# Remittances, Economic Development, and Education Investment

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JOB MARKET PAPER

October 5, 2022

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**Abstract**

Remittances, money sent by overseas migrants, hold great potential to spur development in their area of origin. However, remittances may have adverse effects if the state responds to the remittance flow by reducing public investments in the area of origin. Using arrival records of returning migrants and administrative data of school establishments, I identify the effects of remittances on development indicators and education investments in Indonesian districts. Remittances improve development indicators such as GDP per capita and household expenditures and reduce poverty rate. Households send more children to school, and district governments increase public schools at the primary and junior secondary levels. I observe consistent patterns for other public goods that complement household investments. These responses are not driven by electoral concern or the capture of economic gain through taxation. Instead, my results suggest the state's responses to remittances are influenced by their pre-existing policy commitments and changes in government accountability.

**JEL Classifications:** F22, F24, H41, I25, O15
**Keywords**: International Migration, Remittances, Public Goods, Education

# 1. Introduction

Remittances—money that migrants send to their home countries—are an important resource for many developing countries. Remittances bring in more resources than oil in Nigeria (The Economist, 2019), than the Suez Canal in Egypt, and than the export of IT services in India (Ratha et al., 2016). Estimated total remittances to low and middle-income countries reached US$554 billion in 2019, surpassing the flow of foreign aid (Ratha et al., 2020). For many small nations, remittances comprise significant portions of GDP, including countries as diverse as Tonga (39%), Tajikistan (27%), and El Salvador (24%) (World Bank, 2020). The sheer magnitude of the remittance flow holds great potential to spur development (World Bank, 2006, 2017).

Migrant remittances and their development impact may influence how the state provides public goods. Remittances can finance various household investments, including those that substitutes for public services. In such case, the state may respond to remittances by reducing public investments. On the other hand, the state may make complementary investments if remittances increase the demand for public services. Studying the state's responses to remittances is important to fully understand the effects of remittances in the development of migrant-origin areas, but little research exists on this topic.

Empirically, the analysis of remittances' impact on public goods and local development faces multiple challenges. First, because only migrants remit, it is hard to study the effects of remittances separately from migration. Second, reverse causality also poses a challenge: a positive correlation between remittances and local development could result from places with good outcomes facilitating higher remittances from the diaspora. Third, causal analysis using country-level estimates with cross-country regressions often has to rely on instrumental variables with uncertain validity or low statistical power (Clemens and McKenzie, 2018).

In this paper, I address these issues through an investigation of the effect of remittances on households and districts in Indonesia. I identify the effects of remittances by combining three sources of variation: the share of migration in different regions, their destination countries, and shifts in the currency exchange rates over time. Changes in exchange rates provide unanticipated shocks to the size of remittances that origin households receive at home, with variations in the size of the shock depending on the migration destination. The share of migration differs by region, giving variations at the district level. I thus estimate the reduced form effects of exchange rate shocks on outcomes in Indonesian districts, building on a similar strategy employed by Yang (2008) and Khanna et al. (2022) in the Philippines. While a 2SLS estimation of the effects of remittances on outcomes are also of interest, this approach requires data on actual remittances flow at the sub-national level, which are scarcely available.

Indonesia provides an excellent setting to study the impact of remittances on public goods provision. The country sends nearly one million international migrants abroad per year, and it is the 14th largest remittance receivers in the world (World Bank, 2019). Indonesia also provides reliable subnational data series, making it possible to exploit variations in destination choices and migration scale across hundreds of districts to overcome endogeneity challenges. These

districts operate in a common national environment, providing the opportunity to overcome the limitations of cross-country regressions, where unobserved variables may be correlated with remittances and public goods provision.

I start by showing that positive exchange rate changes increase remittances received by migrant households. I use a migrant household panel (Doi et al., 2014) for an out-of-sample analysis of the impact of exchange rates on remittances. I find that migrant households receive higher remittances when the Indonesian rupiah depreciates against the currency of the migrants' host country. This "first stage" result allows me to build a proxy measure for remittances through migrants' predetermined destination choices and exchange rate fluctuations during their time abroad.

Next, I leverage a unique dataset to construct a remittance proxy at the district level. I use an administrative record of more than one million migrant returnees. Using their destinations and origin addresses, I measure the district-level exposure to foreign currency shocks between 2005-2011. During this period, the global financial crisis led to sharp changes in the exchange rate against the Indonesian rupiah (IDR) with varying magnitudes. For example, the US dollar (USD) and Saudi riyal (SAR) exchange rate to the rupiah both rose by 23% between 2007-2009. By contrast, the Korean won (KRW) lost 9% in value.[1] I construct a remittance proxy using the interaction of migration intensity and currency fluctuations. Districts with many migrants going to countries with strongly appreciating currency receive a positive remittance shock, while districts with few migrants whose destinations have weak currencies receive a negative remittance shock. I combine this measure with rich data from household surveys, school registries, and regional budget reports to estimate the effect of remittances.

I find remittances improve development indicators. Using GDP per capita as an indicator of development, I find that an increase in the remittance proxy by one standard deviation (SD), which corresponds to a back of the envelope windfall of USD 250,000 to the economy in the district, is associated with 0.09 log points higher total GDP per capita. At the mean, this magnitude corresponds to an increase of IDR 507,571 ($\sim$USD 55). The effects of remittances are consistent across estimations using different development indicators. Remittances reduce poverty rate and increase household expenditures, especially at the bottom quintile of expenditure distribution. Households also report a higher asset index, reflecting acquisitions of various durable assets that include motorcycles, refrigerators, and cooking gas canisters.

Households can use remittances to invest in education, and I find remittances lead to households sending more of their children to school. A one SD shock raises the enrollment rate by 2.6 p.p. for children aged 7-18 years in primary and secondary education. At the secondary level, remittances raise enrollment by 4 p.p and 7 p.p.for junior (grade 7-9) and senior (grade 10-12) level, respectively. These effects represent a meaningful gain towards achieving universal secondary education, given the average enrollment rates of 67% and 44% for junior and senior high school.

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[1]The monthly average exchange rates changed from IDR8,827 (June 2007) to IDR10,900 (January 2009) per USD. The Saudi riyal is pegged to the US dollar at a rate of SAR3.75 per USD. The Korean won exchange rate changed from IDR9.51 to 8.65 per KRW in the same period (Refinitiv Datastream, 2021).

Households' education investments induce responses by the state: district exposed to positive shocks of remittances provide more public schools. After the Soeharto regime fell, the Indonesian central government devolved the responsibility to provide education services to district-level governments. In response to a one SD shock in remittances, districts provide 0.87 more public elementary schools and 0.27 more public junior high schools per 10,000 population one year after the shock. The coefficient for public senior secondary schools is positive, but not statistically different from zero. To build junior secondary schools, district governments rely on expansion of existing elementary schools, which allows new schools to be established rapidly with fewer classrooms and teachers. Because of the expansion, the increased enrollment as reported by households may include the effects of relaxing the supply constraint. Provision of other public goods under the purview of the district governments shows a consistent pattern, with the state expanding access for services that complements household investments.

What drives the supply-side responses to remittances? I consider two institutional contexts. First, districts are mandated by the constitution to allocate at least 20% of its budget for education expenditure. On average, education expenditure rose from 27% in 2006 to 41% in 2012. Second, the number of district government increased from 440 to 514 in my study period due to creation of smaller districts ("splitting") from existing district boundaries. Because split districts are smaller, the district center becomes closer to the average citizen (Bazzi and Gudgeon, 2021). This process has the potential to strengthen the government's accountability in providing public service.

I find that remittances influences the provision of local public goods by complementing existing policy commitments by the state as well as the strengthening of its accountability channels. When the remittance shocks occur after the district government allocated a higher share of its budget for education expenditure, I observe higher expansions of public schools. Remittances complement stronger commitments towards education, leading to increases in education investments. Furthermore, I also observe positive interaction between remittances and an indicator of whether the district has split. This suggests that remittances play an important role in districts where the accountability channels has strengthened.

On the other hand, I do not find support for taxation- or election-driven responses. Suppose that the state captures part of the economic boom through taxes, it could use them to finance expansions in public goods. Remittances are not taxed, but the government collects income and property taxes. Part of the revenues collected in the district by the central tax authority is apportioned back to the district budget. At the same time, districts also collect local taxes such as hotel and vehicle taxes. Using budget reports from the Ministry of Finance, I find that remittances did not lead to increased tax revenues for the district. It also appears that the response is not driven by electoral concerns. I do not find systematic differences in the provision of public goods during district election years, when local politicians might have attempted to build schools in a bid to win votes.

To address threats to causal identification, I consider potential violations of the identification assumption. First, I test the relationship between pre-period outcomes with subsequent

remittances and I find future remittances do not predict past outcomes. Second, I account for differential trends by interacting year fixed effects with a set of indicators for island groups or baseline outcomes. I find that the relationship between remittances and outcomes are robust to this check. Third, I construct a proxy for trade windfall from oil and gas as well as palm oil, Indonesia's main export commodities. The coefficients for remittances did not change meaningfully with the inclusion of trade variables, indicating that commodity trade is unlikely to be the main driver of the observed results.

**Literature**. This paper contributes to several strands of the literature. To the literature on the effects of remittances, I provide empirical links between remittances and the actual provision of public goods in a democratic setting. Some researchers analyzing cross-country regressions have proposed theoretical models arguing for the existence of a remittance curse, where governments respond to remittances with cutbacks on the provision of public goods leading to patronage and corruption (Abdih et al., 2012; Ahmed, 2013), which allows autocrats to remain in power (Ahmed, 2012). Other researchers have contested this idea: Desierto (2018) proposed the remittance curse model does not hold in a politically competitive setting, while Easton and Montinola (2017) found that remittances are more likely to increase government spending on education and health in democracies. These conflicting results may stem from difficulties in disentangling the endogenous link between state failure as indicated by corruption, the outmovement of migrants, and its subsequent remittance flow (Mosley and Singer, 2015). Variations in governance structure across countries may also further hinder analysis of how governments provide public goods. Studies that exploit subnational variations in Mexico find some support for the argument that remittances substitute for government provision of public goods, but the lack of variations in migration destinations other than to the US and other limitations in data availability constraints these studies to two-period comparisons (Adida and Girod, 2011; Ambrosius, 2019). By using rich datasets from various Indonesian ministries, I contribute to the literature with an analysis of the effect of remittances on public goods in a setting with a common governance structure and multiple time periods to show a credible positive link between remittances and the provision of public goods in the form of public education facilities.

Furthermore, I provide new empirical evidence on the broader effects of remittances on the economy, particularly on economic growth and household welfare. The existing literature has investigated the effects of remittances on growth through cross-country regressions to show both positive effects (Giuliano and Ruiz-Arranz, 2009; Catrinescu et al., 2009) and negative effects (Chami et al., 2008; Le, 2009). In contrast, evidence from cross-country analysis is more in agreement in evaluating the effects of remittances on poverty (Adams and Page, 2005; Gupta et al., 2009). Microdata from surveys has also provided household-level support on the effects of remittances on household welfare and behaviors, although researchers often face the trade-off between limited coverage in the survey sample and selection issues among remitters (Yang, 2011; Alpaslan et al., 2021). I expand the body of evidence with analysis using subnational data, which relies on plausibly exogenous variations to provide credible estimates on household

outcomes and economic growth.

I also contribute to the literature on the determinants of remittances. Using migrant panel survey data, I link exchange rate fluctuations to variations in remittances. Migrants taking advantage of favorable exchange rates have been reported as early as the 19th century among migrants leaving Europe for the New World (Esteves & Khoudour-Casteras, 2009, 2011). My results also point to a possible driver of remittance countercyclicality that has been observed in national aggregate data (Ratha 2007; Frankel 2011). Furthermore, the relationship I document between currency fluctuations and remittances may bolster similar identification strategies for use in studies involving other migration corridors.

In the broader migration literature, I provide new empirical evidence on the effect of migration on the area of origin through migrant remittances. Rapoport et al. (2020) presents competing frameworks on the pathways through which migration affects origin countries. However, because the decision to migrate and to remit income is tightly linked, existing studies that rely on migration restrictions cannot identify the remittance effect separately (Dinkelman and Mariotti, 2016; Makovec et al., 2014; Theoharides, 2020). By exploiting unexpected foreign currency exchange fluctuations and variations in migration intensity, I estimate the effect of remittances separately from migration in Indonesia. In this regard, my paper is most closely related to studies investigating the effect of remittances to the Philippines after the 1997 Asian financial crisis (Yang, 2008; Khanna et al., 2022).

Lastly, this paper also contributes to the literature on the "flypaper effect" in public finance. Theoretical frameworks in public finance suggest that budget increases for the government and households should have equal effects on development. However, public economists have instead documented that equal-sized transfers to government and households produce different multipliers on development. Arthur Okun called it the flypaper effect, as "money seems to stick where it hits" (Inman, 2009). By investigating a household revenue shock in the form of migrant remittances, this paper complements studies of public spending that look at government revenue shocks (Olsson & Valsecchi, 2015). In doing so, I obtain a more detailed picture of the interaction between the government and households.

## 2.   Context: Indonesian Migrants and Their Remittances

The Indonesian Central Bank estimates that more than four million Indonesian worked abroad between 2005-2012 (BI, 2022). The international migrants, known locally as TKI (*Tenaga Kerja Indonesia*), are mainly women with low education. Placement statistics from the agency for the placement and protection of Indonesian workers (BNP2TKI) recorded about half of them only graduated from primary education, and fewer have completed secondary or post-secondary education (BNP2TKI, 2014). Correspondingly, most of Indonesian workers work as low-skill workers as housekeepers (61%), plantation workers (10%), or fisherman (5%, BNP2TKI, 2014). They come mainly from agricultural households: in 2007, over 60 percent of migrant worker households in rural areas relied on agricultural activities for their income (Bazzi, 2017).

The main destination countries of Indonesian migrant workers include Saudi Arabia and

other Gulf countries, Malaysia, Taiwan, and Singapore (Appendix Table A.3, see also BI, 2022). Village census data reveals that a village's ethnicity and religious composition strongly influenced the country of migration destination. Migrants from a village are more likely to go to Arab countries rather than Malaysia/Singapore as the share of ethnic Arabs in the village gets higher, while the likelihood of migration to Hong Kong and Taiwan is increasing in the share of ethnic Chinese in the village (Bazzi, 2012). With respect to religion, the share of Christians in the village is negatively correlated with the likelihood of its migrants working in Arab countries. Another key factor that influences a migrant worker's destination is the presence of recruiters/"sponsors" in the village. These recruiters connect prospective migrants to a placement agency, and they are commonly the prospective migrant's first point of contact in starting their migration journey (Bazzi et al., 2021).

Indonesian migrants typically work under a fixed-term contract of 2-3 years of work (Bazzi, 2012). They sign a contract prior to departure with an agency, who are then responsible for their training and preparation (Bazzi et al., 2021). The contracts stipulate the workers' salary, typically denominated in the destination country's currency (Bazzi et al., 2021). The salaries are fixed in the host currency rate for the duration of the contract. Nevertheless, because the Indonesian rupiah (IDR) uses a floating rate, in rupiah terms the salary fluctuates following the exchange rate between the destination country's currency to IDR.

Indonesian migrant workers remitted more than USD 11 billion in 2018, making Indonesia the 7th largest remittance receiver in Asia and the 14th largest in the world (World Bank, 2019). A survey of migrants in four Asian countries documented that Indonesian workers send remittances multiple times a year: workers in Hong Kong on average remit monthly while workers in Singapore send money on average every four months (ADB, 2006). Former female migrants surveyed in Bazzi et al. (2021) report they remitted USD 183 to their families on average per month. A summary of survey-based remittance estimates in the literature is listed in Appendix Table A.4. Remittance recipients rank education expenses as one of the top three expenditures for the funds they receive (ADB, 2006). This suggests remittances may have the scope to influence education-seeking behavior at home.

Nearly all remittance recipients in the ADB study report receive remittances through banking institutions (ADB, 2006). Banks and Money Transfer Operators (MTOs) report transaction statistics to the Central Bank, who publishes national aggregate remittance data. Disaggregated data by region are not publicly available, although there are news reports covering important milestones in remittance transactions. For example, the Post Office in Cirebon reported remittances in the district reached USD 40 million (Tribun News, 2013).

Remittances to Indonesia are not taxed by the government. Nevertheless, the government is aware of the remittance flow. Officials have dubbed remitting workers as "foreign currency heroes", and made comments on the size of remittance flow exceeding the revenues from tax amnesty (Media Indonesia, 2017). More generally, the state has weak capacity to enforce taxation: out of 255 million population, fewer than one million people are paying taxpayers (Bloomberg, 2016).

The Indonesian government recognized the worker's vulnerability to exploitation and established an agency for the placement and protection of Indonesian workers (BNP2TKI, Law 39/2004). The agency's responsibilities included the creation of a TKI service post at debarkation points–commonly referred to as the "migrant terminal" in Indonesian airports–where they recorded returning migrants' details and provided other relevant services. The administrative record from this terminal is a key component in the empirical analysis (section 4).

