Abundance from Abroad: Migrant Earnings and Economic Development in the Philippines*

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Abstract

How do earnings by international migrants affect their origin areas? We examine the impacts of shocks to international migrant earnings on economic outcomes across Philippine provinces over two decades. We exploit exogenous variation in migrant earnings driven by exchange rate shocks across Filipino migrant destinations due to the 1997 Asian Financial Crisis. These shocks have heterogeneous effects across provinces on migrant earnings per capita, depending on pre-shock migrant earnings and the distribution of migrants across overseas destinations. Positive province-level shocks to migrant earnings lead to increases in household assets and child schooling. We do not find large or robust impacts on labor supply outcomes (either international or domestic). Shocks to female and male migrant earnings have different effects, with female shocks driving impacts on assets and schooling.

Keywords: Migration, remittances, migrant earnings, assets, schooling, labor force participation, Philippines

JEL classification: F22, J24, L26, O15, O16

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1 Introduction

In 2015, 244 million people were living outside their country of birth, up from 153 million in 1990 (United Nations (2015)). In recent decades, developing country governments and multilateral agencies have incorporated policies related to international migration in development policy-making.[1] The large income gains accruing to migrant workers (Gibson et al. (2010), Clemens et al. (2016)) migrating internationally makes such policies attractive to policy-makers. That said, the empirical evidence on the impact of international migrant earnings on development outcomes in home areas is surprisingly sparse.

We seek to address this gap in knowledge. We study the impact of exogenous shocks to international migrant earnings on development outcomes in migrants' home areas in the Philippines. Compared to existing research on the economic impacts of migration on origin areas, the study has three distinguishing features. First, no previous study has examined the impact of shocks to migrant earnings. Second, we exploit a natural experiment that we argue allows us to provide a credible estimate of the causal impacts. Third, we examine differential impacts of earnings shocks accruing to female and male migrants.

The focus on the impact of migrant earnings is the first unique feature of this study. While previous work has taken the independent variable of interest to be migration or remittances (at household or locality levels),[2] migrant earnings is of independent interest. Migrant earnings do not have to be collinear with migration; they can rise or fall, even if the migration rate remains stable. In addition, impacts of migrant earnings shocks are not necessarily mediated by subsequent changes in remittances, since migrant earnings shocks can also change household expectations regarding future migrant earnings prospects, returns to education, and the like. We estimate migrant earnings at the locality level using an unusual dataset: the universe of new work contracts registered by overseas Filipino workers (OFWs) with the Philippine government (the POEA/OWWA dataset). These data provide the locality of origin of migrants on work contracts overseas and their contractual wages. We

[1] McKenzie and Yang (2015) review empirical evidence on migration-related development policies. Policy-oriented publications include Fajnzylber and Lopez (2007) and World Bank (2006).

[2] Yang (2011) reviews recent research on the economics of migrant remittances.

use data from these work contracts to estimate total migrant annual earnings at the province level, dividing by province population to obtain our independent variable of interest: migrant earnings per capita.

The second key feature of our study is that we exploit a natural experiment to provide plausibly exogenous variation in province-level migrant earnings per capita. The 1997 Asian Financial Crisis caused large, persistent changes in exchange rates across the many overseas destinations of Filipino migrants. Crucially for the analysis, these exchange rate shocks were heterogeneous across migration destinations. Between 1997 and 1998, the US dollar and currencies in key Middle Eastern destinations of overseas Filipino workers rose 50% in value against the Philippine peso. Over the same time period, by contrast, the currencies of Taiwan, Singapore and Japan rose by only 26%, 29% and 32%, while those of Malaysia and Korea actually fell slightly (by 1% and 4%, respectively) against the peso.

How did these exchange rate shocks lead to heterogeneous shocks to migrant earnings per capita across Philippine localities? The variation we exploit derives from two dimensions of heterogeneity across roughly 80 Philippine provinces that, in combination, we argue can be taken as plausibly exogenous. The first dimension of heterogeneity is the pre-shock distribution of a province's migrant earnings across destination countries. This heterogeneity in earnings shares across destinations generated heterogeneity in the size of the *earnings-weighted* exchange rate shock (exchange rate shocks weighted by overseas destination earnings shares) across provinces. A province with a high share of migrant earnings denominated in US dollars (or currencies pegged to it) experienced a much more positive exchange rate shock than one in which a relatively large fraction of earnings came from Malaysia or Korea. For example, Davao del Norte province experienced a positive exchange rate shock of 35.1% from 1997 to 1998, while over the same period Basilan province had a much larger exchange rate shock of 49.7%.[3]

The second dimension of heterogeneity is in migrant earnings per capita (total earnings of migrants from a province, divided by province population) at baseline, prior to the shock. There is a wide variation in migration rates (the share of popu-

[3] All the province-level shocks are positive, since most migration destination currencies appreciated against the Philippine peso.

lation migrating internationally) and average migrant wages across provinces, and therefore wide variation in baseline migrant earnings per capita. For example, Camarines Norte province had migrant earnings per capita in 1993 of just PhP 1,343,[4] while in Bulacan province the corresponding figure was more than twice as large, PhP 3,157 (these provinces experienced similar destination-weighted exchange rate shocks of 37.0% and 38.0%, respectively).[5]

A province's shock to migrant earnings per capita is the product of these two dimensions of heterogeneity: the province's earnings-weighted exchange rate shock multiplied by the province's baseline (pre-shock) migrant earnings per capita. In our analysis, we take only the product of these two dimensions of heterogeneity as exogenous, not either dimension on its own.

We examine the impacts of shocks to migrant earnings per capita on province-level outcomes over two decades. The first outcome of interest is migrant earnings per capita itself, and then we turn to province-level averages of household asset ownership, years of schooling of children, and labor supply. We conduct difference-in-difference analyses with a continuous "treatment" variable (the post-1997 shock to migrant earnings per capita). Regression analyses control for province fixed effects, year fixed effects, and heterogeneous linear trends across provinces (for most outcomes, province-specific linear time trends). We also control for the earnings-weighted exchange rate shock and baseline migrant earnings per capita interacted with a post-shock indicator, so that identification comes only from the product of these two variables.

We first show that the initial shock to province-level migrant earnings per capita is highly persistent over time. The short-run shock (over 1997-1998) predicts the change in migrant earnings per capita over the subsequent decade (through 2007-2009). This persistence arises because the exchange rate shocks themselves were highly persistent, as are migration rates and the destination-country composition at

[4] All money amounts in this paper are in real 2010 Philippine pesos. The exchange rate was approximately 45 pesos to the USD in 2010.

[5] Calculation of the earnings-weighted exchange rate shock as well as the baseline (pre-shock) migrant earnings per capita at the province level both take advantage of the abovementioned POEA/OWWA dataset. Data on migrant origins in the Philippines, their locations overseas, and their overseas earnings are all necessary for exploiting the natural experiment as described.

the province level.[6]

These positive shocks to migrant earnings lead to improvements in a set of key outcomes observable in Census and large-sample Labor Force Survey data. The shock leads to higher household asset ownership. In addition, we see increases in years of schooling completed, in particular among younger children (aged 7-12, or primary school) as well as those aged 19-24 (post-secondary). In contrast to positive impacts on assets and schooling, we find no evidence of substantial impacts on labor supply of adults or children.

We then explore differential impacts of female and male migrant earnings shocks. For each province, we create separate measures of the shocks to female and male migrant earnings per capita. Strikingly, only shocks to female migrant earnings lead to increases in household assets and child schooling in home areas. Impacts of male migrant earnings on these outcomes are typically much closer to zero and are not statistically significantly different from zero.[7]

The magnitude of the effects is nontrivial. Consider increasing the magnitude of a province's shock to migrant earnings per capita by one standard deviation. This would cause migrant earnings per capita to be higher by PhP 1,263 (0.386 standard deviation of migrant earnings per capita, about 3.4% of per capita income) in 2007-2009, about a decade after the initial shock. Such a shock would increase the average provincial asset index by 0.372 standard deviation, and increase average years of schooling of 7-12 year olds by 0.062 years (0.188 standard deviation).

Overall, our results suggest that localities are better off on important dimensions when international migrant earnings improve. They help assuage concerns that international migrant earnings opportunities can have net negative consequences for home areas due, for example, to the departure of skilled individuals from the economy ("brain drain"), reductions in educational investments due to perceived lower returns, lower parental time investment in children, or by creating a culture of "dependency" or reliance on remittances. The increases we see in years of schooling

[6]This positive impact of the shock on migrant earnings per capita occurs even as the migration *rate* (migrants as a share of population) remains roughly stable.

[7]When it comes to labor supply outcomes (both internationally and domestically), female and male shocks have opposite impacts: female shocks tend to have positive effects on labor supply, while male shocks tend to have negative effects.

and assets are consistent with a loosening of credit constraints. The increase in schooling investments may also reflect higher perceived returns to schooling.

We examine impacts on economic development outcomes at the locality level, so our estimates incorporate general equilibrium effects, spillover effects, and changes in incentives for entire local populations (not just households connected to current migrants).[8] The focus on aggregate outcomes is relatively rare in the migration literature, owing to substantial challenges in finding plausibly exogenous variation in migration-related right-hand-side variables of interest.[9] The central methodological concern in such an investigation is that migration-related outcomes are in general not randomly allocated across localities, so that any observed relationship with development outcomes may simply reflect the influence of unobserved omitted variables.[10] A key contribution of our work is to identify and exploit a natural experiment that provides plausibly exogenous variation in migrant earnings across localities, and estimate its effects on local outcomes. We systematically address key threats to causal identification, including omitted variable bias, alternate channels of effects, and selection bias.

This paper builds on Yang (2006) and Yang (2008b), which examine impacts of the 1997 Asian Financial Crisis exchange rate shocks on international migrants' origin households in the Philippines. These papers examine short-term (15-month) impacts for households of migrant workers only, and find that positive exchange rate shocks lead to reduced return migration, increased child schooling, and lower child labor. This paper builds on these prior papers in important ways. We measure impacts on aggregate outcomes across entire populations of migrant-origin areas,

[8] Estimated impacts also reflect aggregate effects studied in the literatures on "brain drain" and "brain gain" (Docquier and Rapoport (2012), Stark et al. (1997), Mountford (1997), Batista et al. (2012), Shrestha (2017), Chand and Clemens (2008)).

[9] Previous studies on the aggregate impacts of international migration on origin areas include Orrenius et al. (2010), Lopez-Cordoba (2005), Adams and Page (2005), Acosta et al. (2008), Dinkelman and Mariotti (2016), Barsbai et al. (2017), Abarcar and Theoharides (2017), Theoharides (2018), and Theoharides (forthcoming). Barham and Boucher (1998) and McKenzie and Rapoport (2010) study impacts on income distribution in migrant home areas. Kinnan et al. (forthcoming) examine impacts of internal migration on origin areas in China.

[10] For example, areas with higher education levels could send more migrants, and also have better outcomes. Alternatively, areas experiencing a negative shock might send more migrants overseas as a coping mechanism (Bazzi (2017), Mahajan and Yang (2018)), so that migration might be negatively correlated with locality outcomes.

not just migrant-origin households. In addition, we access new data to examine impacts of migrant earnings shocks. Our estimates incorporate impacts over a much longer time period, using data up to thirteen years after the shock. Finally, we examine the differential impacts of shocks to female and male migrant earnings, allowing us to contribute in a novel way to the large literature on the impact of female vs. male resources on development outcomes.[11]

This paper is organized as follows. Section 2 provides background on international migration from the Philippines. Section 3 describes the data used in the empirical analyses, Section 4 discusses empirical methods, and Section 5 reports empirical results. Section 6 concludes.

2 Philippine Migration: Overview

The Philippines was the first country to facilitate temporary overseas contract migration on a large scale. Motivated by poor domestic economic conditions, in 1974 the Philippine government implemented explicit policies to facilitate international labor migration. Since then, international migration has increased dramatically. Online Appendix Table 1 shows that in recent decades increasing shares of the Philippine population have migrated, had a household member migrate, or received migrant remittances. The fraction of the population (reported by households in the Census) currently overseas has risen from 0.7% to 1.6% between 1990 and 2010. Over the same period, the fraction of households reporting an overseas migrant member rose from 3.2% to 6.3%. Migrants send remittances to more than just their origin household, however: the share of housesholds receiving remittances rose from 17.6% in 1991 to 26.0% in 2009.

Migration from the Philippines is largely temporary and legal, and occurs through licensed and regulated private recruitment agencies. Recruiting agencies legally can charge fees up to one month's wages, but migrants incur numerous other costs

[11] One difference with the current paper, compared to Yang (2008b) in particular, is that we can only examine impacts on a restricted set of outcome variables. Only the Philippine Census of Population and the large-sample Labor Force Survey (LFS) have sufficient sample size to allow enough precision for province-level outcomes. Of particular note, data on migrant remittances are not available in the Census or LFS. That said, we do show positive impacts on household assets, indicating indirectly that positive migrant earnings shocks lead to resource flows from migrants to Philippine households.

prior to migrating such as travel to Manila, health checks, and passport processing. Overseas temporary contract work is the primary channel through which Filipinos migrate, and most contracts are two years in duration with many Filipinos renewing existing contracts for multiple years. Between 1992 and 2000, 83% of Filipinos abroad were engaged in contract work,[12] with most of the rest being non-temporary migration via family reunification policies or other permanent migration channels. The Philippines now serves as a model for other countries like Indonesia, Sri Lanka, and Bangladesh, who have adopted or are in the process of adopting their own temporary contract migration programs (Rajan and Misha (2007), Ray et al. (2007)).

Crucially for our identification strategy, Filipinos migrate to a wide variety of destination countries. Table 1 shows the top twenty destination countries for all Filipino migrants prior to the Asian financial crisis. Approximately 42% of migrants work in Saudi Arabia, and 16% of migrants work in Japan. No other top destination accounts for more than 10%. The top 20 countries account for 97.6% of all Filipino migrants, with the other 2.41% migrating to 142 other destinations. There is also substantial heterogeneity in the wages earned by migrants in different destinations. For instance, migrants in Saudi Arabia earn, on average, 306,000 Philippine pesos (Php) per year, while the figure for migrants to Japan is Php 1.5 million.

Within the Philippines, migration is more prevalent in certain provinces. Table 2 shows that, across provinces, the average international migration rate for 25 to 64 year olds is 2.1%, with a range of 0.1% to 7.3%. Across provinces, the choice of destination varies substantially, likely due to social networks and the locations of overseas recruiting agencies (Theoharides (forthcoming)). As a result, overseas destinations tend to be persistent, as we show formally below.

3 Data Sources and the Migrant Earnings Shock

3.1 Data Sources

We summarize our data sources here, and provide further details in the Online Appendix. Summary statistics can be found in Table 2.

