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

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Abstract

How do improvements in overseas earnings opportunities affect development in origin areas of international migrants? We study a natural experiment that generated positive, persistent, but heterogeneous improvements in international earnings opportunities for Philippine migrant-origin areas. Over the subsequent decade, we find substantial increases in international labor migration, and in higher-skilled, higher-wage migrant work. By contrast, there is little evidence of impacts on domestic labor market or firm outcomes. A model-based quantification reveals that educational investments are a key mechanism behind impacts on international labor market participation, explaining substantial shares of increases in migration and in high-skilled, high-wage overseas work.

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1 Introduction

How do earnings opportunities abroad affect development in origin areas of international labor migrants? Consider effects in two contexts: in the domestic economy, and in the international labor market. Domestically, migrant workers' earnings may loosen credit constraints on investments in education and enterprises in origin areas. Domestic firms could benefit from access to better-educated workers, and increases in local aggregate demand could stimulate local firm growth. Internationally, there could also be gains. Improved migrant earnings opportunities could raise international labor migration, and correspondingly increase aggregate earnings overseas. If overseas earnings fund education investments back home, there could be further gains over time. Populations with higher human capital may migrate at even higher rates, and do so in higher-skilled, higher-paying overseas jobs.

We examine the impacts of improvements in migrant earnings opportunities on the origin areas of migrants in one of the world's most important international migration source countries, the Philippines. Roughly one in four Philippine households receive remittances from overseas migrants, so it is reasonable to examine potential aggregate impacts on migrants' origin areas. We exploit changes in migrant earnings opportunities driven by the 1997 Asian Financial Crisis exchange rate shocks. Locations across the Philippines had varied exposure to these shocks, because prior to the crisis they differed in their rates of international migration, and also had varied overseas destinations (whose exchange rate shocks were heterogeneous). Novel administrative data from the Philippine government on migrant worker contracts makes this study possible, by allowing us to estimate changes in migrant earnings opportunities in sub-national areas (provinces).

We study impacts over roughly a decade after the shock, looking separately at impacts on the domestic economy (local labor market and firm outcomes), and international labor market outcomes. We find no large or statistically significant effects on the domestic economy in origin areas, in terms of local labor force participation, employment, household entrepreneurship, and domestic firm outcomes.

By contrast, we find substantial positive effects on participation and performance in the international labor market. Improvements in migrant earnings opportunities

lead to increases in new departures for overseas jobs, and increases in migration for higher-skilled overseas jobs. Correspondingly, there are substantial increases in average earnings per migrant. These increases in migration rates and in high-skilled, high-wage migrant work add up to substantial gains in origin-areas' aggregate overseas earnings. These gains in the international labor market are reflected in higher aggregate wealth (higher asset ownership) in origin areas.

The magnitude of impacts is nontrivial. A one-standard-deviation increase in a province's migrant earnings per capita (total annual migrant earnings divided by population) increases the rate of new departures for international jobs by 38.7% (0.38 std. dev.), the share of overseas jobs that are high-skilled by 11.6% (0.28 std. dev.), and the provincial household asset index by 0.18 std. dev.

Another aspect of the impacts bears notice: there is a substantial magnification in the initial shock to migrant earnings over the subsequent decade. A one-standard-deviation increase in the size of the initial migrant earnings per capita shock, or PhP 129, leads migrant earnings per capita in the province to be higher by PhP 1,263 (3.4% of per capita income) a decade later.[1] In other words, each one-peso shock to migrant earnings per capita in a province (driven by to the 1997 Asian Financial Crisis exchange rate shocks) becomes 9.8 additional pesos a decade later.

Is this dramatic magnification of the shock over time at all sensible? What could explain such an effect? We write down a structural model to quantify potential mechanisms behind the long-run effects we find. We are particularly interested in how much of earnings gains might be due to increased educational investments, which affect future migration and earnings.

We start with a gravity model of migration (building on Eaton and Kortum (2002), Bryan and Morten (2019) and Hsieh et al. (2019)), and augment it to allow skill heterogeneity and skill investments. Workers make educational investments to acquire skill and enter skilled occupations. Such investments are inhibited by credit constraints, which may be alleviated by improvements in migrant earnings. With dyadic (origin-destination) data on migration flows and wages, we estimate the wage elasticity of migration, and dyad-level migration costs.

Given the central role of skill acquisition in the model, we estimate impacts on

[1] All monetary amounts in the paper are in real 2010 Philippine pesos. The 2010 exchange rate was 45 pesos to the USD.

educational investments. We find large positive effects: a one-standard-deviation shock to migrant earnings increases years of schooling of 7-18 year-olds in the province by 0.1 years (0.17 std. dev.), and of college-age individuals by 0.17 years (0.15 std. dev.).

Our parameter estimates and model can rationalize the magnitudes from our reduced-form analysis. We quantify the importance of different channels in determining long-run impacts, highlighting the education channel. We find that half (50.1%) of the increase in the international migration rate is due to the education channel. When it comes to the overall increase in migrant earnings per capita in the population, 32% can be attributed to the education channel. Said differently, if the initial improvement in migrant earnings opportunities had not affected household educational investments, the impact on new migration and on migrant earnings a decade later would only have been, respectively, half and two-thirds as large.

All told, an exogenous improvement in migrant earnings opportunities in Philippine provinces led to gains in a different realm than might have been expected. While there were few identifiable gains in the domestic economy, origin areas saw substantial gains in their participation and performance in the international labor market.

Our work relates to research on the economic impacts of international migration on migrants' home areas. Prior work establishes that workers migrating internationally experience substantial income gains (Gibson et al., 2010; Clemens et al., 2016), and that improvements in migrant economic conditions have positive impacts on their origin households (Yang (2006, 2008), Yang (2011)). We examine impacts on outcomes of entire populations of migrant origin areas, not just the source households of current migrants. The focus on aggregate outcomes of origin areas is relatively rare in the migration literature, owing to challenges in finding plausibly exogenous variation in migration-related independent variables.[2] A key concern in such studies is that migrant earnings are not randomly assigned, so that observed relationships with development outcomes may be due to omitted variables.[3]

[2]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 (2018b), and Theoharides (2018a). Barham and Boucher (1998) and McKenzie and Rapoport (2010) study impacts on income distribution in migrant home areas. Kinnan et al. (2019) examine impacts of internal migration on origin areas in China.

[3]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

A key contribution of ours is to leverage a natural experiment that provides plausibly exogenous variation in migrant earnings across localities. In addition, we expand the set of outcomes of interest beyond domestic economic outcomes, on which prior work has tended to focus (Mendola, 2012; Hanson, 2009). Our novel migrant contract data allows us to examine dynamic gains via changes in future migration. We also examine impacts over an unusually long time-frame, a decade. Documenting dynamic gains due to increased education and resulting changes in international labor outcomes requires such an expanded time-frame.

We also contribute by estimating a structural model to provide insights beyond the reduced-form analysis. We build on prior models (Bryan and Morten, 2019; Burstein et al., 2018; Lagakos et al., 2019; Llull, 2018) by incorporating skill acquisition and its consequences for migration and wages. We use the model to estimate the impact of changes in migrant wages on migration probabilities for individuals of given skill, and estimate how changes in skill levels affect migration. The model helps us rationalize the magnitudes of effects, and quantify the role of educational investments in yielding long-run gains.

This paper also contributes to research on the impacts of migration on skill composition at origin. Our findings concord with studies finding that rather than leading to a net loss of skilled individuals from the population (a "brain drain"), international migration could increase skill levels by stimulating educational investments (Stark et al. (1997), Mountford (1997), Shrestha (2017), Chand and Clemens (2019), Batista et al. (2012), Docquier and Rapoport (2012)). These findings contrast with studies finding reductions in schooling investments in response to migration opportunities (McKenzie and Rapoport (2011)). We add to this literature by emphasizing that resulting increases in education in the population may create a virtuous cycle, leading to more, higher-skilled, and higher-wage future migration.

2 Philippine Migration: Overview

The Philippines was the first country to facilitate large-scale temporary overseas contract migration. Migration from the Philippines is largely temporary and legal, and

Yang, 2020), Mahajan and Yang (2020), so that migrant earnings might be negatively correlated with locality outcomes.

occurs through licensed, regulated private recruitment agencies. Filipino contract workers oversas are widely referred to as OFWs ("Overseas Filipino Workers"). In recent decades, increasing shares of the Philippine population have migrated, had a household member migrate, or received migrant remittances (Appendix Table A2). The fraction of the population currently overseas rose from 0.7% to 1.6% from 1990 to 2010. Over the same period, the fraction of households with an overseas migrant member rose from 3.2% to 6.3%. Migrant financial support extends well beyond their origin households: the share of households receiving remittances rose from 17.6% in 1991 to 26.0% in 2009.

The Philippines has perhaps the world's most elaborate government bureaucracy regulating international labor migration. The Philippine Overseas Employment Administration (POEA) issues operating licenses to recruitment agencies and regulates their activities. Due to concerns about worker abuses and human trafficking, recruitment agencies are typically only allowed to recruit workers in approved office locations. The Overseas Workers Welfare Administration (OWWA) works to ensure the well-being of OFWs and their families. It intercedes (via overseas consular posts) for workers experiencing abuse or contract violations, repatriates workers in conflict zones, assists OFW families in hardship, and facilitates the return and "reintegration" of OFWs to the Philippines.

Filipinos migrate to a wide variety of destinations, and the choice of destination varies substantially across origin areas. Table A1 shows the top twenty destinations for all Filipino migrants prior to the Asian financial crisis. Other than Saudi Arabia and Japan, no other destination accounts for more than 10% of migrants. There is also substantial heterogeneity in the wages earned by migrants in different destinations. Migrants to 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, emigration is more prevalent in certain provinces. Table 1 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%.

3 Theoretical Framework

We write down a structural model to relate an initial migrant earnings shock with educational investments and resulting future changes in migration and migrant earnings. We build on recent gravity models of the flows of workers (Bryan and Morten (2019); Hsieh et al. (2019)), which adapt Eaton and Kortum (2002) to model migration. Building on prior work, we endogenize skill investments, and allow for skill-dependent migration and earnings. For identification, we exploit exogenous changes in migrant earnings driven by exchange rate shocks. The model guides our empirical specification, generates testable hypotheses, validates our empirical findings, and quantifies underlying channels.

3.1 Migration Decisions

An individual i's earnings w_{idost} varies across the province of origin o, the destination country d, their skill level s, and over t. It depends on migration costs τ_{dot}, exchange rates EX_{dt}, destination specific ability draws q_{id}, and destination specific wage profiles w_{dst}. Since recruitment agencies take a fraction of wages as their fees, workers lose a percentage of their wages to migration cost. ε_{dot} is any unobservable factor that makes migrants from origin o more productive in destination d.

$$w_{idost} = w_{dst} EX_{dt} (1 - \tau_{dot}) q_{id} \varepsilon_{dot} \tag{1}$$

Here, $\tau_{oo} = 0$. Like most of the literature, we assume ability is distributed multivariate Frechet with a shape parameter θ, as in Eaton and Kortum (2002).[4] This parameter determines the dispersion of skills across locations.[5]

$$F(q_1, ..., q_D) = exp\left\{ - \left[\sum_{d=1}^{D} q_d^{-}\theta \right] \right\} \tag{2}$$

[4] Instead of a trade elasticity, as in Eaton and Kortum (2002), this will produce a migration elasticity: the elasticity between the proportion of migrants and the destination wage.

[5] Abilities may be correlated across locations with a correlation coefficient of ρ. For higher ρ, individuals that have higher ability in location d also are more able in d'. In such cases, we can define $\bar{\theta}$to measure the dispersion of skill, and θ would be a function of both the dispersion and correlation parameter: $\theta = \frac{\bar{\theta}}{1-\rho}$. The distribution would be characterized by: $F(q_1, ..., q_D) = exp\left\{ - \left[\sum_{d=1}^{D} q_d^{-\frac{\bar{\theta}}{1-\rho}} \right]^{1-\rho} \right\}$.

Let π_{dost} be the fraction of people of skill s from origin o who choose to work in d. We can derive this share (the details of which are in Appendix D.1) to be:

$$\pi_{dost} = \frac{(w_{dst} EX_{dt}(1-\tau_{dot})\varepsilon_{dot})^{\theta}}{\sum_k (w_{kst} EX_{kt}(1-\tau_{kot})\varepsilon_{kot})^{\theta}} \tag{3}$$

Taking logs, we derive these gravity equations between origin-destination pairs:

$$\log \pi_{dost} = \theta \log w_{dst} + \theta \log EX_{dt} + \theta \log (1-\tau_{dot}) + \log \left[\sum_k (w_{kst} EX_{kt}(1-\tau_{kot})\varepsilon_{kot})^{\theta} \right] + \theta \varepsilon_{dot} \tag{4}$$

3.2 Earnings Shocks and Human Capital Investments

Households choose schooling levels S when young, how much to borrow from the future $\bar{b}$, and work locations d when older. This location can be the home province o or foreign countries. They maximize their two period utility: $u(c_1) + u(c_2)$.

Period 1 consumption depends on wealth Y (including household migrant earnings), the price of schooling p, and how much they borrow b from period 2. Period 2 consumption depends on earnings and unresolved period 1 debt with interest R:

$$\begin{aligned} c_{1io} &= Y_{io} - p_o S_{io} + b_{io} \\ c_{2io} &= w^m_{ido}(s) - R_o b_{io} \ , \end{aligned} \tag{5}$$

where $w^m_{ido}(s)$ is the maximum wage at the end of the migration decision.