# 3. Remittances and Exchange Rate Shocks

Remittance flows between countries are estimated based on the share of migrants in different countries and the host countries' characteristics (IMF, 2009; KNOMAD, 2017; Ratha and Shaw, 2007). These characteristics include changes in the exchange rate in host countries, although the effects are ex-ante ambiguous. When the currency of the host country appreciates relative to the sending country, transfers in a fixed amount of the host country's currency will increase remittances (Yang, 2008). However, if migrants want their families to receive a fixed sum, exchange rate fluctuations will have no effect on the remittances received.

To study the impact of remittances on origin areas, I first establish that currency fluctuations vary the amount of remittances received by households at the origin using auxiliary out-of-sample dataset. I then shift focus to the impact of remittances on development outcomes and public goods indicators in Section 4.

## 3.1. Regression Specification

If migrants send a fixed amount of remittances denominated in the host country's currency per transfer, the amount received will fluctuate with the exchange rate. I construct the exchange rate change measure for each migrant following Yang (2006, 2008) and other studies looking at the effect of remittances in the Philippines in the aftermath of the Asian financial crisis (Yang and Martinez, 2005; Khanna et al., 2022):

$$XRshock_{it} = \frac{\text{FX rate to IDR}_{ict}}{\text{FX rate to IDR}_{ic}^{o}} \tag{1}$$

I define the exchange rate shock as the appreciation or depreciation of migrant $i$'s host country currency $c$ to Indonesian Rupiah (IDR) at time $t$, relative to a reference period $o$. Each migrant faces a fluctuating exchange rate to IDR when they are sending remittances home.

I use panel data of migrant households to estimate the relationship between exchange rate and remittances, which allows me to add migrant fixed effects, survey wave fixed effects, and other control variables to improve precision (Funkhouser, 2012).

$$Remittances_{it} = \alpha + \beta XRshock_{it} + \gamma X_{it} + \theta_i + \phi_t + + \varepsilon_{it}. \tag{2}$$

$Remittances_{it}$ is the amount received by migrant $i$'s family in the area of origin at time $t$. The coefficient of interest is $\beta$, which expresses changes in remittances due to the change in the

relative exchange rate to IDR, $XRShock$. Both $Remittances$ and $XRShock$ are normalized to have a mean zero and a standard deviation of one. The migrant fixed effect term, $\theta_i$, adjusts for time-invariant characteristics of the household and the household member who migrates. Effects from unobserved invariant characteristics of the migrant will also be absorbed by the migrant fixed effects. The survey wave fixed effect term, $\phi_t$, controls for time effects common to all respondents in each survey wave. This may include price changes or inflation the households face at home. The $X_{it}$ vector adjusts for other time-varying characteristics. Standard errors are clustered at the household level.

I argue that the exchange rate shock that each migrant receive is plausibly exogenous conditional on the included control variables. Migrants take the exchange rate as given: they individually transfer remittances in small amounts relative to the economy and thus are unlikely to move the exchange rate, ruling out reverse causality. Furthermore, changes in the exchange rate are unanticipated by migrant families. Two descriptive statistics lend support to this argument. First, 60% of remitters in Doi et al. (2014) survey stated at baseline that they have either never heard of the term "exchange rate" or they do not understand the meaning. Second, a survey of 5,564 former migrants from Bazzi et al. (2021) shows that only 2% of respondents have their contracts state their salary in Indonesian rupiah. The majority had their contracts denominated in dollars, dinars, or riyals. Their remittances would be subject to the currency rate fluctuations if they were to send a fixed portion of their salary.[2]

To further alleviate the identification concern, I include control variables that could drive variations in remittances: migrant's time abroad and time to the next religious holiday (Eid al-Fitr). The variable of time abroad serves as an important proxy to the migrant's experience, which may help in locating a remittance service that charges a smaller fee, has a better exchange rate, or provides a faster transfer, all of which would influence the size of remittances received by the migrant family at home. Migrants may also be more likely to remit money to finance religious holiday celebrations at home. For Muslims, who comprise the majority of the Indonesian population, Eid al-Fitr is the biggest annual religious holiday. It is traditionally celebrated with the giving of alms for the poor (*zakat fitrah*) and feasts during a family gathering, which compels domestic migrants to return to their hometowns. International migrants, who have to pay a higher travel cost, are less likely to return during the holiday, especially if they work under a fixed-term contract in non-Muslim environments. In such cases, migrants might send more remittances to their families to help defray the cost of the festivities.

## 3.2. Migrant Panel Data

I use panel data from Doi et al. (2014) experiment with Indonesian workers in other Asian countries. They evaluated the impact of a financial literacy program on migrant households. The authors' original analysis showed that none of the treatment arms have significant effects

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[2]From a different setting, a survey of Tongan migrants in New Zealand shows that 39% of respondents try to send a constant amount of NZ dollars each month (Gibson et al., 2006). In contrast, only 14% of remitters try to send a constant amount of Tongan pa'anga each month. The majority of respondents (48%) send remittances only for special occasions (Gibson et al., 2006).

on the likelihood of receiving remittances, their frequency, or the amount received (Doi et al., 2014). The pilot recruited and tracked 400 migrant households from East Java. The study conducted a baseline (Feb–Jun 2010) prior to the migrant's overseas departure. The same members of the household were re-interviewed in the three follow-up surveys (Mar–Apr 2011, Sep–Oct 2011, and January 2012). The recontact rates were 91-98% in the three follow-ups.

I reanalyze this data and focus on a subsample of migrant households receiving remittances.[3] This definition leaves 418 observations in my sample from 183 households with migrants working in Taiwan, Hongkong, Malaysia, or Singapore. In each follow-up survey, households were asked the IDR amount of remittances from the migrant. They reported an average of IDR9.5 million (USD1,119) total remittances since migrant departure. With an average transfer frequency of 4.5, this corresponds to a typical ∼USD250 per transfer.[4]

Because the survey phrased the remittance question as the total remittances received since departure, I use total remittances in the first follow-up and the difference with the previous response in subsequent follow-ups as the measure of remittances for each period. I transform this measure with natural logarithm and standardize it in the regression of equation (2). Assignment into experimental treatment arms was randomized at the migrant household level, so they are absorbed by the migrant fixed effect. For the exchange rate shock, I use the monthly average exchange rate for the follow-up survey month as the observed exchange rate. I fix the reference period to March 2011, the month of the first follow-up survey after the respondents have started working abroad. The time to the next Eid is calculated based on the 2011 and 2012 Eid al-Fitr dates (September 1st, 2011, and August 19th, 2012).

**Exchange rate data**. Using data from Refinitiv Datastream (2021), workers in Hong Kong observed an average exchange rate of IDR1,123 per Hong Kong dollar (HKD) in March 2011, and by January 2012, the rate had appreciated by 3.8% (Figure A.1). At the same time, the exchange rate to Taiwan New Dollar (TWD) moved from IDR296.7/TWDto IDR301.7/TWD, an appreciation of just 1.6%. In these two examples, the raw measure of exchange rate shock for Hong Kong and Taiwan are 1.038 and 1.016, respectively. Overall, the average raw exchange rate shock for migrants in my sample is 0.995 in the second follow-up and 1.029 in the last follow-up. Table 1 (Panel A) presents the summary statistics of the main outcome variable and the regressor variable for my estimation sample.

## 3.3. Variations in Remittances Due to Currency Exchange Rates

Migrant households at home receive more remittances when the currency of their host country appreciates against the Indonesian rupiah. Table 2 presents the estimation results of equation

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[3]Specifically: (1) the migrant was located abroad in more than one follow-up rounds, (2) they reported receiving international remittances, and (3) the migrant sent remittances after the last follow-up survey. On criteria (1) I exclude households who did not know which country the migrant was working in; on criteria (3) I use changes between follow-up surveys in the reported amount of remittances since the migrant's departure as an indicator of subsequent remittance transfers.

[4]Gibson and McKenzie (2017) surveyed pairs of Tongan immigrants in New Zealand and their household in Tonga, where remitters and receivers should be reporting the same remittance transactions. They found that the survey responses produce reliable estimates.

(2), with progressive addition of control variables from columns 1-4. OLS correlation between exchange rate shock is positive, and with the inclusion of migrant and survey wave fixed effects, the estimated coefficient for a one standard deviation exchange rate shock rose to 0.38 standard deviation of remittances (Column 2). This coefficient is in line with the responses among Philippines migrants to the 1998 exchange rate shocks (0.6, see Yang, 2008). This relationship is robust to two additional variables that may influence the amount remitted: time abroad and time to the next religious holiday. The coefficient changes little (column 3-4).

These findings present one of the first systematic investigations that links remittance responses to exchange rate fluctuations using household panel data. The panel structure provides a way to mitigate self-selection bias among migrants and remitters in cross-sectional data (Funkhouser, 2012). Furthermore, the Doi et al. (2014) survey data that I use here explicitly collected information on remittances to migrant households, which are rarely captured in general purpose household surveys fielded in developing countries.[5]

These findings also affirm the observations made by researchers studying changes in aggregate remittance estimates during major financial crises from various contexts, past and present. Following the 2008 Global Financial Crisis, the year-on-year remittances to Nepal rose by 28% in Q1 2009 (Riester, 2012; Mohapatra et al., 2012), and 94% of respondents in a multi-country South Asian migrant household survey reported regular remittances during the crisis period (Rajan and Narayana, 2012). The resilience of the remittance flow was attributed to the depreciation of South Asian currencies against the currencies of Gulf countries (Sirkeci et al., 2012). Researchers have also argued that migrants are willing to absorb negative income shocks to continue sending remittances, which was exemplified by reports of unskilled South Asian migrant workers in the Gulf sharing accommodations and reducing their consumption to save money to send home during this period (Sirkeci et al., 2012). In estimating remittances from from pre-World War I migration out of Europe, Esteves and Khoudour-Casteras (2010) described that "migrants often waited for the most favorable exchange rates before sending money [to Europe]." They noted that migrants took advantage of the best opportunities in cross-exchange rates between Rio de Janeiro, London, and Lisbon.

My finding suggests that the relationship between remittances and exchange rates is not limited to major financial crisis episodes, given the lack of economic disruption in the region during the survey period of my sample. For Indonesian migrants in my analysis, the positive relationship could be driven by an increased frequency of sending remittances. Appendix Table A.5 presents the positive relationship between the number of remittance transactions and the exchange rate shock variable. If remittance transactions are costless, total remittances received at home will increase mechanically with the full amount of the additional transfer. However, migrant households at home do not receive the full amount as each transaction is subject to fees imposed by the banks and money transfer operations (MTOs) facilitating the transactions.

It is unlikely that Indonesian migrants are responding to exchange rate changes by changing jobs or industries. Because each migration spell is based on a fixed-term contract signed

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[5]There are only 47 households reported receiving international remittances from 10,992 Indonesia Family Life Survey/IFLS panel (Cuecuecha and Adams, 2016). IFLS was not designed as a remittances survey,

prior to departure, this leaves little room for the migrants to respond to currency rate appreciation through employment adjustment. In comparison, it may be easier for migrants in factories to adjust their work hours through overtime work (SMERU, 2009). This adjustment stands in contrast with Nekoei (2013), who found that migrants in the US do not change jobs although they work less and send less in response to the appreciation of the US dollar.

More broadly, researchers have argued that currency depreciation causes increases in remittances using analysis of single country time series or cross-country regressions. Studies with single-country time series have used aggregate data from countries with a high ratio of remittances to GDP, such as Samoa (Chamon et al., 2005), Tonga (Lin, 2001), and Nepal (Pant and Budha, 2016). Effect sizes range from 1.17 in Nepal to 4.67 for remittances to non-profit organizations in Tonga. Individual migrant responses such as the ones I analyze in the Doi et al. (2014) panel could provide a foundation for the aggregate effects observed by the existing studies in the remittance literature.

# 4.  A Proxy Measure for District-Level Remittances

For a subnational level analysis of the effects of remittances, I use a proxy measure of district remittance shocks constructed following an approach similar to constructions of bilateral remittance flow estimates (KNOMAD, 2017; Ratha & Shaw, 2007). I construct the district-level remittance proxy using exchange rate shocks and variations in migration intensity. This section describes the construction of the proxy measure, the empirical strategy that uses it as the explanatory variable, and the sources of data.

## 4.1.  Remittance Proxy Construction and Regression Specification

If remittance flows are exogenously distributed among migrant districts $d$, the impact of remittances on development can be identified through an OLS regression.

$$Y_{dt} = \alpha + \beta Remittances_{dt} + \varepsilon_{dt} \tag{3}$$

This strategy requires observations of sub-national remittance flows, which are scarcely available[6]. In the absence of direct observations of the remittance, I construct a district-level remittance proxy using the districts' migration intensity and their exposure to international exchange rate fluctuations.

The exchange rate shock for each district is defined as follows:

$$XRshock_{dt} = \frac{1}{mig_{dt}} \sum_c mig_{dct} \frac{\text{FX rate to IDR}_{ct}}{\text{FX rate to IDR}_c^o} \tag{4}$$

Here, $d$ indexes districts, $c$ indexes destination countries, and $t$ indexes time. The $mig_{dct}$ is

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[6]The Indonesian Central Bank (BI) publishes national remittance estimates aggregated from reports by commercial banks and money transfer operations (MTOs) to the central bank. Staff from one of Indonesia's biggest banks with knowledge of the bank's remittance desk operations described these reports as proprietary and confidential.

thus the number of migrants from a district $d$ who are abroad in country $c$ in period $t$. The last term denotes the relative appreciation or depreciation of the host country's currency for these migrants, relative to a reference period $o$. This is an average of foreign exchange rate shocks that districts face due to their migrants' locations, weighted by the share of its migrants in each destination. The $XRshock_{dt}$ represents the variation in remittances flow a district will receive due to the currency rate fluctuation from its destination mix in a given year.

I complement this with a measure of the district's migration intensity at baseline, which I define as the natural log of the proportion of its migrant workers per one million population.

$$MigShare_d^0 = \log(\frac{migrant_d}{pop_d}). \tag{5}$$

The remittance proxy is the interaction between the exchange rate shock and migration intensity. I use this measure to estimate the following regression by ordinary least squares.

$$Y_{dt} = \alpha + \beta MigShare_d^0 \times XRshock_{dt-1} + \gamma XRshock_{dt-1} + \theta_t + \theta_d + \varepsilon_{dt} \tag{6}$$

where $Y_{dt}$ is the outcome of interest, and we are interested in the $\beta$ coefficient for the interaction term of migration intensity and exchange rate shock, which serves as the proxy for remittance flow to the district. The interacted $XRshock$ term is lagged by one period to $t-1$ to alleviate concerns of reverse causality between the outcome of interest and the remittance proxy because the shock precedes any changes in the outcome of interest. The regression equation also includes the time-varying $XRshock_{dt-1}$ as control, also lagged by one year. The baseline district migration intensity is absorbed by the district fixed effect $\theta_d$, which captures the variations in outcomes due to the time-invariant characteristics of the district. The $\theta_t$ term is the year fixed effects that capture common time effects shared across all districts. The term $\varepsilon_{dt}$ is a mean-zero error term. Standard errors in this estimation are clustered at the district level.

The $\beta$ coefficient could be interpreted as a reduced form estimate from a two-stage least square (2SLS) estimation. In the 2SLS framework, the first stage is the regression of remittances on the plausibly exogenous interaction term, and the second stage is the regression of the outcome variable on the predicted remittances. For the reduced form, a causal interpretation of $\beta$ relies on the identification assumption that unobserved determinants of outcomes in the district must be unrelated to the interaction term conditional on control variables and fixed effects. The interaction term is plausibly exogenous, as omitted variables in the error term would need to be distributed in a similar manner as the district's migration intensity, its country destinations, and the fluctuations of its currency exchange rate simultaneously.

## 4.2. Data

**Migrant destinations.** To construct the district-level exchange rate shock, I use administrative records from the "migrant terminal" in Soekarno-Hatta International Airport (SHIA). Located about 20 km from the capital, it is the primary embarkation point for workers leaving the country to work abroad. For returning migrants, officials at the migrant terminal recorded

the migrant's gender, date of departure, date of arrival, country of work, and origin district. From arrivals between March 2008-2011, they recorded 1,006,241 migrants from 366 districts returning from 116 different countries. I use the departure and arrival dates to create a measure of the destination mix for a district's migrants in each month to create a district-month-country level dataset. I merge this with exchange rates from various currencies to IDR from Refinitiv Datastream (2021). I fix June 2007 as the reference period for equation (4), one year prior to the rapid exchange rate changes due to the 2008 Global Financial Crisis (see Figure 1).

