856	856	814	250
Number of households			449	449	407	125
R-squared	0.03	0.03	0.05	0.05		
Endogeneity test for migration/remittance variable					0.313	1.273
p-value					0.5761	0.2591
Overidentification test (Hansen J statistic)						0.11
p-value						0.7404

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used. Total land holdings include the house lot as well as net rented land (land rented in – land rented out).

suggest that we again cannot reject the exogeneity of remittances or migration. OLS (model 1) results suggest that having an international migrant in the previous period increases total land holdings by .668 hectares, however this result is not robust across specifications. In Table 10, which explains the value of livestock holdings of the household, we fail to reject the null hypotheses of exogeneity of remittances and migration. OLS results suggest that one standard deviation increase in remittances in the previous period leads to an increase in the value of livestock in the current period of $US394. However, given that the selection issue is not accounted for in the OLS this result may be biased upward since we would expect households with larger livestock holdings (a proxy for wealth) to be more likely to engage in migration.

One would expect that given the previous results suggesting that migrant households are pulling out of cash crop activities and moving toward more subsistence crops that their input use would decrease with migration, since one would expect less investment in chemical inputs in a subsistence system. The sign of the coefficients on lagged migration and remittances explaining the value of agricultural inputs (Table 11) in the OLS model support this hypothesis however the coefficients are not statistically significant. Further, results in both FE models (models 3–6) have inconsistent signs and are not significant.

Lastly, Table 12 presents results on the effect of migration and remittance on agricultural return to labour and land. Again, we fail to reject the null hypothesis of exogeneity for both migration and remittances. Fixed effects results (model 4) suggest that a one standard deviation increase in remittances in the previous period leads to a decrease in returns to labour and land. This is consistent with the above results suggesting that migrant households are shifting back into subsistence agricultural production which would lead to a lower return on labour and land. However, again this result should be considered with caution given the selection issues inherent in the OLS specification and the fact that this result however is not robust across specifications.[14]

These results generally suggest that households are moving away from cash crop production toward less labour-intensive, food security oriented crops such as basic grains. This finding suggests that migration and remittance are not spurring investment into riskier cash crops or other agricultural capital, as suggested by the second theory section presented above. Further, these findings also do not suggest that migration and remittances are acting as insurance, allowing households to move into riskier higher return crops, since the results suggest the exact opposite reaction. The empirical results are most consistent with the first theoretical assertion that a loss of labour is changing agricultural household production activities. Results suggest that family members are dedicating more land to producing basic grains on-farm. This could imply that family labour and hired labour are not perfect substitutes and that the knowledge of cash crop production or investment in cash crop production decreases with the loss of a family member to migration. In Damon (2008), it was found that migrant families reduce off-farm labour for males, females, and children, and reallocate this labour back to the family farm. This would be further evidence of the imperfect substitutability between family and hired labour. Further, it is evidence that migrant families are more interested in maintaining their food security through the production of basic grains rather than increasing their participation in commercial agriculture.

Table 10. Determinants of the value of livestock (in US$)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	144.155	–	−84.414	–	1,187.72	–
	(123.13)	–	(81.46)	–	(806.05)	–
Standard deviation of remittances last period	–	396.467***	–	333.162	–	296.349
	–	(71.51)	–	(247.55)	–	(315.23)
Number of adults 65+ years old	−64.654	−48.843	58.904	50.667	108.059	178.605
	(113.14)	(111.29)	(112.30)	(113.90)	(150.43)	(314.15)
Female (HH head)	−330.845*	−403.943**	−360.329	−490.631*	−608.546*	−1,536.911**
	(171.85)	(169.19)	(285.07)	(292.82)	(312.04)	(635.02)
Level of education (HH head)	23.402	25.996	16.981	20.726	15.868	5.991
	(27.53)	(27.08)	(20.37)	(20.46)	(22.95)	(44.71)
Age (HH head)	8.929*	6.829	19.818*	13.617	14.626	23.415
	(5.23)	(5.14)	(11.24)	(11.54)	(15.32)	(18.32)
Number of household members (in El salvador)	12.252	14.446	42.43	41.555	18.827	133.694
	(33.43)	(32.86)	(32.53)	(34.65)	(43.56)	(107.07)
Number of children 0 to 16 years old	−43.486	−47.941	−28.235	−34.987	−39.367	−105.976
	(42.64)	(41.92)	(39.39)	(42.77)	(54.23)	(199.38)
Salvadoran wage rate	27.072	24.767	−17.282	−9.473	−1.339	−50.763
	(28.29)	(27.83)	(48.53)	(44.17)	(46.86)	(96.39)
Constant	−60.123	137.92	−567.04	−260.838		
	(327.63)	(323.19)	(631.66)	(687.25)		
Observations	886	886	886	886	874	260
Number of households			449	449	437	130
R-squared	0.02	0.05	0.02	0.07		
Endogeneity test for migration/remittance variable					3.487	0.12
p-value					0.0618	0.7285
Overidentification Test (Hansen J statistic)						0.067
p-value						0.7959

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used.