In equilibrium, the share of skilled s workers are ℓ_{so} and unskilled u workers are $\ell_{uo} = (1-\ell_{so})$. If the average years of education for skilled workers is ed_1 and for unskilled is ed_0, then the average years of education in an origin o is simply: $S_o = \ell_{so} ed_1 + \ell_{uo} ed_0$.

Province-level earnings depend on the distribution of where workers work. The short-run income change (due to exchange rate shocks) in the origin O depends on the share of migrants in each destination:

$$\Delta Y_o = \sum_s \ell_{sot} \sum_{k,o=O} \pi_{kost} \overline{w_{kost}} \frac{\Delta EX_{kt}}{EX_{kt}} \ , \tag{6}$$

where $\overline{w_{dost}}$ is the average wage in destination d for all workers of skill s from origin o, π_{dost} is the share of workers from o working in d, and $\frac{\Delta EX_{kt}}{EX_{kt}}$ is the exchange rate shock. Equation (6) motivates our empirical specifications, where we leverage variation in exchange rate shocks.[6]

We may expect that changes in migrant earnings help drive investments in human capital at home, for instance, by easing liquidity constraints for households.[7] For reasonable assumptions on $u(.)$ and w (for instance, $w_{od}(s)$ linear in s, and $u(c)$ continuous, increasing but at a decreasing rate), and for credit constrained households $\bar{b} = 0$, schooling will respond to shocks to migrant earnings: $\Delta S_o = \frac{1}{2p}\Delta Y_o$.

For ease of notation let us define: $\Psi \equiv (ed_1 - ed_0)2p$, as the cost of becoming skilled. The change in the share of skilled workers in an origin O will be:[8]

$$\Delta \ell_{sOt} = \frac{1}{\Psi}\Delta Y_O = \frac{1}{\Psi}\sum_s \ell_{sot} \sum_{k,o=O} \pi_{kost}\overline{w_{kost}}\frac{\Delta EX_{kt}}{EX_{kt}} \tag{7}$$

3.3 Changes in Migration Flows in Response to the Shock

Migration flows from origin o to destination d depend on the probability of migrating by skill level, and the share of workers who are skilled (ℓ_{sot}) and unskilled (ℓ_{uot}) :

$$\pi_{dost}\ell_{sot} + \pi_{dout}\ell_{uot} \tag{8}$$

We can derive the changes in flows between origin o and destination d pairs. This equation is important in that it drives the intuition behind our later analysis. We find that the change in flows can be grouped into two components:

$$\Delta\, Flows_{dot} = \underbrace{\Delta\ell_{sot}\left(\pi_{dost} - \pi_{dout}\right)}_{\text{Education channel in flows}} + \underbrace{\theta\left(\ell_{sot}\pi_{dost} + \ell_{uot}\pi_{dout}\right)\frac{\Delta EX_{dt}}{EX_{dt}}}_{\text{Exchange rate channel in flows}} \tag{9}$$

[6] As we show, from Frechet properties, we know $\overline{w_{dost}} = w_{dst}\pi_{dost}^{-\frac{1}{\theta}}\Gamma\left(1 - \frac{1}{\theta(1-\rho)}\right)$, where Γ is the Gamma function.

[7] In a similar manner, we may model liquidity constraints in investments in local enterprises. As we fail to find supportive empirical evidence for this, we exclude it from the current setup for tractability purposes.

[8] In Appendix D.2 we derive changes to human capital when there are no liquidity constraints or when there is no borrowing possible. For the purposes of our study, we are agnostic about whether the education response is due to easing of liquidity constraints or changing the returns to education. Some combination of the two is possible, as we discuss in the appendix. Additionally, we note that if period 2 consumption is subjectively discounted, say at the rate β, then both the education and skill-share response will be scaled by $\frac{\beta}{1+\beta}$.

First, skilled workers may have different migration probabilities than the unskilled. If the likelihood of migrating is higher for the skilled, then an increase in the fraction of skilled workers will raise migration. If, on the other hand, most of the demand from abroad is for low skill work, then the probability of migrating may fall with skill. How skill changes affect flows are captured by the first term, 'Education channel in migrant flows.' Intuitively, it is the product of two components: (a) the education response to earnings $\Delta\ell_{sot}$, and (b) the skill-differential in migration probabilities $(\pi_{dost} - \pi_{dout})$.

Second, as exchange rates change favorably, there will be a migration response to higher compensation. This depends on the Frechet parameter, which is the elasticity of migration with respect to destination wages. Together, the size of the shock $\frac{\Delta EX_{dt}}{EX_{dt}}$, the probabilities of migration $\ell_{sot}\pi_{dost} + \ell_{uot}\pi_{dout}$, and the responsiveness to shocks θ, determine the change in migrant flows for a given skill level. This is what we call the 'Exchange rate channel in migrant flows.'

Similarly, the aggregate outflows of migrants from an origin o are summed over various destinations, and follow the same intuition:

$$\Delta\, Flows_{ot} = \underbrace{\Delta\ell_{sot} \sum_{k} (\pi_{kost} - \pi_{kout})}_{\text{Education channel in flows}} + \underbrace{\theta \sum_{k} (\ell_{sot}\pi_{kost} + \ell_{uot}\pi_{kout}) \frac{\Delta EX_{kt}}{EX_{kt}}}_{\text{Exchange rate channel in flows}} \tag{10}$$

We use this set up to determine the importance of each channel, and quantify their contributions. We need to estimate not just the change in education $\Delta\ell_{sot}$ and the migration elasticity θ, but also the baseline shares for ℓ and π which determine how the shock in exchange rates propagates across different origins. Together, we see how much of the changes in flows can be accounted for by the education and exchange rate channels.

The equations also show that the change in flows is a function of the earnings shock. This is true, not just for the exchange rate channel, but also for the education channel. For instance, we know from Equation (7) for $\Delta\ell_{sot}$, that the education channel directly depends on the migrant earnings shock:

$$\frac{1}{\Psi}\underbrace{\left[\sum_{s}\ell_{sot}\sum_{k,o=O}\pi_{kost}\overline{w_{kost}}\frac{\Delta EX_{kt}}{EX_{kt}}\right]}_{\Delta Y_o=\text{Migrant Earnings Shock}}\sum_{k}(\pi_{kost}-\pi_{kout}) \tag{11}$$

3.3.1 Change in Earnings and Consumption Expenditure

The average earnings for the population in an origin O is a weighted average of wages between origin o and destination d, which varies by skill s. The weights are the fraction of the population in each skill group ℓ_{sot}, and the probability of working in destination d given their skill level π_{dost}:

$$\sum_{d}\ell_{sOt}\overline{w_{dost}}\pi_{dost}+\sum_{d}\ell_{uOt}\overline{w_{dout}}\pi_{dout}=\ell_{sOt}\left(\sum_{d}\overline{w_{dost}}\pi_{dost}-\sum_{d}\overline{w_{dout}}\pi_{dout}\right)+\sum_{d}\overline{w_{dout}}\pi_{dout} \tag{12}$$

Once again, the change in earnings per capita, will depend on what happens to two different components, driven by: (1) the change in human capital , and (2) the persistent change in exchange rates, which raises earnings and encourages flows to favorable destinations. The education channel in earnings can be written as:

$$\Delta\ell_{sOt}(\underbrace{\sum_{d}\overline{w_{dost}}\pi_{dost}}_{\text{avg skilled wage}}-\underbrace{\sum_{d}\overline{w_{dout}}\pi_{dout}}_{\text{avg unskilled wage}}) \tag{13}$$

Here, we know $\Delta\ell_{sOt}$ is a function of the migrant earnings shock from Equation (7). For ease of exposition, define $\beta=(\sum_d\overline{w_{dost}}\pi_{dost}-\sum_d\overline{w_{dout}}\pi_{dout})$ as the skill premium. This allows us to rewrite the education channel contribution to the change in earnings as:

$$\frac{\beta}{\Psi}\underbrace{\left(\sum_{s}\ell_{sot}\sum_{k,o=O}\pi_{kost}\overline{w_{kost}}\frac{\Delta EX_{kt}}{EX_{kt}}\right)}_{\Delta Y_o=\text{Migrant Earnings Shock}} \tag{14}$$

The remaining change in earnings is driven by persistent changes in the exchange rate. This 'Exchange rate channel in earnings' captures the increase in long run earn-

ings, not simply due to the fact that better exchange rates directly increase earnings, but also because they induce a greater flow of migrants (both skilled and unskilled) to places with lucrative exchange rates. This contribution is:

$$\left(\sum_k \ell_{sot}\overline{w_{kost}}\theta\pi_{dost}\frac{\Delta EX_{dt}}{EX_{dt}}\right)+\left(\sum_k \ell_{uot}\overline{w_{kout}}\theta\pi_{dout}\frac{\Delta EX_{dt}}{EX_{dt}}\right)=\theta\underbrace{\left(\sum_s \ell_{sot}\sum_{k,o=O}\pi_{kost}\overline{w_{kost}}\frac{\Delta EX_{kt}}{EX_{kt}}\right)}_{\Delta Y_o=\text{Migrant Earnings Shock}} \tag{15}$$

In other words, this is $\theta\Delta Y$. Again, the migration elasticity plays an important role in determining long-run earnings. Together, the overall change in earnings is:

$$\left(\frac{\beta}{\Psi}+\theta\right)\Delta Y \tag{16}$$

There is intuition behind this relationship. First, a higher skill-premium β means that as students get more educated (say, as liquidity constraints are eased), the more the rise in earnings. Second, a lower cost of education Ψ means that easing liquidity constraints has a larger impact on the education margin, as more children can easily go to school. These two parameters determine the education channel's contribution in earnings. Third, a higher migration elasticity θ means that migration flows, and thereby earnings, are more responsive to favorable exchange rates. This last parameter helps determine the importance of the changes in exchange rates in determining long run earnings.

In the short run, total earnings and expenditures simply increase by $\Delta c_{1O}=\Delta Y_O$. In the long run, total migrant earnings, and as a result total household expenditures, may increase by an amount greater than the initial gain in income:

$$\Delta\left(c_{1O}+c_{2O}\right)=\Delta Y_O\left(1+\frac{\beta}{\Psi}+\theta\right)>\Delta Y_O \tag{17}$$

These overall changes in consumption expenditure reflect changes in long-run consumption welfare. We use these derived lessons from our theoretical framework to discipline our empirical analysis, interpret the coefficients of our reduced form estimates, rationalize the magnitudes, and quantify the contribution of each of the

different channels discussed.

4 Data Sources

We summarize data sources here, providing details in Appendix Section A.

4.1 Exchange Rate Shock Variables

Two 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. These datasets are from the two agencies with primary charge over overseas Filipino workers, OWWA and POEA (described in Section 2 above). The first dataset is from OWWA. 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 POEA, provides data on migrant earnings. POEA uses these data to verify that contracted wages meet minimum wage requirements. 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. We combine the POEA/OWWA data with monthly exchange rate data from Bloomberg LP to construct the exchange rate shock.

4.2 Data on Outcomes

We use POEA/OWWA data from 1993, 2007, 2008 and 2009 on migrant contracts. We focus on the numbers of new contracts and on their occupational characteristics. The POEA/OWWA data categorize each occupational code into broad occupational groups (professionals, production workers, service workers), and we use these groups when describing the change in the occupational distribution. In the parameterization of migration costs in the structural estimation, we also use information on the locations of recruitment agency activity as recorded by the POEA.

Data on years of schooling come from four rounds of the Philippine Census of Population (1990, 1995, 2000, and 2010). The Census contains 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 variables (Filmer and Pritchett (2001)).[9]

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. We examine province-level domestic labor force participation rates for those aged 16 and above, employment rates for children aged 10-15 (for whom labor force participation is not measured), and household entrepreneurial work.

We use the Annual Survey of Philippine Business and Industry (ASPBI) to study domestic firm production. We construct annual panel data (1988-2015) of province-level means of manufacturing firm outcomes (revenues, exports, inventories, employment, hours worked, and compensation paid).

5 Estimation and Empirical Strategy

5.1 Gravity Equation Parameters θ and τ_{od}

Our gravity equation determines migrant flows from o to d. In Equation (4) the unknown parameters are the migration elasticity θ and migration costs τ_{od}.

$$\log \pi_{dots} = \theta \log w_{dst} + \theta \log EX_{dt} + \theta \log (1-\tau_{dot}) + \log \left[\sum_{k} (w_{kst} EX_{kt} (1-\tau_{okt}) \varepsilon_{okt})^{\theta} \right] + \theta \varepsilon_{dot} \tag{4}$$

5.1.1 Estimating Migration Elasticities θ

To estimate the Frechet parameter, θ, first, we directly use Equation (4), and leverage the exogenous exchange rate shocks. As such, the coefficient on $\log EX_{dt}$ identifies

[9] These asset data are only available in the 1990, 2000, and 2010 rounds of the Census. The 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 Appendix Table A6.

θ. We implement this in two different ways by structuring our data at the origin-destination-skill level, and then simply at the destination-skill level. In the former method we include origin-by-skill fixed effects and two-way cluster our errors at the origin and destination level. In the latter method, we include the requisite skill fixed effects and cluster our errors at the destination level.

For our second strategy, we recognize from the Frechet properties that, $E(q_d|d) = \pi_{do}^{-\frac{1}{\theta}}\Gamma$, where $\Gamma = \Gamma\left(1-\frac{1}{\theta(1-\rho)}\right)$ is the Gamma function. This allows us to derive an earnings relationship to determine θ:

$$\log\ \overline{w_{dost}} = \log\ w_{dst} - \frac{1}{\theta}\log\ \pi_{dost} + \log\Gamma + \varepsilon_{dot} \tag{18}$$

As more and more workers from o move to d, it lowers the average wage, since the marginal migrant has lower ability than the first set of migrants. We use earnings data by origin, destination and skill-level of migrants. We include destination and origin fixed effects, in a regression where our main independent variable is the log of flows from origin to destination, and two-way cluster our errors at the origin-destination pair level.