Using this construction, I find that there is considerable variation in the exchange rate shock that districts are exposed to, which is driven by the destination mix of their migrants. For example, compare the Purwakarta district in West Java and Pesawaran in Lampung: 95% of Purwakarta migrants worked in Saudi Arabia or Gulf countries, while only 70% of Pesawaran migrants worked in that region. At the same time, a much smaller proportion of Purwakarta migrants worked in Malaysia or Singapore (2%) than migrants from Pesawaran (21%). These differences in the destination mix channel different magnitudes of exchange rate shocks. Compared to June 2007, Purwakarta migrants on average saw their host country's currency appreciate by 5.6 p.p. in 2008, while Pesawaran migrants' average currency appreciation was 10.1 p.p. due to its smaller exposure to Saudi Riyal (which is pegged to US dollar at 3.75 riyals per dollar). One year later, Purwakarta migrants' average currency exchange rate rose steeply by 10.3 p.p. while Pesawaran migrants only rose by 1.5 p.p.

**Migration intensity.** I construct district migration intensity using data from the 2005 Village Potential survey (Podes). Podes collects information from village heads every 2–3 years with a coverage of the universe of Indonesian villages. The 2005 survey is the first year in which Podes collect systematic data about the number of migrants from each village, which I then aggregate to the district level. The village-level information allowed a more complete estimation of the migration intensity from the district.

**Outcome data**: I compile information from various datasets to build my analysis sample. I briefly describe my data sources below for my primary outcomes of interest in public goods. A summary of the descriptive statistics for key outcomes and explanatory variables are tabulated in Table 1, Panel B-E.

Data on school establishment comes from *Dapodik*, a registry maintained by the Ministry of Education and Culture. This dataset covers the universe of primary, junior secondary, and high schools under the ministry's purview and includes each school's location and year of establishment. This registry also maintains the status of the school, i.e., whether a school is public or private. The public schools are the focus of my analysis.

The national socio-economic surveys (*Susenas*) are a series of household surveys designed to be representative at the district level. Susenas provided information on school enrollment, education attainment, and household expenditures. The details of individual household members allow disaggregation of education statistics by gender. *Susenas* also provides information on the source of household drinking water and electrification status, public goods which requires public investment.

I use the World Bank's Indo-Dapoer dataset (Indonesia Database for Policy and Economic Research) to obtain information on the net enrollment ratio with inflation based on population projection. This dataset also provides information on various governance outcomes, including district budgets, poverty levels, and regional GDPs. The information on the district budget, including its revenues and spending summaries, is compiled from the Ministry of Finance. Further details on other datasets I use for district-level analysis are described in Appendix Table A.1.

## 4.3. Remittance Proxy Measure

There are considerable spatial and temporal variations in the resulting remittance proxy measure. I plot the residual variation in the remittance proxy measure after adjusting for the exchange rate fluctuation, district fixed effects, and year fixed effects in Figures 2-3, overlaid on district boundaries. Districts on the map are colored by the magnitude of the residual variation in blue-red gradation, where the blue color denotes exposure to a smaller remittance shock while the red color denotes exposure to a higher remittance shock. Prior to the Global Financial Crisis, districts with positive shocks are scattered across all main island groups, mainly in Riau in Sumatera, some urban districts in Java, and districts in Kalimantan and northern/Central Sulawesi (Figure 2). After the rapid currency valuation change in 2010, there is considerable variation in the districts that received greater shocks (Figure 3). While many districts in Java ended with a positive shock, some gained considerably less from the remittance shock and remained blue on the map in 2010. Similarly, not all southern Sumatera and southern Sulawesi districts benefited from the exchange rate shock: some districts remained blue.

These variations are unlikely to merely capture an unobserved trend in the outcomes of interest, as future remittances are not correlated with past district outcomes. In Table 3, I report the coefficients from regressing equation (6), but with the right hand side variable shifted forward by three periods to capture future remittances. If the remittance variable is merely a proxy for an unobserved trend, we should see a statistically significant correlation between this "future" remittance and past outcomes. I regress this on my main outcomes, a set of outcomes on enrollment and public goods. Reassuringly, I find that the magnitude of the coefficients is small and statistically indistinguishable from zero.

How big is the windfall in aggregate? Summary statistics from the migrant panel survey suggest that districts with the normalized remittance proxy of one receive ~USD 45,000 more remittances per 100,000 people compared to districts at the mean of remittance proxy distribution. With an average of 588,456 population size for districts in my sample, a back-of-the-envelope calculation suggests a windfall of the size of USD 260,000 to the district for one standard deviation of the remittance proxy shock. This figure is roughly half of the average district budget for social protection in 2008, underscoring the importance of the financial flow to the region.[7]

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[7]In comparison, Dinkelman et al. (2020) estimated that Malawi migrants working in South African mine created a capital flow of USD 115,000 on average per district in 1973.

# 5.    Development Impacts of Remittances

The remittance shocks provide extra resources to households, which they can consume and/or invest. In this section, I look at the effects on household expenditures and asset ownerships. At the aggregate level, I look into poverty outcomes and GDP per capita per sector.

## 5.1.    Remittances Raise Consumption

Remittances are a direct way for migrants to support their families at home, and increased resources from remittances may allow them to increase their consumption. I test this relationship by estimating equation (6) on consumption outcomes. I look at key consumption indicators: monthly expenditure per capita for the average household and the household in the bottom quintile, and per capita expenditures for education. All variables are in log IDR unit. Data for these indicators come from Dapoer, which aggregates household responses in *Susenas* to create district averages. Table 4, Panel A presents the results.

I find that remittances increase household consumption, especially for those at the bottom of the expenditure distribution. They also increase education expenditure. For households in the lowest quintile, a one standard deviation (SD) of remittance proxy shock increases the average household expenditure per capita by 0.10 log points (column 2). This coefficient is more than twice the coefficient for the average household, which lacks the precision to be statistically significantly different from zero (column 1). The shock also increases the monthly per capita expenditure for education by 0.28 log points. These increases are unlikely to be a mechanical response to rising prices. In Column 4 I regress the core price index from 47 districts, benchmarked to 2007 price. I cannot reject the null hypothesis that remittances has no effect on price. Although the estimates is positive, it is smaller than the 7% average annual inflation rate in the 2005-2012 period and I can rule out effects larger than 6% ($3.19 \times 1.96$). The increases I observe in household consumptions are thus unlikely to be an artifact of mechanical response to rising prices. I defer the discussion on the robustness of the results in this section and the next to section 7.

The effect of remittances on consumption is comparable to a government cash transfer program. At the mean, the remittance proxy coefficient imply a higher monthly per capita consumption of IDR 18.5 thousand for the bottom quintile households. In the same time period, Alatas (2011) evaluated PKH, an Indonesian social protection program that provide IDR 200-600 thousand per quarter to eligible households. She found that found that the program raises beneficiary households' consumption per capita by IDR 19 thousand per month, approximately 10 percent of the mean. Meanwhile, the effect on education expenditure is similar to the estimates from the Philippines. Yang (2008) found that migrant households with overseas members raise their education expenditure by 55% in response to the exchange rate shocks due to the 1998 crisis, although he did not observe an effect on the overall household consumption.

## 5.2. Remittances Raise Asset Ownerships and Reduce Poverty

Remittances may finance purchases of durable assets, often the preferred mode of investment among households in developing countries. I summarized household asset ownerships in the 2010-2012 Susenas surveys using an asset index.[8]

I find remittances increase the asset ownership index by 0.03 (Panel B, column 1). This value represents 16% of the dependent variable mean. The assets included are motorcycles, cars, bicycles, refrigerators, natural gas canisters, water heaters, air conditioners, cable TVs, and boats. Appendix Table A.8 presents the detailed breakdown for each asset. I estimate precise effects in vehicle ownerships, with 4-7 p.p. increases for motorcycles, cars, and bicycles. Motorcycles are the most common vehicles in my sample, with three-fifths of households owning a motorcycle, while cars are the least common, with less than one-fifth ownership rate. Households also appear to acquire refrigerators and natural gas canisters in response to the remittance proxy shock. 15 p.p. more households have refrigerators and 10 p.p. more households use 12 kg gas canisters due to a one SD remittance shock, up from an average ownership rate of 17% and 12%, respectively. These results track the reported use of remittances from the migrant panel data. Appendix Table A.9 reports the coefficients from regression of equation (2) with reported remittance use as the outcomes of interest. Households in the migrant panel data use the increased remittances to purchase electronics and durables.

These results track findings from the Philippines (Yang, 2008), although the responses to specific assets vary. Migrant households benefiting from the 1998 exchange rate shocks responded with increases in vehicle and radio ownerships. From a different context, Mexican households receiving cash from the Oportunidades program invested 25% of the transfer in productive assets (Gertler et al. 2012). Early descriptive work on Indonesian migrants from Java and East Nusa Tenggara described similar responses, reporting that migrant families used remittances to buy refrigerators, televisions, radios, motorcycles, and houses (Sukamdi et al., 2004).

More broadly, asset ownerships can indicate escape from poverty. Developing country governments frequently determine poverty status using asset-based proxy-means tests in the absence of complete household income data (Banerjee et al., 2020). Using three different measures, I examine the effect of remittances on poverty and inequality. I use the share of district population living below the poverty line, the poverty gap–a measure of poverty intensity, and gini coefficient, a measure of inequality.

Remittances reduce poverty. With households in the bottom quintile showing the strongest gain in household expenditures due to remittances, it translates into reduction in district poverty rate. A one SD remittance proxy shock reduces poverty by nearly 4 p.p., roughly a quarter of the mean poverty rate of 15%. It also reduces the poverty gap by 1.3 p.p., nearly halving the mean distance of 2.7% between the poor's income with the poverty line. These re-

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[8]This aggregation improves statistical power to detect effects that go in the same direction within a domain (Kling et al., 2007; see also a similar asset index in Martinez-Bravo et al., 2017). All individual asset variables share a common range of [0,1].

sults underscore the powerfulness of remittances as a poverty alleviation strategy. My findings echo results from the Phillipines, where remittance shocks due to 1998 exchange rate depreciation reduced the incidence of household poverty by two thirds of the pre-crisis mean and offset the mean increase in poverty gap in the aftermath of the crisis (Yang & Martinez, 2005). With the benefit of remittances mostly accruing to the poorer households, I also observed a reduction in inequality by 0.03 Gini coefficient. This is one-tenth of the mean dependent variable in the sample.

## 5.3. Remittances Lead to Economic Growth

In aggregate, the infusion of resources from remittances can stimulate growth. To measure growth, I use the district-level gross domestic product (GDP) from Dapoer, which is calculated from official reports issued by an independent statistical agency. Indonesia is one of the few developing countries with reliable regional GDP estimates, and it has been used to benchmark night light satellite data with economic growth measures (Gibson et al., 2021). GDP data is expressed in constant price, benchmarked to the year 2000. I divide the district GDP figure by population to obtain the GDP per capita value in IDR, then transform it with a natural logarithm. The figure is available by sector, grouped into three major sectors: agriculture, service, and manufacturing. Table 4, Panel C reports the results.

Remittances increase the overall GDP per capita in the district, and this increase is driven by the increase in the agriculture and service sector. A one SD remittance proxy shock leads to an increase of 0.09 log points of the overall GDP per capita (column 1), 0.13 log points of the agriculture sector GDP per capita (column 2), 0.24 service sector GDP per capita (column 3), and 0.19 in manufacturing sector GDP per capita (column 4) one year after the shock. The coefficients are most precisely estimated for the agriculture sector, while the estimate for the manufacturing sector is not statistically significantly different from zero. At the mean, the increase is equivalent to higher total GDP per capita by IDR 507,571 or USD 55 at the 2010 exchange rate. This estimate is roughly one third the effects on the global income in the Philippines one decade after the 1998 exchange rate shocks.

The increase in GDP per capita for agriculture possibly reflects the composition of the migrant workers, who predominantly come from agricultural households, while households' purchases of goods and use of financial institutions and other services may contribute to the boost in service GDP.[9]

# 6. Remittances and Education Investments

Education provides a path for development through investment in human capital. Remittances can relax the budget constraints that prevent households from investing in education. Because education services are commonly provided by the state, analysis of its policies can reveal the

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[9]See Appendix Table A.22 for estimated effects on employment outcomes: remittances do not appear to change the sectoral composition of employment although it reduces the size of the total labor force.

patterns of state responses to remittances.

## 6.1.  Remittances and Enrollment

I investigate the effect of remittances by looking into net enrollment rates for elementary school (grade 1-6), junior secondary school (grade 7-9), and senior secondary school (grade 10-12). Net enrollment ratio expresses the total school-age students enrolled in schools as a percentage of the population of the same age group. The official age range is 7-12 years old for elementary level, 13-15 for junior secondary level, and 16-18 for senior secondary level. Using age and enrollment information from *Susenas*, I estimate the effects for all children, and separately by gender. Table 5 presents the results.

Remittances lead to overall increased enrollment. One standard deviation of the shock is associated with 2.6 p.p increases in school enrollment among children aged 7-18 (Panel A, column 1). This effect appears to be driven by enrollment increases in junior secondary schools (4.4 p.p.) and senior secondary schools (7.5 p.p.). The estimated effect for elementary school enrollment among 7-12-year-olds is positive, although not significantly different from zero. The increase in secondary education enrollment is particularly noteworthy as the participation rate in post-primary education lags behind the primary level. With a net participation ratio of 66.8% for junior secondary schools and 46.5% for senior secondary schools on average across districts, these secondary level statistics are markedly lower than the average net enrollment ratio for elementary schools at 93.5%. The smaller impact on the elementary school net enrollment ratio reflects a smaller room for improvement. However, in an alternate estimation using a population inflation-adjusted enrollment rate from Dapoer, the effect on elementary school enrollment is more precisely estimated (Appendix Table A.6). Similarly, using district statistics with individual survey weights largely preserves the results (Appendix Table A.7).

The effects of remittances on school enrollments differ by gender for different education levels. Panel B and C of Table 5 present the effects of remittances on enrollments for boys and girls, respectively. At the elementary level, girls gain with 1.6 p.p. higher enrollment rate in response to a one SD shock, while the estimate for boys is very close to zero. However, the gains in secondary school enrollments mainly reflect the gains in enrollments for boys in junior secondary (6.3 p.p.) and senior secondary (12 p.p.). In contrast, the enrollment gain for girls is merely one-fourth to one-third of the effect sizes for boys. These gendered responses hint at the possibility that some girls forego secondary education to work as migrant workers. The windfall may send the message that only primary education is important as the remittances were sent by women with only primary school education. The Indonesian government had intended to raise the educational requirement to work abroad to at least junior secondary school (Law 39/2004 on Migrant Placement), but the Constitutional Court ruled it unconstitutional. With the ruling, elementary school education remains sufficient for Indonesians to seek work placement abroad.

In contrast, for a placebo regression where I estimate the effects of remittances on school enrollment for the 19-24-year-old population, who are older than the normal primary and

secondary school enrollment, I do not observe any effect of remittances on this population (Table 6).

## 6.2. Public goods

After the Soeharto regime fell in 1998, the Indonesian central government devolved the responsibility of frontline service provision to district-level governments. This policy environment underlies the selection of educational facilities as the main outcomes of interest in my analysis. I look into the density of public schools at the primary, junior, and senior secondary levels, defined as the number of schools per 10,000 population. Public schools are provided free of charge, and the primary and junior secondary levels are compulsory. In combination, public schools educate 83% of total enrolled students at the primary and junior secondary levels. Because of the high attrition rate for students graduating from primary school, the junior secondary level presents the next bottleneck in ensuring education access for all. Table 7 presents the estimation results of equation (6) to investigate the impact of a remittance shock on the publicly provided goods in the district and Figure 4 compares the effect on enrollment and school densities for different levels.

I find remittance shocks positively influence the provision of education facilities. A one standard deviation shock leads to 0.87 more public elementary schools and 0.27 more public junior secondary schools per 10,000 population one year after the shock. The coefficient for public senior secondary school is also positive at 0.02, but it is smaller and not statistically significantly different from zero. The coefficients for elementary and junior secondary school density amount to 13% of the mean density of elementary schools across districts (6.39 schools per 10,000 population) and 23% of the mean density of junior secondary schools (1.18 schools per 10,000 population). At 0.23-0.25 SD, this is a significant expansion of education facilities in support of universal basic education.

Panel B results for asphalt roads, electricity, and piped water access support an overall pattern that remittances improve the provision of public goods. Piped water represents a public investment in clean water, and they are managed by the district government-owned enterprise. These stand in contrast to other safe drinking water sources such as bottled water, protected wells, or boreholes, which households access through private investments. Electricity as infrastructure is provided similarly as piped water–through a state-owned enterprise–and the grid capacity is commonly the main constraint for house- holds to access the service. Both electricity and piped water require complementary private investments in the form of a connection fee. Asphalt roads in the village are often cited as a canonical example of a non-rivalrous and non-excludable goods. In practice, investments in asphalt roads often partly funded with informal taxation from the villagers in form of labor or goods (Olken and Singhal, 2011). For electricity and piped water, a one SD of remittance shocks increases the share of households with access by 5 and 9 p.p., respectively. This effect size for piped water is more than 50% of the mean share of household access to piped water (16 per cent), representing a meaningful expansion to service. The share of villages with asphalt roads in the district

rises by 25 p.p., from a mean share of 70 per cent. The improvements in road quality in the district could reduce transportation costs for tens of thousands of villagers. Appendix table 19 presents evidence of informal tax to build roads and other village infrastructures from survey data collected by Olken et al. (2014) and Cahyadi et al. (2020). Households in remittance-positive villages are more likely to report money or in-kind contribution to village building projects and with higher amounts.