[12] Authors' calculation from the Survey of Overseas Filipinos (SOF), a rider survey of the country's nationally-representative Labor Force Survey (LFS).

3.1.1 *The POEA/OWWA Dataset*

Two unique administrative datasets from agencies of the Philippine government allow us to calculate the two key province-level variables needed for our analysis: 1) the earnings-weighted exchange rate shock, and 2) baseline (pre-shock) migrant earnings per capita.[13] The first dataset is from the Overseas Worker Welfare Administration (OWWA), the government agency tasked with ensuring the well-being of overseas migrants and their families. All Filipinos departing on overseas work contracts are required to obtain OWWA membership prior to departure, and OWWA keeps a detailed membership database that includes the migrant's home address in the Philippines. The second dataset, from the Philippine Overseas Employment Administration (POEA), provides data on migrant earnings. POEA is tasked with enforcing regulations related to work contracts of OFWs. In particular, POEA verifies that contracted wages meet minimum wage requirements (see McKenzie et al. (2014) for a detailed discussion) and keeps a database of wages and other contractual information for departing OFWs. Both the OWWA and POEA data include name, date of birth, destination, and gender, and so we match the two datasets using probabilistic matching in order to determine the province of origin for all migrants in the POEA database.

3.1.2 *Census Data*

Data on child years of schooling in our panel of provinces come from four rounds of the Philippine Census of Population (1990, 1995, 2000, and 2010). The exchange rate shocks occurred in 1997, so for each province observation we have years of schooling data for two pre-shock years and two post-shock years.

The Philippine Census does not contain data on wealth or poverty status of households, and so it is not possible to create an aggregated measure of province-level poverty using the Census micro data. However, the Census does contain data on ownership of a number of durable goods, access to utilities, housing quality, and land and home ownership. We construct an index of household assets by taking the first principal component of these binary variables (Filmer and Pritchett (2001)).[14]

[13] Theoharides (forthcoming) also uses these data.

[14] These asset data are only available in the 1990, 2000, and 2010 rounds of the Census. The

3.1.3 Labor Force Survey

The Philippine Census does not ask about employment status in all years, so we use data from the Philippine Labor Force Survey (LFS), quarterly from 1992-2011, to create a panel of labor supply outcomes, including international migration specifically. We have five years of pre-shock data, and 14 years of post shock data. The first two quarters of 1997 are assigned to the pre-shock period, while the latter two quarters of 1997 are considered post-shock. We examine province-level labor force participation rates for individuals aged 16 and above, and employment rates for children aged 10-15 (for whom labor force participation is not measured). These outcomes are defined as *overall* labor supply rates, including individuals working overseas.[15] In addition, we examine international migration rates for individuals aged 16 or more.

3.1.4 Exchange Rates

The monthly exchange rate data that are used to construct the exchange rate shock variable are from Bloomberg LP., while annual data used to show the persistence of the exchange rate shocks are from World Development Indicators.

3.2 The Migrant Earnings Shock

Our causal variable of interest is the province-level shock to migrant earnings per capita. This variable is the product of two dimensions of heterogeneity across provinces: the earnings-weighted exchange rate shock multiplied by baseline (pre-shock) migrant earnings per capita.

3.2.1 Earnings-weighted exchange rate shock

Because Filipino provinces differ in the destinations of their international migrants (and their corresponding earnings), there was substantial heterogeneity in the earnings-weighted exchange rate shocks experienced by different provinces following the Asian financial crisis. In July 1997, the Thai baht was devalued, setting off a series

loadings on the individual variables are obtained from the principal component analysis for the 1990 data, and the resulting loadings are then used to construct an asset index for 2000 and 2010. The principal component loadings can be found in Online Appendix Table 4.

[15] We show that results are nearly identical if overseas individuals are excluded when calculating these variables.

of speculative attacks on national currencies located primarily in Southeast and East Asia. The crisis was unexpected on the part of the affected countries themselves as well as financial market analysts (Radelet and Sachs (1998)), and so migrants and their home areas should also have been surprised by the shock. The crisis led to the devaluation of numerous currencies throughout Southeast and East Asia, including the Philippines'. As a result, the exchange rate vis-a-vis the Philippine peso changed dramatically in many of the key destinations of Filipino migrants. An appreciation of the exchange rate in a given destination country provides a positive income shock to Filipino migrants working in that destination; each unit of foreign currency earned abroad would be convertible to more Philippine pesos.

For each migrant destination country j, we construct the following measure of the change in the exchange rate between the twelve months preceding July 1997 and the twelve months preceding October 1998:

$$ERCHANGE_j = \frac{\text{Average country j exchange rate from Oct. 1997 to Sep. 1998}}{\text{Average country j exchange rate from Jul. 1996 to Jun. 1997}} - 1 \qquad (1)$$

Exchange rate changes for the 20 major destinations of Filipino migrants are presented in Table 1. Migrants in Saudi Arabia, Hong Kong, and the United Arab Emirates experienced positive exchange rate shocks of approximately 50%. Migrants in Japan and Taiwan experienced positive shocks, but of a smaller magnitude. Migrants in Malaysia and South Korea actually experienced slightly negative shocks.

We then calculate the average exchange rate shock for a Philippine province, taking into account a province's shares of migrant earnings across overseas destinations, as estimated using data from pre-shock contracts in the matched POEA/OWWA dataset. Let y_{pj} indicate the total annual earnings of migrants from province p who are overseas in country j prior to the Asian financial crisis. The weighted-average exchange rate shock measure for each province p is:

$$ERSHOCK_p = \frac{\sum_{j=1}^{J} y_{pj} ERCHANGE_j}{\sum_{j=1}^{J} y_{pj}} \qquad (2)$$

In other words, the exchange rate shock for a province is the weighted average exchange rate change across those countries, with each country's exchange rate weighted by the fraction of a province's migrant earnings in that country. Table 2 shows that this variable has a mean of 0.410 and a standard deviation of 0.045.

3.2.2 Baseline migrant earnings per capita

The POEA/OWWA dataset allows us to estimate average migrant earnings in each province prior to the shock. We estimate average earnings per migrant in the provice using the pre-shock contract data, then multiply average earnings per migrant by the number of migrants in each province from the 1995 Census, obtaining estimated total migrant wages for each province. This assumes that the average wage observed for new contracts in the POEA/OWWA data is a reasonable proxy for the wages of migrants whose contracts are not captured in the dataset. We then divide total migrant wages by the province's population (from the 1995 Census) to obtain pre-shock migrant earnings per capita in the province, $MigEarn_{p0}$.

Table 2 shows summary statistics for $MigEarn_{p0}$. The average is Php 4,263, the standard deviation is Php 3,275, and the range runs from Php 838 to Php 12,611.[16]

3.2.3 The shock to migrant earnings per capita

Our causal variable of interest is the province's shock to migrant earnings per capita: the product of the earnings-weighted exchange rate shock and baseline (pre-shock) migrant earnings per capita. We construct this variable from the demeaned component variables ($ERshock_p$ and $MigEarn_{p0}$). This variable has a mean of -0.014, and a standard deviation of 0.129.

Figure 1 displays the spatial distribution of the residual shock to migrant earnings per capita across Philippine provinces (after partialling out baseline migrant earnings per capita and the earnings-weighted exchange rate shock). The shock appears to be evenly distributed across the country. All regions contain provinces with a range of different values of the shock variable.

It is of interest to examine the correlates of the shock to migrant earnings per

[16] By comparison, per capita income in the Philippines ranged from PhP 33,958 in 1991 to PhP 38,446 in 2009 (real 2010 PhP, based on authors' calculations from the Family Income and Expenditure Survey of the Philippines).

capita, and its two component variables. We explore these such correlations in Online Appendix Table 5. In Column 1, we see that $ERshock_p$ is larger (exchange rate shocks are more positive) for provinces with high baseline migrant earnings per capita, lower baseline years of schooling, lower female employment rates, and higher rural share of population. $MigEarn_{p0}$ (column 2) is higher for provinces with more positive exchange rate shocks, higher share rural, and with higher asset index. For $ERshock_p * MigEarn_{p0}$, when migrant earnings per capita and the exchange rate shock are not included as RHS variables, there is a statistically significant positive association with years of schooling and female employment, and a negative one with the asset index. When we control for the baseline level of migrant earnings per capita and the exchange rate shock, only the latter is statistically significant (it is negative in sign), while the coefficients on the baseline province characteristics all decline substantially in magnitude, with only average years of schooling being statistically signficantly different from zero (and positive in magnitude).

3.2.4 Persistence of exchange rate shocks and migration patterns

There is persistence over time in both the exchange rate shocks and province-level overseas migration patterns. This leads to persistence of the shock to province-level migrant earnings per capita.

Online Appendix Figure 1 shows the exchange rates for the top ten destinations for Filipino migrants over time. The Asian financial crisis is denoted by the dashed line in 1997, after which there is substantial dispersion of the exchange rates. Notably, the exchange rate shock is persistent through the year 2010. Persistence of exchange rate shocks can also be seen Table 1 (columns 4 and 5).

In Online Appendix 2.1, we discuss formal statistical tests of the persistence of the exchange rate shocks as well as the overseas migration destination patterns across Philippine provinces. There is strong evidence of both types of persistence. The immediate (one-year) exchange rate shocks have a statistically significant relationship with exchange rates up to 13 years after the Asian Financial Crisis (through 2010). In addition, the pre-shock (pre-1997) international migration destination patterns of Philippine provinces have a positive and statistically significant relationship with destination patterns more than a decade after the shock (in 2009).

4 Methodology

We estimate the impact of province-level shocks to migrant earnings on province-level outcomes using the following regression specification:

$$Y_{pt} = \beta_0 + \beta_1 ERshock_p * MigEarn_{p0} * Post_t + \beta_2 ERshock_p * Post_t + \beta_3 MigEarn_{p0} * Post_t + \alpha_p + \gamma_t + \phi_p * Trend_t + \varepsilon_{pt} \quad (3)$$

where Y_{pt} is the outcome variable of interest for province p in period t. $ERshock_p$ is the earnings-weighted exchange rate shock for province p (expression 2 above). $Post_t$ is a dummy variable equal to 1 in July 1997 and after, and zero otherwise. $MigEarn_{p0}$ is annual migrant earnings per capita in the province (based on pre-shock earnings and population). α_p are province fixed effects, γ_t are period fixed effects, and $\phi_p * Trend_t$ is a province-specific linear time trend. ε_{pt} is a mean-zero error term. Year and province fixed effects are crucial, so that estimates are purged of any association between the shocks and time-invariant locality characteristics or province-invariant time period characteristics. The province-specific linear time trend captures long-running linear changes in outcomes that are specific to each province.[17] Standard errors are clustered at the level of the provinces.[18]

The regression specification also includes $ERshock_p$ and $MigEarn_{p0}$ interacted with $Post_t$. This is imporant: we do not presume that $ERshock_p$ and $MigEarn_{p0}$ by themselves to be strictly exogenous. The interaction terms with $Post_t$ account

[17] In a few cases (e.g., for migrant earnings), outcome variables are not available for enough time periods to allow inclusion of province-specific linear time trends. In these cases, we instead capture heterogeneity in trends by including in the regression a vector of pre-shock (1990) province-level control variables interacted with a time trend ($X_{p0} * Trend_t$). The variables in X_{p0} are all calculated using the 1990 Census, and are: school attendance rate (ages 7-18), female employment rate (ages 25-64), male employment rate (ages 25-64), share of population rural, overall asset index, share of individuals (ages 25-64) working in a household enterprise, and population, with the exception of the employment variables which are not available in 1990 and thus calculated from the 1995 Census. This term captures long-running changes in outcomes that are correlated with baseline province characteristics.

[18] For outcomes in the Census data, we define provinces based on 2000 geographic boundaries, resulting in 82 provinces. Outcomes in the LFS data use provinces based on 1990 geographic boundaries, resulting in 77 provinces.

for changes from before to after the shock that are related to provinces' exchange rate shocks and their pre-shock migrant earnings. Only the interaction between the province's destination-weighted exchange rate shock and its pre-shock per capita migrant earnings is taken to be exogenous. Therefore, our coefficient of interest is β_1 on the $ERshock_p * MigEarn_{p0} * Post_t$ term. To ease interpretation of coefficients on $ERshock_p$ and $MigEarn_{p0}$, both these variables are demeaned (so they have mean zero) when included in the regression and also when creating the interaction term. $MigEarn_{p0}$ is expressed in thousands of real 2010 Php. The coefficient β_1 is therefore interpreted as the impact of a positive one-unit (Php 1,000) shock to baseline migrant earnings per capita.

The identifying assumption is that a province's shock to migrant earnings is unrelated to underlying trends in outcome variables over the two decade time period. This is the parallel-trend assumption underlying difference-in-differences empirical approaches. Province fixed effects account only for differences in time-invariant characteristics across provinces, not for potential differences in time-trends. Concerns about differential trends in outcomes across provinces motivates inclusion – whenever possible – of province-specific linear time trends in the regressions. In all results tables, we show coefficient estimates without and with the province-specific linear trends, to gauge the robustness of results to their inclusion.

5 Results

5.1 Migrant earnings

We first show that the shock variable we construct does have a lasting impact on migrant earnings per capita. We estimate regression equation 3 where the dependent variable is province-level migrant earnings per capita (total migrant earnings divided by province population, denominated in thousands of real 2010 Philippine pesos). There is one pre-shock observation for each province (1993) and three post-shock observations (2007, 2008, and 2009).

Results are in the first row of Table 3, panel (a). The coefficient on the migrant earnings shock is positive and statistically significant at the 1% level in column 1, the regression without controls for heterogeneous time trends (baseline province characteristics interacted with a linear time trend), and slightly larger in magnitude

and statistically significant at the 5% level in column 2 when these controls are included in the regression.

The magnitude of this effect is large. Column 2's coefficient estimate indicates that for each one-peso increase in the initial migrant earnings per capita shock, migrant earnings per capita are higher by nearly ten pesos (9.794) a decade later. What can account for this large, roughly ten-fold effect? We can point to two (likely overlapping) factors that contribute to the size of the effect.

First, our study period saw substantial growth in migrant earnings overall. Online Appendix Table 6 presents summary statistics of province-level migrant earnings per capita in 1993, 2007, 2008, and 2009. In 1993, prior to the shock, migrant earnings per capita at the province level was PhP 1,594 (standard deviation 1,230). One and a half decades later, in 2007-2009, this figure had increased more than threefold (3.137 times), to a mean of PhP 5,091 (standard deviation 4,000). With persistence in exchange rate shocks and migrant destination patterns across provinces over the time period, this factor alone can explain roughly a third (3.137 / 9.794) of the coefficient (9.794) in the regression for migrant earnings per capita.