We estimate the models using Poisson pseudo-maximum likelihood (PPML), which assumes that errors are uncorrelated with the exponential of the regressions. Yet, one may think that ε_{dot} is correlated with $\log\pi_{dost}$. To get unbiased estimates, we use instrumental variables, following Bryan and Morten (2019).[10]

Table A5 produces estimates of θ using the different methods. Our estimates of θ lie between 3 and 3.7 across the different estimation procedures. Our IV-PPML estimates are not statistically distinguishable from our PPML estimates of θ. We use the estimate of 3.4 as our preferred estimate, but in sensitivity checks we vary it for values between 2 and 7 when doing our model quantification exercises.

[10]We construct a vector of all flows (and squared flows) to a destination from all *other* origins (i.e. excluding flows from the origin of interest). We then use this vector Π_{dst-o} to predict flows from the origin of interest π_{dost} to the destination. Specifically, we create $\log\Pi_{dst-o}$ to be a vector $\{\log\pi_{d1st}....,\log\pi_{dOst},(\log\pi_{d1st})^2,.....(\log\pi_{dOst})^2\}$. And then predict $\widehat{\log\pi_{dost}} = \alpha_1\log\Pi_{dst-o}$. We then run our 2SLS regression, where the first stage regresses $\log\pi_{dost}$ on $\widehat{\log\pi_{dost}}$, and the second stage implements Equation (18). We do this using IV-PPML with origin, destination and skill fixed effects, and bootstrap our standard errors.

5.1.2 Estimating Migration Costs

In our framework, migration costs help drive the persistence in migration patterns, and thereby the persistence in changes to migrant earnings. One reason underlying persistence is the central role of recruitment agencies in international labor migration. Agencies enter into contracts with overseas employers to fill specified positions (e.g., nursing positions for a hospital in Qatar). Agencies interview potential job applicants in licensed branches. Agencies therefore source job applicants from particular localities, that tend to be persistent over time.

Recruitment agencies also specialize in placing workers in particular overseas destinations where they have contacts and past experience. Overseas employers choose agencies with whom they have worked before, or that have experience in the same country and industry. The overseas destinations of workers placed by particular agencies therefore also tend to be persistent over time.

As a result of persistence in the Philippine areas of operation of recruitment agencies, and of persistence in the overseas destinations served by particular agencies, the costs of migrating from a particular Philippine origin location to a particular destination country overseas are highly heterogeneous. We parameterize migration costs between origin o and destination d as depending on the presence of recruitment agencies, and their overseas areas of operation. Because agencies serve specific destinations, the presence of an agency in origin o that serves destination d lowers the cost of migrating from o to d. Furthermore, competition between agencies in origin o placing workers in destination d should lower how much they charge potential migrants, also lowering o to d migration costs.

If recruitment agencies do not rapidly spread across origins or destinations, then the distribution of origin-destination flows may be strongly persistent over time (as we empirically show later). This persistence in origin-destination flows may further drive persistence in migrant earnings in the face of changes in exchange rates. We parameterize the migration cost relationship in the following manner:

$$\log\left(1-\tau_{dot}\right) = \lambda_1 \,\#\, Rec\, Agen_{dot} + \lambda_2 HHI\, Rec\, Agen_{dot} + \varepsilon^1_{dot}, \qquad (19)$$

where $\#\, Rec\, Agen_{dot}$ is the number of recruitment agencies in province o that send at

least one migrant to destination d, and $HHI\,Rec\,Agen_{dot}$ is the Hirschman-Herfindahl Index for the competitiveness of the market that sends migrants from o to d.[11]

We use Equation (19) in conjunction with Equation (4). The migration costs we estimate vary at the od-pair level. In Equation (4), $\theta \log w_{dst} + \theta \log EX_{dt}$ are absorbed by destination fixed effects μ_d, and $\log \left[\sum_k \left(w_{kst}(1-\tau_{kot})\right)^{\theta} \varepsilon_{kot}\right]$ by origin fixed effects, μ_o.

$$\log \pi_{dot} = \mu_o + \mu_d + \theta\lambda_1 \#\,Rec\,Agen_{dot} + \theta\lambda_2 HHI\,Rec\,Agen_{dot} + \varepsilon^2_{dot} \quad \text{for } t = T \tag{20}$$

In Equation (20), we control for both origin and destination fixed effects, and migration costs are only identified by variation at the $o-d$ pair level. This means that whether the origin is a big city or a small town, or whether the destination is a rich or a poor country, is not associated with the migration cost estimates.

That recruitment agencies play such a meaningful role in determining migration flows can be seen by the raw data scatter-plot version of Equation (20) in Figure A3. We residualize all the variables purging them of the origin μ_o and destination μ_d fixed effects, and estimate the regression separately for 1993, and for the 2007-9 period. While this relationship is not meant to be causal, it quantifies the migration costs for workers who wish to migrate from origin o to destination d. The relationship between flows and agencies is strong, and also stable over the 16 year period of our study. This stable and important role played by agencies may explain the underlying heterogeneity in origin-destination flows, and the persistence in such flows (and thereby migrant earnings) over time.

5.2 The Migrant Earnings Shock

As we show in Section 3, we expect migrant earnings to increase:

$$\Delta Y_o = \sum_s \ell_{sot} \sum_{k,o=O} \pi_{kost} \overline{w_{kost}} \frac{\Delta EX_{kt}}{EX_{kt}} \tag{6}$$

We rewrite this relationship to facilitate estimation. Let baseline population in an origin province (from the 1995 Census) be Pop_o, and the number of skilled workers

[11] If h_{aod} is the share of workers sent by agency a to d, then $HHI_{od} = \sum_a h^2_{aod}$.

in the province L_{so}. Let the number of skilled workers going from origin o, to destination d simply be L_{sdo}. This means that $\ell_{sot} \equiv \frac{L_{sot}}{Pop_o}$, and $\pi_{dost} \equiv \frac{L_{sdot}}{L_{sot}}$. We can rewrite Equation (6) in the following manner:

$$\Delta Y_o = \sum_s \sum_{k,o=O} \frac{L_{sot}}{Pop_o} \frac{L_{skot}}{L_{sot}} \overline{w_{kost}} \frac{\Delta EX_{kt}}{EX_{kt}} = \frac{1}{Pop_o} \sum_s \sum_{k,o=O} L_{skot} \overline{w_{kost}} \frac{\Delta EX_{kt}}{EX_{kt}} \qquad (6)'$$

In terms of total migrant earnings for those from origin o and working in destination d, since $w_{dot} \equiv \sum_s L_{sdot} \overline{w_{dost}}$:

$$\Delta Y_o = \underbrace{\frac{\sum_k w_{ko}}{Pop_o}}_{MigEarn_o} \times \underbrace{\frac{\sum_k w_{ko} \frac{\Delta EX_{kt}}{EX_{kt}}}{\sum_k w_{ko}}}_{ERshock_o} \qquad (21)$$

We take this specification directly to the data, defining each of the components in the product above in detail. As such, 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: baseline (pre-shock) migrant earnings per capita $MigEarn_{o0}$, and the earnings-weighted exchange rate shock $ERshock_o$.

5.2.1 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. The crisis was unexpected (Radelet and Sachs 1998), and so migrants and their home areas should 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 provides a positive income shock to Filipino migrants working there; each unit of foreign currency earned abroad would be convertible to more Philippine pesos.

For each destination d, we measure the change in exchange rates between the

twelve months preceding July 1997 and twelve months preceding October 1998:

$$\frac{\Delta EX_d}{EX_d} = \frac{\text{Average country } d \text{ exchange rate from Oct. 1997 to Sep. 1998}}{\text{Average country } d \text{ exchange rate from Jul. 1996 to Jun. 1997}} - 1 \tag{22}$$

Exchange rate changes for the 20 major destinations of Filipino migrants are presented in Table A1. Migrants in Saudi Arabia, Hong Kong, and the United Arab Emirates experienced positive exchange rate shocks of approximately 50%. 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 baseline share of migrant earnings across overseas destinations. Let w_{do} be the total annual earnings of migrants from province o who are in country d prior to the Asian financial crisis. The weighted-average exchange rate shock for each o is the second term in Equation (21):

$$ERshock_o = \frac{\sum_k w_{ko} \frac{\Delta EX_k}{EX_k}}{\sum_k w_{ko}} \tag{23}$$

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 1 shows that this variable has a mean of 0.410 and a standard deviation of 0.045.

5.2.2 Baseline migrant earnings per capita

We estimate average earnings per migrant in the province using pre-shock contract data, then multiply it by the number of migrants in each province from the 1995 Census, obtaining total migrant wages for each province. We divide total migrant wages by the province's population to obtain a province's pre-shock migrant earnings per capita; the first term of Equation (21):

$$MigEarn_o = \frac{\sum_k w_{ko}}{Pop_o} \tag{24}$$

Table 1 shows summary statistics for $MigEarn_o$. The average is Php 4,263, and the standard deviation is Php 3,275.

5.2.3 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 from demeaned component variables ($ERshock_o$ and $MigEarn_o$). It has a mean of -0.014 (std. dev. 0.129).

Figure A1 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 shock values.[12]

5.2.4 Persistence of exchange rate shocks and migration patterns

There is temporal persistence in both the exchange rate shock and overseas migration patterns, leading to persistence of the shock to province-level migrant earnings per capita. Appendix Figure A2 shows the exchange rates for the top ten destinations. The Asian financial crisis is denoted by the dashed line in 1997, after which there is substantial dispersion of the exchange rates. The exchange rate shock is persistent through the year 2010, as can also be seen Table A1 (columns 4 and 5).

In Appendix B.1, we formally test persistence of exchange rate shocks and overseas migrant destinations across provinces, and find 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. 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.

[12] We explore what correlates with the shock in Appendix Table A7. In Column 1, we see that $ERshock_o$ 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. $MigEarn_o$ (column 2) is higher for provinces with more positive exchange rate shocks, higher share rural, and with higher asset index. For $ERshock_o \times MigEarn_o$, 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 significantly different from zero (and positive in magnitude).

5.3 Estimating the Impact of Migrant Earnings on Outcomes

The following is our regression specification:

$$y_{ot} = \beta_0 + \beta_1 ERshock_o * MigEarn_o * Post_t + \beta_2 ERshock_o * Post_t + \beta_3 MigEarn_o * Post_t + \alpha_o + \gamma_t + \phi_o * Trend_t + \varepsilon_{ot}, \quad (25)$$

y_{ot} is an outcome of interest for province o in period t. $ERshock_o$ is the earnings-weighted exchange rate shock for province o (expression (23)). $Post_t$ is an indicator for periods after 1997. $MigEarn_o$ is annual migrant earnings per capita in the province. α_o are province fixed effects, γ_t are period fixed effects, and $\phi_o * Trend_t$ is a province-specific linear time trend. ε_{ot} is a mean-zero error term. Year and province fixed effects account for time-invariant locality characteristics and common time effects. Province linear trends capture long-running linear changes in outcomes specific to each province.[13] Standard errors are clustered by province.

The regression specification includes $ERshock_o$ and $MigEarn_o$ interacted with $Post_t$. We do not presume that $ERshock_o$ and $MigEarn_o$ by themselves to be exogenous. The interaction terms with $Post_t$ account for changes from before to after the shock related to these variables. Only the interaction between $ERshock_o$ and $MigEarn_o$ is taken to be exogenous. Therefore, our coefficient of interest is β_1 on the $ERshock_o * MigEarn_o * Post_t$ term.

The identifying assumption is that a province's shock to migrant earnings is unrelated to underlying trends in outcome variables. This is the parallel-trend assumption underlying difference-in-difference estimates. In all results tables, we show coefficient estimates without and with controls for heterogeneous province trends, to gauge the robustness of results to their inclusion.

5.3.1 Human Capital, the Flow of Migrants, and Skilled Jobs

Our model predicts that schooling $\Delta S_o = \frac{1}{2p}\Delta Y_o$ at the origin changes in response to migrant earnings shocks. We estimate Equation (25) with years of education as the

[13] For some outcomes, data are not available for enough periods to support province-specific linear time trends. In these cases, we include a vector of pre-shock province-level controls interacted with a time trend ($X_{p0} * Trend_t$). The variables in X_{p0} are school attendance rate (age 7-18), female employment rate (age 25-64), male employment rate (age 25-64), share of population rural, asset index, share of individuals (age 25-64) working in a household enterprise, and population.

dependent variable. Equation (21) reveals that the shock affects the share of skilled workers:

$$\Delta \ell_{sOt} = \frac{1}{\Psi} \Delta Y_O = \frac{1}{\Psi} \underbrace{\frac{\sum_k w_{ok}}{Pop_o}}_{MigEarn_o} \times \underbrace{\frac{\sum_k w_{ok} \frac{\Delta EX_{kt}}{EX_{kt}}}{\sum_k w_{ok}}}_{ERshock_o} \quad (7)'$$

We classify occupations to be high- or low-skill based on the average years of education by occupation. We consider occupations where workers have 13 or more years of education on average to be "high-skilled".[14]

Next, we divide the occupations into the three largest categories in descending order of skill: Professional jobs, production jobs, and service jobs. Professional jobs (about 14% of contracts) are the highest skilled, with a mean monthly salary of Php 1357, while service workers (about 45% of our contracts) on average earn Php 297 a month. Our model predicts that the shock may shift migration flows toward high-skill jobs as workers acquire more education (as emigration probabilities are higher for skilled workers). We study the distribution of occupations in the POEA/OWWA data to identify occupational upgrading.