# 7. Alternative Explanations: Commodities and Trends

Could the presented findings not actually be caused by remittances? I consider several alternative explanations: commodity trade, differential trends depending on baseline outcome, and differential regional trends.

## 7.1. Commodity Trade in Oil, Natural Gas, and Palm Oil

It is possible that the exchange rate shock mechanism actually works through a trade channel on various commodities. An appreciation in the trading partners' currency will make Indonesian commodities cheaper and more attractive in the international market, leading to a trade surplus that can finance public goods provision by the districts. If the exchange rate shocks are ordered in a similar distribution among migration destination partners and trading partners, this will undermine the mechanism I proposed in this paper. However, the foreign trade statistics aggregating export data reports from all ports of entry (Appendix Table A.10) show that only a few countries overlap as top migration destinations and export destinations. While some Southeast Asian neighbor countries are represented in both lists, other top Indonesian trading partners such as the USA, China, and the EU are markedly different destinations than the MENA countries where many more migrants work. Regressions at the country level of the export value and the number of migrants recorded in the migrant terminal data also show little correlation between the two variables (Appendix Table A.11).

To further corroborate the incompatibility of the trade channel with the estimated impact of remittances on public goods, I analyze two primary export commodities from Indonesia: oil and natural gas and palm oil. Oil and natural gas is Indonesia's most valuable commodity, bringing in USD 22 billion in 2007 and making up nearly one-fifth of total Indonesian export that year. I construct a measure of districts' oil and gas production by using its oil and gas revenue share in 2005 with an intuitive relation: the more intensive the oil production in a district, the higher its revenue share will be. From the foreign trade statistics, I also obtain the export destination countries for specific categories of oil and gas commodities: crude petroleum oil, condensate, other lubricating oil, liquid natural gas, liquid propane, liquid butanes, and liquid ethylene. For these countries, I then retrieve the currency rate fluctuations to construct a $XRshockOil_t$ variable, which I interact with the oil production intensity.

Similarly, palm oil is Indonesia's most valuable agricultural export commodity, with USD 7.9 billion worth of export in 2007. I obtain the export destination countries for crude palm

oil and crude olein and construct $XRshockPalm_t$ variable.[10] I use the area of land used for oil palm plantation from the 2003 agricultural census/village census to obtain a measure of palm oil intensity at the district level and interact the two variables to obtain the trade shock exposure variable to palm oil.[11] I then include these trade shock variables to the regression equation 6.

Table 8 reports the results with the inclusion of commodity trade controls. In Panel A, I examine the coefficients of the remittance proxy on regression with development indicators as the outcome variables. Panel A1 reproduces the main estimates, and Panel A2 presents the coefficients including the two commodities as control. Although as the effect for total GDP per capita is revised downward it loses statistical significance, the estimates in general change little. The magnitudes of the effects on the expenditures for households in the bottom quintile, asset index, and poverty rate did not vary more than 5% of the original estimates. In Panel B, I examine the coefficients of the remittance proxy for education outcomes. Panel B2 presents the coefficients from regressions that include the two commodities as control. In comparison to the main estimates in Panel B1, the patterns are the same and the inclusion of controls raises the magnitudes of the coefficients by 6-18% of the main estimates. The most pronounced increase is in the effect of junior secondary school enrollment from 4.4 p.p. to 5.2 p.p. in response to a one SD remittance shocks. By and large, the coefficients on the oil and gas trade shock and the palm oil trade shock themselves are an order of magnitude smaller than the remittance coefficients (not shown).

These results are consistent with the estimates reported in Cassidy (2021), who ruled out changes in public service delivery due to the oil and gas grant. In an alternate specification, I interact the remittance shock directly with the pre-period revenue from oil and gas production or with the pre-period palm oil production to check if the remittance effects are systematically different in oil/gas-producing areas or in palm-oil producing area. In this specification, the magnitude of the interaction is roughly one-tenth of the remittance shock coefficients. In contrast, the effects of remittances on their own remain positive. Together, these results present evidence against trade shock being the underlying driver of public service delivery change that is associated with remittances in this paper.

## 7.2. Baseline Trends and Regional Trends

Another alternative account for the presented results concerns differential trends. If areas observed with high remittances have the inherent propensity to exhibit different development paths due to their characteristics, it would challenge the attribution of the effects to remittances. Two sources of trends are relevant: regional trends and differential trends based on their baseline outcomes. I test for the robustness of the effects of remittances with the inclusion

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[10]India is the single biggest buyer of Indonesia's crude palm oil, along with the Netherlands and other South Asian countries. Japan, South Korea, and China are the biggest buyers of Indonesian crude oil and LNG for oil and natural gas.

[11]Appendix Table A.12 shows that the intensity of migration at the district level and the intensity of oil and gas production as well as palm oil land area are not significantly correlated.

of variables that flexibly controls for these trends.

Table 9 reports the results with the inclusion of regional trends. The regressions reported in this table add island-year interaction terms that flexibly accounts for potential differential trajectories in outcome variables between districts in the same island. Panel A1 and B1 reproduces the main estimates, while Panel A2 and B2 present the results with regional trends for various development indicators and education outcomes, respectively. The remittance proxy coefficient are stable across the two specifications both for development indicators and education outcomes. All development indicators but the total GDP per capita income maintain their precisions and magnitudes (Panel A2). In Panel B2, estimates on education outcomes largely maintain their statistical precision and magnitudes. For the density of senior secondary school, the estimated coefficient is nearly 50% larger, which improves the precision of the effect.

Table 10 reports the results with the inclusion of baseline trends. To account for potential differential responses to remittances in districts that depends on their pre-period outcome, I use two different sets of baseline trends. In Panel A, I include the 2004 agriculture GDP per capita interacted with year dummies as the baseline level-specific trend. My inclusion of the agriculture sector GDP per capita reflects the fact that it is the largest sector of employment in the country and that migrant households also predominantly come from agriculture households (Bazzi, 2017, Makovec et al., 2018). Comparison between Panel A2 and the main estimates in Panel A1 show that the main estimates are robust to the addition of trends specific to the level of agricultural GDP per capita prior to the shocks. In Panel B, I include the school densities in 2004 separately by levels (elementary, junior secondary, and senior secondary), interacted with year dummies. Inclusion of these variables would adjust for potential differential trends that could be due to the fact that the government simply decided to build more schools where there had been fewer schools to serve the school-age populations. Panel B2 shows that all estimates increased in magnitudes with the inclusion of these variables, and the statistical precision are maintained from the main estimates. The estimates for enrollment rates and basic education facility densities rise by 18-36% of the main specification (column 1-5).

## 7.3.    Other Robustness Checks

I further test for several other robustness checks: construction of migration intensity using alternative counts, construction of exchange rate shock measure using alternative data source, and the inclusion of lagged outcome variables.

Because I use migrant count from the 2005 village survey as the measure of district migration intensity, one concern is that the number of migrants may have changed substantially by the end of my sample period. In Appendix Table A.14, I presents estimates from an alternate construction that addresses this concern using data from three waves of village survey (2005, 2008, 2011). I limit the use of 2005 migrant count to the year of 2006-2008, and I use the 2008 and 2011 survey to update the count for 2009-2011 and 2012, respectively. The results do not change substantially. The consistent results reflect the strong correlation between migrant counts in the three periods within a district.

Another possible concern is the destination inaccuracies from the migrant terminal dataset, which is recorded at migrants' return to Indonesia. These measurement errors in the true destination composition can bias the results. I address this using village-level plurality destination recorded in the 2005 village survey. This is the only year in which the village survey collects migrant destination information, and the answer details are limited to only the top 11 migrant destinations and only record one country per village, i.e., the country with the most migrants from the village. Using the same exchange rate data, I measure the shock and aggregate it to the district level. Appendix Table A.15 presents the estimation results. The main estimates are robust to a different information source of migration destinations.

The inclusion of lagged outcome variable as a regressor tests a concern that future outcomes are predicted by past outcomes. If past outcomes are correlated with the remittance proxy when it is omitted from the right hand side of equation (6), this will bias the coefficient upward. In Appendix Table A.16, I show that the results are also robust to the inclusion of lagged outcomes as a control variable.

Lastly, I test for the possibility that the errors are simultaneously correlated within region and within time (Cameron et al., 2010). I first note that the inclusion of year dummies have mitigated this concern somewhat as the fixed effects inclusion in practice reduces within cluster correlations (Cameron et al., 2010). Appendix Table A.17 presents the estimation results. The statistical precisions of the results are preserved most strongly for the public school densities and the poverty rate.

## 8. Mechanisms

What drives the government to provide public goods in the presence of positive remittances shock? Because remittances are private transfers between individuals, they may be invisible to local governments in the area of origin. In this way, we may not expect local governments to respond to it directly. Furthermore, the constructions of public facilities typically require significant investment, and governments in developing countries are often resource-strapped.

I investigate several pathways through which migrant remittances may influence public goods provision by local governments. First, remittances may influence government policies through interactions with pre-existing policy priorities. Second, governments may capture remittance windfall through taxation. Third, decentralization may put local governments in a better position to provide public goods for their population. Finally, electoral competition may induce politicians to provide public goods to win votes.

### 8.1. Pre-existing policy priorities

Governments pursue their policy goals by allocating public budgets to reflect their priorities. With limited resources, they may decide to improve their provision of public goods and services only if it aligns with pre-existing policy priorities. For the education sector, a government with a solid commitment to education may interpret increased enrollment changes brought

by remittance windfall as a positive feedback signal, leading to improved provision of public education facilities.

To test this mechanism, I proxy districts' commitment to education with the share of the district's expenditure for education out of its total expenditure, using district finance data from the Ministry of Finance. Under government regulations, classifications of district expenditures for education cover teachers' salaries and benefits, asset purchases for education facilities, and social assistance/education scholarships (PMK 84/2009). Districts are required to spend at least 20 percent of their budget on the education function, and the average share of education expenditure in my sample is 35 percent.

I estimate a regression of education facilities at time $t$ on the interaction of remittance proxy at time $t-1$ and the district's share of education expenditure at time $t-2$. The two-period lag for the education expenditure variable helps guard against the contemporaneous effect of the remittances shock on the district's spending profile. The coefficient of the interaction term in this regression will inform our understanding of the relationship between remittances and districts' policy priorities.

The results in Table 11, Panel A suggests that remittances strengthen the provision of education facilities in districts with a stronger fiscal commitment to education. The interaction term between remittance proxy and share of education expenditure has positive and significant coefficients in estimations with elementary and junior secondary schools as the outcome. This finding suggests the marginal impact of remittance shocks on basic education facilities is increasing with the level of fiscal commitment to education by the district government.

**Village Head Survey.** How does government policy adaptation operate in practice? At the lowest level of government, village governments has the best vantage points as they frequently interact with both villagers and the service providers (teachers and school principals). I use a survey from Olken et al. (2014) and Cahyadi et al. (2020), who interviewed village heads in six provinces for an evaluation of cash transfer programs in the same time period. Village heads were asked to list the main challenges in education service provision in their villages. Frequent answers include inadequate facilities, or families not being able to afford educating their children. I use the survey responses and create indicators of whether the village heads mention facilities, cost concern, and whether they rank facilities concern higher than cost concern. I regress this on a modified equation (6), specifying the remittance proxy variable at the village level instead of the district level. Panel B, Table 11 reports the results.

Village heads are less likely to mention education cost concern in villages with remittance-positive shocks (column 2), consistent with the positive effects on household welfare I have documented earlier. The coefficient for facility concern is positive, but it is not statistically significantly different than zero (column 1). In direct comparison between facility concern and cost concern, they are more likely to rank inadequate education infrastructure higher as the top three challenges than ranking inaffordability of school education as a top challenge (column 3). These would have made them more supportive of policies to increase and improve education facilities in their villages.

**Junior High School constructions.** One such policy to increase education facilities would be to build junior high schools through intensifying the use of existing resources. In the 1970s and 1980s, the Indonesian government built numerous public elementary schools across the country through the INPRES program (Duflo, 2001). This celebrated program provided an initial stock of land that the later government in the 2000s could use to expand junior secondary schooling.

I look into a program that allows the government to build junior high schools more cheaply, mainly by using existing elementary schools, building smaller schools, and providing fewer amenities. The district government can "build" junior high schools attached to existing elementary schools under a "One-Roof Policy", which expands an elementary school to serve students in the subsequent three grades normally served by junior high schools. The governments are still responsible for hiring new teachers for the newly created school, although in practice existing elementary school teachers or available educated locals may be asked to teach the students (Departemen Pendidikan Nasional, 2008). Similarly, the new junior high school may also borrow existing classrooms while constructions for new classrooms and facilities are underway. Because the junior high schools are attached to elementary schools, the elementary school principals are responsible for the joint management of both schools. This policy would also allow rapid school establishments, as the district governments do not need to first acquire land to locate the new schools. Appendix Figure presents some examples of these schools.

I use detailed school-level characteristics from the Ministry of Education administrative data to examine this margin of response. I look into the following outcome variables: an indicator of whether a junior high school is attached to an elementary school, the average number of classrooms per junior high school in the district, and the average number of teachers per junior high school. When new schools are constructed with fewer amenities, as would typically happen under this program, they would bring the district average number down. I regress these variables on the left-hand side of the equation (6) on the remittance proxy variable, and Panel C Table 11 reports the results.

I find district governments economize on new school constructions to allow them to respond rapidly to the remittance shocks. In column 1, a one standard deviation shock in the remittance proxy variable results in 3 p.p. increases in the share of junior high schools that are attached to a primary school in the district. These newly created junior high schools also have fewer classrooms than "normal" junior high schools (column 2), and fewer teachers (column 3). Overall, these results point to the trade-off district governments made in the educational system to respond to the remittances shock. They created schools with less-than-perfect facilities, but these were instrumental in ensuring more children access secondary education.

## 8.2. Taxation

Taxation of economic activities transfers part of the economic gain to the government budget, which they may use to provide public goods. With an increase in local economic growth due to remittances, does it change government revenues through taxation? I test this pathway by

estimating the effects of remittances on government's various revenue streams.

Districts in Indonesia finance their operations through several revenue streams, in descending order by size: general DAU grants (61%), central tax revenue share (8%), special allocation DAK grants (7%), local taxes (6.5%), and natural resource revenue share (6%). The DAU grants are formulaic transfers that depend on mostly fixed characteristics of the district, e.g., its land area and population size (Brodjonegoro and Martinez-Vasquez 2005). The central government collects income taxes, property taxes, and tobacco excise and returns a portion of the revenue to district governments through a predetermined formula (12% for the income tax and 9% of the property tax). This revenue is reported as a Tax Revenue Share (DBH). The DAK grants are conditional, matching transfers provided by central government on a discretionary basis. Districts need to match at least 10% of the fund provided from the central government. Funds are earmarked for (physical) developments of education facilities and other types of infrastructure (see Cassidy 2021). I also look into revenues from local taxes, classified as Own Source Revenue (PAD). This revenue stream collects local taxes and fees imposed by the district governments, such as vehicle and hotel taxes. I use data from the Ministry of Finance for this analysis, reporting the outcomes in the log IDR unit and as a share of the total revenues for the district.

Suppose the government is able to capture part of the economic growth in their districts through taxation. In that case, we should expect positive coefficients for the remittance shock on the regression of tax revenues from centrally or locally collected taxes using equation (6). We shall not expect remittances to alter neither the general DAU budget that comes from unconditional intergovernmental transfers nor the share from natural resources revenues. With respect to the DAK budget, the effects are ex-ante ambiguous. Table 12 reports the results.

I do not find supporting evidence for higher tax revenues collected by the government with a positive remittance shock. The coefficients for tax revenues and other revenue streams are imprecisely estimated in log IDR (Panel A). The 90% confidence intervals from estimation in columns (1-2) suggests I can rule out effects where remittances shock leads to the tax revenue increases in log IDR that are higher than 1 percent. Furthermore, when I look at the revenue streams as a share of total budget, the negative effect on revenue sharing from centrally collected taxes attains statistical significance at the 5% level (Panel B, column 1).

## 8.3. Decentralization and district splits

In the presence of a positive remittances shock, decentralized governance could facilitate better provisions of public goods by the government. In Indonesia, the decentralization process involved the transfer of responsibilities to provide public goods from the central government to district-level governments. This process has led to the creation of new, smaller districts within existing district boundaries–"district splits" (Bazzi and Gudgeon, 2021; Cassidy and Velayudhan, 2022). Between 2004-2012, district splits in 57 districts created 131 smaller children districts, roughly a quarter of the total districts in my sample. Overall, it increased the number of districts from 440 to 514 districts. As district splits reduce the average distance

between governments and citizens, it may well improve public goods provision.