Second, the shock also appears to have caused an increase in earnings *per migrant*. In the second row of Table 3, panel (a), we show estimated coefficients on the migrant earnings shock for regressions where the dependent variable is earnings per migrant (calculated from the administrative migrant labor contract data). The coefficient on $ERshock_m * MigEarn_{m0} * Post_t$ is positive and statistically significant at the 1% and 5% levels in columns 1 and 2 respectively. The initial shock to migrant earnings per capita leads to substantially higher earnings per migrant a decade later. Migrants as a share of province population is roughly 1.2% over our study period, so the coefficient in column 2 implies an increase in migrant earnings per capita of roughly 8.8 (which is 1.2% of 734.578).[19] In other words, the increase in earnings per migrant can explain about nine-tenths of the 9.794 coefficient in the

[19]This impact on earnings per migrant is striking in itself, and we are exploring this finding further in a separate paper on occupational upgrading among migrants. We have found empirically that the migrant earnings shock leads to higher education levels for migrants themselves, which could in part explain their higher earnings levels. It is also possible that shock may change some aspect of the job search process (e.g., longer search times, higher threshold wages for job acceptance, use of better job placement agencies) that leads to higher wages.

regression for migrant earnings per capita.

5.2 Assets

Having established that the increases in migrant earnings persist for at least a decade after the initial 1997 shock, we turn to examining changes in household assets. While migrant workers often claim that asset accumulation in the origin household is a key financial objective (Ashraf et al. (2015)), migrants typically have imperfect ability to control or monitor how remitted funds are used in the origin household.[20] Some have argued that resources received from overseas rarely fund asset accumulation or investments, and mainly lead to higher consumption.[21]

We run regressions where the dependent variable in equation 3 is the provincial average household asset index, using asset data from 1990, 2000, and 2010. Results are in Table 3, panel (b). Regressions in column 1 of the table are without province-specific linear time trends, while those in column 2 include them.

The shock has a positive impact on the household asset index. The coefficient on the shock is positive and statistically significant at the 1% and 5% levels in columns 1 and 2 respectively. The effect is large in magnitude: a one-standard-deviation increase in the size of the shock (0.129) leads to a 0.302 increase in the asset index (0.372 standard deviation).

We also present nonparametric regression plots of the relationship between the asset index and the shock. In Figure 2, we plot the pre-to-post change in assets (average of 2000 and 2010 minus 1990) against the migrant earnings shock. Both the y-axis and x-axis variables are residuals (partialled-out) from regressions on the main effects of the exchange rate shock ($ERshock_m$) and baseline migrant earnings per capita ($MigEarn_{m0}$). The nonparametric regression plot also shows a positive relationship between the change in assets and the migrant earnings shock. The relationship appears approximately linear.

[20] Ashraf et al. (2015), Ambler et al. (2015), Ambler (2015), DeArcangelis et al. (2015), Batista and Narciso (2016), Seshan and Zubrickas (2015), Viceisza and Torero (2015), de Laat (2014), Chen (2013), de Weerdt et al. (forthcoming) and Wang et al. (forthcoming).

[21] Massey et al. (1987), Brown and Ahlburg (1999), and references cited in Durand et al. (1996).

5.3 Schooling

Another central outcome of interest is the education of children. Positive shocks to migrant earnings could loosen financial constraints on investment in children's schooling (Cox-Edwards and Ureta (2003), Yang (2008b), Gibson et al. (2011), Gibson et al. (2014), Theoharides (forthcoming)), and also change the expected return to education in the population at large (even for households not currently connected to migrants). Theoretically, then, expected impacts are unclear. Positive migrant earnings shocks could raise schooling investments overall if the return to education is perceived to rise (Chand and Clemens (2008), Shrestha (2017)), but it is also possible to find reductions in schooling if the return to education is perceived to have fallen (McKenzie and Rapoport (2011)).

In Table 4, we present results from estimating regression equation 3 where the dependent variables are average years of completed schooling for various age and gender groupings. The unit of observation is the province/Census-year. As in the asset index results, regressions in column 2 include province-specific linear time trends.

We find a positive effect for all children age 7-18 (row 1), which is statistically significantly different from zero at the 1% level in both specifications. Looking at narrower age groups, we find positive and statistically significant effects for primary-school-aged children (age 7-12) and for young adults (aged 19-24, tertiary schooling age) at the 5% or 1% levels across columns 1 and 2. For lower-secondary (age 13-15) and upper-secondary (age 16-18) children, regression coefficients are also positive (and similar in magnitude to the coefficients for the other age groups), but are not consistently statistically significantly different from zero at conventional levels across columns 1 and 2. Results are very similar when we examine impacts on years of schooling separately for girls and boys. Comparing coefficient estimates across columns 1 and 2, results tend to be quite stable (or increasing in magnitude) when province-specific time trends are added to the regression.

Figure 3, Panel A displays a nonparametric regression plot of the relationship between years of schooling for 7-12 year-olds and the shock. We plot the pre-to-post change (average across post-shock years minus average across pre-shock years) against the migrant earnings shock. As in Figure 2, both the y-axis and x-

axis variables are residuals (partialled-out) from regressions on the exchange rate shock ($ERshock_m$) and baseline migrant earnings per capita ($MigEarn_{m0}$). The nonparametric regression plot shows a positive relationship between the change in years of schooling and the migrant earnings shock.

We also show a "placebo" experiment, taking advantage of the fact that we have two observations of pre-shock data for this outcome variable (1990 and 1995). Panel B of Figure 4 displays a nonparametric regression plot that is analogous in to the plot of Panel A, except that the variable on the y-axis is the change in the pre-shock period (1995 minus 1990). This constitutes a partial test of the identification assumption that no differential pre-existing trends exist that are related to the shock. The plot supports this assumption: there does not appear to be a clear positive relationship between the pre-shock change in years of schooling and the shock; if anything, the relationship appears to be slightly negative.[22]

5.4 Labor supply

We now turn to examining impacts on labor supply, both internationally (international migration) and overall (labor supply outcomes that include international migrants in the calculation).[23] Positive migrant earnings shocks can cause increases in leisure consumption (reductions in labor supply) due simply to income effects (Hanson (2007), Baird et al. (2018)). On the other hand, such shocks could increase labor supply if they alleviate constraints on entrepreneurial investments that use household labor (McCormick and Wahba (2001), Woodruff and Zenteno (2007), Mesnard (2004), Taylor et al. (2003), Mendola (2008), Yang (2006)).[24] The impact of migrant earnings shocks on international migrant work is ambiguous, depending on the relative size of income and substitution effects in labor supply (Lundberg (1985), Stephens (2002), Fajardo et al. (2017)).

[22] Similar "true" and "placebo" experiments are shown in Online Appendix Figures 2 and 3, for 7-18 year-olds and 19-24 year olds, respectively. The patterns are very similar to those of Figure 4: there is a positive relationship Panel A (true experiment) and no relationship in Panel B (placebo experiment).

[23] Inclusion or exclusion of international migrants from the calculation of provincial labor supply outcomes has negligible impact on the estimates. We discuss results that exclude migrants from outcome variable definitions in section 5.6.3.

[24] Informal insurance provided by international migrants could also promote entrepreneurship in home areas (Yang and Choi (2007), Yang (2008a)).

We estimate regression equation 3 for quarterly province-level labor supply outcomes from Q1 1992 to Q4 2011. $Post_t$ is equal to zero in Q2 1997 or prior, and equal to one in Q3 1997 and after. Regression results are in Table 5. In columns 1 and 2 for each outcome variable, we present results without and with (respectively) inclusion of province-specific linear time trends in the regression.

Panel (a) presents impacts of the migrant earnings shock on the international migration rate (share of the population who are international migrants), separately for those aged 25-64 and 16-24. Unlike for previous outcomes we have examined, for these outcomes the inclusion of controls for province-specific time trends in column 2 makes an important difference. In column 1, without such controls, the coefficient on $ERshock_m * MigEarn_{m0} * Post_t$ is positive for adults (age 25-64) and negative for young adults (age 16-24), and statistically significantly different from zero in both cases (at the 10% and 1% levels respectively). But with inclusion of province-specific linear time trends in column 2, the point estimates become smaller in magnitude and lose statistical significance. Coefficient magnitudes are small.

We now turn to overall labor supply outcomes. In panel (b), we estimate regressions where the dependent variable in equation 3 is the share of the adult population in the labor force, for adults (aged 25-64) and young adults (aged 16-24). For children (aged 10-15), we show employment rates (share of population working) because labor force participation is not recorded.[25] While negative and statistically significant impacts appear in column 1 for adult labor force participation (overall and for males), coefficients become smaller in magnitude and lose statistical significance with inclusion of province-specific linear time trends in column 2.

Giving priority to the more conservative estimates that include province specific time trends, we conclude that there is no strong evidence of substantial impacts on labor supply, either internationally or overall.

5.5 Differential impacts of female and male migrant earnings shocks

We now ask how the impacts of female and male migrant earnings shocks differ. A substantial literature in development economics finds that resources in the hands of women have different impacts than resources controlled by men (Thomas

[25] In section 5.6.2 below we discuss impacts on employment rates of adults (aged 16 and up), which are very similar to impacts on adult labor force participation rates.

(1990), Duflo (2003), Edmonds (2006)). Observational studies have documented differences between the remittance behavior of women and men, and in how their remittances are used in remittance-recipient households (de la Briere et al. (2002), DeSilva (2013), Semyonov and Gorodzeisky (2005)).

For each province, we create separate measures of the shocks to female and male migrant earnings per capita, and include both in the regression simultaneously. While female and male migrant earnings shocks are correlated, there is substantial independent variation in each of the shock measures. The correlation between the two province-level shock measures is 0.21.

The regression specification modifies equation 3 as follows:

$Y_{pt} = \lambda_0 + \lambda_1 FemaleERshock_p * FemaleMigEarn_{p0} * Post_t + \lambda_2 MaleERshock_p * MaleMigEarn_{p0} * Post_t + \lambda_3 FemaleERshock_p * Post_t + \lambda_4 MaleERshock_p * Post_t + \lambda_5 FemaleMigEarn_{p0} * Post_t + \lambda_6 MaleMigEarn_{p0} * Post_t + \alpha_p + \gamma_t + X_{p0} * Trend_t + \varepsilon_{pt}$

There are now separate shock variables for males and females. The coefficients of interest are λ_1 on $FemaleERshock_p * FemaleMigEarn_{p0} * Post_t$ (the impact of shocks to female migrant earnings per capita) and λ_2 on $MaleERshock_p * MaleMigEarn_{p0} * Post_t$ (the impact of shocks to male migrant earnings per capita). The regression also includes corresponding gender-specific exchange rate shock and baseline migrant earnings per capita variables, interacted with $Post_t$, so that identification only derives from the interaction between gender-specific baseline migrant earnings per capita and exchange rate shock variables.[26]

Regression coefficients for key outcome variables are presented in Table 6. For each outcome variable, we present the coefficients λ_1 on $FemaleERshock_p * FemaleMigEarn_{p0} * Post_t$ and λ_2 on $MaleERshock_p * MaleMigEarn_{p0} * Post_t$. Just below each pair of coefficients, we present the p-value of an F-test of the equality of the two coefficients (that $\lambda_1 = \lambda_2$).

The first row indicates that female and male migrant earnings shocks have similar effects on migrant earnings itself, approximately a decade later. In neither

[26]The regression specifications are otherwise the same as the corresponding regressions in earlier tables. In the migrant earnings regression, column 2 adds baseline province controls interacted with a linear time trend. For all other outcomes, column 2 adds province-specific linear time trends.

columns 1 nor 2 can we reject at conventional levels that the coefficients on the male and female shock variables are equal. The point estimates are similar to the corresponding results in Table 3, panel (a), even as standard errors have increased.

The pattern is very different when we turn to impacts on assets, and child schooling. Impacts of non-gender-specific migrant earnings shocks on these outcomes shown in previous results tables appear to be driven entirely by shocks to female migrants. Only shocks to female migrant earnings have positive and statistically significant impacts on household assets and child schooling. Impacts of male migrant earnings on these outcomes are typically much closer to zero, often opposite in sign, and never statistically significantly different from zero.

In regressions for labor supply outcomes, on the other hand, patterns are somewhat different. Female and male migrant shocks tend to have opposite effects, with coefficients on female shocks being positive and those on male shocks being negative. For international migration, for adults as well as young adults, the positive female coefficients and negative male coefficients are all statistically significantly different from zero, and for each pair of coefficients an F-test rejects at conventional statistical significance levels the null that the female and male coefficients are equal.

The gender patterns are similar, if less statistically precise, for overall labor supply outcomes. Female coefficients tend to be positive and the male ones negative, but fewer coefficients are individually statistically significantly different from zero. Only for the employment rate of children aged 10-15 (in column 2) does an F-test reject the null at conventional levels that the female and male shock coefficients are equal.

We can say formally that female and male migrant earnings shocks have different effects. The bottom row of the table presents results of an F-test of the joint equality of the female and male coefficients (across the eleven regressions). In each of columns 1 and 2, the test indicates strong rejection (p-val<0.000) of the null that the female and male coefficients are equal across all regressions.

The pattern that emerges is that female shocks improve asset and schooling outcomes more than shocks to male migrants. Shocks to male migrants tend to reduce labor supply (both internationally and domestically), while shocks to female migrants tend to increase labor supply of both types.

What might explain these differences in the impact of female and male shocks? We do not find significant differences in the impact of female and male shocks on migrant earnings per capita (panel (a) of Table 6), so differences in impacts on other outcomes may derive from differences in the preferences of females and males, and/or differences in their (or their origin households') characteristics.

We explore such differences in Online Appendix Table 7, which displays mean values of migrant and household characteristics for female and male migrants separately. Perhaps the most striking difference is that female migrants are much less likely to be married: marriage rates for female migrants range from 43.5% to 51.1% over the two-decade period, compared to 66.9% to 76.4% for male migrants. In addition, females are much less likely to be head of household, and much more likely to be the child of the household head. These features may suggest that they hold more subordinate positions within their origin households, compared to male migrants. At the same time, it may mean they are more free to share their resources with more than just their origin household. Female migrants also appear to originate from more disadvantaged households. Compared with male migrant origin households, female origin households are more likely to be rural, have fewer assets, and have heads who are more likely to be female, with less education, and who are more likely to be farmers.

While we can point to these differences in female and male migrant characteristics, we cannot definitively say that these differences explain why female and male migrant earnings shocks have such different effects in home areas. What we can say is that these results are broadly consistent with findings in other contexts that resources in the hands of women have different (and, often, more positive) impacts on development outcomes than do resources in men's hands.

5.6 Additional Analyses

In this section, we provide additional discussion and empirical analyses to address key concerns related to causal identification.