Furthermore, our model suggests that the changes in migrant earnings will affect the flows of migrants. This can be seen directly from Equations (10) and (11). Better exchange rates drive migrant flows, and skill upgrading may amplify this further. We test this hypothesis studying the number of new contracts in the POEA/OWWA data.

5.3.2 Long-run Migrant Earnings per capita and consumption

Persistent favorable exchange rate shocks will increase the stock of earnings, and the flow of migrants going to places with such positive shocks. If the probability of emigrating is higher for skilled than unskilled workers, then the new flow of migrants may be disproportionately skilled. This would raise the earnings per migrant, and thereby the overall migrant earnings per capita in the long run. In Equation (16), our model predicts that this shock to baseline migrant earnings will increase long-run earnings due to both the increase in human capital accumulation (and occupational upgrading), and the increased migrant outflows to favorable destinations. We test

[14] Empirically, 13 years is a reasonable bifuracation point separating low from high skill. Figure A6 presents the density of migrant education levels, which is bimodal with peaks just below and above 13 years.

this hypothesis by examining long-run changes to migrant earnings per capita between 1993 and 2009.

These changes should also affect durable consumption in the long run, in the manner that we describe in the model:

$$\Delta(c_{1O}+c_{2O}) = \left(1+\frac{\beta}{\Psi}+\theta\right)\Delta Y_O = \left(1+\frac{\beta}{\Psi}+\theta\right)\underbrace{\frac{\sum_k w_{ok}}{Pop_o}}_{MigEarn_o} \times \underbrace{\frac{\sum_k w_{ok}\frac{\Delta EX_{kt}}{EX_{kt}}}{\sum_k w_{ok}}}_{ERshock_o} \quad (17)'$$

We use the Census data to examine how durable consumption changes, by creating an asset index for households.

6 Empirical Results

6.1 Migrant earnings and flows of workers

We first examine impacts of the initial migrant earnings per capita shock on migrant earnings per capita over the subsequent decade. We estimate regression Equation (25) where the dependent variable is province-level migrant earnings per capita (total migrant earnings divided by province population, in thousands of real 2010 Philippine pesos). There is one pre-shock observation (1993) and three post-shock observations (2007, 2008 and 2009) for each province.

These results are in the first row of Table 2, panel (a). The coefficient on the migrant earnings shock is positive and statistically significant across sets of controls. The effect is large in magnitude. Column 2's coefficient estimate indicates that for each one standard deviation increase in the initial migrant earnings per capita shock, migrant earnings per capita are higher by nearly 1,263 pesos (9,810 pesos$\times$0.129) a decade later (equal to 3.4% of per capita income). The coefficient estimate of 9.8 indicates that the initial shock to migrant earnings is substantially magnified over time: for each one-peso initial migrant earnings per capita shock, migrant earnings per capita are nearly ten pesos higher a decade later.

What can account for such a considerable magnification over the subsequent decade? Our theoretical framework guides us in unpacking the explanations.

First, the shock also appears to have caused an increase in earnings *per migrant*. In the second row of Table 2, panel (a), we show estimated coefficients on the migrant earnings shock where the dependent variable is earnings per migrant. The initial shock to migrant earnings per capita leads to substantially higher earnings per migrant a decade later.

These increased earnings per migrant may reflect a few changes in origin provinces, as suggested by our model. In panel (b), we show that the positive migrant earnings shock led to meaningful increases in the education levels of the population. Coefficient estimates in column 2 indicate that a one-standard deviation migrant earnings shock leads to 0.10 and 0.17 more years of schooling, for 7-18 year olds and 19-24 year olds, respectively. This increase in population skill levels may lead to higher migration rates, and higher-skilled, higher-wage jobs abroad.

The shock did, in fact, lead to an increase in new migrant contracts, as can be seen in panel (c). Theoretically, these increased flows are a result of better prospects abroad given the persistent change in exchange rates, and occupational upgrading, as provinces with positive shocks gain more education (as we will show, the high-skilled are more likely to migrate).

Together, the education-driven occupational upgrading and the increased flow in response to persistent favorable opportunities abroad drive the increase in migrant earnings per capita. In Section 7 we quantify the role played by each of these channels in explaining the overall increase in migrant earnings.

In Figure 1a, we plot the pre-to-post change in migrant earnings per capita (average of 2007-9 minus 1993) against the migrant earnings shock. Both the x and y-axis variables are residuals (partialled-out) from regressions on the exchange rate shock ($ERshock_o$) and baseline migrant earnings per capita ($MigEarn_o$). The non-parametric regression plot also shows a positive relationship between the change in migrant earnings per capita over the decade and the initial migrant earnings shock.

6.2 Assets

We turn to examining changes in assets, as a summary measure of household well-being. We estimate equation (25) where the dependent variable is the average household asset index. Results are in Table 2, panel (d). The shock has a positive impact

on the asset index, and is of substantial magnitude.

We also present nonparametric regression plots of the relationship between the asset index and the shock. In Figure 1b, we plot the nonparametric relationship of the pre-to-post change in assets (average of 2000 and 2010 minus 1990) against the migrant earnings shock. Once again, both the y-axis and x-axis variables are residuals (partialled-out) from regressions on the main effects of the exchange rate shock ($ERshock_o$) and baseline migrant earnings per capita ($MigEarn_o$). The plot shows a positive relationship that appears approximately linear.

6.3 Schooling

Since human capital accumulation is central to our analysis, we examine changes in schooling in detail. As our framework suggests, positive shocks to migrant earnings could loosen financial constraints on investment in children's schooling (Cox-Edwards and Ureta, 2003; Yang, 2008; Gibson et al., 2011, 2014; Theoharides, 2018a), and also change the expected return to education in the population at large.[15]

In Appendix Table A8, we present results from estimating regression Equation (25) where the dependent variables are average years of completed schooling for various age and gender groupings. The unit of observation is the province by Census-year. We find a positive effect for all children age 7-18 (row 1). 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). For lower-secondary (age 13-15) and upper-secondary (age 16-18) children, regression coefficients are similar in magnitude, but are not consistently statistically significantly different from zero. Results are 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 stable (or increasing in magnitude) when province-specific time trends are added to the regression.

Figure 2a displays a nonparametric regression 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

[15] As we discuss in Appendix D.2, positive migrant earnings shocks could raise schooling investments overall if the return to education is perceived to rise (Chand and Clemens (2019), Shrestha (2017)), but could reduce schooling investments if returns to education are seen to fall (McKenzie and Rapoport (2011)).

migrant earnings shock. The nonparametric plot shows a positive relationship.

We also show a "placebo" experiment, taking advantage of the fact that we have two observations of pre-shock data for this outcome (1990 and 1995). Figure 2b displays a nonparametric regression plot that is analogous 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 is a partial test of the parallel-trend identification assumption. The plot supports this assumption: no positive relationship between the pre-shock change in schooling and the shock is apparent.[16]In Table A10 we formally test for pre-trends across all these education outcomes by looking at the changes between 1990 and 1995. We fail to reject the null of no differential pre-trends across all our specifications in panel (a) on education outcomes.

6.4 Skills and occupational upgrading

The increase in schooling levels may change the flow and composition of migrants. Workers with more education find it relatively easier to find work abroad.[17] These workers may also be more likely to find higher-paying jobs. Alternatively, workers with more education may have more employment prospects at home, leading to negatively selected migration following exchange rate shocks.

For ease of exposition, we classify each detailed occupation code as skilled or unskilled. Figure A6 shows two modes that appear around the 13 year mark, so we use 13 years as a threshold to divide the occupations.[18]

Panel (a) of Table 3 shows these results for the full population (including migrants) and migrant workers separately. First, it is clear that migrant workers are about twice as likely to be skilled than the general population. The migrant earnings shock increases the share of skilled workers in both the full population and the migrant population, and the coefficients are statistically significant. Column 2 shows a that a one-standard-deviation shock leads to a 0.6 percentage point increase (0.0464×0.129) in the share skilled in the full population. Relative to a mean of 17.3

[16]Similar "true" and "placebo" experiments are shown in Appendix Figures A4 and A5, for 7-18 year-olds and 19-24 year olds, respectively. The patterns are very similar to those of Figure 2: there is a positive relationship Panel A (true experiment) and no relationship in Panel B (placebo experiment).

[17]In our model this depends on the relative probabilities of skilled and unskilled migrant flows, π_{dost} and π_{dout}.

[18]Our results are not sensitive to varying this cutoff. Those with 12 years are likely to have a vocational degree. Those with 14 years are likely to have finished college.

percent, these magnitudes are meaningful. For the migrant population, the increase is about 4 percentage points, about a 12% increase from the baseline mean. The migrant earnings shock had a meaningful impact on skill-upgrading at home.

We use the 1990 and 1995 Census waves to test for pre-trends in these skill-share variables. Panel (a) of Table A10 shows that for both the migrant population and the full population, there are no detectable pre-trends in the share of skilled workers.

Based on our data that link occupations with education levels, service jobs require the least amount of skill. Production jobs usually require some more education, while professionals are most likely to be skilled (Appendix Table A11). Panel (b) of Table 3shows the results for migrant contracts in the three large occupation groupings. In the top half of the panel, we look at flows as a fraction of the 1990 province level working-age population. A one standard deviation increase in migrant earnings has a substantial effect on both professional and production worker flows, but no detectable impact on service sector workers. In the lower half of panel (b) we study migrant occupations as a share of migrant contracts. We find a shift in the share of contracts away from service jobs and toward professional jobs. While the effect on service jobs is imprecise, the magnitudes are meaningful.

The combination of the Census and migrant contracts data show that migrant earnings shocks are associated with an increase in the population working in skilled jobs and subsequent migrant flows are concentrated in high-skilled occupations. This occupational upgrading for migrants may be related to the increase in migrant flows, since (as we show later) skilled workers have a higher probability of migrating abroad. Importantly, the increase in flows, particularly in high-skilled jobs, will increase long-run migrant earnings for regions that received more positive shocks.

6.5 Domestic firm production

Positive migrant earnings shocks may allow liquidity-constrained entrepreneurs at home to invest in enterprises, driving firm activity and raising revenue and employment. Panel (a) of Table A9 shows the results for firm production, using data from the ASPBI firm survey. We fail to reject the null of no effects across all outcomes. There do not seem to be any detectable effects on revenues, exports, inventories, domestic employment, total compensation paid, or total hours of labor hired.

In panel (b) of Table A9, we analyze changes in household entrepreneurship, using data from the Labor Force Survey (LFS). We study whether positive migrant earnings shocks are associated with rates of household enterpreneurship. We use the LFS data that asks about the type of work, and examine several types of entrepreneurial activity: having a private household enterprise, being self-employed, being an employer, and working in family-based employment (either paid or unpaid). We fail to find evidence of increases in household entrepreneurship.

6.6 Domestic labor supply

We estimate regression Equation (25) for quarterly province-level labor supply outcomes from Q1 1992 to Q4 2011.[19] In panel (c) of Table A9, the dependent variable in Equation (25) 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) as labor force participation is not recorded. Based on the specification that include province specific time trends, we find no strong evidence of impacts on domestic labor supply.[20]

Overall, the various results in Table A9 are mutually consistent with one another. There are no apparent effects of the migrant earnings shocks on labor demand of manufacturing firms or of household entrepreneurial enterprises, and this is reflected in the finding of no effects on aggregate labor supply in the population.

6.7 Pre-trends, other channels, and selection biases

In Appendix Section C we analyze threats to identification and alternative channels. First, we discuss the possible threats to identification, given that our specifications rely on the interaction between the exchange rate shock, baseline migrant earnings, and a post-shock indicator. Since we condition on each of these components (and their two-way interactions), and on the possibility of different trends over time,

[19] 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)), or increase labor supply by alleviating 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)), making the overall effects ambiguous. Informal insurance provided by international migrants could also promote entrepreneurship at home (Yang and Choi (2007)).

[20] Table A12 shows similar results for employment rates of adults (again, after excluding migrants). Both for the group of young adults (ages 16-24) and adults (25-64) we fail to detect impacts on domestic employment rates.

any remaining threat would need to be driven by systemic differential trends across provinces that are somehow associated with the interaction between exchange rate shocks and baseline earnings, but not correlated with controls for province-specific trends. To address any remaining concerns we run falsification experiments in our pre-shock period to show that changes in outcomes prior to the shock have no relationship with the future shock to migrant earnings per capita. Our results in Table A10, and Figures 2b, A4b and A5b help support our assumptions of parallel-trends.

We also discuss the possibility of other channels like trade and FDI. Given the lack of effects on firm production and exports (Table A9), and domestic employment (Table A12), these channels are unlikely to be important. We also address the possibility of selection bias by showing that there are no detectable effects on internal migration (Table A13).

7 The Contribution of the Education Channel

The long-run impacts of the migrant earnings shocks are potentially magnified by increased educational investments in origin provinces, because higher skilled populations migrate at higher rates, work in skilled migrant jobs, and earn higher wages. Our model allows us to quantify how much of long-run changes in migration flows and earnings can be attributed to the education channel. Said differently, how much larger are the long-run impacts on migration and migrant earnings, compared to a situation where there was no increased educational investment?

We outline below our calculation of the contribution of the education channel. For data details, please see Appendix section A.5.