I interact the remittance proxy with an indicator of district splits to test this mechanism, using the same public goods outcomes as my main specification. This district split indicator takes a value of 1 for parent districts and their children in the year the split happens/the children district is created and thereafter. On the other hand, the indicator takes a value of 0 for the following two scenarios: (i) districts that are never split and (ii) districts that eventually split before the split happened. Most splits occurred outside Java, where the average district area is bigger, and the land is less densely populated. Nevertheless, eight new children districts were also created in Java in the same period. I regress the public school density on the remittance proxy interacted with the district split indicator.

Table 13, Panel A reports the estimation results: some of the effects of remittances on public goods are driven by the creation of public schools in districts that had split as a result of governance decentralization. In a regression with public elementary schools per 10,000 population as the outcome, the interacted term has a coefficient roughly half the size of the remittance proxy coefficient in the main specification (column 1). For public junior high school density, the coefficient for the interaction is roughly a third of the coefficient in the main specification (column 2). For these outcomes, the coefficients for the remittance proxy remain precisely estimated. Taken together, these suggest the positive association between remittances and public goods is stronger in districts that underwent a splitting process.

## 8.4. Election

Politicians may provide public goods to bolster their chances of winning votes during elections. In election years, they may become sensitive to citizen demand for public goods as they campaign for public offices. As remittances increase the use of public facilities such as schools (section 5), mayoral candidates may intensify the construction of public goods in high remittance areas during the election period. Where the accountability mechanism between citizens and elected politicians is weak, the construction of public goods will slacken correspondingly outside of this period.

I test this mechanism by interacting the remittance proxy variable in equation (6) with a dummy for election years. Since 2005, mayors in Indonesian districts have been elected through direct popular elections every five years. Election timing varies across districts for two reasons: (1) appointed mayors by Soeharto before the direct election system had idiosyncratic start years, which carried over when the direct election was introduced, and (2) a massive decentralization reform since 2000 led to the creation of new districts (splitting), where new mayors need to be elected but the timing were not synchronized to the election cycle (Martinez-Bravo et al., 2019). I compile various public information to create a district-year election dummy, which takes a value of 1 if the district holds a direct election in that year and 0 otherwise. Suppose elections are the main mediator of the remittance effects on public goods. In that case, we should expect positive coefficients on the remittance and election interaction term, while the uninteracted remittance proxy variable loses precision. Table 13, Panel B

presents the results where I estimate regressions with the same public goods outcomes (public schools) on the interaction between remittances and election.

I find it unlikely that electoral competition drives the local governments' responses to remittances. The interaction term coefficients in columns 1-3 suggest the responses on public goods provision are no different in election years than in non-election years. In contrast, the coefficients for the remittance proxy are largely unchanged.

Household survey data from Olken et al. (2014) suggests that remittances lead to lower turnout for elections, with statistically significant loewr turnout in mayoral election (Appendix Table A.20). Villagers also complains less about the implementations of anti-poverty programs in the village to the village head. Despite the lower engagement in formal channel, villagers may still interact informally through various community groups. Remittances lead to heterogenous effects in different community group participations, with positive effect on credit and recreation groups and negative effects on production groups (Appendix Table A.21).

# 9.    Conclusion

Do remittances lead to local development? Yes, when we look at the provision of public goods in education and infrastructure in migrant-origin districts in Indonesia. To isolate the causal effect of remittances, I leverage preexisting spatial variations in migration intensity across districts, along with unanticipated currency rate fluctuations in migrants' host countries. This approach builds on the positive relationship between currency rate fluctuations and remittance receipts at the household level that I document using a migrant panel survey. At the district level, I find that the remittance shock leads to an improved provision of public goods: increases in the density of elementary and junior high schools. An analysis of district revenue streams shows little apparent pass-through between remittances to households and the district budget.

This study provides new evidence on the link between remittances and development in the area of origin. With a plausibly exogenous variation of remittances, I investigate the causal impact of remittances on local development. The variations allow me to obtain the effect of migrant incomes separately from the migration decision itself. Furthermore, I take advantage of a rich panel dataset from Indonesian districts to analyze the interactions between migrant households and public finance to provide insight into how remittances might influence public goods provision.

Since remittances can be linked to public goods provision in sectors that are especially salient to migrant households, this is an empirical relationship that can be of interest to policymakers in the migrant-sending area. Stakeholders can direct capital crowd-in from public finance to take further advantage of the remittances windfall. Ultimately, more empirical research will be necessary to provide a full understanding of the pathways between remittances, migration, and development.

# References

Abdih, Yasser et al. (Apr. 2012). "Remittances and Institutions: Are Remittances a Curse?" In: *World Development* 40.4, pp. 657–666. DOI: 10.1016/j.worlddev.2011.09.014.

Adams, Richard H. and John Page (2005). "Do international migration and remittances reduce poverty in developing countries?" In: *World Development* 33.10, pp. 1645–1669. ISSN: 0305750X. DOI: 10.1016/j.worlddev.2005.05.004.

ADB (2006). "Workers' Remittance Flows in Southeast Asia". In: *Asian Development Bank*, p. 262. URL: http://www.adb.org/Documents/Reports/workers-remittance/workers-remittance.pdf.

Adida, Claire L. and Desha M. Girod (2011). "Do migrants improve their hometowns? remittances and access to public services in Mexico, 1995-2000". In: *Comparative Political Studies* 44.1, pp. 3–27. DOI: 10.1177/0010414010381073.

Ahmed, Faisal Z. (2012). "The perils of unearned foreign income: Aid, remittances, and government survival". In: *American Political Science Review* 106.1, pp. 146–165. DOI: 10.1017/S0003055411000475.

— (2013). "Remittances deteriorate governance". In: *Review of Economics and Statistics* 95.4, pp. 1166–1182. ISSN: 00346535. DOI: 10.1162/REST_a_00336.

Alpaslan, Barış et al. (2021). "Economic Effects of Remittances on Migrants' Country of Origin". In: *The Economic Geography of Cross-Border Migration*, pp. 449–483. ISBN: 9783030482916. DOI: 10.1007/978-3-030-48291-6_20. URL: http://link.springer.com/10.1007/978-3-030-48291-6%7B%5C_%7D20.

Ambrosius, Christian (2019). "Government reactions to private substitutes for public goods: Remittances and the crowding-out of public finance". In: *Journal of Comparative Economics* 47.2, pp. 396–415. ISSN: 10957227. DOI: 10.1016/j.jce.2019.02.004. URL: https://doi.org/10.1016/j.jce.2019.02.004.

Bank Indonesia (2018). *Statistik Ekonomi dan Keuangan Indonesia*. Tech. rep. Bank Indonesia, pp. 222–223.

Barajas, Adolfo et al. (2009). "Do Workers' Remittances Promote Economic Growth?" In: *IMF Working Papers* 09.153, p. 1. DOI: 10.5089/9781451873009.001.

Bazzi, Samuel (2012). "International Migration from Indonesia: Stylized Facts". In: *Mimeo*.

— (2017). "Wealth heterogeneity and the income elasticity of migration". In: *American Economic Journal: Applied Economics* 9.2, pp. 219–255. ISSN: 19457790. DOI: 10.1257/app.20150548.

Bazzi, Samuel, Lisa Cameron, et al. (2021). "Information, Intermediaries, and International Migration".

Bazzi, Samuel and Matthew Gudgeon (2021). "The Political Boundaries of Ethnic Divisions". In: *American Economic Journal: Applied Economics* 13.1, pp. 235–266. ISSN: 1945-7782. DOI: 10.1257/app.20190309.

Bellemare, Marc F. and Casey J. Wichman (2020). "Elasticities and the Inverse Hyperbolic Sine Transformation". In: *Oxford Bulletin of Economics and Statistics* 82.1, pp. 50–61. ISSN: 14680084. DOI: 10.1111/obes.12325.

BPS (2005). *Survei Potensi Desa*.

Cassidy, Traviss (2021). "Do Intergovernmental Grants Improve Public Service Delivery in Developing Countries?" In: *Working Paper*.

Cassidy, Traviss and Tejaswi Velayudhan (2022). "Government Fragmentation and Economic Growth". DOI: 10.2139/ssrn.4038546.

Catrinescu, Natalia et al. (2009). "Remittances, Institutions, and Economic Growth". In: *World Development* 37.1, pp. 81–92. ISSN: 0305750X. DOI: 10.1016/j.worlddev.2008.02.004. URL: http://dx.doi.org/10.1016/j.worlddev.2008.02.004.

Chami, Ralph, Adolfo Barajas, et al. (2008). *Macroeconomic Consequences of Remittances*. Occasional Papers 259. Washington, D.C.: International Monetary Fund, pp. 1–84. ISBN: 978-1-58906-701-1. DOI: 10.5089/9781589067011.084. URL: http://elibrary.imf.org/view/IMF084/04374-9781589067011/04374-9781589067011/04374-9781589067011.xml.

Chami, Ralph, Ekkehard Ernst, et al. (2018). "Is there a remittance trap?" In: *Finance and Development* 55.3, pp. 44–47. ISSN: 15645142.

Chamon, Marcos, Romuald Semblat, and Anne Morant (2005). *Samoa: Selected Issues and Statistical Appendix*. Tech. rep. IMF Country Report 05/221.

Clemens, Michael A. and David McKenzie (2018). "Why Don't Remittances Appear to Affect Growth?" In: *Economic Journal* 128.612, F179–F209. ISSN: 14680297. DOI: 10.1111/ecoj.12463.

Cuecuecha, Alfredo and Richard H. Adams Jr. (2016). "Remittances, Household Investment and Poverty in Indonesia". In: *Journal of Finance and Economics* 4.3, pp. 12–31. ISSN: 22914951. DOI: 10.12735/jfe.v4n3p12.

Departemen Pendidikan Nasional (2008). *Petunjuk Pelaksanaan Depdiknas untuk Pembangunan Sekolah Satu Atap (SATAP)*.

Desierto, Desiree A. (2018). "What resource curse? The null effect of remittances on public good provision". In: *Journal of Theoretical Politics* 30.4, pp. 431–450. ISSN: 14603667. DOI: 10.1177/0951629818791033.

Dinkelman, Taryn and Martine Mariotti (2016). "The Long-Run Effects of Labor Migration on Human Capital Formation in Communities of Origin". In: *American Economic Journal: Applied Economics* 8.4, pp. 1–35. DOI: 10.1257/app.20150405.

Doi, Yoko, David McKenzie, and Bilal Zia (2014). "Who you train matters: Identifying combined effects of financial education on migrant households". In: *Journal of Development Economics* 109, pp. 39–55. ISSN: 03043878. DOI: 10.1016/j.jdeveco.2014.03.009.

Duflo, Esther (Sept. 2001). "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment". In: *American Economic Review* 91.4, pp. 795–813. ISSN: 0002-8282. DOI: 10.1257/aer.91.4.795. URL: http://pubs.aeaweb.org/doi/10.1257/aer.91.4.795.

Dustmann. C., Ku. H., Surovtseva. T. (2021). "Real Exchange Rates and the Earnings of Immigrants".

Easton, Malcolm R. and Gabriella R. Montinola (2017). "Remittances, Regime Type, and Government Spending Priorities". In: *Studies in Comparative International Development* 52.3, pp. 349–371. ISSN: 00393606. DOI: 10.1007/s12116-016-9233-7.

Economist, The (2019). "In much of Africa the family is bank, business and welfare state". In: *The Economist* 14 December 2019. URL: https://www.economist.com/middle-east-and-africa/2019/12/12/in-much-of-africa-the-family-is-bank-business-and-welfare-state.

Esteves, Rui and David Khoudour-Casteras (2011). "Remittances, capital flows and financial development during the mass migration period, 1870-1913". In: *European Review of Economic History* 15.3, pp. 443–474. ISSN: 13614916. DOI: 10.1017/S1361491611000037.

Esteves, Rui and David Khoudour-Castéras (2009). "A fantastic rain of gold: European migrants' remittances and balance of payments adjustment during the gold standard period". In: *Journal of Economic History* 69.4, pp. 951–985. ISSN: 00220507. DOI: 10.1017/S002205070900134X.

Frankel, Jeffrey (2011). "Are Bilateral Remittances Countercyclical?" In: *Open Economies Review* 22.1, pp. 1–16. ISSN: 09237992. DOI: 10.1007/s11079-010-9184-y.

Funkhouser, Edward (2012). "Using longitudinal data to study migration and remittances". In: *Handbook of Research Methods in Migration*, pp. 186–206. DOI: 10.4337/9781781005231.00016.

Gibson, John and David McKenzie (2017). "How reliable are survey estimates of remittances? Evidence from a cross-reporting survey exercise". In: *Migration Studies* 5.1, pp. 97–115. ISSN: 20495838. DOI: 10.1093/migration/mnw029.

Gibson, John, David J. McKenzie, and Halahingano Rohorua (2006). "How cost-elastic are remittances? Estimates from Tongan migrants in New Zealand". In: *Pacific Economic Bulletin* 21.1, pp. 112–128. ISSN: 08178038.

Gibson, John, Susan Olivia, et al. (2021). "Which night lights data should we use in economics, and where?" In: *Journal of Development Economics* 149.December 2020, p. 102602. ISSN: 03043878. DOI: 10.1016/j.jdeveco.2020.102602. URL: https://doi.org/10.1016/j.jdeveco.2020.102602.

Giuliano, Paola and Marta Ruiz-Arranz (2009). "Remittances, financial development, and growth". In: *Journal of Development Economics* 90.1, pp. 144–152. ISSN: 03043878. DOI: 10.1016/j.jdeveco.2008.10.005. URL: http://dx.doi.org/10.1016/j.jdeveco.2008.10.005.

Gupta, Sanjeev, Catherine A. Pattillo, and Smita Wagh (2009). "Effect of Remittances on Poverty and Financial Development in Sub-Saharan Africa". In: *World Development* 37.1, pp. 104–115. ISSN: 0305750X. DOI: 10.1016/j.worlddev.2008.05.007. URL: http://dx.doi.org/10.1016/j.worlddev.2008.05.007.

Inman, Robert P. (2008). "The Flypaper Effect". In: *NBER Working Paper* 14579.

Kapur, Devesh (2010). *Diaspora, development, and democracy: The domestic impact of international migration from india*. Princeton University Press.

Khanna, Gaurav et al. (2022). "Abundance from Abroad: Migrant Income and Long-Run Economic Development". In: *Working Paper*.

KNOMAD (Oct. 2017). *Migration and Remittances: Recent Developments and Outlook*. October. World Bank, Washington, DC. DOI: 10.1596/28444.

Le, Thanh (Sept. 2009). "Trade, Remittances, Institutions, and Economic Growth". In: *International Economic Journal* 23.3, pp. 391–408. ISSN: 1016-8737. DOI: 10.1080/10168730903119443. URL: http://www.tandfonline.com/doi/abs/10.1080/10168730903119443.

Lin, Hannah Huidan (2011). "Determinants of Remittances: Evidence from Tonga".

Makovec, Mattia et al. (2018). "Intended versus unintended consequences of migration restriction policies: evidence from a natural experiment in Indonesia". In: *Journal of Economic Geography* 18.4, pp. 915–950. ISSN: 1468-2702. DOI: 10.1093/jeg/lby029.

Martinez-Bravo, Monica, Priya Mukherjee, and Andreas Stegmann (2017). "The Non-Democratic Roots of Elite Capture: Evidence From Soeharto Mayors in Indonesia". In: *Econometrica* 85.6, pp. 1991–2010. ISSN: 0012-9682. DOI: 10.3982/ecta14125.

Mohapatra, Sanket, Dilip Ratha, and Ani Silwal (2012). "Migrant Remittances in Nepal: Impact of Global Financial Crisis and Policy Options". In: *Migration and Remittances during the Global Financial Crisis and Beyond*. Ed. by Ibrahim Sirkeci, Jeffrey H. Cohen, and Dilip Ratha. Chap. 9, p. 121.

Mosley, Layna and David A. Singer (2015). "Migration, labor, and the international political economy". In: *Annual Review of Political Science* 18, pp. 283–301. ISSN: 10942939. DOI: 10.1146/annurev-polisci-020614-094809.

Nekoei, Arash (2013). "Immigrants' labor supply and exchange rate volatility". In: *American Economic Journal: Applied Economics* 5.4, pp. 144–164. ISSN: 19457782. DOI: 10.1257/app.5.4.144.

Olsson, Ola and Michele Valsecchi (2015). "Resource Windfalls and Local Government Behavior: Evidence from a Policy Reform in Indonesia". In: *Working Paper* 635.

Pant, Bhubanesh and Birendra Bahadur Budha (2016). "Remittances and Exchange Rate Linkages: Experiences of Nepal".