5.6.1 Omitted variable bias

Most prominently, there are concerns of omitted variable bias: third factors could be correlated with the shock and changes in key outcomes. To address omitted variable

concerns, all our regression specifications focus only on the *interaction* between ER shock and baseline migrant earnings per capita as the right-hand-side variable of interest. Second, we give the most weight to regression specifications that include province-specific linear time trends. In all results tables, we directly compare coefficient estimates from regressions that do not (column 1) and do (column 2) include these strong controls for heterogeneity in time trends across provinces; coefficient estimates are stable across these specifications for most key outcomes, in particular migrant earnings, assets, and child schooling. For other outcomes (international migration and domestic labor supply), impacts become closer to zero when province-specific linear time trends are added. In these cases, we take a conservative approach and emphasize the coefficient estimates in regressions with province-specific linear time trends.

In addition, for most outcomes we can run "placebo" experiments in the pre-shock period to show that changes in outcome prior to the shock have no relationship with the future shock to migrant earnings per capita. This is a partial test of the parallel-trend assumption underlying difference-in-differences.[27] In Online Appendix Table 8 we present coefficient estimates from placebo experiments.[28] We keep only observations prior to the June 1997 shock, and partition the pre-shock obserations in to an earlier "control" period and a later "false treatment" period. We run regressions where $Post_t$=1 in this "false treatment" period, and 0 otherwise. No patterns emerge in this analysis that mirror our main results; trends in key outcome variables in the pre-1997 period do not appear to be related to the size of their (future) shocks to migrant earnings per capita. We take this as support of validity of the parallel trend assumption.

5.6.2 Channels other than migrant earnings

A key question is whether the shock variable we construct affects outcomes only via its effect on migrant earnings, or whether other channels might be operative. In particular, trade or foreign direct investment (FDI) patterns (between Philippine provinces and overseas destinations) might reflect migration patterns. It is imagin-

[27] Data are not available for us to be able to run these placebo experiments for the household asset index (only one pre-shock year is available, the 1990 Census).

[28] These complement the nonparametric plots of placebo experiments in section 5.3.

able that positive shocks to migrant earnings per capita might be collinear to some degree with shocks to domestic earnings due to increased trade and FDI. Our results are inconsistent with trade- and FDI-mediated effects, however, since the shock does not lead to increases in employment rates. In Online Appendix Table 9, we present impacts on employment rates (share of population working) of adults (age 25-64) and young adults (age 16-24), in total and by gender.[29] Coefficients in nearly all regressions are small in magnitude (and actually negative for young adults) and not statistically significantly different from zero.[30]

5.6.3 Selection bias

Finally we address the possibility of selection bias: changes in the composition of households or individuals across rounds of data (since we have a panel of localities, not a panel of households or individuals). We check for the possibility of selection bias via internal migration by examining the impact of the migrant earnings shock on internal migration rates. Results are in Online Appendix Table 10. We find no large or statistically significant relationship between internal migration (post-1997) and the shock. In addition, to address the possibility that changes in international migration may be affecting the composition of individuals remaining behind at home, and thus biasing our estimated impacts on labor supply, in our labor supply regressions (Table 5, panel b) international migrants are included in the calculation of labor supply outcomes (they are in both the numerator and denominator of the labor supply rate variables). It turns out that this adjustment makes no material difference. In Online Appendix Table 11, we show impacts on labor force participation rates of adults and young adults, where international migrants are *excluded* from the calculation of the outcome variables. Coefficients are nearly identical to the corresponding coefficients in Table 5. All told, these analyses provide no indication that selection biases have an important influence on our estimates.

[29] In Table 5, discussed previously, we presented regressions for labor force participation rates in these age groups. Impacts on employment rates for children (age 10-15) were already shown in Table 5.

[30] The exception is the negative and statistically significant coefficient in the regression for male adults in column 1, which declines to zero and loses statistical significance when province-specific linear time trends are added to the regression in column 2.

6 Conclusion

How do earnings by international migrants affect development in migrant origin areas? We study the impact of migrant earnings on assets, schooling, and labor supply across Philippine provinces. Positive province-level shocks to migrant earnings lead to increases in household assets and child schooling. We do not find substantial impacts on domestic or international labor supply. Impacts of female and male migrant earnings shocks are quite distinct. Female migrant earnings shocks drive impacts on household assets and child schooling levels.

Our study provides new insights in the literature on the economics of migration. It is rare to be able to examine impacts of migration on locality (rather than household) development outcomes. Due to data limitations, no previous study has been able to examine the impact of migrant earnings, or to compare impacts of female and male migrant earnings. What's more, we take advantage of a unique natural experiment that provides plausibly exogenous variation in migrant earnings.

These findings also provide insights for policy-makers. There has been great interest in academic and policy circles in development policies related to migration. As developing country policymakers seek to design migration policies to foster economic development at home, it is important to determine the effects of migration on migrant sending regions more broadly, and on whether such impacts depend on migrants' gender. Policy-makers in migrant host countries may also be interested in understanding the impacts of policies that affect migrants' economic prospects on outcomes in their origin areas.

Our findings raise a number of additional questions. Why are origin-destination patterns of migration so persistent, even in the face of very large exchange rate shocks? Do impacts of migrant earnings shocks work via alleviation of liquidity or financing constraints, or via changing perceptions of returns to migration, returns to education, and the like? Do pecuniary externalities such as demand-induced increases in nontradable (e.g., property, private schooling) prices offset the overall gains? Why do impacts of female and male migrant earnings differ so substantially? We believe such questions are promising starting points for future research.

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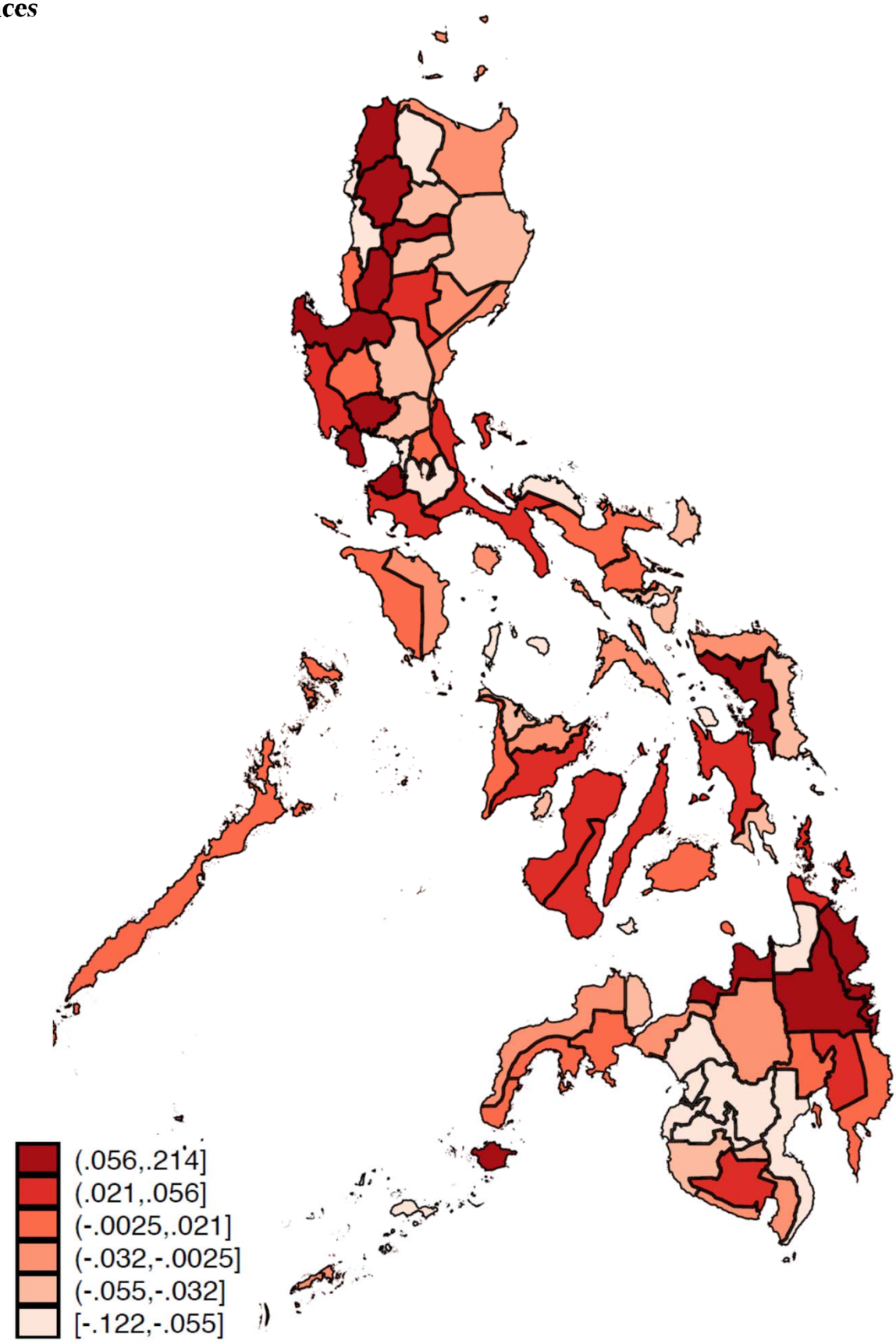
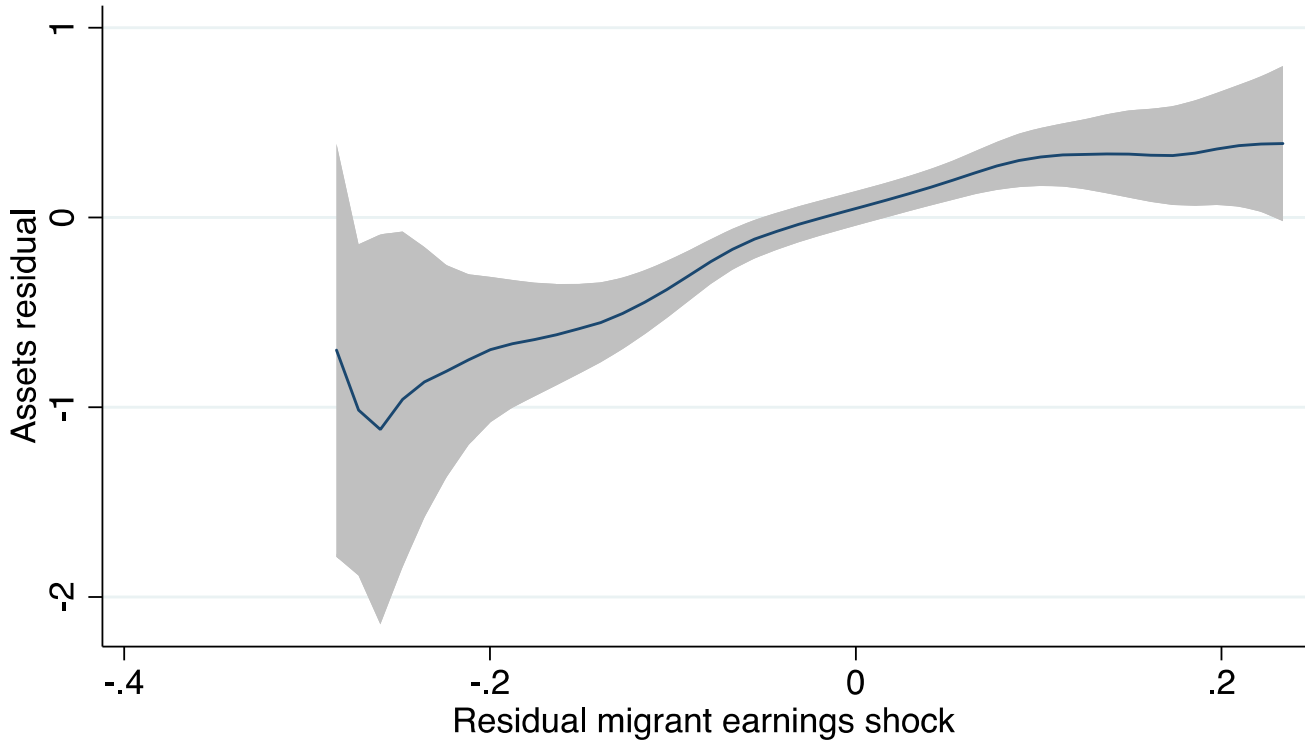
<u>Figure 1</u>: Spatial Distribution of Migrant Earnings Shock Across Philippine Provinces



Notes: Figure presents ranges of residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita) after partialling-out main effects of earnings-weighted exchange rate shock and baseline migrant earnings per capita.

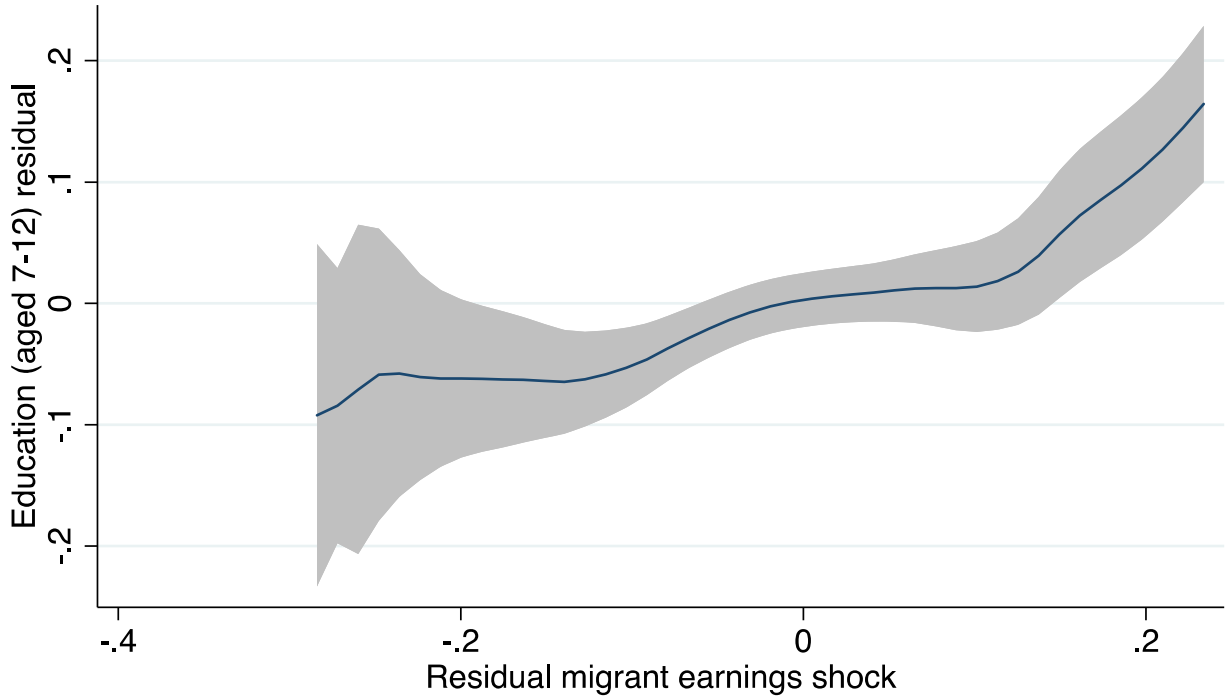
<u>Figure 2</u>: Change in Provincial Asset Index on Migrant Earnings Shock