7.1 Contributions to the change in migration flows

The discussion in Section 3 allows us to determine the contribution of each channel to changes in flows and in long-run earnings:

$$\Delta\, Flows_{ot} = \underbrace{\Delta\ell_{sot}\sum_{k}\left(\pi_{kost}-\pi_{kout}\right)}_{\text{Education channel in flows}} + \underbrace{\theta\sum_{k}\left(\ell_{sot}\pi_{kost}+\ell_{uot}\pi_{kout}\right)\frac{\Delta EX_{kt}}{EX_{kt}}}_{\text{Exchange rate channel in flows}} \qquad (10)$$

The first contributor to changes in flows is investments in education. If the like-

lihood of migrating abroad is higher when one is skilled, then an increase in the fraction of skilled workers will raise the flow of migrants.

In Figure A7 we plot the difference in the baseline probabilities to (the share of workers that) migrate between skilled and unskilled workers. The figure shows that for every province in the country, the likelihood of becoming an overseas worker is higher when the worker has more years of education. Therefore, increases in education should increase the flow of migrants from all provinces.

The contribution of the education channel is the product of two components: (a) the education response to earnings shocks $\Delta\ell_{sot}$, and (b) the skill-differential in the migration probabilities $(\pi_{dost} - \pi_{dout})$. The first component is obtained from the regression coefficient in panel (a) of Table 3. We use the specification for the full population which includes controls, as we consider it to be both what the model requires and empirically conservative. The second component is obtained directly from data and shown in Figure A7. Together they predict the rise in migration flows due to the education channel.

To estimate the role played by the exchange rate channel, we recognize that as rates change favorably in a persistent manner, there will be a migration response to this higher compensation. This response depends on the Frechet parameter, which pins down the migration elasticity. In Table A5 we estimate θ, and together with the size of the shock we determine the extent of the change in migrant flows for a given level of education. Again, we measure the shares of skilled and unskilled, and propensity to migrate abroad by skill group at baseline (in 1990), and use that to weight exchange rate changes by destination, as in the second part of Equation (10).

Together, the exchange rate and education channel in flows predict the change in migration flows. We validate the structure of our model by comparing the model predicted flows to the simple OLS prediction based on the regression from panel (c) of Table 2, which we refer to as $\widehat{Flows_{ot}}$. We plot the relationship between these predicted flows in Figure 3a.

The strong upward sloping relationship in Figure 3a indicates that the model does a good job of predicting migration flows. A number of provinces with a high predicted flow lie above the 45-degree line, suggesting that there may be other changes in those provinces or non-linearities in the empirical relationship between flows and

migrant earnings changes.

Finally, we quantify the role played by each channel. To do so, we calculate the share of the total regression based predicted flows that are attributable to the education channel. In other words, we measure: $\frac{\Delta \ell_{sot} \sum_k (\pi_{kost} - \pi_{kout})}{\widehat{Flows_{ot}}}$.

Figure 3b plots the distribution of the contribution of the education channel across provinces. On average about half of the increase in migrant flows is attributable to the increased education response.[21] We do a similar exercise for the exchange rate channel. This time, measuring: $\frac{\theta \sum_k (\ell_{sot} \pi_{kost} + \ell_{uot} \pi_{kout}) \frac{\Delta EX_{kt}}{EX_{kt}}}{\widehat{Flows_{ot}}}$. On average, about one-fourth of the increase in migrant flows is attributable to the exchange rate channel. The remaining one-fourth is unexplained.

We may not expect to explain the entirety of flows as we are building off of baseline (1990) shares of migration flows, and using the empirically conservative specification from panel (a) of Table 3.[22]

7.2 Contributions to the change in migrant earnings

The change in earnings per capita can also be decomposed into: (1) the education channel, and (2) the persistent change in exchange rates, which raises earnings and encourages flows to favorable destinations. The education channel in earnings is:

$$\Delta \ell_{sOt} \Big(\underbrace{\sum_d \overline{w_{dost}} \pi_{dost}}_{\text{avg skilled wage}} - \underbrace{\sum_d \overline{w_{dout}} \pi_{dout}}_{\text{avg unskilled wage}} \Big) \tag{13}$$

Here, we know $\Delta \ell_{sOt}$ is a function of the migrant earnings shock from Equation (7), which we again obtain with the help of linear fit of the regression shown in panel (a) of Table 3. We use the conservative result on the full population with controls in column 2. The second component is the probability-weighted skill-premium $\beta = (\sum_d \overline{w_{dost}} \pi_{dost} - \sum_d \overline{w_{dout}} \pi_{dout})$. We plot the skill premium $(\overline{w_{dost}} - \overline{w_{dout}})$ at the origin-destination pair level in Figure A8. The median origin-destination pair

[21] Theoretically, the contribution of the education channel may be negative if low-skill workers had a higher probability of migrating. Figure A7 shows that across provinces, the likelihood of migrating abroad is higher for skilled workers.

[22] Using baseline migration rates systematically produces conservative predictions. Using post-shock (but thereby endogenous) measures of the probability of migration from the 2000 Census allows us to explain roughly the entirety of flows. In the 1990 baseline data, the migration probability for skilled workers was 3.2% and for the unskilled was 0.9%. In the 2000 post-shock data, the migration probability for the skilled was 4.9% and for the unskilled was 1.6%.

offers a skill-earnings premium of about 38 percent (about 9.5 percent per year of education), but there is heterogeneity in returns across destinations.[23]

The remaining component of the change in earnings is driven by persistent changes in the exchange rate. This captures the increase in long run earnings, not simply because better exchange rates directly increase migrant earnings, but also because they induce a greater flow of migrants (both skilled and unskilled) to places with lucrative exchange rates. This contribution can be represented by:

$$\left(\sum_k \ell_{sot}\overline{w_{kost}}\theta\pi_{dost}\frac{\Delta EX_{dt}}{EX_{dt}}\right)+\left(\sum_k \ell_{uot}\overline{w_{kout}}\theta\pi_{dout}\frac{\Delta EX_{dt}}{EX_{dt}}\right) \tag{26}$$

A higher migration elasticity θ (measured in Table A5) means that migration flows, and thereby earnings, are more responsive to exchange rate shocks. The other shares ℓ_{sot} and π_{dost} we measure at baseline (1990), multiply them with the wages in the post-shock period $\overline{w_{dost}}$ and $\overline{w_{dout}}$, and use them as weights for the exchange rate change $\frac{\Delta EX_{dt}}{EX_{dt}}$ as in Equation (26).

We add up the predicted earnings estimate due to the education channel and the exchange rate channel, and create a composite measure of predicted increases in migrant earnings per capita. Once again, we can validate the structure of our model by comparing the model predicted earnings per capita to the simple OLS prediction based on the regression from panel (a) of Table 2, which we refer to as $\widehat{Earnings}_{ot}$. We plot the relationship between these predicted flows in Figure 4a.

As before, we see a strong upward sloping relationship in Figure 4a which indicates that the model does a good job of predicting migrant earnings per capita. Predicted values are distributed around the forty-five degree line.

To quantify the role played by each channel, we measure the predicted education channel in earnings as a ratio of the predicted increase in migrant earnings per capita. We plot this in Figure 4b. We do a similar exercise for the exchange rate channel in migrant earnings. On average (unweighted by population), the education channel explains about 32% of the increase in earnings, whereas the exchange rate channel explains about 57%. The remaining 11% is unexplained.[24]

[23] These returns would also capture the fact that for many low-skilled occupations there are no migrant opportunities for certain destinations. As such, increases in skill raise earning prospects by raising employment prospects.

[24] These estimates may be somewhat conservative, as we use the baseline 1990 shares for migration probabilities.

8 Conclusion

We study how improvements in earnings from international labor migration affect origin provinces in the Philippines. Novel administrative data and a large-scale natural experiment allow us unusual insight. An improvement in overseas earnings opportunities initiates a virtuous cycle: over the course of a decade, households raise their rates of international labor migration, and increasingly enter higher-skilled, higher-wage overseas work. A structural migration model helps shed light on underlying mechanisms, revealing that increases in educational investments account for a substantial fraction of future gains.

These findings depart from the existing literature on the economic impacts of migration opportunities on migrant home areas, which focuses on impacts on domestic economic outcomes. We find little impact of improved migrant earnings opportunities on domestic outcomes, such as labor force participation, employment rates, household entrepreneurship, or firm performance. In contrast, we show that an initial shock to migrant earnings opportunities leads to gains that remain in the context of international migrant work: long-run increases in participation and performance in international labor markets.

We highlight impacts of international migrant work that prior economics research has tended to overlook. When opportunities for international migrant work expand, resulting gains are poorly captured in analyses that focus on the earnings of *residents* of origin areas, and ignore those working elsewhere, even if those away remain strongly tied to origin areas (Clemens and Pritchett, 2009). Migrants engaged in work overseas support families back home, improving their living standards and supporting educational investments. The vast majority of temporary labor migrants do eventually return to origin areas. Returned migrants enjoy not only the assets accumulated during their overseas work, but may also be supported by the next generation of migrants, who themselves engage in higher-skilled, better-compensated overseas work. It is a distinct development path, but one that is becoming increasingly prominent as households in developing countries seek to take advantage of labor market opportunities beyond their own borders.

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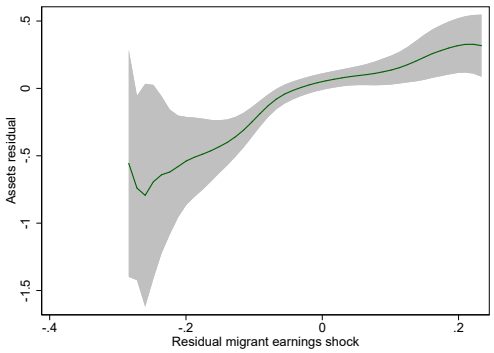
Figure 1: Change in Migrant Earnings and Assets on Migrant Earnings Shock

(a) Change in Migrant Earnings per capita

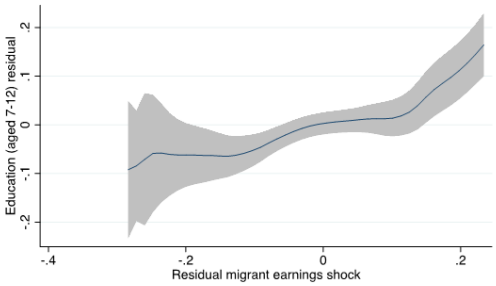
(b) Change in Asset Index



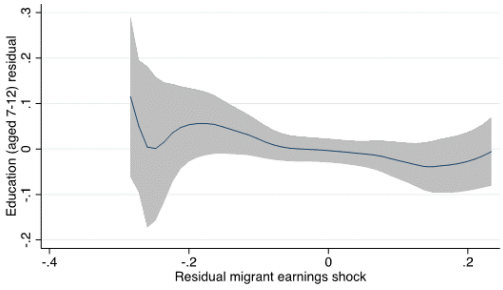
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0, pwidth 0.2) of change in outcomes on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval. Outcome in Figure 1b is change in residual household asset index (average of 2000 and 2010 minus 1990), and in Figure 1a is change in residual migrant earnings per capita (average of 2007-9 minus 1993)

Figure 2: Change in Years of Schooling (Children 7-12) on Migrant Earnings Shock

(a) Change from pre-shock to post-shock



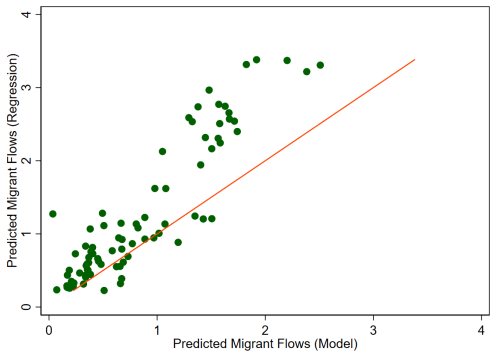
(b) Placebo: change in pre-shock period



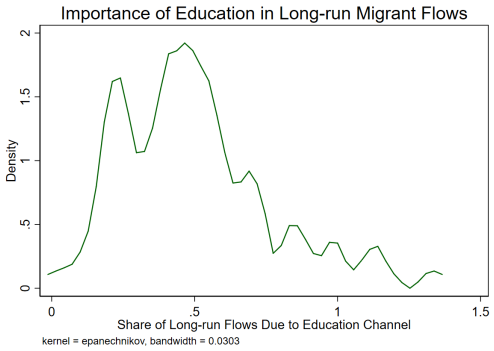
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange rate shock and baseline migrant earnings per capita. Solid line is nonparametric regression estimate. Gray area is 90 percent confidence interval. Figure 2a is the true impact: it is the change from pre-shock (1990 and 1995 average) to the post-shock period (2000 and 2010 average). Figure 2b shows the placebo experiment: comparing the change over the pre-shock period between 1990 and 1995.