Rajan, S. Irudaya and D. Narayana (2012). "The Financial Crisis in the Gulf and Its Impact on South Asian Migration and Remittances". In: *Migration and Remittances during the Global Financial Crisis and Beyond2*. Ed. by Ibrahim Sirkeci, Jeffrey H. Cohen, and Dilip Ratha. The World Bank, p. 67.

Rapoport, Hillel, Sulin Sardoschau, and Arthur Silve (2020). "Migration and Cultural Change". In: *Working Paper*.

Ratha, Dilip (2007). "Leveraging remittances for development". In: *Migration, Trade, and Development*. Ed. by James F. Hollifield, Pia M. Orrenius, and Thomas Osang. Federal Reserve Bank of Dallas, pp. 173–186. ISBN: 0976349434. URL: https://www.dallasfed.org/assets/documents/research/pubs/migration/migration.pdf%7B%5C#%7Dpage=195.

Ratha, Dilip, Supriyo De, et al. (2020). *Covid-19 crisis through a migration lens*. Tech. rep. 32. KNOMAD-World Bank.

Ratha, Dilip, Sonia Plaza, and Caglar Ozden (2016). *Migration and Development: A Role for the World Bank Group*. Tech. rep.

Ratha, Dilip and William Shaw (2007). "South-South Migration and Remittances".

Riester, Andrea (2012). "Resilience of Remittances during the Global Financial Crisis and the Entrenchment of Migration". In: *Migration and Remittances during the Global Financial Crisis and Beyond*. Ed. by Ibrahim Sirkeci, Jeffrey H. Cohen, and Dilip Ratha. The World Bank. Chap. 11, p. 141.

Sirkeci, Ibrahim, Jeffrey H. Cohen, and Dilip Ratha, eds. (2012). *Migration and Remittances during the Global Financial Crisis and Beyond*. ISBN: 9780821388266. DOI: 10.1596/978-0-8213-8826-6.

SMERU (2009). *Monitoring the socioeconomic impact of the 2008/2009 global financial crisis in Indonesia*. Tech. rep.

Theoharides, Caroline (2020). "The unintended consequences of migration policy on origin-country labor market decisions". In: *Journal of Development Economics* 142.July, p. 102271. ISSN: 03043878. DOI: 10.1016/j.jdeveco.2018.07.012. URL: https://doi.org/10.1016/j.jdeveco.2018.07.012%20https://linkinghub.elsevier.com/retrieve/pii/S0304387818310307.

World Bank (2006). *Global Economic Prospects: Economic Implications of Remittances and Migration*. Tech. rep.

— (2017). *Indonesia's Global Workers: Juggling Opportunities and Risks*. Tech. rep., pp. 1–94.

— (2019). *Leveraging Economic Migration for Development: A Briefing for the World Bank Board*. Tech. rep. World Bank.

Yang, Dean (2006). "Why do migrants return to poor countries? Evidence from Philippine migrants' responses to exchange rate". In: *Review of Economics and Statistics* 88.4, pp. 715–735. ISSN: 00346535. DOI: 10.1162/rest.88.4.715.

— (2008). "International Migration, Remittances and Household Investment: Evidence from Philippine Migrants' Exchange Rate Shocks". In: *The Economic Journal* 118.528, pp. 591–630. ISSN: 0013-0133. DOI: 10.1111/j.1468-0297.2008.02134.x.

— (Aug. 2011). "Migrant Remittances". In: *Journal of Economic Perspectives* 25.3, pp. 129–152. ISSN: 0895-3309. DOI: 10.1257/jep.25.3.129. URL: http://pubs.aeaweb.org/doi/10.1257/jep.25.3.129.

Yang, Dean and Claudia A Martínez (2005). "Remittances and Poverty in Migrants' Home Areas: Evidence from the Philippines". In: *International Migration, Remittances, and the Brain Drain*. Ed. by Caglar Ozden and Maurice Schiff. World Bank.

# Figures and Tables
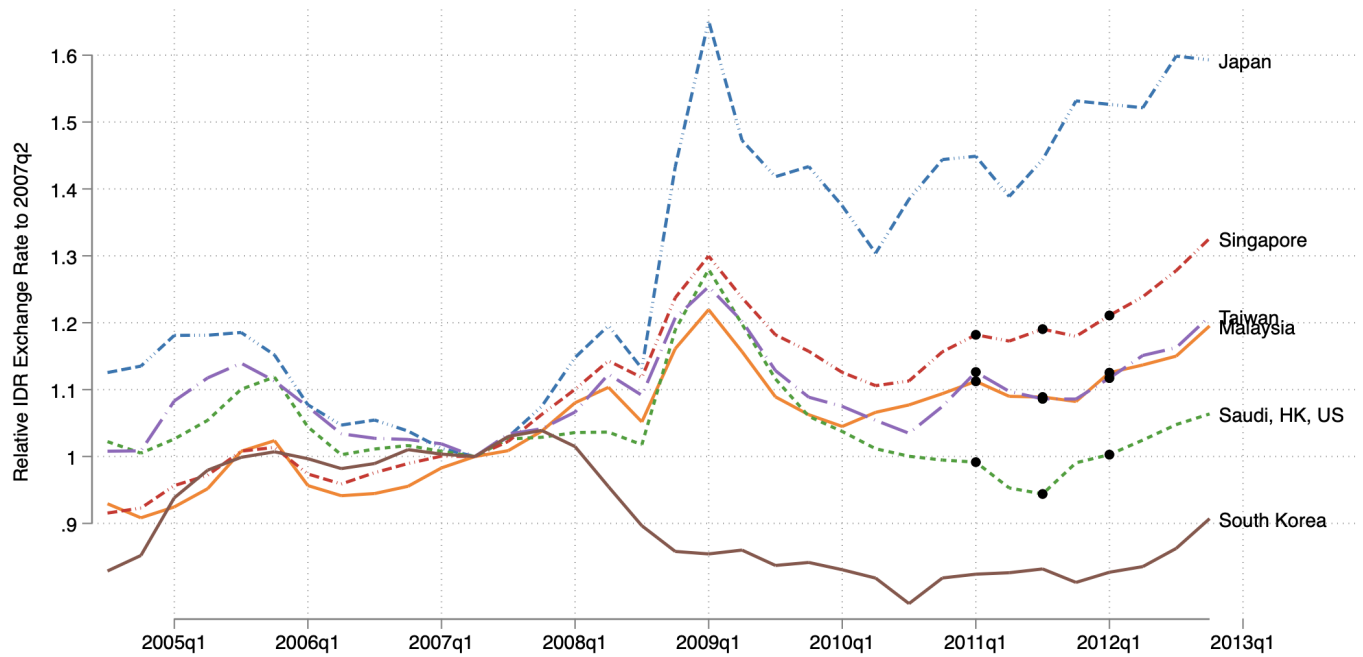


Figure 1: Variations of exchange rate from currencies in selected migration destination countries against Indonesian rupiah (IDR) relative to the prevailing exchange rate in Q2-2007. Quarterly data averaged from monthly exchange rate data provided by Refinitiv Datastream (2021).

Residualized remittance proxy 2008 by district

Legend:
- (.14,.5]
- (.016,.14]
- (-.11,.016]
- [-.9,-.11]
- No data
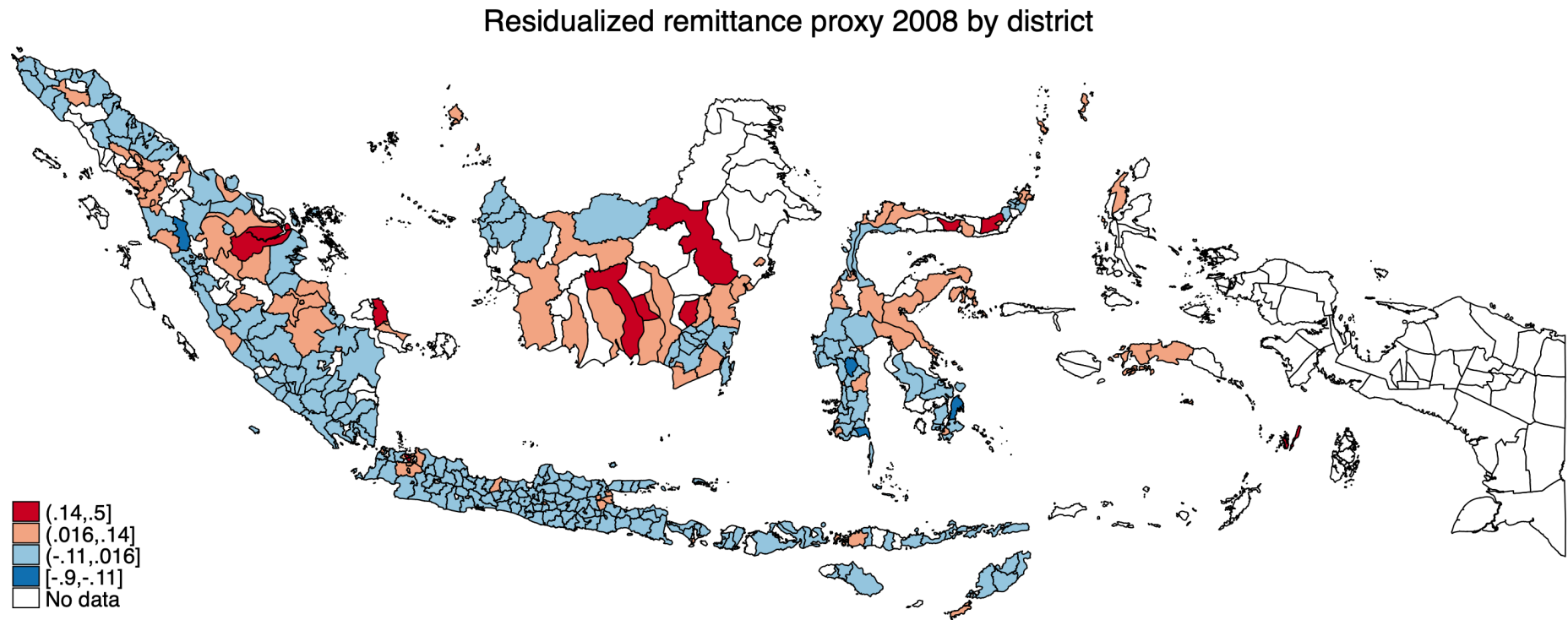
Figure 2: Distribution of residualized remittance proxy in 2008, by kabupaten

## Residualized remittance proxy 2010 by district



(.14,.5]
(.016,.14]
(-.11,.016]
[-.9,-.11]
No data
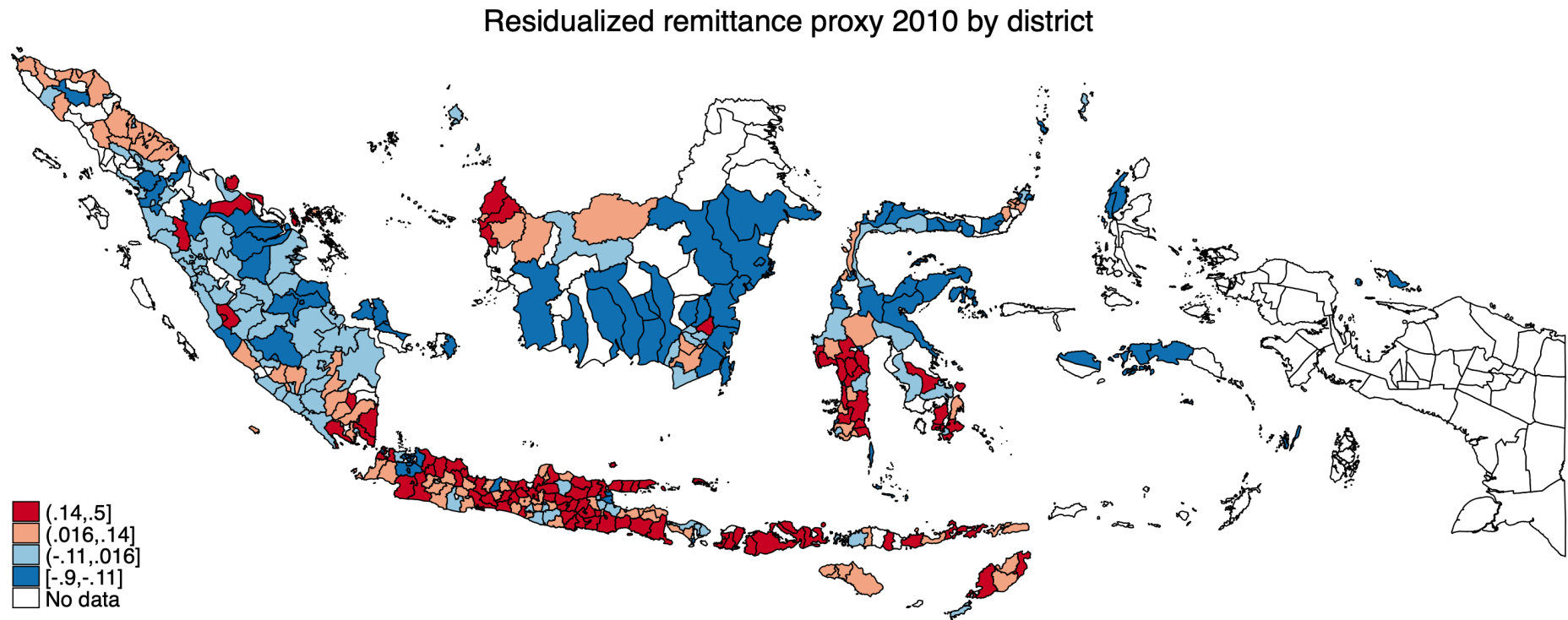
Figure 3: Distribution of residualized remittance proxy in 2010, by kabupaten
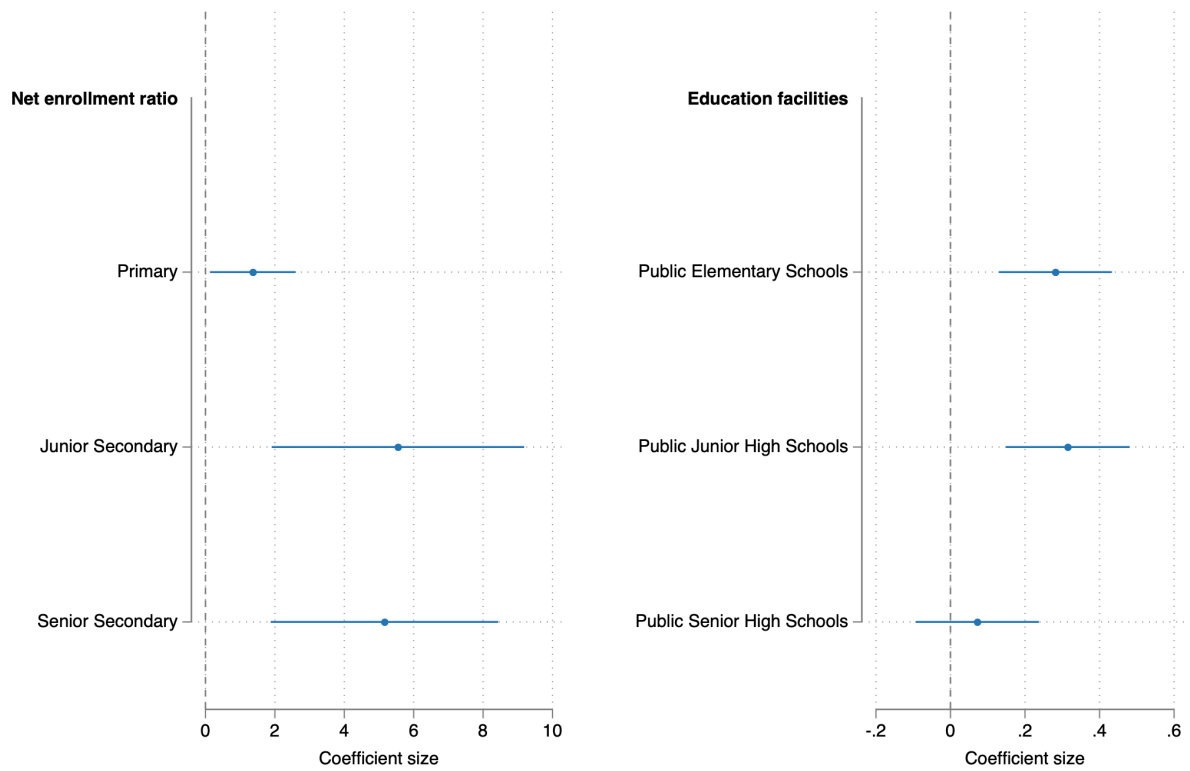
Figure 4: Effects of remittance shocks on education participation and public good provision. Note: each outcome in right panel is expressed in per 10,000 population and standardized. Plot shows point estimates and 90% confidence intervals.