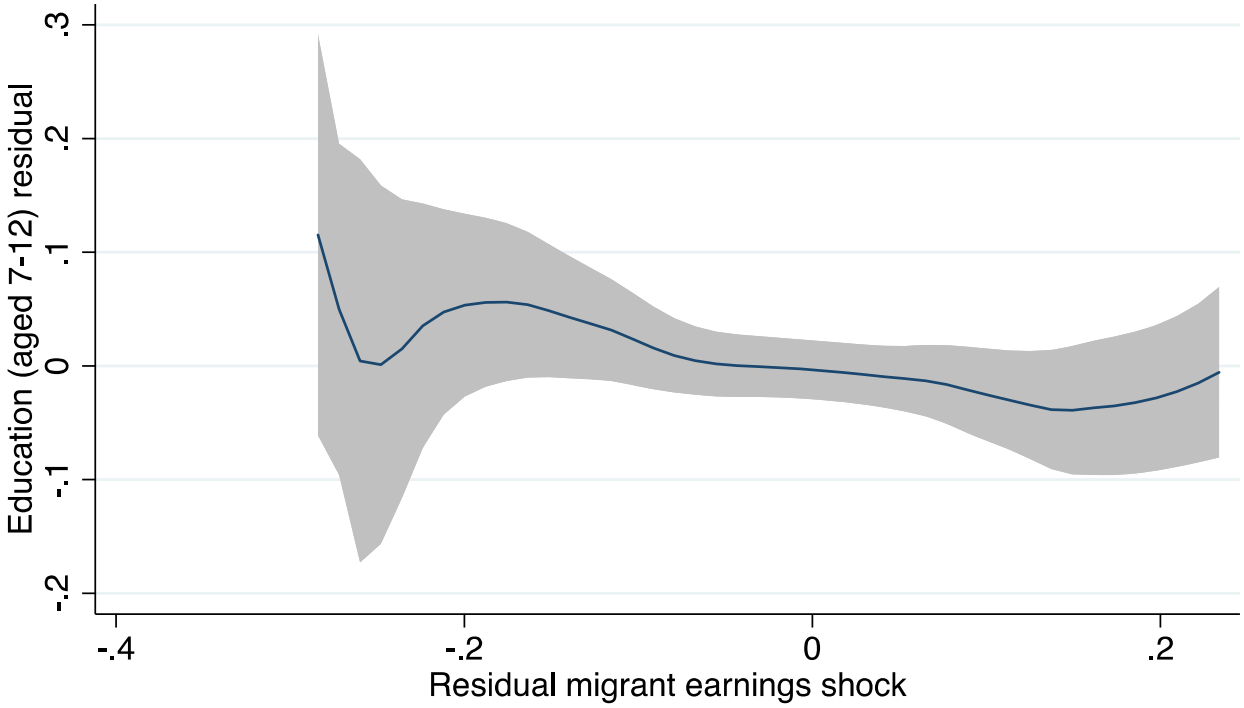
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0, pwidth 0.2) of change in residual household asset index (average of 2000 and 2010 minus 1990) on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval.

<u>Figure 3</u>: Change in Provincial Years of Schooling (of Children Aged 7-12) on Migrant Earnings Shock

A. True impact: change from pre-shock (1990 and 1995 average) to post-shock (2000 and 2010 average)



B. Placebo experiment: change in pre-shock period (1995 minus 1990)



Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval.

Table 1: Top 20 Locations of Filipino Migrants Prior to Asian Financial Crisis

Destination	% of Total	Average Annual Earnings (000, Real 2010 Php)	Exchange Rate Shock (June 1997-Oct 1998)	Exchange Rate Shock: 2000	Exchange Rate Shock: 2010
Saudi Arabia	41.85	305.93	0.52	0.69	0.72
Japan	16.09	1457.57	0.32	0.70	1.13
Taiwan	8.45	426.99	0.26	0.48	0.50
Hong Kong	7.31	379.98	0.52	0.67	0.71
United Arab Emirates	5.66	246.97	0.52	0.69	0.72
Malaysia	3.70	216.19	-0.01	0.12	0.34
Singapore	2.28	243.72	0.29	0.38	0.78
Italy	1.96	497.01	0.38	0.24	0.82
Qatar	1.85	217.71	0.52	0.69	0.72
Brunei Darussalam	1.71	271.96	0.30	0.38	0.78
Kuwait	1.24	366.61	0.50	0.65	0.80
United States	1.20	1903.52	0.52	0.69	0.72
Bahrain	1.17	275.66	0.52	0.69	0.72
Northern Mariana Islands	1.11	298.79	0.52	0.69	0.72
Libya	1.09	527.83	0.57	0.44	-0.41
Oman	0.49	267.11	0.52	0.69	0.72
Lebanon	0.34	177.74	0.55	0.76	0.79
Guam	0.32	1309.29	0.52	0.69	0.72
South Korea	0.26	546.72	-0.04	0.20	0.20
India	0.11	380.18	0.35	0.33	0.33
Other	2.41	484.43	0.34	0.16	0.25
Total	100.00				

Notes: Average annual earnings (in thousands) calculated using data from POEA and OWWA in 1993 and is based on 269,990 new migrant contracts in 1993. "Other" includes all migrant destinations outside the top 20 (142 destinations). Exchange rate shock is change in Philippine pesos (Php) per local currency unit prior to the Asian Financial Crisis. The change is defined as the fractional change between July 1996-July 1997 and October 1997-September 1998 (e.g., 10% appreciation is 0.1). The exchange rate shock in 2000 and 2010 are defined as the fractional change in the exchange rate between 2000 and 1997, and 2010 and 1997 respectively. Sources: POEA, OWWA, World Development Indicators.

Table 2: Summary Statistics

Shock Variables	Mean	Std. Dev.	Min	Max	Obs.
Shock to Migrant Earnings per Capita ($ERshock_p * MigEarn_{p0}$)	-0.014	0.129	-0.370	0.561	82
Earnings-weighted Exchange Rate Shock ($ERshock_p$)	0.410	0.045	0.204	0.511	82
Migrant Earnings per Capita ($MigEarn_{p0}$)	4.263	3.275	0.838	12.611	82
Household Asset Index	-0.316	0.811	-1.985	3.164	246
Years of Schooling					
Total, age 7-18	4.880	0.573	3.132	6.123	328
Total, age 7-12	2.776	0.332	1.758	3.508	328
Total, age 13-15	6.401	0.619	4.337	7.706	328
Total, age 16-18	8.196	0.951	4.804	10.355	328
Total, age 19-24	9.049	1.109	5.259	11.907	328
Female, age 7-12	2.874	0.331	1.809	3.532	328
Female, age 13-15	6.656	0.601	4.437	7.857	328
Female, age 16-18	8.621	0.977	4.908	10.812	328
Female, age 19-24	9.447	1.137	5.177	12.226	328
Male, age 7-12	2.684	0.337	1.710	3.490	328
Male, age 13-15	6.157	0.649	4.213	7.575	328
Male, age 16-18	7.795	0.943	4.699	9.950	328
Male, age 19-24	8.674	1.104	5.359	11.624	328
Labor Supply					
Labor Force Participation Rate, age 25-64	0.770	0.068	0.517	1.000	6,159
Labor Force Participation Rate, age 16-24	0.526	0.104	0.157	1.000	6,159
Employment Rate, age 10-15	0.129	0.123	0.000	0.943	6,159
Female Labor Force Participation Rate, age 25-64	0.596	0.128	0.090	1.000	6,159
Female Labor Force Participation Rate, age 16-24	0.383	0.121	0.000	1.000	6,159
Female Employment Rate, age 10-15	0.093	0.108	0.000	0.926	6,159
Male Labor Force Participation Rate, age 25-64	0.651	0.114	0.243	1.000	6,159
Male Labor Force Participation Rate, age 16-24	0.645	0.124	0.243	1.000	6,159
Male Employment Rate, age 10-15	0.164	0.147	0.000	1.000	6,159
International Migration Rates					
Total, age 25-64	0.026	0.020	0.000	0.195	6,159
Total, age 16-24	0.009	0.011	0.000	0.161	6,159
Female, age 25-64	0.026	0.026	0.000	0.334	6,159
Female, age 16-24	0.014	0.019	0.000	0.286	6,159
Male, age 25-64	0.027	0.025	0.000	0.203	6,159
Male, age 16-24	0.005	0.008	0.000	0.157	6,159

Notes: Unit of observation is province. Shock variables are constructed from POEA/OWWA dataset and other sources (see text). Shock to Migrant Earnings per Capita constructed from demeaned component variables ($ERshock_p$ and $MigEarn_{p0}$). Years of schooling and asset data are from Census (82 provinces; assets available in 1990, 2000, 2010; years of schooling available in 1990, 1995, 2000, 2010). Labor force participation and migration outcomes are from Labor Force Survey (77 provinces, quarterly data, 1992-2011). Age specific variables are out of the province population in that age group.

Table 3: Impact of Migrant Earnings Shocks on Migrant Earnings and Household Assets

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock.

Dependent variable (periods included in regression)	*Mean (std. dev.) of dependent variable*	*Regressions*		*Number of obs.*
		(1) No controls	*(2) Controls for heterogeneous province trends*	
(a) Migrant earnings (1993, 2007, 2008, 2009)				
Migrant earnings per capita	5.254	8.889***	9.794**	328
in province	(4.261)	(3.316)	(4.295)	
Earnings per migrant	401.431	629.001***	734.578**	328
	(317.901)	(199.192)	(314.474)	
(b) Assets (1990, 2000, 2010)				
Asset index	-0.316	2.971***	2.339**	246
	(0.811)	(0.816)	(1.057)	

Notes: All regressions include province and year fixed effects. Controls for heterogeneous province trends are: for panel (a), baseline controls interacted with linear annual time trend; for panel (b), province-specific linear annual time trend. The baseline controls in panel (a) use 1990 data and include: average years of schooling for 7 to 18 year olds, average female employment rate for 25 to 64 year olds, average male employment rate for 25 to 64 year olds, share of households that are rural, the asset index, the share of individuals working in household enterprises, and the population. Panel (a) uses 1993, 2007, 2008, and 2009 wage data from POEA/OWWA dataset. In panel (b), asset index is calculated from the 1990, 2000, and 2010 Philippine Censuses as first principal component of indicators for: radio, tv, refrigerator, phone, running water, electricity, trash collection, uses wood fuel to cook, uses a high quality fuel to cook, flush toilet, house has metal roof, house has brick walls, household owns land, and household owns home. For panel (a) post equals 1 in 2007-2009, in panel (b) post equals 1 in 2000 and 2010, and 0 otherwise. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Table 4: Impact of Migrant Earnings Shocks on Years of Schooling Completed

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock. Data from each of 82 provinces over four periods (1990, 1995, 2000, 2010).

		Regressions		
Dependent variable: Years of schooling of…	*Mean (std. dev.) of dependent variable*	*(1) No controls*	*(2) Province-specific linear time trends*	*Number of obs.*
Children aged 7-18	4.880	0.680***	0.767***	328
	(0.573)	(0.187)	(0.209)	
Children aged 7-12	2.776	0.484***	0.484**	328
	(0.332)	(0.127)	(0.188)	
Females	2.874	0.495***	0.506***	328
	(0.331)	(0.122)	(0.174)	
Males	2.684	0.473***	0.462**	328
	(0.337)	(0.134)	(0.207)	
Children aged 13-15	6.401	0.342**	0.269	328
	(0.619)	(0.156)	(0.279)	
Females	6.656	0.310**	0.304	328
	(0.601)	(0.155)	(0.281)	
Males	6.157	0.375**	0.242	328
	(0.649)	(0.162)	(0.288)	
Children aged 16-18	8.196	0.217	0.998	328
	(0.951)	(0.259)	(0.759)	
Females	8.621	0.221	1.167	328
	(0.977)	(0.275)	(0.789)	
Males	7.795	0.262	0.875	328
	(0.943)	(0.264)	(0.752)	
Young adults, aged 19-24	9.049	0.583**	1.311***	328
	(1.109)	(0.239)	(0.418)	
Females	9.447	0.532**	1.314***	328
	(1.137)	(0.263)	(0.421)	
Males	8.674	0.681***	1.383***	328
	(1.104)	(0.232)	(0.440)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. Regressions in column 2 include province-specific linear time trends. Average years of schooling are calculated from the 1990, 1995, 2000, and 2010 Philippine Censuses. Post equals 1 in 2000 and 2010, and 0 in 1990 and 1995. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Table 5: Impact of Migrant Earnings Shocks on Labor Supply

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock. Data from each of 77 provinces over 80 quarters (Q1 1992 - Q4 2011).

Dependent variable	*Mean (std. dev.) of dependent variable*	*Regressions*		*Number of obs.*
		(1) No controls	*(2) Province-specific linear time trends*	
(a) International migration rate				
Adults (age 25-64)	0.026	0.016*	0.012	6159
	(0.020)	(0.009)	(0.011)	
Females	0.026	0.011	0.015	6159
	(0.026)	(0.014)	(0.014)	
Males	0.027	0.022**	0.011	6159
	(0.025)	(0.009)	(0.015)	
Young adults (age 16-24)	0.009	-0.022***	0.005	6159
	(0.011)	(0.007)	(0.007)	
Females	0.014	-0.042***	0.012	6159
	(0.019)	(0.013)	(0.010)	
Males	0.005	-0.003	-0.002	6159
	(0.008)	(0.005)	(0.009)	
(b) Overall labor supply				
Labor force participation rate, adults	0.770	-0.059*	0.023	6159
(aged 25-64)	(0.068)	(0.032)	(0.038)	
Females	0.596	-0.082	0.053	6159
	(0.128)	(0.058)	(0.069)	
Males	0.945	-0.034***	-0.006	6159
	(0.027)	(0.013)	(0.013)	
Labor force participation rate, young adults	0.526	-0.055	-0.077	6159
(aged 16-24)	(0.104)	(0.064)	(0.054)	
Females	0.383	-0.092	-0.067	6159
	(0.121)	(0.091)	(0.061)	
Males	0.651	-0.032	-0.068	6159
	(0.114)	(0.058)	(0.053)	
Employment rates, children	0.129	-0.039	-0.033	6159
(aged 10-15)	(0.123)	(0.067)	(0.060)	
Females	0.093	-0.059	-0.049	6159
	(0.108)	(0.074)	(0.059)	
Males	0.164	-0.033	-0.030	6159
	(0.147)	(0.070)	(0.069)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. Regressions in column 2 include province-specific linear time trends. Employment outcome data are from the Philippine Labor Force Survey, and cover the years 1992-2011. The unit of observation is the province-quarter-year. International migration rate is share of migrants within a given age group out of total population of the age group. Labor force participation rate is share in the labor force out of total population in the age group. Employment rate is share working out of total population in age group. International migrants are included in calculation of outcome variables in panel (b). Post equals 1 in 1997, quarter 3 to 2011, and 0 in 1992-1997, quarter 2. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Table 6: Impact of Female and Male Migrant Earnings Shocks on Key Outcomes

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on female and male migrant earnings shocks.