Table 11. Determinants of the value of agricultural inputs (in US$)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	−892.195	–	−35.796	–	8,727.46	–
	(738.15)	–	(357.32)	–	(9731.39)	–
Standard deviation of remittances last period	–	−194.337	–	98.611		−22.965
	–	(394.62)	–	(173.19)		(50.46)
Number of adults 65+ years old	−902.674	−890.839	−1,068.39	−1,072.83	−753.979	−49.354
	(671.77)	(672.46)	(758.44)	(768.69)	(923.27)	(36.75)
Female (HH head)	−668.041	−737.896	−125.75	−189.493	−3,222.89	−183.477***
	(1044.14)	(1045.93)	(788.05)	(752.09)	(3597.62)	(62.52)
Level of education (HH head)	224.186	223.078	483.756	487.401	562.271	−9.612
	(184.36)	(184.53)	(344.35)	(348.03)	(426.60)	(7.95)
Age (HH head)	54.367	50.832	99.637	97.371	83	4.382
	(33.11)	(33.01)	(91.18)	(89.25)	(88.13)	(2.98)
Number of household members (in El salvador)	−139.854	−128.344	338.744	340.133	301.867	14.567
	(197.46)	(197.36)	(295.66)	(296.11)	(295.07)	(21.56)
Number of children 0 to 16 years old	382.934	371.725	877.645	878.272	899.838	−8.961
	(249.97)	(250.02)	(1086.72)	(1085.44)	(1073.00)	(35.53)
Salvadoran wage rate	−78.635	−85.517	109.764	111.047	−1.677	10.573
	(210.42)	(210.52)	(235.12)	(235.67)	(189.13)	(8.28)
Constant	−1,721.67	−1,907.79	−10,392.91	−10,300.58		
	(2146.72)	(2154.14)	(10090.91)	(10004.55)		
Observations	677	677	677	677	466	164
Number of households			444	444	233	82
R-squared	0.01	0.01	0.03	0.03		
Endogeneity test for migration/remittance variable					0.914	0.203
p-value					0.339	0.6521
Overidentification test (Hansen J statistic)						5.082
p-value						0.0242

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used. Value of agricultural inputs is calculated by a household reported quantity and price of fertilisers, herbicides, and fungicides.

Table 12. Determinants of agricultural return to labour and land (in US$)

	OLS		FE		FE-IV	
	(1)	(2)	(3)	(4)	(5)	(6)
International migrant last period (1/0)	30.262	–	−533.775	–	3,596.19	–
	(268.44)	–	(394.60)	–	(3810.49)	–
Standard deviation of remittances last period	–	4.688	–	−388.102**	–	−1,037.94
	–	(143.25)	–	(176.82)	–	(947.89)
Number of adults 65+ years old	−86.117	−86.674	473.034	514.989	620.709	8.948
	(244.31)	(244.33)	(559.47)	(568.64)	(758.05)	(660.82)
Female (HH head)	−488.228	−485.369	50.281	62.709	−1,409.78	−1,168.95
	(379.38)	(379.71)	(964.94)	(917.37)	(1356.63)	(1092.26)
Level of education (HH head)	63.855	63.912	−91.231	−99.653	−53.772	−67.078
	(67.15)	(67.15)	(114.32)	(114.00)	(107.64)	(110.31)
Age (HH head)	10.438	10.575	−23.22	−15.605	−31.044	58.616*
	(12.05)	(12.00)	(45.15)	(46.53)	(60.57)	(31.30)
Number of household members (in El salvador)	35.409	34.99	47.759	39.378	30.508	−138.433
	(71.86)	(71.76)	(84.05)	(82.90)	(139.88)	(264.07)
Number of children 0 to 16 years old	−147.089	−146.649	−175.524	−176.493	−165.756	27.029
	(91.13)	(91.06)	(116.06)	(112.59)	(215.19)	(397.01)
Salvadoran wage rate	118.692	118.937	218.808*	205.155*	166.016	200.807
	(76.45)	(76.42)	(119.96)	(113.17)	(149.39)	(150.10)
Constant	159.069	164.419	1,800.84	1,293.85		
	(780.20)	(782.28)	(2361.59)	(2378.10)		
Observations	675	675	675	675	462	164
Number of households			444	444	231	82
R-squared	0.02	0.02	0.03	0.03		
Endogeneity test for migration/remittance variable					1.871	0.704
p-value					0.1714	0.4031
Overidentification test (Hansen J statistic)						0.501
p-value						0.4789

Note: *significant at 10 per cent; **significant at 5 per cent; ***significant at 1 per cent. All standard errors are clustered at the municipal level. Data from 1996, 1998, 2000, and 2002 are used. Agricultural returns to labour and land is calculated as agricultural revenue from both livestock and crops net of agricultural inputs.