Table 1: Summary statistics

| | Mean | Std dev | Min | Max | Obs. |
|---|---|---|---|---|---|
| **A. Migrant Panel Data from Doi et al. (2014)** | | | | | |
| Remittance (z-score) | -0.00 | 1.00 | -3.87 | 2.76 | 418 |
| Remittance (USD) | 804.60 | 885.59 | 6.87 | 9943.21 | 418 |
| Exchange rate shock (z-score) | 0.00 | 1.00 | -3.05 | 1.70 | 418 |
| Exchange rate shock (%) | 1.01 | 0.02 | 0.96 | 1.04 | 418 |
| | | | | | |
| **B. District-level regressors** | | | | | |
| Migrants (Podes 2005) | 3,185 | 6,494 | 1 | 38,367 | 353 |
| Population (Podes 2005) | 588,456 | 593,375 | 44,699 | 4,004,632 | 353 |
| Migrants per one million people (log) | 7.2 | 1.8 | .16 | 11 | 353 |
| Exchange rate shock (%) | 1.07 | 0.07 | 0.86 | 1.31 | 2419 |
| Remittance proxy (z-score) | -0.00 | 1.00 | -3.92 | 2.47 | 2419 |
| | | | | | |
| **C. Household outcomes** | | | | | |
| Enrollment elementary level (%) | 93.34 | 2.96 | 70.38 | 100.00 | 2393 |
| Enrollment junior secondary level (%) | 66.52 | 9.93 | 20.25 | 91.47 | 2393 |
| Enrollment senior secondary level (%) | 46.03 | 12.84 | 1.35 | 86.62 | 2393 |
| Household per capita expenditure (log IDR) | 12.83 | 0.45 | 11.59 | 14.33 | 2062 |
| Household p.c. expenditure for poorest 20% | 12.08 | 0.38 | 10.85 | 13.10 | 2062 |
| Household p.c. education expenditure (log IDR) | 9.62 | 0.69 | 7.56 | 11.73 | 2062 |
| Poor population (% of population) | 15.13 | 7.79 | 1.52 | 45.18 | 2394 |
| Poverty gap (index) | 2.66 | 1.78 | 0.06 | 13.19 | 2394 |
| | | | | | |
| **D. District Education Supply** | | | | | |
| Public elementary schools per 10,000 people | 6.39 | 3.03 | 0.02 | 17.00 | 2419 |
| Public junior high schools per 10,000 people | 1.18 | 0.86 | 0.00 | 6.56 | 2419 |
| Public high schools per 10,000 people | 0.31 | 0.25 | 0.00 | 1.83 | 2419 |
| District education expenditure (% of total) | 0.35 | 0.11 | 0.00 | 1.00 | 2222 |
| | | | | | |
| **E. Other district outcomes** | | | | | |
| District GDP per capita excl. oil & gas (log IDR) | 15.50 | 0.64 | 12.79 | 18.68 | 2401 |
| Agriculture GDP per capita (log IDR) | 13.98 | 1.03 | 8.57 | 15.68 | 2401 |
| Industry GDP per capita (log IDR) | 13.81 | 2.50 | -12.29 | 18.08 | 2419 |
| Service GDP per capita (log IDR) | 14.40 | 2.36 | -12.29 | 18.57 | 2419 |

Table 2: Effect of currency exchange fluctuations on remittances

|  | (1) Remittance | (2) Remittance | (3) Remittance | (4) Remittance |
|---|---|---|---|---|
| XR shock | 0.050 | 0.378** | 0.410** | 0.406** |
|  | (0.048) | (0.159) | (0.162) | (0.163) |
| Time abroad |  |  | -0.001 | -0.001 |
|  |  |  | (0.000) | (0.000) |
| Time to next Eid |  |  |  | -0.069 |
|  |  |  |  | (0.192) |
| mean(y) | -0.0 | -0.0 | -0.0 | -0.0 |
| FE |  | hh wave | hh wave | hh wave |
| HH | 183 | 183 | 183 | 183 |
| Observations | 418 | 418 | 418 | 418 |

Notes: Standard errors clustered at the individual level in parentheses. Sample is migrant household panel from Doi et al. (2014) who reported receiving remittances in more than one follow-up surveys (March 2011-January 2012). Remittances are total received remittances since migrant departure in the first follow-up, and the difference with previous response in subsequent follow-ups. Remittances are expressed in log Indonesian rupiah (IDR) normalized. XR shock is the exchange rate to IDR relative to March 2011, normalized. Exchange rate data from Refinitiv Datastream. Standard errors are clustered at the household level. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table 3: Correlations between Subsequent Remittances and Past Outcomes

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | A. GDP per capita and household consumption expenditure (log IDR) | | | | | |
| | Household Expenditure | Household exp bottom 20% | GDP Total | GDP Agriculture | GDP Service | GDP Industry |
| Migration×XRShock$_{t+2}$ | 0.01 | -0.00 | -0.00 | -0.00 | 0.23 | 0.20 |
| | (0.02) | (0.02) | (0.02) | (0.02) | (0.16) | (0.16) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.45 | 11.77 | 15.40 | 13.94 | 14.23 | 13.68 |
| Districts | 341 | 341 | 350 | 350 | 353 | 353 |
| Observations | 1522 | 1522 | 1907 | 1907 | 1924 | 1924 |
| | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
| | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| Migration×XRShock$_{t+2}$ | -0.24 | 0.51 | 1.48 | 0.16 | -0.00 | 0.01 |
| | (0.35) | (1.41) | (1.02) | (0.10) | (0.04) | (0.01) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.65 | 65.73 | 44.24 | 6.59 | 1.11 | 0.29 |
| Districts | 350 | 350 | 350 | 353 | 353 | 353 |
| Observations | 1590 | 1590 | 1590 | 1924 | 1924 | 1924 |

Notes: This table reports estimates of a modified version of equation (6), where the exchange rate shock variable (XR-Shock) is shifted forward by two periods. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t+2}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 4: Effects of Remittances on Development Indicators

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | A. Household Expenditures per capita (log IDR) | | | |
| | Average Household | Bottom 20% Household | Education Expenditures | Core Price Index |
| Migration×XRShock$_{t-1}$ | 0.04 | 0.10*** | 0.28*** | 1.90 |
| | (0.04) | (0.03) | (0.09) | (3.19) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 9.62 | 113.76 |
| Districts | 350 | 350 | 350 | 47 |
| Observations | 2060 | 2060 | 2060 | 330 |

| | B. Asset and Poverty | | | |
|---|---|---|---|---|
| | Asset Index | Poverty Rate | Poverty Gap | Gini Coefficient |
| Migration×XRShock$_{t-1}$ | 0.03*** | -3.93*** | -1.29*** | -0.03** |
| | (0.01) | (0.76) | (0.23) | (0.01) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.19 | 15.13 | 2.66 | 0.29 |
| Districts | 327 | 350 | 350 | 319 |
| Observations | 907 | 2392 | 2392 | 1844 |

| | C. GDP per capita (log IDR) | | | |
|---|---|---|---|---|
| | GDP Total | GDP Agriculture | GDP Service | GDP Industry |
| Migration$_d$×XRShock$_{t-1}$ | 0.09* | 0.13*** | 0.24* | 0.19 |
| | (0.05) | (0.04) | (0.14) | (0.14) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 15.50 | 13.98 | 14.40 | 13.81 |
| Districts | 350 | 350 | 353 | 353 |
| Observations | 2399 | 2399 | 2417 | 2417 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 5: Effects on School Enrollment

| | (1) School Enrollment All Levels Among 7-18 yo. | (2) Elementary School Enrollment Among 7-12 yo. | (3) Jun Sec School Enrollment Among 13-15 yo. | (4) Sen Sec School Enrollment Among 16-18 yo. |
|---|---|---|---|---|
| | A. Boys and Girls | | | |
| Migration×XRShock$_{t-1}$ | 2.62*** | 0.83 | 4.37** | 7.48*** |
| | (0.77) | (0.67) | (2.14) | (2.21) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 85.75 | 93.48 | 66.76 | 46.55 |
| Districts | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2411 |
| | B. Boys | | | |
| Migration×XRShock$_{t-1}$ | 3.47*** | 0.10 | 6.29*** | 11.95*** |
| | (0.94) | (0.86) | (2.34) | (2.74) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 85.22 | 93.64 | 65.61 | 46.01 |
| Districts | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2411 |
| | C. Girls | | | |
| Migration×XRShock$_{t-1}$ | 1.68* | 1.58* | 1.87 | 2.82 |
| | (0.91) | (0.83) | (2.86) | (2.78) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 86.33 | 93.32 | 68.01 | 47.20 |
| Districts | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2411 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data from Susenas household surveys. Other outcomes data details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 6: Placebo Effects on School Enrollment

| | (1) Elementary School Enrollment Among 19-24 yo. | (2) Jun Sec School Enrollment Among 19-24 yo. | (3) Sen Sec School Enrollment Among 19-24 yo. |
|---|---|---|---|
| | A. Boys and Girls | | |
| Migration×XRShock$_{t-1}$ | -0.12 | -0.12 | -0.79 |
| | (0.09) | (0.18) | (0.79) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.03 | 0.20 | 2.86 |
| Districts | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 |
| | B. Boys | | |
| Migration×XRShock$_{t-1}$ | -0.10 | 0.11 | -0.34 |
| | (0.10) | (0.20) | (0.88) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.03 | 0.23 | 3.44 |
| Districts | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 |
| | C. Girls | | |
| Migration×XRShock$_{t-1}$ | -0.19 | -0.36 | -1.21 |
| | (0.15) | (0.27) | (0.97) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.03 | 0.16 | 2.29 |
| Districts | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data from Susenas household surveys. Other outcomes data details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 7: Effects on Public Goods Provision

|  | (1) | (2) | (3) |
|---|---|---|---|
|  | A. Public Schools (per 10,000 population) | | |
|  | Elementary (Grade 1-6) | Junior Secondary (Grade 7-9) | Senior Secondary (Grade 10-12) |
| Migration×XRShock$_{t-1}$ | 0.85*** (0.28) | 0.27*** (0.09) | 0.02 (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 |
| Observations | 2417 | 2417 | 2417 |
|  | B. Other Public Goods | | |
|  | Share Household with Electricity | Share Household with Piped Water | Share Villages with Asphalt Roads |
| Migration×XRShock$_{t-1}$ | 0.05*** (0.02) | 0.09*** (0.03) | 0.25** (0.10) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.89 | 0.16 | 0.70 |
| Districts | 350 | 353 | 308 |
| Observations | 2175 | 2411 | 831 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 8: Effects on Development and Education Outcomes, Robustness with Main Trade Commodities

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | A. Development Indicators | | | |
| | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates* | | | | | | |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
| | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. With Commodity Trade Controls (Oil and Natural Gas, Palm Oil)* | | | | | | |
| $\text{Migration} \times \text{XRShock}_{t-1}$ | 0.06 | 0.11*** | 0.03*** | -4.14*** | 0.06 | 0.13*** |
| | (0.04) | (0.03) | (0.01) | (0.75) | (0.05) | (0.04) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |
| | | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | |
| | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates* | | | | | | |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
| | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. With Commodity Trade Controls (Oil and Natural Gas, Palm Oil)* | | | | | | |
| $\text{Migration} \times \text{XRShock}_{t-1}$ | 0.72 | 5.17** | 8.00*** | 0.90*** | 0.31*** | 0.03 |
| | (0.69) | (2.11) | (2.12) | (0.29) | (0.09) | (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition of two control variables on the right hand side to account for commodity trades. The variables are $\text{OilGas}_d^0 \times \text{XROilGas}_{t-1}$ and $\text{PalmOil}_d^0 \times \text{XRPalmOil}_{t-1}$. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable $\text{Migration}_d \times \text{XRShock}_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$. Standard errors clustered at the district level in parentheses.

Table 9: Effects on Development and Education Outcomes, Robustness with Island-specific Trends

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | A. Development Indicators | | | | | |
|  | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| **A1. Main Estimates** | | | | | | |
| $\text{Migration}^o_d \times \text{XRShock}_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| **A2. With Island Trends** | | | | | | |
| $\text{Migration} \times \text{XRShock}_{t-1}$ | 0.05 | 0.11*** | 0.05*** | -4.14*** | 0.05 | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.85) | (0.05) | (0.05) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |

|  | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
|---|---|---|---|---|---|---|
|  | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| **B1. Main Estimates** | | | | | | |
| $\text{Migration}^o_d \times \text{XRShock}_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
|  | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| **B2. With Island Trends** | | | | | | |
| $\text{Migration} \times \text{XRShock}_{t-1}$ | 0.77 | 5.03** | 6.74*** | 0.66** | 0.25*** | 0.04** |
|  | (0.78) | (2.21) | (2.40) | (0.30) | (0.08) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition island trends on the right hand side. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$. Standard errors clustered at the district level in parentheses.

Table 10: Effects on Development and Education Outcomes, Robustness with Baseline Trends

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | A. Development Indicators | | | | | |
|  | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates* | | | | | | |
| Migration$^o_d$ × XRShock$_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. With Baseline Trends – 2004 Agriculture GDP per capita* | | | | | | |
| Migration×XRShock$_{t-1}$ | 0.01 | 0.09*** | 0.03** | -2.27*** | 0.11** | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.82) | (0.05) | (0.05) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
|  | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates* | | | | | | |
| Migration$^o_d$ × XRShock$_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
|  | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. With Baseline Trends – 2004 school density* | | | | | | |
| Migration×XRShock$_{t-1}$ | 1.03 | 5.16** | 10.20*** | 1.03*** | 0.32*** | 0.03 |
|  | (0.72) | (2.27) | (2.01) | (0.31) | (0.10) | (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition of baseline trends on the right hand side. In Panel A the baseline trend is the 2004 Agriculture GDP per capita interacted with a set of year dummies. In Panel B the baseline trend is 2004 public schools per 10,000 population interacted with a set of year dummies, each level of schooling added separately. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 11: Effects of Remittances on Education Supply

| | (1) | (2) | (3) |
|---|---|---|---|
| | A. Public Schools (per 10,000 population) | | |
| | Elementary (Grade 1-6) | Junior Secondary (Grade 7-9) | Senior Secondary (Grade 10-12) |
| Migration × XRShock$_{t-1}$ | 0.65** | 0.28*** | 0.03 |
| | (0.31) | (0.10) | (0.03) |
| Migration × XRShock$_{t-1}$ × $EduBudget_{t-2}$ | 0.45* | 0.13* | 0.00 |
| | (0.26) | (0.08) | (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep.Var Mean | 6.45 | 1.20 | 0.32 |
| Districts | 341 | 341 | 341 |
| Observations | 1999 | 1999 | 1999 |
| | B. Challenges in Jr Secondary Education | | |
| | Facility Inadequate | Cost Unaffordable | Facility over cost |
| Migration x $XRShock_{t-1}$ | 0.353 | -0.506* | 0.206* |
| | (0.373) | (0.286) | (0.119) |
| Village FE, Survey FE | ✓ | ✓ | ✓ |
| mean(y) | 0.791 | 0.365 | 0.244 |
| Villages | 572 | 572 | 572 |
| Observations | 6886 | 6886 | 6886 |
| | C. Jr. Secondary Type and Facilities | | |
| | Jr Sec Attached to Elementary | Classrooms per Jr Sec School | Teachers per Jr Sec School |
| Migration×XRShock$_{t-1}$ | 0.03*** | -0.45*** | -0.57** |
| | (0.01) | (0.15) | (0.27) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.08 | 10.91 | 19.43 |
| Districts | 353 | 353 | 353 |
| Observations | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6). Panel A include interaction terms with lagged education expenditure budget as a share of total expenditures. Sample Panel A and C are 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Sample Panel B is Village Head Survey from Olken et al. (2014) and Cahyadi et al. (2020). Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 12: Effects on District Revenue Streams

|  | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
|  | Central Taxes (DBH) | Local Taxes (PAD) | Natural Resources | Special Grant (DAK) | Formulaic Base Grant (DAU) |
| | A. District Revenue Streams (log IDR) | | | | |
| Migration×XRShock$_{t-1}$ | -1.58 | -1.21 | -0.23 | 0.57 | 1.82 |
|  | (1.15) | (0.74) | (2.20) | (1.71) | (1.26) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 23.98 | 24.01 | 21.01 | 23.60 | 26.38 |
| Districts | 345 | 345 | 345 | 345 | 345 |
| Observations | 2324 | 2324 | 2324 | 2324 | 2324 |
| | B. Revenues as share of total (%) | | | | |
| Migration×XRShock$_{t-1}$ | -0.05** | -0.01 | 0.03 | 0.03*** | -0.01 |
|  | (0.02) | (0.01) | (0.02) | (0.01) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.07 | 0.07 | 0.06 | 0.07 | 0.62 |
| Districts | 345 | 345 | 345 | 345 | 345 |
| Observations | 2320 | 2320 | 2320 | 2320 | 2320 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d$×XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table 13: Effects of Remittances, Interaction with District Split and Election Indicators

| | (1) Public Elementary (Grade 1-6) | (2) Public Junior Secondary (Grade 7-9) | (3) Public Senior Secondary (Grade 10-12) |
|---|---|---|---|
| | A. District Splitting | | |
| Migration $\times$ XRShock$_{t-1}$ | 0.52*** (0.18) | 0.18** (0.07) | 0.1 (0.02) |
| Migration $\times$ XRShock$_{t-1} \times 1[Split]_t$ | 0.41** (0.16) | 0.094* (0.056) | -0.01 (0.01) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 |
| Observations | 2417 | 2417 | 2417 |
| | B. Election | | |
| Migration $\times$ XRShock$_{t-1}$ | 0.87*** (0.28) | 0.28*** (0.09) | 0.02 (0.03) |
| Migration $\times$ XRShock$_{t-1} \times 1[Election]_t$ | -0.01 (0.02) | -0.00 (0.01) | -0.00 (0.00) |
| District FE, Year FE | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 |
| Observations | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6). Panel A includes interaction terms with an indicator of whether the district has split into smaller districts, Panel B includes interaction terms with an indicator of whether there is a district-level election in the year. Sample are 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable Migration$_d \times$XRShock$_{t-1}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Other outcomes data sources and details as described in Appendix A.1. * p$\leq$ 0.10, ** p$\leq$ 0.05, *** p$\leq$ 0.01. Standard errors clustered at the district level in parentheses.