Dependent variable:	*Mean (std. dev.) of dependent variable*	*Regressions* (1) No controls: *Female shock coeff. (γ_1)*	(1) No controls: *Male shock coeff. (γ_2)*	(2) Controls for heterogeneous province trends: *Female shock coeff. (γ_1)*	(2) Controls for heterogeneous province trends: *Male shock coeff. (γ_2)*	*Number of obs.*
(a) Migrant earnings						
Migrant earnings per capita in province	5.254	9.335**	3.130	6.459	6.799	328
	(4.261)	(3.844)	(11.857)	(4.928)	(11.317)	
P-val.: $\gamma_1 = \gamma_2$		*0.606*		*0.979*		
(b) Assets						
Asset index	-0.316	4.829***	-1.424	3.903**	-0.877	246
	(0.811)	(1.170)	(2.445)	(1.558)	(3.194)	
P-val.: $\gamma_1 = \gamma_2$		*0.018*		*0.175*		
(c) Years of schooling of children						
Age 7-12	2.874	0.727***	-0.265	0.832**	0.227	328
	(0.331)	(0.170)	(0.416)	(0.332)	(0.531)	
P-val.: $\gamma_1 = \gamma_2$		*0.028*		*0.328*		
Age 13-15	2.684	0.505**	-0.154	0.476	0.596	328
	(0.337)	(0.192)	(0.334)	(0.384)	(0.607)	
P-val.: $\gamma_1 = \gamma_2$		*0.077*		*0.829*		
Age 16-18	8.196	0.269	0.244	1.576	1.267	328
	(0.951)	(0.332)	(0.529)	(1.022)	(1.609)	
P-val.: $\gamma_1 = \gamma_2$		0.967		0.838		
Age 19-24	9.049	0.827**	-0.002	1.898***	1.232	328
	(1.109)	(0.364)	(0.578)	(0.530)	(1.495)	
P-val.: $\gamma_1 = \gamma_2$		*0.238*		*0.643*		
(d) Labor supply						
International migration rate, adults (age 25-64)	0.021	0.032**	-0.075***	0.035**	-0.047*	6159
	(0.015)	(0.014)	(0.026)	(0.014)	(0.025)	
P-val.: $\gamma_1 = \gamma_2$		*0.000*		*0.013*		
International migration rate, young adults (age 16-24)	0.009	-0.020*	-0.069***	0.019**	-0.089***	6159
	(0.007)	(0.010)	(0.019)	(0.009)	(0.010)	
P-val.: $\gamma_1 = \gamma_2$		*0.013*		*0.000*		
Labor force participation, adults (age 25-64)	0.770	-0.026	-0.103	0.091	-0.041	6159
	(0.068)	(0.077)	(0.133)	(0.064)	(0.102)	
P-val.: $\gamma_1 = \gamma_2$		*0.659*		*0.308*		
Labor force participation, young adults (age 16-24)	0.526	0.043	-0.201*	0.085	-0.235	6159
	(0.104)	(0.125)	(0.117)	(0.111)	(0.154)	
P-val.: $\gamma_1 = \gamma_2$		*0.181*		*0.201*		
Employment rate, children (age 10-15)	0.129	0.053	0.046	0.167	-0.383*	6159
	(0.123)	(0.162)	(0.162)	(0.142)	(0.223)	
P-val.: $\gamma_1 = \gamma_2$		*0.979*		*0.065*		
P-val.: Joint test that $\gamma_1 = \gamma_2$ across all regressions		*0.000*		*0.000*		

Notes: Regressions and outcome variables are as in corresponding previous tables, but with shock variables defined separately for female and male migrants. All regressions include province fixed effects, year fixed effects, baseline female migrant earnings per capita times post, weighted-average female exchange rate shock times post, baseline male migrant earnings per capita times post, and weighted-average male exchange rate shock times post. Controls for heterogeneous province trends are as follows: for migrant earnings, baseline controls interacted with linear time trend, as listed in Table 3; for all other regressions, province-specific linear annual time trend. Standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

FOR ONLINE PUBLICATION: Appendix

for "Abundance from Abroad: Migrant Earnings and Economic Development in the Philippines"

By Caroline Theoharides and Dean Yang

July 26, 2018

1 Data Appendix

1.1 Migration Data

Calculation of key variables in our analyses (the migrant-earnings-weighted exchange rate shock and migrant earnings per capita from each Philippine province) requires unusual data on migrant earnings and migrant overseas locations by province. To calculate these variables, we obtained two unique administrative datasets from agencies of the the Philippine government. The Philippine Overseas Employment Administration (POEA) is tasked with approving migrant contracts and providing exit clearance. They maintain a rich database on all new contract migrants, including data on name, date of birth, sex, marital status, occupation, destination country, employer, recruitment agency, salary, contract duration, and date deployed. The Overseas Worker Welfare Administration (OWWA) is responsible for the welfare of overseas workers and their families, and all migrants are required to register with OWWA. OWWA maintains a database that includes migrants' name, date of birth, sex, destination country, date deployed and home address in the Philippines.

To create a dataset that includes migrant wages, destination, and province of origin, we combine the datasets from POEA and OWWA using fuzzy matching

techniques (Winkler, 2004) for the years 1993, 2007, 2008, and 2009. In the pre-shock (pre-1997) period, we use only data from 1993 work contracts for this calculation because it has the fewest missing values for migrant origin address in the OWWA data (86% non-missing) of all pre-crisis years (1992-1996). In the post-shock (post-1997) years, we use only the 2007-2009 contract data because in order to create migrant earnings per capita, we later match these data with the 2007 and 2010 Philippine Census, as discussed below. We match the POEA and OWWA data using first name, middle name, last name, date of birth, destination country, sex, and year of departure. We achieve a match rate of 95%.

Using the matched dataset, we then calculate the share of total province-level migrant annual earnings from each destination country in 1993. We aggregate migrant wages in each destination-province, and then divide these destination-province specific wage totals by the total migrant wages for the province. These wage shares are then used to create the earnings-weighted exchange rate shock. All wages are in thousands of real 2010 Philippine pesos.

To calculate migrant earnings per capita, we calculate total migrant earnings from the province by multiplying average province earnings in 1993 by the number of migrants in a given province reported in the 1995 Census. Since the POEA data only includes new hires, we used data from the Census to aggregate to total migrant earnings in the province (the Census includes all migrants, not just new hires). We then divide by the 1995 province population, obtaining migrant earnings per capita prior to the 1997 shock. We go through a similar calculation for migrant earnings per capita in 2007, 2008, and 2009. For each year, we calculate average migrant earnings from the POEA/OWWA data. We then multiply by the total number of migrants in the 2007 Census (for 2007 migrant earnings per capita), in the 2010 Census (for 2009 migrant earnings per capita), or the average of the 2007 and 2010 Census (for 2008 migrant earnings per capita).

There is one caveat with using the home address variable to calculate province-level wages: the home address variable in the OWWA data includes municipality, but not province. Out of 1630 municipalities in the Philippines, 332 have ambiguous names that are used in more than one province. This accounts for between 10 and 19% of migration episodes depending on the year. Thus, to calculate province-

level variables, we assign municipalities with such duplicate names their population share of the total wages across municipalities with the same name. In addition, a small minority of migrants fail to report municipality in the OWWA data (14% in 1993). Theoharides (forthcoming), who also uses the matched POEA/OWWA dataset, shows that municipalities appear to be missing at random, so we simply drop observations with missing municipalities from our analysis.

1.2 Census Data

We created a panel of schooling and asset outcomes using the 1990, 1995, 2000, and 2010 Philippine Census of Population from the Philippine Statistical Authority. Each census wave inclues 100% of the non-institutionalized Philippine population. In each round of the census, we take the average within the province across all households (for the asset index) or individuals within age groups (for years of schooling).

1.3 Labor Force Survey Data

Data on employment rates are from the 1992-2011 quarterly Philippine Labor Force Survey (LFS). The LFS is widely used by the Philippine Statistical Authority (PSA) to calculate official government statistics, such as employment statistics, as well as by academic researchers. The data are collected in January, April, July, and October. Each survey round includes approximately 200,000 individuals and 44,000 households, and includes sampling weights.[1] One-quarter of households are rotated out of the sample in each quarter, and the data are repeated cross-sections.

Labor force participation, international migration status, and employment-related variables are available for all household members aged 15 and above, while employment status is available for individuals age 10 and above. Individuals are defined as employed if they did some work, even for an hour, during the past week. Households are asked about migrant members and their demographics, but employment status is not asked about migrant members. We assume that all household members who are currently overseas on a work contract are employed. We calculate the employment rate by dividing by the province population in a given age-gender group.

[1] More technical details on the LFS can be found here: https://psa.gov.ph/content/technical-notes-labor-force-survey-lfs

We also create variables for the share of employed workers engaged in each employment class out of the province population. Labor supply outcomes in Table 5 include international migrants in the rate calculations. As a check for selection bias, we show in Appendix Table 11 that impacts are nearly identical when international migrants are excluded from the calculation of the labor supply outcome variables.

2 Additional Empirical Analyses

2.1 Persistence of exchange rate shocks and migration patterns

We present here empirical analyses of the persistence of exchange rate shocks and of overseas migration destination patterns from Philippine provinces.

We first provide evidence of long-run persistence of the exchange rate shocks generated by the Asian Financial Crisis. In Online Appendix Table 2, we test whether the initial (short run) exchange rate shock persists over three and thirteen years after the shock. In Columns 1 through 3, we regress the three-year (1997-2000) change in the exchange rate on the one-year (1997-1998) change in the exchange rate. The shocks are persistent across various country subsamples (all countries, as well as only countries with large numbers of Filipino migrants). Columns 4 through 6 show the correlation of the 13-year (1997- 2010) and one-year exchange rates, showing that the exchange rate shocks are also highly persistent over this longer time window.

Also crucial to the analysis is that the destinations of migrants from particular provinces (and thus the locations of their overseas earnings) show persistence or "stickiness" over time. We provide evidence of persistence in origin-province/overseas-destination in Online Appendix Table 3. In Online Appendix Table 3a, we first show that total province-level international migration rates are highly persistent: when regressing post-shock (2000 or 2010) migration rates on the initial (1995, pre-shock) migration rate, the coefficient on the initial migration rate is highly statistically significant and the regression with this single RHS variable has a very high R-squared (close to 0.8). Online Appendix Table 3b then tests persistence of specific overseas destinations by province. We run one regression for each of the top 20 pre-shock overseas destinations, regressing the share of the province's population migrating to the destination in 2009 on the corresponding share in 1995. Each row presents the

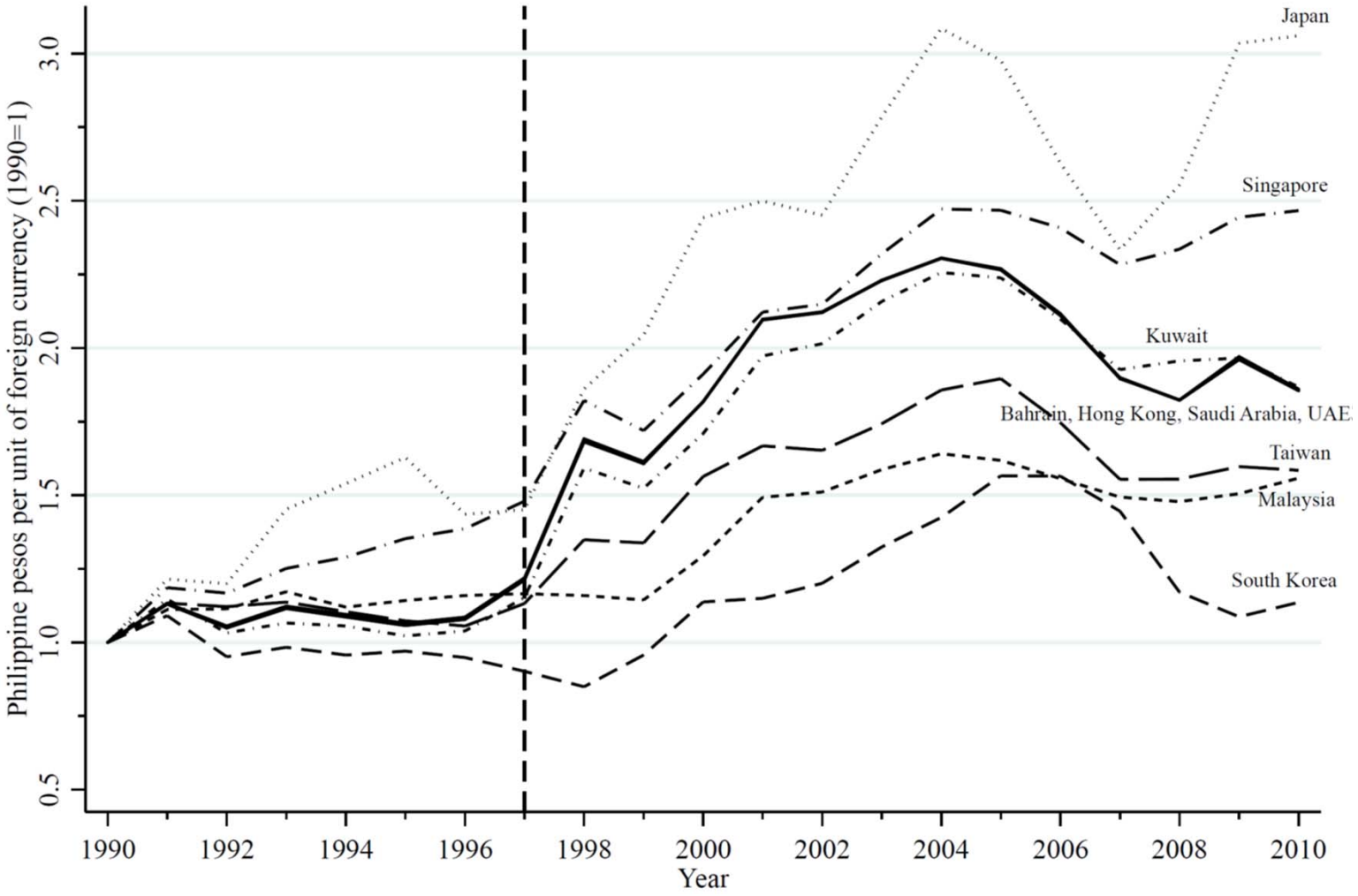
coefficient on the 1995 share. The positive and statistically significant coefficients indicate strong persisence in overseas destinations at the province level: knowing a province's pre-shock migrant destination pattern has strong predictive power for its post-shock destination pattern. While not every coefficient in this set of 20 is statistically significant at conventional levels (three are not), a test of joint significance of these 20 coefficients rejects the null of no statistical relationship (p-value<0.001).