VI. Conclusions

This paper examines the impact of international migration and remittances on household agricultural production in El Salvador. Theory suggests that remittances and migration can help overcome either insurance or credit constraints or result in a loss of family labour. If remittances and migration are used to overcome credit constraints, it is expected that the inflow of remittances would increase agricultural asset accumulation, whereas if remittances are used as an insurance mechanism, we would expect to see a reallocation of productive resources, possibly toward riskier crops, depending on the risk preferences of the household.

Results suggest that migration and remittances have a significant effect on land use allocation. Both migration and remittances increase land area dedicated to basic grains production. While the area of basic grains cultivation increases, results suggest that both pasture and other cash crop areas decrease if the household has a migrant in the previous period and with an increase in remittances. Empirical results do not clearly support the insurance or credit motives of migration, but lend evidence that family and hired labour are imperfect substitutes causing families to pull out of cash crop production and allocate land resources toward basic grains production. Evidence on the effect of migration and remittances on agricultural asset accumulation is weaker and mixed. There is some weak evidence that migration and remittances contribute to agricultural asset accumulation in the form of land and livestock, there is no evidence that they affect the use of agricultural inputs, and only weak evidence that an increase in remittances decreases returns to land and labour.

Overall, the results presented in this paper are similar to found in Rozelle and others (1999). Rozelle and others find that in China agricultural productivity fell as a result of migration because of imperfect labour markets. In El Salvador, families are reallocating resources back into basic grains production, away from cash crops, in the face of migration because of the imperfect substitutability of labour. Hired labour is likely insufficient to perform the management tasks previously performed by the migrated family labourers and therefore basic grain production increases by the remaining family members. Findings in this paper are also broadly consistent with those found in the studies examining migration in the case of Albania, as they find that migrant households in Albania are investing more in livestock and less labour intensive agriculture (McCarthy et al., 2006; Miluka et al., 2007). Both cases characterize migration as a means to pull out, or decrease the importance of agriculture in a household's livelihood strategy.

Evidence found in this paper suggests that growth in the Salvadoran commercial agricultural sector may be significantly inhibited with the increasing prevalence of migration from the rural sector. This paper documents this by showing how productive resources are systematically allocated away from cash crop production when a household engages in migration. This trend is an important consideration for the future development trajectory of the Salvadoran economy, given that it implies that migrant households are less likely to produce cash crops. Policy makers should consider programmes that maintain or increase the growth of the commercial agricultural economy, such as incentive programmes to reallocate rural resources toward their most productive uses, given that land and labour are being allocated away from cash crop production into basic grains production. Without concerted

efforts by policy makers to maintain competitiveness in the agricultural sector, this sector will surely continue its decline in relative economic importance as migration from Salvadoran rural areas continues.

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Notes

1. This figure of 800,000 people is likely an underestimate. Other estimates suggest that there are between 1.5 and 2.5 million Salvadorans living in the United States.
2. These remittance figures are a lower bound, since a significant proportion of remittance flows occur through informal channels and such remittances are never accounted for.
3. Amuedo-Dorantes and Pozo (2006) question whether the relationship between income shocks and remittances can accurately be called an insurance mechanism. They suggest that proving a statistical relationship between income shocks in the home country and remittance levels does not uniquely identify remittances as an insurance mechanism. However, this distinction, while important in proving remittances as insurance, is not important for the purposes of this paper, which is to examine the agricultural outcomes in the face of remittances as insurance.
4. In Spanish: Fundación Salvadoreña para el Desarrollo Económico y Social.
5. Land holding, agricultural households are those households that hold more than .1 hectares of agricultural land. In years 1998, 2000, and 2002 agricultural land specifically excludes the housing lot, however, the housing lot was not measured in 1996, and therefore the house lot area is included in the agricultural land measure in 1996 only. Land holdings include rented land, which partly explains the increase in landholding households over the survey period.
6. To examine any potential bias introduced by attrition, a probit model to explain the probability of staying in the panel was run. Results suggest that there are no significant characteristics that increase the chances of a household remaining in the panel all four years, suggesting that attrition was random. Results are available from the author.
7. Where municipal estimates are unavailable, department level estimates are used.
8. In 1996, agricultural household are defined as households that hold 0.1 hectares of land including the housing lot, since the size of the house lot was not measured in 1996.
9. Both livestock value and land area are dropped in the regressions that explain the levels of these variables.
10. Acosta justifies this instrument by saying that a person that lived abroad and then returned may receive remittances given the connections that person has in the destination labour market.
11. This test statistic is distributed as chi-squared with as many degrees of freedom as the regressors.
12. While parsimony is somewhat sacrificed with the inclusion of the US unemployment rate, its inclusion does not change the qualitative results in the second stage equations and at times strengthens the significance of the results.
13. Coffee is excluded from the 'cash crop' area. The effect of migration and remittances on coffee area was also investigated but found to have no effect. This result is not surprising given that coffee is a permanent crop that takes more than five years to mature.
14. A number of other agricultural outcomes were examined but did not yield significant results, but their insignificance is worth mentioning. Specifically, housing lot area, fallow area, coffee area, net rented land, and the value of crop production were all estimated but no significant results were found.

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