Figure 3: Model Validation & Contribution of Education Channel in Migrant Flows

(a) Validation: Migrant flows



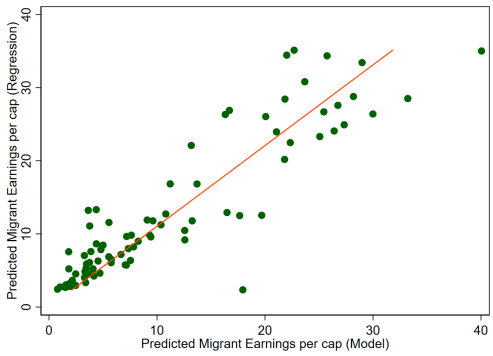
(b) Contribution of Education Channel



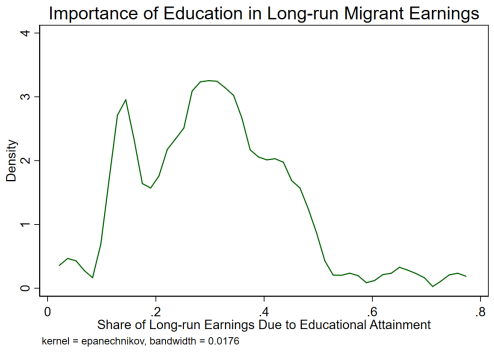
Notes: Figure 3a plots the predicted flows of migrants from the regression in panel (c) of Table 2 (vertical axis) vs the predicted flows as determined by the components of Equation (10). The red line has an angle of 45 degrees. Each point represents a province. Figure 3b plots the province-level distribution of the contribution of the education channel in predicting migrant flows: $\frac{\Delta\ell_{sot}\sum_k(\pi_{kost}-\pi_{kout})}{Flows_{ot}}$

Figure 4: Model Validation & Contribution of Education in Migrant Earnings

(a) Validation: Migrant earnings per cap



(b) Contribution of Education Channel



Notes: Figure 4a plots the predicted migrant earnings per capita from the regression in panel (a) of Table 2 (vertical axis) vs the predicted flows as determined by the education and exchange rate components. The red line has an angle of 45 degrees. Each point represents a province. Figure 4b plots the province-level distribution of the contribution of the education channel in predicting migrant earnings per capita.

Table 1: Summary Statistics

Shock Variables	Mean	Std. Dev.	Min	Max	Obs.
Normalized 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	-0.306	0.809	-1.971	3.227	246
Years of Schooling					
Age 7-18	4.880	0.573	3.132	6.123	328
Age 7-12	2.776	0.332	1.758	3.508	328
Age 13-15	6.401	0.619	4.337	7.706	328
Age 16-18	8.196	0.951	4.804	10.355	328
Age 19-24	9.049	1.109	5.259	11.907	328
Share skilled (13 or more years of education)	0.173	0.064	0.021	0.347	328
Share migrants skilled (13 or more years education)	0.348	0.143	0.039	0.763	328
New Migrant Contracts					
Total (% of 1990 population)	0.348	0.268	0.011	1.542	328
Professional Jobs (share of new contracts)	0.139	0.076	0.000	0.606	328
Production Jobs (share of new contracts)	0.343	0.126	0.060	0.735	328
Service Jobs (share of new contracts)	0.454	0.159	0.108	0.899	328
Labor Supply					
Labor Force Participation Rate, age 25-64	0.763	0.070	0.517	1.000	6,159
Labor Force Participation Rate, age 16-24	0.521	0.105	0.157	1.000	6,159
Employment Rate, age 10-15	0.129	0.123	0.000	0.943	6,159
International Migration Rates (share of total population)					
Total, age 25-64	0.021	0.015	0.001	0.073	6,159
Total, age 16-24	0.009	0.011	0.000	0.161	6,159
1990 Population (in 1000s)	735.869	606.314	14.973	2741.496	82

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). New migrant contracts are from the POEA/OWWA dataset. 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 2: Impact of Migrant Earning Changes on Migrant Earnings, Assets, Education and Flows of New Migrants

Dependent variable (periods included in regression)	*Mean (std. dev.) of dependent variable*	*Regressions* (1) *No controls*	*Regressions* (2) *Controls for heterogeneous province trends*	*Number of obs.*
(a) Migrant earnings (1993, 2007, 2008, 2009)				
Migrant earnings per cap	5.254	8.889***	9.810**	328
in province	(4.261)	(3.316)	(4.285)	
Earnings per migrant	401.431	629.001***	739.339**	328
	(317.901)	(199.192)	(316.591)	
(b) Education (1990, 1995, 2000, 2010)				
Ages 7-18	4.880	0.680***	0.767***	328
	(0.573)	(0.187)	(0.209)	
Ages 19-24	9.049	0.583**	1.311***	328
	(1.109)	(0.239)	(0.418)	
(c) New contracts (1993, 2007, 2008, 2009) as a percent of 1990 working-age population:				
New migrant contracts	0.348	0.870**	0.945**	328
	(0.268)	(0.386)	(0.371)	
(d) Assets (1990, 2000, 2010)				
Asset index	-0.306	2.059***	1.160***	246
	(0.809)	(0.521)	(0.438)	

Notes: All regressions include province and year fixed effects. Controls for heterogeneous province trends are: for panel (a), (c) and (d), baseline controls interacted with linear annual time trend; for panel (b), province-specific linear annual time trend. The baseline controls 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) and (c) use 1993, 2007, 2008, and 2009 data from POEA/OWWA dataset. Panel (b) and (d), are from Philippine Census. 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) and (c) post equals 1 in 2007-2009, in panel (b) and (d) 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 3: Impact of Migrant Earning Changes on Skill Share of Workforce

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) Share skilled (1990, 1995, 2005, 2010)				
Full population	0.173	0.0858***	0.0464*	328
	(0.0637)	(0.0245)	(0.0259)	
Migrants	0.349	0.344***	0.313***	328
	(0.143)	(0.0653)	(0.0898)	
(b) New migrant contracts (1993, 2007, 2008, 2009)				
as a percent of 1990 working-age population:				
Professional	0.049	0.449***	0.410***	328
	(0.057)	(0.101)	(0.092)	
Production	0.130	0.387**	0.446**	328
	(0.136)	(0.158)	(0.171)	
Service	0.145	0.032	0.06	328
	(0.107)	(0.136)	(0.125)	
as a share of new migrant contracts:				
Professional	0.139	0.416***	0.221*	328
	(0.076)	(0.136)	(0.129)	
Production	0.343	0.008	-0.002	328
	(0.126)	(0.077)	(0.093)	
Service	0.454	-0.368***	-0.159	328
	(0.159)	(0.112)	(0.115)	

Notes: All regressions include province and year fixed effects. Controls for heterogeneous province trends are: for panel (a) province-specific linear annual time trend; for panel (b) baseline controls interacted with linear annual time trend. Share skilled defined as having 13 or more years of education in the Census data. Migrant occupations are from the POEA/OWWA dataset. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Online Appendix

A Data Appendix

A.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 detailed occupations are also classified into broad occupation categories by the POEA. 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 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. The wage shares are then used to create the earnings-weighted exchange rate shock, and the wage returns to skill. 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).

We use the POEA/OWWA classification of broad occupation categories to create migration rates by occupation. There are three broad categories we examine: (1) Professional occupations include performing artists, engineers, medical professionals and teachers, among other professions. (2) Service workers are usually caretakers and caregivers, cooks and waiters, and domestic helpers among other occupations. (3) Production workers comprise of brick-layers and carpenters, electrical workers, and plumbers among other occupations. Together, these three categories cover about 94 percent of migrant contracts.

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 (2018a), 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.

A.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 includes 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).

To study the impact on the skill composition of jobs, we use information on occupations and educational attainment from the Survey of Overseas Filipinos (SOF). The survey ask families about the education and occupations of household members, and we calculate an average education level for each occupation in the Philippine

Standard Occupational Classification (PSOC), which we match to the Census data.

A.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. 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. Each survey round includes approximately 200,000 individuals and 44,000 households, and includes sampling weights.[25] 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. 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 A9 exclude international migrants in the rate calculations.

A.4 Firm Production Data

Data on firm revenue, exports, inventories, employment, hours and compensation are from the Annual Survey of Philippine Business and Industry (ASPBI). This is a sample-survey covering the entire country. We obtain data between 1988 and 2015 only for province-year observations that had more than 3 manufacturing firms in their survey. This means that at most we have information for about 76 (out of 82) provinces, and some years have fewer observations. Yet, to the best of our knowledge, this is the longest detailed comprehensive panel of firm activity. The survey uses the official List of Establishments (LE) as their sampling frame. An establishment is the unit of enumeration in the survey, defined to be an “economic unit under a single ownership or control." The sampling design is stratified systematic sampling with employment size-group as the stratification variable. In our analysis, we use

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

sample weights when examining the ASPBI data. Unweighted regressions produce qualitatively similar results.

Our main variables of interest include employment (the number of workers on payroll in November of the survey year) and number of hours workers by production workers (including wait time and overtime, but excluding sick and vacation leave). Revenue includes cash received for goods sold and services rendered, while inventories refer to the stock of goods by and under the control of establishment regardless of where the stocks are located.

A.5 Data for Quantifying Contribution of the Education Channel

We create a database at the origin-destination-skill group-by-year level from our raw data in order to perform the quantification exercise. From the 1990 Census we construct the baseline shares of the working-age population that migrated abroad for each skill group. We use these baseline shares as the probability of migration by skill-group. In addition, we use the POEA/OWWA data to construct measures of migrant earnings for each origin-destination pair, by skill group and year. We use the post-shock period to determine the returns to skill using these earnings. We exclude origin-destination-skill-time observations where there were no flows. We trim the salary data at the 99th percentile.

Our quantification exercise also requires us to rely on a measure of the predicted change in education levels at the origin. We use the results in panel (a) of Table 3, for the full population sample, and the specification that includes all the controls, to create an out-of-sample linear prediction at the origin level. When we compare our quantification exercise to predicted changes in flows and earnings-per-capita from Table 2, again we use the estimates that rely on the full set of controls to be consistent.

B Additional Empirical Analyses

B.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 Appendix Table A3, 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 Appendix Table A4. In Appendix Table A4, 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). Appendix Table A4 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 persistence 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).

C Details behind pre-trends, other channels, and selection biases

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

C.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 the exchange rate 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 controls for heterogeneous province 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 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.[26] In Appendix Table A10 we present coefficient estimates from placebo experiments.[27] We keep only observations prior to the June 1997 shock, and partition the pre-shock observations 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. We also show non-parametric relationships for different education outcomes in the pre-period in Figures 2b, A4b and A5b. 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 for the validity of the parallel trend assumption.

C.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 imaginable 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 affect domestic employment rates or firm production outcomes (Table A9). Indeed, we directly estimate the effects on exports for manufacturing firms in Table A9 and fail to find any detectable changes. In Appendix Table A11, 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.[28] Coefficients in nearly all regressions are small in magnitude (and actually negative for young adults) and not statistically significantly different from zero.[29]

C.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,

[26] 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), and migrant contracts (the only available pre-shock year is 1993).

[27] These complement the nonparametric plots of placebo experiments in section 6.3.

[28] In Table A9, 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 A9.

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

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 Appendix Table A13. We find no large or statistically significant relationship between internal migration and the shock.

D Model Derivations

D.1 Deriving share of flows from o to d

Wages for workers are as defined in the text, to be:

$$w_{iodst} = w_{sdt} EX_{dt} (1 - \tau_{odst}) q_{id} \varepsilon_{odt} \equiv \widetilde{w_{dost}} q_{id} \tag{27}$$

Workers will pick the destination with the highest value of $w_{iodst} = \widetilde{w_{dpst}} q_{id}$. The probability that they pick destination 1 is given by:

$$\begin{aligned} \pi_{1ost} &= Pr\left[\widetilde{w_{1ost}} q_1 > \widetilde{w_{d'ost}} q_{d'}\right] \ \ \forall d' \neq 1 \\ &= Pr\left[q_{d'} < \frac{\widetilde{w_{1ost}} q_1}{\widetilde{w_{d'ost}}}\right] \ \ \forall d' \neq 1 \\ &= \int \frac{dF}{dq_1}(q_1, \alpha_1 q_1, ..., \alpha_D q_D)\, dq_1 \end{aligned} \tag{28}$$

where we define $\alpha_d \equiv \frac{\widetilde{w_{1ost}}}{\widetilde{w_{d'ost}}}$. We assume that the abilities are distributed with the following Frechet distribution:

$$F(q_1, ..., q_D) = exp\left\{-\left[\sum_{d=1}^{D} q_d^{-\theta}\right]\right\} \tag{29}$$

So the derivative of the CDF is given by:

$$\frac{dF}{dq} = \theta q^{-\theta-1} exp\left\{-\left[\sum_{d=1}^{D} q_d^{-\theta}\right]\right\} \tag{30}$$

This derivative evaluated at $(q_1, \alpha_1 q_1, ..., \alpha_D q_D)$, allows us to determine the prob-

ability of choosing destination 1:

$$\begin{aligned}
\pi_{1ost} &= \int \theta q^{-\theta-1} exp\left\{-\left[\sum_{d=1}^{D}(\alpha_d q)^{-\theta}\right]\right\} dq \\
&= \frac{1}{\sum_{d=1}^{D}\alpha_d^{-\theta}} \int \left(\sum_{d=1}^{D}\alpha_d^{-\theta}\right) q^{-\theta-1} exp\left\{-\left[q^{-\theta-1}\left(\sum_{d=1}^{D}\alpha_d^{-\theta}\right)\right]\right\} dq \\
&= \frac{1}{\sum_{d=1}^{D}\alpha_d^{-\theta}} \int dF(q) \\
&= \frac{1}{\sum_{d=1}^{D}\alpha_d^{-\theta}}.1 \\
&= \frac{\widetilde{w_{1ost}}^{\theta}}{\sum_{d=1}^{D}\widetilde{w_{dost}}^{\theta}}
\end{aligned} \tag{31}$$

The third line comes from the properties of the Frechet distribution, where we know that the term in the integral of the second line is simply the PDF with a shape parameter θ, and a scale parameter $\sum_{d=1}^{D}\alpha_d^{-\theta}$. Expanding on the definitions for $\widetilde{w_{dost}}$, and including the subscripts, we have:

$$\pi_{dost} = \frac{\left(w_{dst} EX_{dt}(1-\tau_{odt})\varepsilon_{odt}\right)^{\theta}}{\sum_k \left(w_{kst} EX_{dt}(1-\tau_{okt})\varepsilon_{okt}\right)^{\theta}} \tag{32}$$