References

Theoharides, Caroline, "Manila to Malaysia, Quezon to Qatar: International Migration and the Effects on Origin-Country Human Capital," *Journal of Human Resources*, forthcoming.

Winkler, William E., "Methods for Evaluating and Creating Data Quality," *Information Systems*, 2004, *29* (7), 531–550.

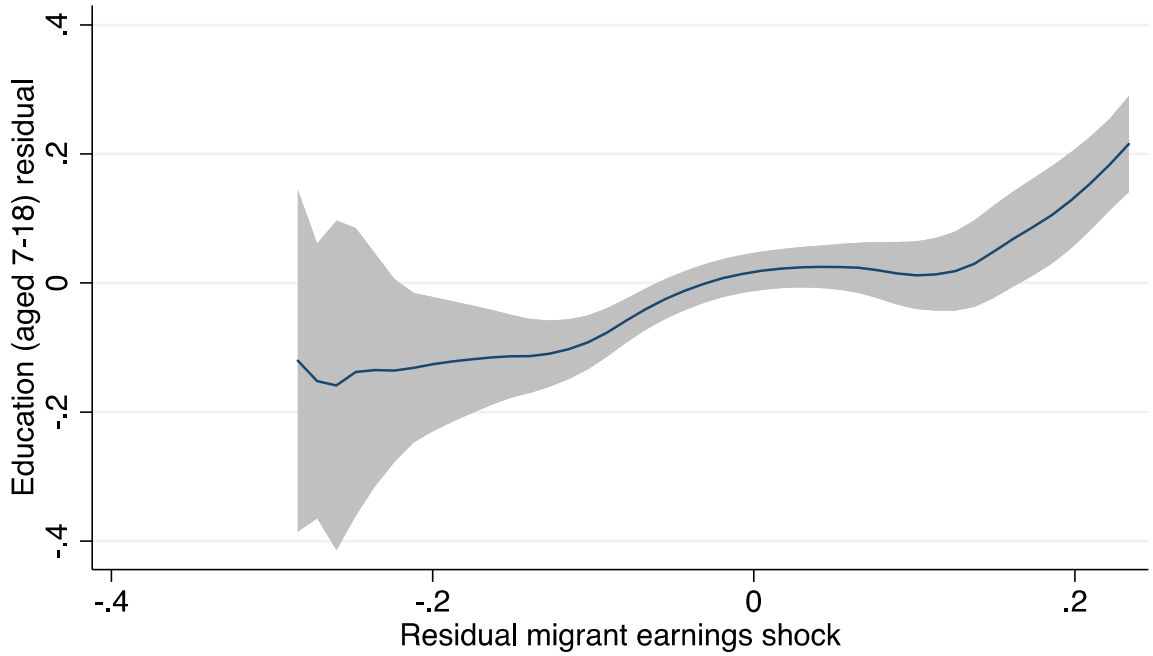
Appendix Figure 1: Exchange Rate Shocks Due to 1997 Asian Financial Crisis



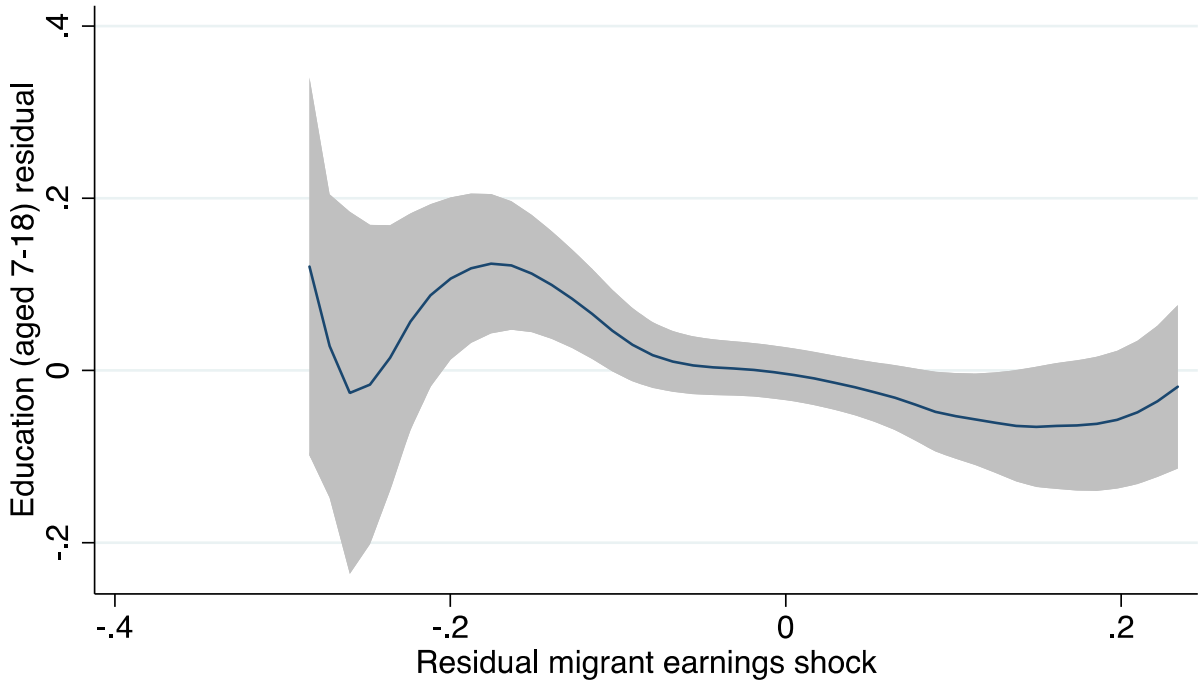
Notes: Data are from World Development Indicators. Annual average exchange rates are in units of foreign currency per Philippine peso, normalized to 1 in 1990, for key destinations of Philippine labor migrants. Vertical dashed line indicates 1997 (year of the Asian Financial Crisis).

<u>Appendix Figure 2</u>: Change in Provincial Years of Schooling (of Children Aged 7-18) on Migrant Earnings Shock

A. True impact: change from pre-shock (1990 and 1995 average) to post-shock (2000 and 2010 average)



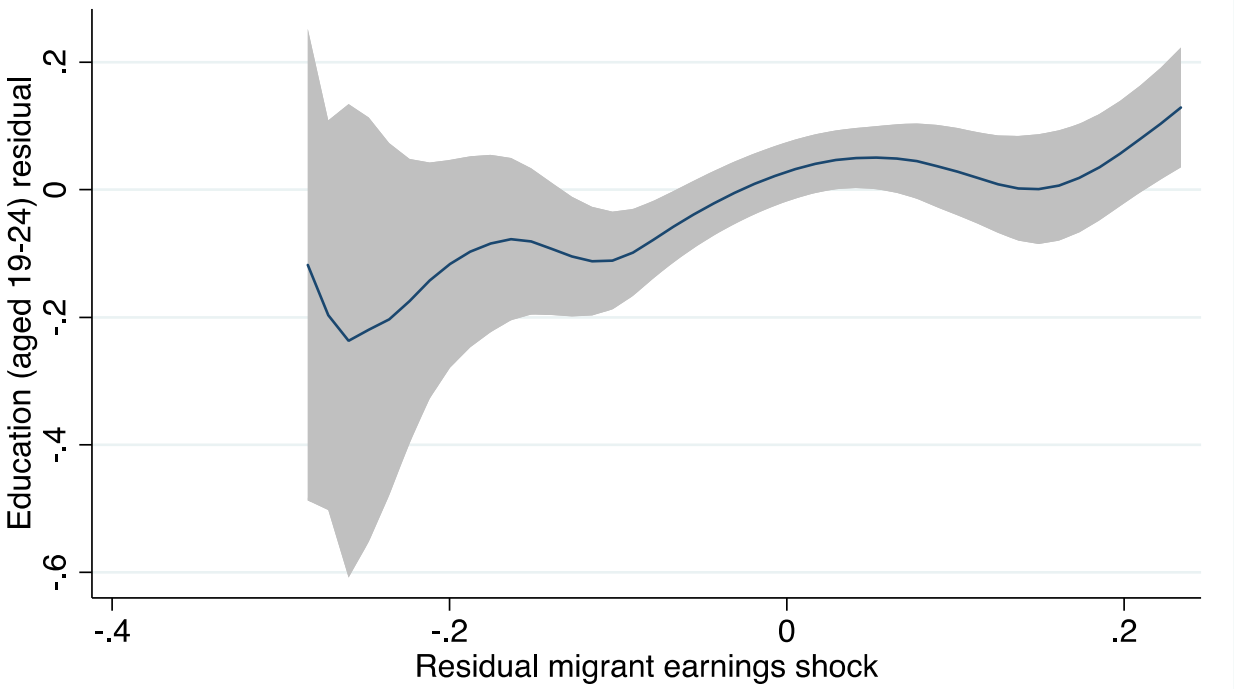
B. Placebo experiment: change in pre-shock period (1995 minus 1990)



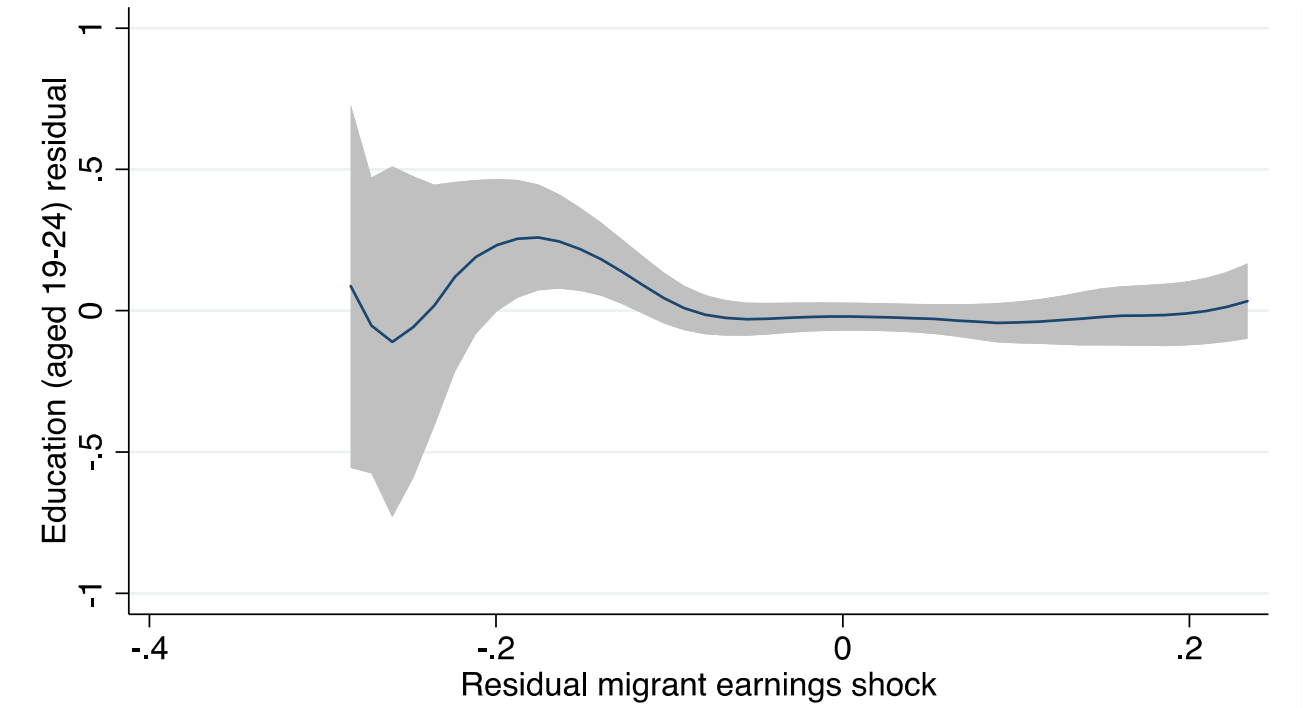
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval.

<u>Appendix Figure 3</u>: Change in Provincial Years of Schooling (of Children Aged 19-24) on Migrant Earnings Shock

A. True impact: change from pre-shock (1990 and 1995 average) to post-shock (2000 and 2010 average)



B. Placebo experiment: change in pre-shock period (1995 minus 1990)



Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval.

Appendix Table 1: Share of Households with Migrant Connections

Year	Migrants as % of population	% of households with a migrant member	% of households receiving remittances
1990	0.7%	3.2%	
1991			17.6%
1994			19.8%
1995	1.1%	5.0%	
1997			17.3%
2000	1.3%	5.2%	18.1%
2003			20.7%
2006			23.3%
2009			26.0%
2010	1.6%	6.3%	

Source: Authors' calculations from the Philippine Census (1990, 1995, 2000, and 2010) and the triennial Family Income and Expenditure Survey (FIES) from 1991-2009 inclusive. Migrants as % of population is number of individuals reported as migrants divided by total population in Census. % of households with a migrant member is fraction of all households reporting a migrant member in Census. % of households receiving remittances is share of households receiving remittances from overseas (not necessarily from a household member), from FIES (nationally representative survey of households).

Appendix Table 2: Persistence of Exchange Rate Shock

	2000 Exchange Rate Shock			2010 Exchange Rate Shock		
	All destinations	Destinations with >1000 migrants	Destinations with >5000 migrants	All destinations	Destinations with >1000 migrants	Destinations with >5000 migrants
	(1)	(2)	(3)	(4)	(5)	(6)
1997-1998 exchange rate shock	1.194***	1.310***	0.840***	1.191***	1.034***	0.511***
	(0.068)	(0.169)	(0.117)	(0.103)	(0.316)	(0.179)
N	163	41	25	163	41	25
R2	0.746	0.642	0.593	0.319	0.192	0.088

Notes: Results from regressions of the exchange rate shock through 2000 or 2010 on the 1997-1998 exchange rate shock. Reported coefficients are the coefficient on the 1997-1998 exchange rate shock variable. Exchange rate shocks are defined as Philippine pesos per local currency unit exchange rate in a given year, divided by the 1997 exchange rate minus 1. Robust standard errors are in parentheses. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.
Source: POEA, OWWA, and Census.

Appendix Table 3a: Persistence of Total OFW Rate

	2000 Migration Rate	2010 Migration Rate
	(1)	(2)
1995 Migration Rate	0.740***	0.977***
	(0.034)	(0.055)
N	82	82
R2	0.779	0.797

Notes: The unit of observation is the province. Migration rates are the number of migrants in province j out of the total population in province j. Outcome variables are reported in the column headings. Robust standard errors are in parentheses. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 3b: Persistence of Migrant Shares Over Time

Bahrain	0.796***
	(0.161)
Brunei Darusssalam	0.209**
	(0.095)
Guam	1.149***
	(0.157)
Hong Kong	0.885***
	(0.072)
India	0.453
	(0.584)
Italy	0.466***
	(0.031)
Japan	0.027***
	(0.005)
Kuwait	0.642
	(0.581)
Lebanon	-0.000
	(0.000)
Libya	1.009***
	(0.184)
Malaysia	0.046***
	(0.013)
Northern Mariana Islands	0.022***
	(0.004)
Oman	0.725***
	(0.271)
Qatar	2.573***
	(0.442)
Saudi Arabia	0.698***
	(0.128)
Singapore	0.856***
	(0.311)
South Korea	0.034**
	(0.013)
Taiwan	0.419***
	(0.107)
United Arab Emirates	1.521***
	(0.308)
United States	0.212***
	(0.029)
P-val.: Joint signif. of all coeffs.	*0.000*

Notes: The unit of observation is the province. N=82. Reported coefficients are from regressions of the number of migrants from province j going to a given destination in 2009 divided by the population in province j regressed on the the number of migrants from province j going to a given destination in 1995 divided by the population in province j. Results are reported for the top 20 pre-shock migrant destinations. Robust standard errors are in parentheses. Bottom row of the table reports the p-value on a F-test of joint significance of the migrant shares in 1995 from a seemingly unrelated regression (SUR) model. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 4: First Principal Component Loadings

Refrigerator	0.322
Television	0.3521
Radio	0.175
Water	0.2271
Phone	0.1736
Electricity	0.3305
Metal Roof	0.2944
Brick Walls	0.2339
Trash collection	0.2678
Wood Fuel	0.3414
High Quality Fuel	0.3476
Flush Toilet	0.2945
Home Ownership	0.1123
Land Ownership	0.0278

Notes: This table shows the principal component loadings for each asset in the the asset index. Source: Philippine Census.

Appendix Table 5: Correlates of shock variables

	Exchange Rate Shock	Migrant Earnings Per Capita	Exchange Rate Shock times Migrant Earnings Per Capita	Exchange Rate Shock times Migrant Earnings Per Capita
	(1)	(2)	(3)	(4)
Migrant Earnings Per Capita	0.008***			-0.003
	(0.003)			(0.008)
Exchange Rate Shock		11.825***		-1.754***
		(4.475)		(0.310)
Average Years of Schooling (ages 7-18)	-0.064***	0.947	0.220***	0.110***
	(0.015)	(0.581)	(0.049)	(0.039)
Female employment rate (ages 25-64)	-0.116***	0.679	0.265*	0.049
	(0.040)	(2.029)	(0.144)	(0.093)
Male employment rate (ages 25-64)	-0.017	-1.483	0.048	-0.014
	(0.036)	(1.524)	(0.118)	(0.081)
Share rural	0.077*	5.769***	-0.141	0.122
	(0.043)	(1.949)	(0.105)	(0.091)
Asset index	0.006	3.107***	-0.108***	-0.035
	(0.014)	(0.468)	(0.031)	(0.029)
Rate of employment in enterprises	-0.033	1.073	0.168	0.123
	(0.062)	(2.088)	(0.171)	(0.121)
Population (1000's)	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
p-val.: joint significance of all coeffs.	*0.000*	*0.000*	*0.000*	*0.000*
N	82	82	82	82
R2	0.427	0.842	0.403	0.655
Mean Dependent Variable	-0.000	-0.000	-0.014	-0.014

Notes: The outcome variables are indicated in the column headers, and are regressed on 1990 province characteristics. Robust standard errors. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 6: Summary Statistics for Migrant Earnings Per Capita

				Percentiles					
Year	*Mean*	*SD*	*Min*	*10th*	*25th*	*50th*	*75th*	*90th*	*Max*
1993	1.594	1.230	0.313	0.400	0.679	1.157	2.442	3.351	4.715
2007	5.450	4.909	0.697	1.412	2.335	3.652	7.004	10.974	28.333
2008	4.964	3.898	0.891	1.645	2.353	3.661	6.865	8.619	26.666
2009	4.858	2.986	1.025	1.851	2.439	3.919	7.198	8.481	14.166
2007-2009	5.091	4.000	0.697	1.645	2.370	3.736	6.930	9.834	28.333

Note: Summary statistics are for migrant earnings per capita, as defined in main text section 3.2.2. Data are in thousands of real 2010 Philippine pesos. 82 province-level observations per row. "2007-2009" row is average of 2007, 2008, and 2009 observations.

Appendix Table 7: Summary Statistics by Migrant Gender

	1990		1995		2000		2010	
	Females	Males	Females	Males	Females	Males	Females	Males
Migrant Characteristics								
Gender	0.407	0.593	0.457	0.543	0.497	0.503	0.434	0.566
Age	31.843	35.934	32.609	35.813	30.199	34.811	35.109	37.785
Years of Schooling	10.687	11.116	10.573	11.305	9.582	10.782	11.575	12.246
Married	0.434	0.764	0.461	0.710	0.447	0.669	0.511	0.721
Widowed	0.041	0.007	0.042	0.009	0.037	0.011	0.037	0.008
Single	0.497	0.222	0.458	0.262	0.433	0.270	0.373	0.222
Head of Household	0.044	0.634	0.050	0.589	0.067	0.547	0.085	0.608
Spouse of Head	0.304	0.011	0.341	0.018	0.268	0.018	0.368	0.025
Child of Head	0.514	0.232	0.472	0.267	0.522	0.314	0.418	0.249
Household Head Characteristics								
Female	0.180	0.084	0.179	0.104	0.196	0.102	0.228	0.116
Age	51.184	45.799	50.456	46.683	49.504	47.165	50.969	47.871
Years of Schooling	7.952	9.836	8.239	10.019	8.282	9.833	9.607	11.261
Employed	0.859	0.767	0.925	0.865	0.894	0.877	0.728	0.709
Head is Farmer	0.331	0.156	0.423	0.212	0.389	0.184	0.282	0.103
Household Characteristics								
Urban	0.549	0.727					0.430	0.552
Asset Index	1.551	2.548			0.584	0.903	0.842	1.045
Number of Children in Household (18 and under)	2.385	2.511	2.214	2.295	2.383	2.271	1.847	1.902
Presence of Working Children (Ages 10-15)	0.126	0.081	0.208	0.128	0.137	0.112	0.048	0.032
Presence of Household Enterprise	0.690	0.514	0.794	0.665	0.783	0.623	0.552	0.381

Notes: Data are means of female and male migrants, household heads, or households, from Philippine Census and Labor Force Survey (LFS).

Appendix Table 8: Placebo Experiments (Test for Pretrends)

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock.

Dependent variable	*Mean (std. dev.) of dependent variable*	*Regressions* (1) *No controls*	(2) *Controls for heterogeneous province trends*	*Number of obs.*
(a) Years of Schooling				
Children aged 7-12	2.576	-0.233	-0.051	164
	(0.270)	(0.155)	(0.180)	
Females	2.666	-0.234	-0.037	164
	(0.261)	(0.154)	(0.175)	
Males	2.490	-0.233	-0.065	164
	(0.283)	(0.159)	(0.189)	
Children aged 13-15	6.155	-0.218	-0.041	164
	(0.590)	(0.223)	(0.182)	
Females	6.399	-0.313	-0.068	164
	(0.554)	(0.208)	(0.186)	
Males	5.921	-0.132	-0.005	164
	(0.635)	(0.245)	(0.193)	
Children aged 16-18	7.853	-0.540	-0.275	164
	(0.920)	(0.395)	(0.341)	
Females	8.244	-0.623	-0.261	164
	(0.921)	(0.406)	(0.310)	
Males	7.484	-0.446	-0.280	164
	(0.935)	(0.414)	(0.401)	
Young adults, aged 19-24	8.612	-0.394	-0.290	164
	(1.047)	(0.442)	(0.330)	
Females	8.955	-0.383	-0.260	164
	(1.052)	(0.496)	(0.340)	
Males	8.285	-0.394	-0.323	164
	(1.061)	(0.397)	(0.343)	
(b) Labor Supply				
International migration rate, adults (age 25-64)	0.022	0.005	-0.000	1693
	(0.020)	(0.009)	(0.018)	
International migration rate, young adults (age 16-24)	0.011	0.024***	0.027*	1693
	(0.013)	(0.008)	(0.014)	
Labor force participation, adults (age 25-64)	0.758	-0.035*	-0.017	1693
	(0.075)	(0.020)	(0.029)	
Labor force participation, young adults (age 16-24)	0.545	0.041	-0.074	1693
	(0.115)	(0.042)	(0.086)	
Employment rate, children (age 10-15)	0.155	0.076*	-0.059	1693
	(0.134)	(0.046)	(0.104)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. In panel (a), observations are at province/census-year level, for 1990 and 1995; post=1 if 1995, and 0 in 1990. In panel b, observations are at province-quarter level; "post" equals 1 in 1994 through 1997 quarter 2, and 0 otherwise. Controls for heterogeneous province trends are as follows: years of schooling (panel a), baseline controls as included in Table 3; for labor supply outcomes (panel b) , province-specific linear time trends. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 9: Impact of Migrant Earnings Shocks on Adult Employment Rates

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock. Data from each of 77 provinces over 80 quarters (Q1 1992 - Q4 2011).

Dependent variable	*Mean (std. dev.) of dependent variable*	*Regressions*		*Number of obs.*
		(1) No controls	*(2) Province-specific linear time trends*	
Employment rate, adults (age 25-64)	0.744	-0.054	0.031	6159
	(0.073)	(0.033)	(0.038)	
Females	0.576	-0.067	0.064	6159
	(0.128)	(0.058)	(0.068)	
Males	0.913	-0.037*	0.000	6159
	(0.047)	(0.021)	(0.017)	
Employment rate, young adults (age 16-24)	0.457	-0.032	-0.038	6159
	(0.107)	(0.067)	(0.054)	
Females	0.318	-0.058	-0.011	6159
	(0.114)	(0.100)	(0.062)	
Males	0.578	-0.018	-0.040	6159
	(0.133)	(0.060)	(0.051)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. Regressions in column 2 include province-specific linear time trends. Employment outcome data are from the Philippine Labor Force Survey, and cover the years 1992-2011. The unit of observation is the province/quarter. Employment rate is share working out of total population in age group. International migrants are included in calculation of outcome variables. Post equals 1 in 1997, quarter 3 to 2011, and 0 in 1992-1997, quarter 2. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 10: Impact of Migrant Earnings Shocks on Internal Migration

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock. Data from each of 77 provinces over three periods (1990, 2000, 2010).

Dependent variable: Internal Migration	*Mean (std. dev.) of dependent variable*	*Regressions* (1) *No controls*	(2) *Province-specific linear time trends*	*Number of obs.*
Inmigration rate				
Aged 25-64	0.029	0.071**	0.054	231
	(0.022)	(0.032)	(0.053)	
Aged 16-24	0.035	0.099***	0.048	231
	(0.029)	(0.036)	(0.052)	
Aged 7-12	0.022	0.061*	0.043	231
	(0.017)	(0.031)	(0.044)	
Aged 13-15	0.021	0.077***	0.053	231
	(0.018)	(0.029)	(0.039)	
Outmigration rate				
Aged 25-64	0.030	-0.018	-0.056	231
	(0.024)	(0.025)	(0.041)	
Aged 16-24	0.046	-0.044	-0.079	231
	(0.036)	(0.034)	(0.057)	
Aged 7-12	0.021	-0.011	-0.030	231
	(0.019)	(0.019)	(0.040)	
Aged 13-15	0.022	-0.019	-0.039	231
	(0.020)	(0.019)	(0.034)	
Net migration rate				
Aged 25-64	0.000	-0.089*	-0.111	231
	(0.025)	(0.046)	(0.078)	
Aged 16-24	0.011	-0.143***	-0.127	231
	(0.043)	(0.053)	(0.090)	
Aged 7-12	-0.001	-0.072*	-0.074	231
	(0.020)	(0.042)	(0.072)	
Aged 13-15	0.001	-0.096**	-0.092	231
	(0.022)	(0.038)	(0.064)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. Regressions in column 2 include province-specific linear time trends. Internal migration rates are calculated from the 1990, 1995, 2000, and 2010 Philippine Censuses. There are 77 provinces per year rather than the 82 shown in the other tables using Census data due to corrupt internal migration data for five provinces in 1990. At the recommendation of the PSA, we have dropped these 5 provinces in all years. Net migration rate is outmigration rate minus inmigration rate. Post equals 1 in 2000 and 2010, and 0 otherwise. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Appendix Table 11: Impact of Migrant Earnings Shocks on Labor Supply, Excluding International Migrants

Fixed effects regressions. Columns 1 and 2 report coefficients (standard errors) on migrant earnings shock.
Data from each of 77 provinces over 80 quarters (Q1 1992 - Q4 2011).

Dependent variable	*Mean (std. dev.) of dependent variable*	*Regressions*		*Number of obs.*
		(1) No controls	*(2) Province-specific linear time trends*	
Labor force participation, adults	0.763	-0.064*	0.021	6159
(aged 25-64)	(0.070)	(0.033)	(0.041)	
Females	0.585	-0.084	0.049	6159
	(0.129)	(0.059)	(0.073)	
Males	0.943	-0.037***	-0.007	6159
	(0.029)	(0.013)	(0.014)	
Labor force participation, young adults	0.521	-0.046	-0.077	6159
(aged 16-24)	(0.105)	(0.064)	(0.054)	
Females	0.375	-0.066	-0.072	6159
	(0.122)	(0.091)	(0.061)	
Males	0.649	-0.032	-0.067	6159
	(0.115)	(0.058)	(0.054)	
Employment rates, children	0.129	-0.039	-0.033	6159
(aged 10-15)	(0.123)	(0.067)	(0.061)	
Females	0.093	-0.059	-0.049	6159
	(0.108)	(0.074)	(0.059)	
Males	0.164	-0.033	-0.029	6159
	(0.147)	(0.070)	(0.069)	

Notes: All regressions include province fixed effects, year fixed effects, baseline migrant earnings per capita times post, and weighted-average exchange rate shock times post. Regressions in column 2 include province-specific linear time trends. Employment outcome data are from the Philippine Labor Force Survey, and cover the years 1992-2011. The unit of observation is the province-quarter. Labor force participation rate is share in the labor force out of total population in the age group. Employment rate is share working out of total population in age group. International migrants are excluded from calculation of outcome variables. Post equals 1 in 1997, quarter 3 to 2011, and 0 in 1992-1997, quarter 2. Robust standard errors are clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.