D.2 Extensions on Education Responses

Non Credit Constrained Households and Changes in Returns: Non constrained households may also respond to exchange rate shocks. Exchange rate shocks may not change the returns to education as they change both the educated and non-educated wage. For those who are not constrained, we derive that for a cost of education $= p_1 S + p_2 S^2$, the optimal amount of schooling does not depend on Y, but only on the returns to education:

$$S_i^u = \frac{w'(s)_d (1-\tau_{dost}) EX_{dt} q_{id} - p_1}{2p_2} \tag{33}$$

where S_i^u are the years of schooling for unconstrained households. The average education levels of non-constrained households from origin o to destination d are:

$$S_{od}^u = \frac{w'(s)_d (1-\tau_{dost}) EX_{dt} \pi_{dot}^{\frac{-1}{\theta}} \Gamma - p_1}{2p_2} \tag{34}$$

And the average change in education for unconstrained households from origin o is:

$$S_o^u = \sum_d S_{od}\pi_{dot} = \sum_d \frac{w'(s)_d(1-\tau_{dost})EX_{dt}\pi_{dot}^{\frac{-1}{\theta}+1}\Gamma - p_1}{2p_2} \tag{35}$$

Since $\frac{\Delta\pi_{dot}^{\frac{-1}{\theta}}}{\Delta EX_{dt}} = -\frac{\pi_{dot}^{\frac{-1}{\theta}}}{EX_{dt}}$, we know that:

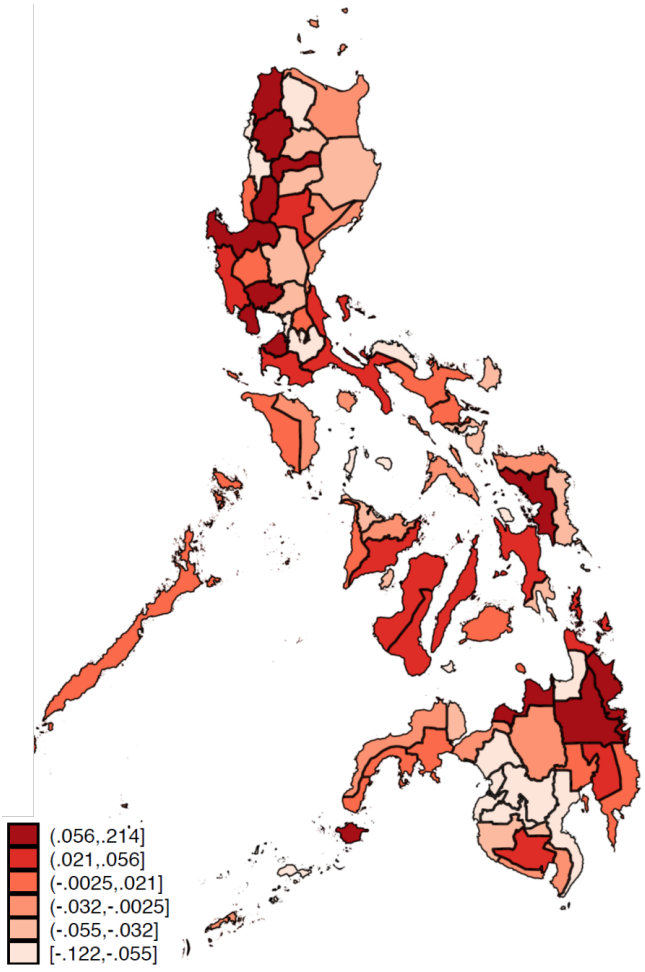
$$\Delta S_o^u = \sum_d \frac{w'(s)_d(1-\tau_{dost})\theta\pi_{dot}\Gamma}{2p_2}\frac{\Delta EX_{dt}}{EX_{dt}} \tag{36}$$

If δ fraction of the population is credit constrained, then the education response will also depend on δ. Notice that for unconstrained households to respond, students must also expect the exchange rate shocks to be permanent.

Constraints on borrowing from future: Setting $\bar{b} = 0$ represents completely constrained households. For partially binding credit constraints., we know $\Delta S = \frac{-R\bar{b}}{2p\gamma_d(1-\tau_{od})q_{id}EX_{td}2}\frac{\Delta EX_{dt}}{EX_{dt}}$.

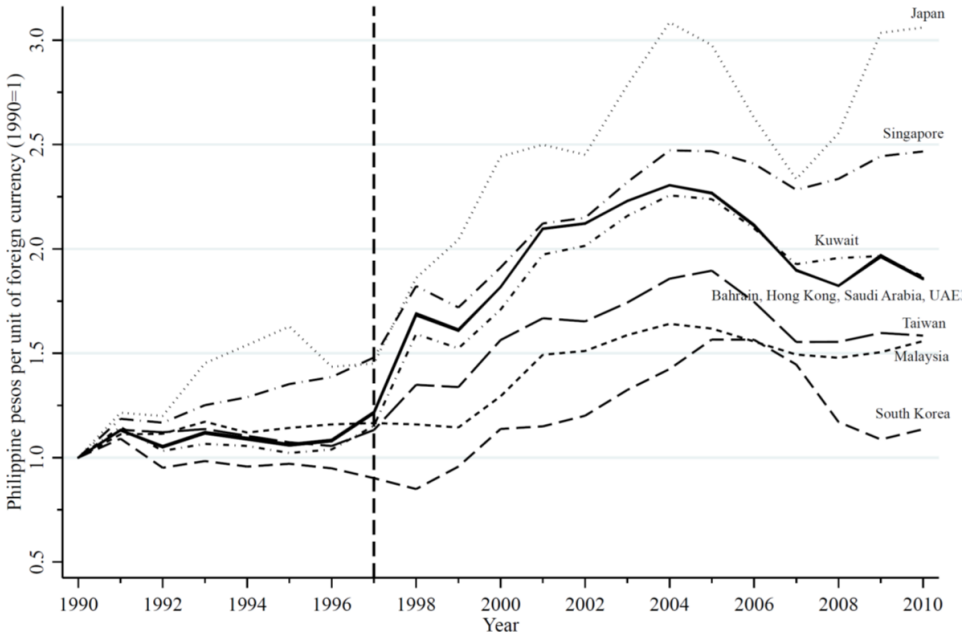
E Additional Tables and Figures

Figure A1: Spatial Distribution of Migrant Earnings Shock Across Philippine Provinces



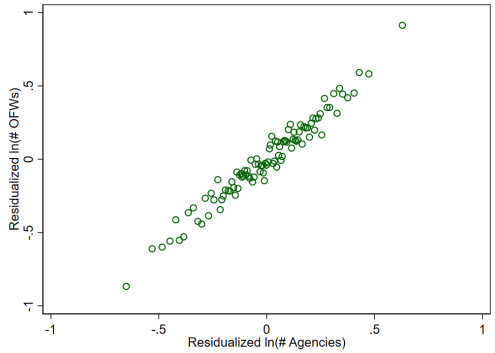
Notes: Figure presents ranges of residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita) after partialling-out main effects of earnings-weighted exchange rate shock and baseline migrant earnings per capita.

Figure A2: Exchange Rate Shocks Due to 1997 Asian Financial Crisis

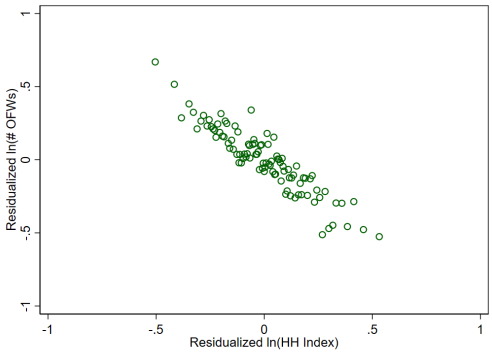


Notes: Data are from World Development Indicators. Annual average exchange rates are in units of foreign currency per Philippine peso, normalized to 1 in 1990, for key destinations of Philippine labor migrants. Vertical dashed line indicates 1997 (year of the Asian Financial Crisis).

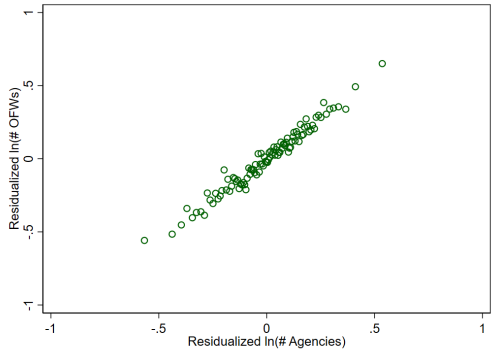
Figure A3: Migrant Flows at Recruitment Agencies at the Origin-Destination Level



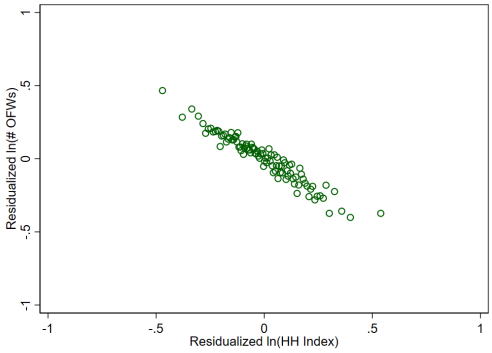
(a) Migrants Flows and # of Agencies 1993



(b) Migrant Flows and HHI of Agencies 1993



(c) Migrants Flows and # of Agencies 2007-9

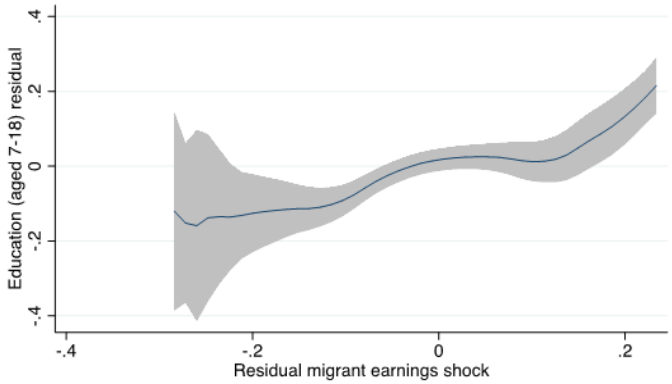


(d) Migrant Flows and HHI of Agencies 2007-9

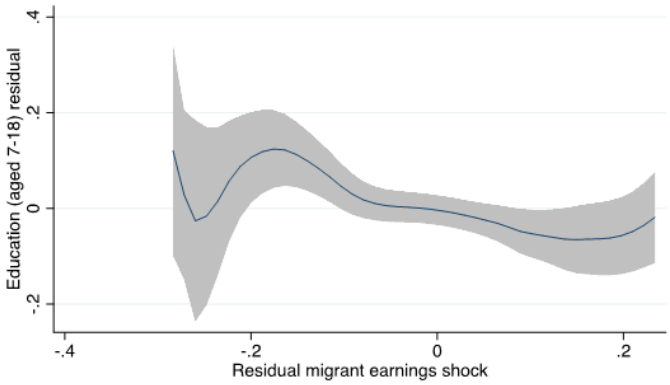
Notes: Figures plot the relationship between Log(Number of Oversees Foreign Workers (OFWs)) on the vertical axis recruitment agencies on the horizontal axis. In panel (a) and (c) we plot the Log(Number of Recruitment Agencies) on the horizontal axis. In panel (b) and (d) we plot the Log(Hirschman-Herfindahl Index of Agencies) on the horizontal axis. Panel (a) and (b) are for 1993, whereas panel (b) and (d) are averaged over the 2007-9 period. The data are at the origin-destination pair level, and all variables are residualized by origin μ_o and destination μ_d fixed effects.

Figure A4: 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)



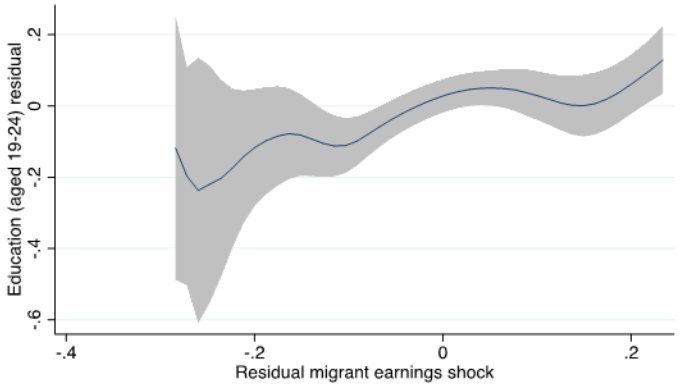
(b) Placebo experiment: change in pre-shock period (1995 minus 1990)



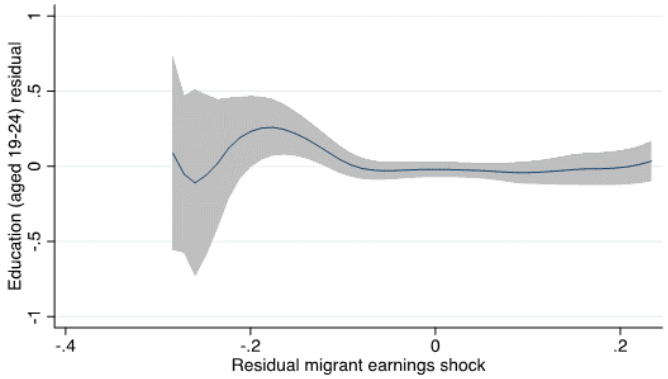
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange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

Figure A5: 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)

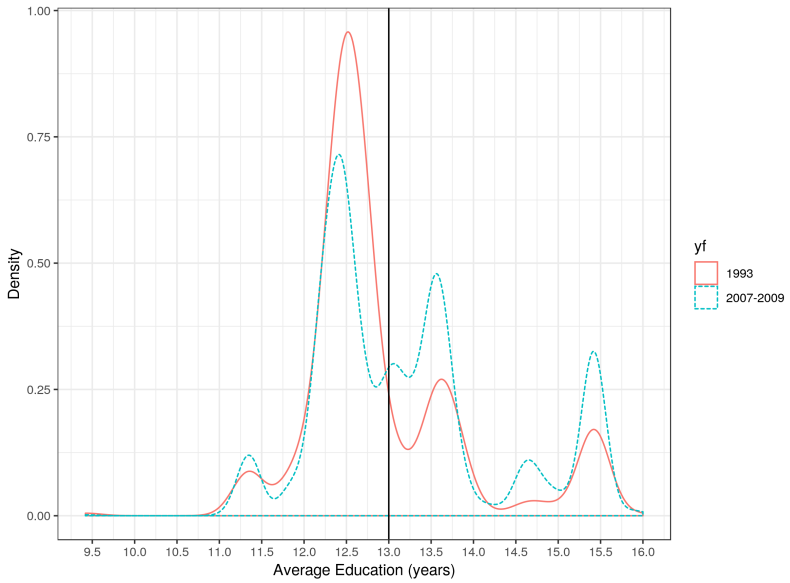


(b) Placebo experiment: change in pre-shock period (1995 minus 1990)



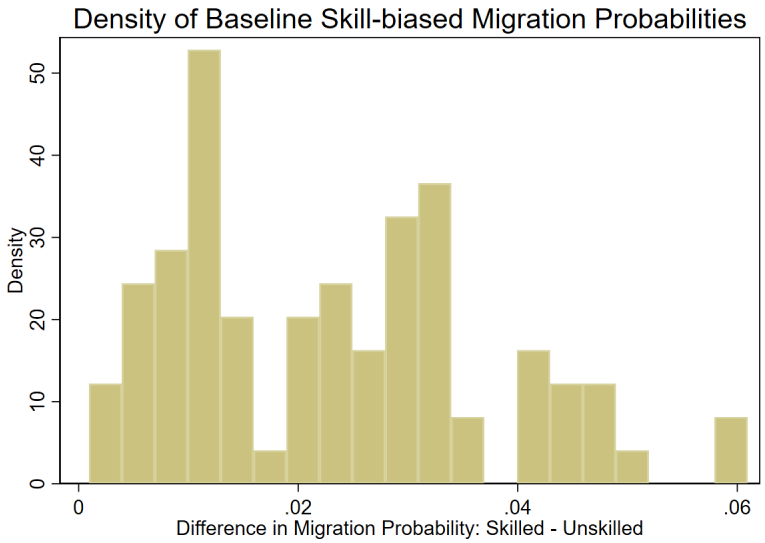
Notes: Nonparametric regressions (biweight kernel, bandwidth=0.1, degree=0), of residual years of schooling on residual migrant earnings shock (earnings-weighted exchange rate shock times baseline migrant earnings per capita). Residuals taken from regression of variable on earnings-weighted exchange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

Figure A6: Density of Migrant Worker Education



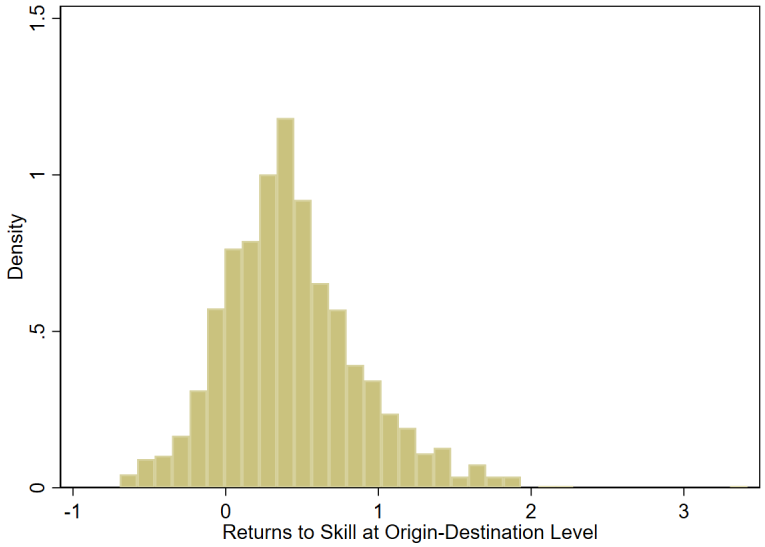
Notes: This figure presents density plots of the distribution of education of migrant workers, separately for worker contracts in the 1993 and the 2007-9 periods. For each worker contract in the POEA/OWWA contract data, workers are assigned the average level of education observed for OFWs reported in the Philippine Census in the same detailed occupational category.

Figure A7: Skilled-Unskilled Migration Probabilities



Notes: Figure plots a binned histogram of the difference in migration probabilities by skill, across provinces in 1990. We calculate the share of the skilled population that in the age-group 25-64 that is an overseas worker in destination d to be π_{dos}. We similarly do this for unskilled workers in π_{dou}. We then aggregate the difference across destinations, and plot $\sum_k (\pi_{kos} - \pi_{kou})$.

Figure A8: Wage skill-premium among migrants



Notes: Figure plots the distribution of $\overline{w_{dost}} - \overline{w_{dout}}$ at the origin-destination pair level

Table A1: 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 A2: 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).

Table A3: 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.

Table A4: Persistence of Total OFW Rate

Panel A: 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.

Panel B: 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.

Table A5: Estimating θ using Poisson Pseudo-maximum Likelihood

	Change in Migrant Flows		Earnings	
Log(EX Rate Change)	3.424*	3.024*		
	(1.808)	(1.748)		
Log(Migrants)			-0.317*	-0.268**
			(0.168)	(0.113)
Observations	23,127	258	7,684	7,282
Specification	Origin-Dest-Skill	Destination-Skill	PPML	IV PPML
Clusters	Origin Destination	Destination	Origin Destination	Bootstrap
Fixed Effects	Origin x Skill	Skill	Origin Destination Skill	Origin Destination Skill
Theta			3.155*	3.728**
Std Error			(1.670)	(1.568)

Notes: PPML estimates of theta. First two columns estimate theta using the migration response to a destination shock. Last two columns study the wage change as migrant flows increase -- the estimate of theta is the negative reciprocal of the coefficient reported in the last 2 rows. Migrant earnings and migrant flows are from the POEA/OWWA dataset. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Table A6: 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.

Table A7: 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		12.177***		-1.757***
		(4.502)		(0.311)
Average Years of Schooling (ages 7-18)	-0.064***	0.968	0.220***	0.112***
	(0.015)	(0.588)	(0.049)	(0.039)
Female employment rate (ages 25-64)	-0.116***	0.468	0.265*	0.054
	(0.040)	(2.060)	(0.144)	(0.093)
Male employment rate (ages 25-64)	-0.017	-1.444	0.048	-0.014
	(0.036)	(1.540)	(0.118)	(0.080)
Share rural	0.077*	5.698***	-0.141	0.115
	(0.043)	(1.971)	(0.105)	(0.089)
Asset index	0.006	3.086***	-0.108***	-0.038
	(0.014)	(0.475)	(0.031)	(0.028)
Rate of employment in enterprises	-0.033	0.802	0.168	0.125
	(0.062)	(2.077)	(0.171)	(0.120)
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	0.841	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.

Table A8: Impact of Migrant Earnings Shocks on Years of Schooling Completed

Dependent variable: Years of schooling of...	*Mean (std. dev.) of dependent variable*	*Regressions*		*Number of obs.*
		(1) No controls	*(2) Province-specific linear time trends*	
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 A9: Impact of Migrant Earnings Shocks on Firm Production and Labor Supply

Dependent variable	*Mean (std. dev.) of dependent variable*	*Regressions* (1) *No controls*	(2) *Province-specific linear time trends*	*Number of obs.*
(a) Firm production				
Log total revenue	14.79	-0.306	0.699	1388
	(1.527)	(0.774)	(1.091)	
Log value of exports	0.264	-0.0272	-0.227	1388
	(0.709)	(0.343)	(0.515)	
Log total inventories	9.698	0.419	2.139	1388
	(3.079)	(1.910)	(2.528)	
Log total employment	2.785	0.061	0.069	1388
	(1.024)	(0.401)	(0.558)	
Log gross salaries and wages	11.96	-0.318	-2.186	1388
	(2.751)	(1.227)	(2.604)	
Log total hours worked	9.541	-0.665	-1.086	1388
	(2.010)	(0.785)	(1.666)	
(b) Household and small entreprenuership, adults (aged 25-64)				
Private household enterprise	0.0248	0.007	0.006	6159
	(0.094)	(0.0097)	(0.0138)	
Self employed	0.300	-0.056	0.009	6159
	(0.094)	(0.0395)	(0.0267)	
Employer of other employees	0.0326	0.038*	-0.009	6159
	(0.094)	(0.0225)	(0.0172)	
Family employment	0.0909	-0.119***	-0.051	6159
(paid or unpaid)	(0.094)	(0.0380)	(0.0442)	
(c) Domestic labor supply (no migrants)				
Labor force participation, adults	0.763	-0.064*	0.021	6159
(aged 25-64)	(0.070)	(0.033)	(0.041)	
Labor force participation, young adults	0.521	-0.046	-0.077	6159
(aged 16-24)	(0.105)	(0.064)	(0.054)	
Employment rates, children	0.129	-0.039	-0.033	6159
(aged 10-15)	(0.123)	(0.067)	(0.061)	

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. Manufacturing firm production, panel (a), data are from the Annual Survey of Philippine Business and Industry (ASPBI). The data are annual from 1988 to 2015, except 1995, 2000, 2002, 2004, 2007 and 2011, when there was no survey. The sample only includes province-year observations that have more than 3 firms recorded in the year. Employment outcomes and household entreprenuership data are from the Philippine Labor Force Survey, and cover the years 1992-2011. The unit of observation is the province-quarter-year. 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 in calculation of outcome variables in panel (c). Post equals 1 in 1997, quarter 3 to 2011, and 0 in 1992-1997, quarter 2. Robust standard errors clustered at the province level. *** indicates significance at the 1% level. ** indicates significance at the 5% level * indicates significance at the 10% level.

Table A10: Falsification Tests (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	-0.044	164
	(0.270)	(0.155)	(0.181)	
Females	2.666	-0.234	-0.030	164
	(0.261)	(0.154)	(0.175)	
Males	2.490	-0.233	-0.057	164
	(0.283)	(0.159)	(0.189)	
Children aged 13-15	6.155	-0.218	-0.032	164
	(0.590)	(0.223)	(0.181)	
Females	6.399	-0.313	-0.058	164
	(0.554)	(0.208)	(0.183)	
Males	5.921	-0.132	0.004	164
	(0.635)	(0.245)	(0.193)	
Children aged 16-18	7.853	-0.540	-0.269	164
	(0.920)	(0.395)	(0.342)	
Females	8.244	-0.623	-0.253	164
	(0.921)	(0.406)	(0.311)	
Males	7.484	-0.446	-0.274	164
	(0.935)	(0.414)	(0.402)	
Young adults, aged 19-24	8.612	-0.394	-0.279	164
	(1.047)	(0.442)	(0.329)	
Females	8.955	-0.383	-0.248	164
	(1.052)	(0.496)	(0.340)	
Males	8.285	-0.394	-0.313	164
	(1.061)	(0.397)	(0.343)	
Share skilled in full population	0.196	0.0119	-0.0024	164
	(0.024)	(0.0185)	(0.0199)	
Share skilled migrants	0.302	0.120	0.0826	164
	(0.095)	(0.0759)	(0.0969)	
(b) Labor Supply				
Labor force participation, adults	0.758	-0.033*	-0.022	1693
(age 25-64)	(0.075)	(0.019)	(0.027)	
Labor force participation, young adults	0.545	0.028	-0.121	1693
(age 16-24)	(0.115)	(0.038)	(0.085)	
Employment rate, children	0.155	0.065	-0.059	1693
(age 10-15)	(0.134)	(0.043)	(0.098)	

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.

Table A11: Distribution of Education by Occupation

Occupation	*Years of education*	1993	2007-9
Professional	*Mean*	13.6	15.1
	Std. dev.	(1.28)	(0.85)
Production	*Mean*	12.8	12.8
	Std. dev.	(0.80)	(0.79)
Services	*Mean*	12.5	12.7
	Std. dev.	(0.24)	(0.39)

Notes: Table shows the education distribution by major occupation category. The last column (2007-9) takes the average across 3 years of the data: 2007, 2008 and 2009.

Table A12: Impact of Migrant Earnings Shocks on Adult Domestic 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)	0.737	-0.0588*	0.0296	6159
	(0.075)	(0.0338)	(0.0407)	
Females	0.565	-0.0686	0.0601	6159
	(0.129)	(0.0586)	(0.0720)	
Males	0.910	-0.0418*	-0.0004	6159
	(0.051)	(0.0218)	(0.0185)	
Employment rate, young adults (age 16-24)	0.452	-0.0222	-0.0377	6159
	(0.108)	(0.0661)	(0.0533)	
Females	0.308	-0.0297	-0.0139	6159
	(0.114)	(0.1000)	(0.0623)	
Males	0.576	-0.0181	-0.0388	6159
	(0.134)	(0.0600)	(0.0503)	

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 excluded 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.

Table A13: 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*		*Number of obs.*
		(1) No controls	*(2) Province-specific linear time trends*	
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.