# Appendix
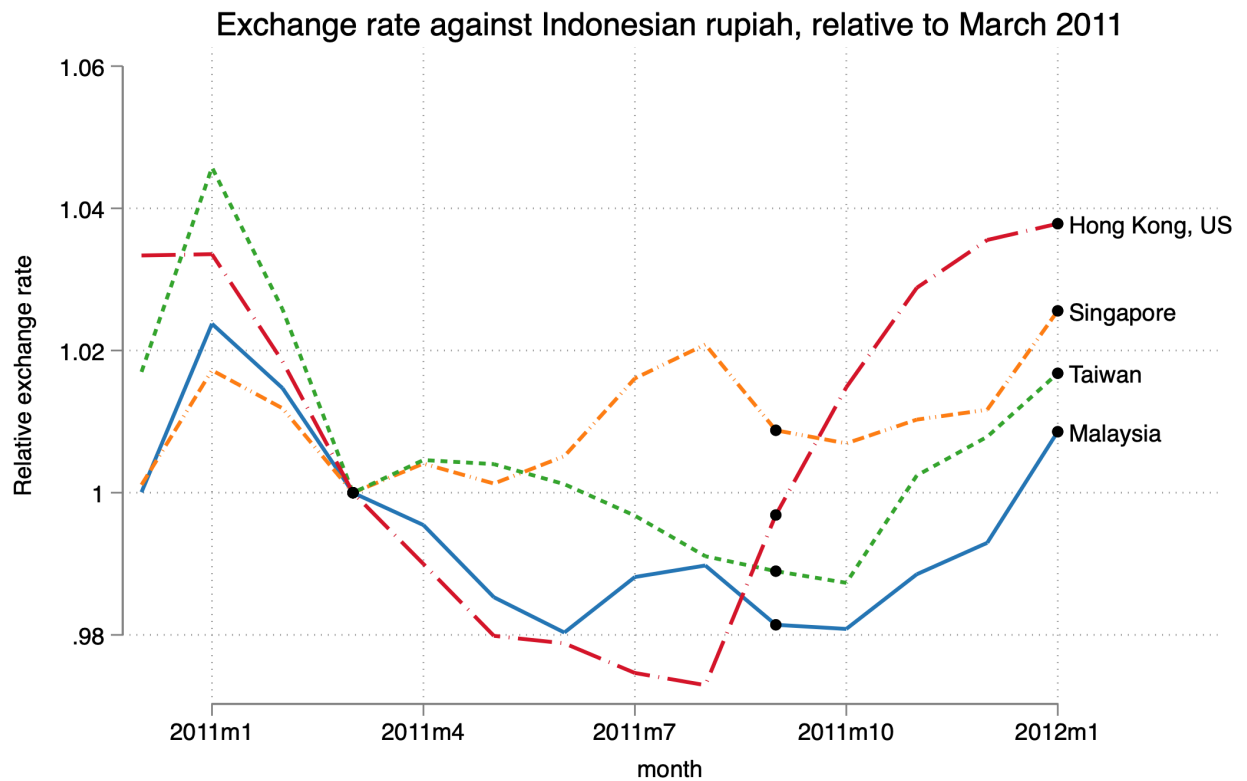


Figure A.1: Monthly exchange rate variation for year 2011, by destination countries. Data are from Refinitif Datastream (2021)

Table A.1: Data sources

| Variables | Years | Source |
|---|---|---|
| School establishment | 2005-2012 | Data Pokok Pendidikan (Dapodik) 2018, an administrative registry maintained by the Ministry of Education and Culture. Covers the universe of all primary and secondary schools under the purview of the MoEC in Indonesia. Has year of establishment, location (province and district), level (primary, junior secondary, senior secondary), and status (public or private). |
| Population | 2005-2011 | World Bank Indo-Dapoer, aggregating information from Population Census 2000, 2010 and population projection in intervening years from BPS. Because Indo-Dapoer has observations from post-split children district backcasted to years before the split for other variables, missing population variables for some districts are filled in using its earliest available year population variable. |
| Exchange Rate data | 2005-2011 | Refinitiv Datastream provides monthly exchange rates to Indonesian Rupiah from the following currencies: US Dollar, Euro, British Pound, Singapore Dollar, Canadian Dollar, Swiss Franc, Danish Kroner, Malaysian Ringgit, New Zealand Dollar, Norwegian Kroner, Philippines Peso, Thai Baht, and Australian Dollar. Currencies to other migration destination countries not listed above are only available against US Dollar, British Pound, and Euro. These are converted to the exchange rate to Indonesian rupiah using the prevailing USD-IDR, GBP-IDR, and EUR-IDR exchange rates for the same month. This data is supplemented with data from Pacific Exchange Rate Service for Kuwait Dinar and Bahrain Dirham to Indonesian Rupiah, and Bloomberg Terminal for Syrian Pound and Solomon Islander Dollars to US Dollar. |
| Migration Intensity | 2005, 2008, 2011 | Potensi Desa (Podes), a tri-annual survey of all villages in Indonesia. Informations about the number of Overseas Indonesian Workers (TKI) were provided by village heads, and aggregated to the district level. TKI information was asked by gender (male and female) for 2005 and 2011 Podes, but was only asked in total for 2008. Migration Intensity is expressed as the natural logarithm of the ratio of total migrant population in the district to total population in the district. Population denominator uses population estimate from Podes in the same year. |
| Migrant stock | 2005-2011 | BNP2TKI Soekarno Hatta migrant terminal arrival records March 2008- March 2011. Collects individual-level information: migrant home district, country of work, date of departure, date of arrival, gender, and reason for return. |
| School Enrollment, Poverty, GDP, Electricity | 2005-2011 | World Bank Indo-Dapoer, aggregating information from Susenas household surveys. |
| Tax collection | 2005-2011 | Ministry of Finance, Direktorat Jenderal Perimbangan Keuangan. Dataset is downloadable at http://djpk.kemenkeu.go.id/ |
| Commodity export | 2007 | Indonesia Foreign Trade Statistics |

## Table A.2: Summary statistics – Supplementary

| | Mean | Std dev | Min | Max | Obs. |
|---|---|---|---|---|---|
| **A. Other Migrant Panel Variables from Doi et al. (2014)** | | | | | |
| Remittances since departure (IDR) | 7,149,120 | 7,953,597 | 60,000 | 90,000,000 | 418 |
| Remittance transactions since departure | 4.54 | 3.79 | 1 | 23 | 418 |
| Work in Hong Kong | 0.58 | 0.49 | 0 | 1 | 418 |
| Work in Taiwan | 0.41 | 0.49 | 0 | 1 | 418 |
| Work in Singapore | 0.01 | 0.12 | 0 | 1 | 418 |
| IDR exchange rate per 1 Hong Kong Dollar | 1138.23 | 21.06 | 1095 | 1166 | 242 |
| IDR exchange rate per 1 Taiwan New Dollar | 297.15 | 3.66 | 284 | 302 | 170 |
| IDR exchange rate per 1 Singapore Dollar | 6990.25 | 72.87 | 6903 | 7080 | 6 |
| Days since migration departure | 160.81 | 217.18 | 0 | 1100 | 418 |
| Month to next Eid al-Fitr | 7.81 | 2.46 | 1 | 11 | 418 |
| | | | | | |
| **B1. Alternative district-level regressors** | | | | | |
| Migrants (Podes 2008) | 3,811 | 7,995 | 0 | 57,067 | 353 |
| Population (Podes 2008) | 591,363 | 583,632 | 47,824 | 4,219,324 | 353 |
| Migrants (Podes 2011) | 3,857 | 8,412 | 0 | 55,459 | 353 |
| Population (Podes 2011) | 604,238 | 613,640 | 47,591 | 4,626,937 | 353 |
| Migrants 2008 per one million people (log) | 7.3 | 1.9 | .47 | 12 | 352 |
| Migrants 2011 per one million people (log) | 7.2 | 2 | .34 | 12 | 348 |
| District Oil & Gas Revenues 2005 (log IDR) | 11.7 | 11 | 0 | 28.5 | 353 |
| Palm oil plantation (Podes 2003, in ha.) | 6,382 | 22,565 | 0 | 299,541 | 291 |
| | | | | | |
| **B2. Time-varying regressors common to all districts** | | | | | |
| Exchange Rate shock, Oil & Gas export dest. | 1.13 | 0.10 | 1.00 | 1.29 | 8 |
| Exchange Rate shock, Palm Oil export dest. | 1.02 | 0.06 | 0.95 | 1.10 | 8 |
| | | | | | |
| **C. Other Household Outcomes** | | | | | |
| Ownership of a motorcycle | 0.59 | 0.17 | 0.11 | 0.94 | 928 |
| Ownership of a car | 0.07 | 0.05 | 0.00 | 0.28 | 580 |
| Ownership of a bicycle | 0.34 | 0.21 | 0.00 | 0.85 | 928 |
| Ownership of a refrigerator | 0.31 | 0.17 | 0.02 | 0.83 | 928 |
| Ownership of a 12-kg LPG canister | 0.14 | 0.12 | 0.00 | 0.65 | 928 |
| Household water from piped water | 0.16 | 0.15 | 0.00 | 0.95 | 2413 |
| Household water from a protected well | 0.29 | 0.18 | 0.00 | 0.82 | 2413 |
| Households with electricity | 0.89 | 0.15 | 0.10 | 1.00 | 2177 |
| Villages with asphalt road (%) | 69.54 | 24.15 | 3.39 | 100.00 | 873 |
| | | | | | |
| **D. Other District-level Education Characteristics** | | | | | |
| Public elementary schools | 323.88 | 250.95 | 1 | 1534 | 2419 |
| Public junior high schools | 45.57 | 23.29 | 0 | 152 | 2419 |
| Public high schools | 12.35 | 7.45 | 0 | 45 | 2419 |
| District education expenditure (log IDR) | 25.61 | 3.27 | 0.00 | 28.00 | 2222 |
| | | | | | |
| **E. District finances** | | | | | |
| Total district revenues | 27.10 | 1.25 | 0.00 | 29.47 | 2326 |
| Tax sharing rev. with central govt (log IDR) | 23.98 | 3.19 | 0.00 | 28.64 | 2326 |
| Own district rev. (local taxes & fees, log IDR) | 24.01 | 2.55 | 0.00 | 28.46 | 2326 |
| Share central govt tax sharing out of total rev. | 0.07 | 0.06 | 0.00 | 0.86 | 2322 |
| Share own revenues out of total rev. | 0.07 | 0.06 | 0.00 | 1.00 | 2322 |

Table A.3: Major migration destination countries

|    | Country | Migrants Arrival 2008-2010 |
|----|---------|---------------------------|
| 1  | Saudi | 563,016 |
| 2  | UAE | 83,629 |
| 3  | Kuwait | 74,101 |
| 4  | Malaysia | 73,346 |
| 5  | Taiwan | 41,332 |
| 6  | Singapore | 32,096 |
| 7  | Jordan | 31,139 |
| 8  | Oman | 27,966 |
| 9  | Qatar | 25,373 |
| 10 | Hong Kong | 19,067 |
| 11 | Syria | 9,057 |
| 12 | Bahrain | 8,944 |
| 13 | Brunei | 5,755 |
| 14 | Samoa | 2,040 |
| 15 | Egypt | 1,108 |
| 16 | United Kingdom | 1,080 |
| 17 | South Korea | 718 |
| 18 | Macao SAR | 638 |
| 19 | Yemen | 575 |
| 20 | Malawi | 538 |
|    | Total | 1,006,241 |
|    | Top 20 subtotal | 99% |

Table A.4: Remittance Estimates from Survey Data

| Publication | Survey year | N | Average surveyed remittances | unit | Average frequency | Estimated annual remittances | Destinations | Survey Locations |
|---|---|---|---|---|---|---|---|---|
| ADB (2006) | 2005 | 647 | USD 376 | per transaction | 7 | USD 2,390 | Hong Kong, Japan, Malaysia, Singapore | Hong Kong, Japan, Malaysia, Singapore |
| World Bank (2010) | 2008 | 3,368 | USD 200 | per transaction | N/A | N/A | Saudi Arabia and Malaysia | East Java, NTB, NTT |
| Doi et al. (2014) | 2011 | 400 | USD 1,119 | since departure | 4 | USD 1,119 | Hong Kong, Taiwan, Malaysia, Singapore | East Java |
| World Bank (2017) | 2013 | 4,660 | USD 82 | monthly | N/A | USD 984 | Middle East, Malaysia | 15 Indonesian provinces |
| Bazzi et al. (2021) | 2019 | 2,705 | USD 183 | monthly | N/A | USD 2196 | Taiwan, Hongkong, Singapore, UAE, Saudi, Malaysia, Qatar, and others | West Java, East Java, Central Java |

Table A.5: Effect of currency exchange fluctuations on remittances frequency

|  | (1) Remittances frequency | (2) Remittances frequency | (3) Remittances frequency | (4) Remittances frequency |
|---|---|---|---|---|
| XR shock | 1.400*** | 0.896* | 0.903* | 0.929* |
|  | (0.191) | (0.502) | (0.510) | (0.504) |
| Time abroad |  |  | -0.000 | -0.000 |
|  |  |  | (0.001) | (0.001) |
| Time to next Eid |  |  |  | 0.478 |
|  |  |  |  | (0.396) |
| mean(y) | 4.5 | 4.5 | 4.5 | 4.5 |
| FE |  | hh wave | hh wave | hh wave |
| HH | 183 | 183 | 183 | 183 |
| Observations | 418 | 418 | 418 | 418 |

Notes: Standard errors clustered at the individual level in parentheses. Sample is migrant household panel from Doi et al. (2014) who reported receiving remittances in more than one follow-up surveys (March 2011-January 2012). Remittances are total received remittances since migrant departure in the first follow-up, and the difference with previous response in subsequent follow-ups. Remittances are expressed in log Indonesian rupiah (IDR), and XR shock is the exchange rate to IDR relative to March 2011. Exchange rate data from Refinitiv Datastream. Standard errors are clustered at the household level. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.6: Effects on School Enrollment Alternative Measure

|  | (1) Elem. School enrolment | (2) Jun. Sec. School enrolment | (3) Sen. Sec. School enrolment |
|---|---|---|---|
| Migration x $XRShock^{t-1}$ | 1.37* | 5.55** | 5.16*** |
|  | (0.75) | (2.21) | (1.99) |
| mean(y) | 93.34 | 66.52 | 46.02 |
| Clusters | 350 | 350 | 350 |
| Observations | 2391 | 2391 | 2391 |

Notes: Standard errors clustered at the kabupaten level in parentheses. Sample is 2005-2012 unbalanced panel of Indonesian districts in the World Bank Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration intensity is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data sources as described in Appendix A.1. All regressions include district and year fixed effects. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.7: Effects on school enrollment

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | Elem | Jun Sec | Sen Sec |
| | School | School | School | School |
| | Enrollment | Enrollment | Enrollment | Enrollment |
| | among | among | among | among |
| | 7-18 yo. | 7-12 yo. | 13-15 yo. | 16-18 yo. |
| | (weighted) | (weighted) | (weighted) | (weighted) |
| A. Boys and Girls | | | | |
| Migration x $XRShock^{t-1}$ | 2.5*** | 1.0 | 4.6** | 6.1*** |
| | (0.8) | (0.7) | (2.2) | (2.0) |
| | | | | |
| B. Boys | | | | |
| Migration x $XRShock^{t-1}$ | 3.5*** | 0.1 | 5.9** | 10.2*** |
| | (0.9) | (0.9) | (2.4) | (2.6) |
| | | | | |
| C. Girls | | | | |
| Migration x $XRShock^{t-1}$ | 1.5 | 1.9** | 2.6 | 1.8 |
| | (0.9) | (0.8) | (2.8) | (2.6) |
| | | | | |
| mean(y) boys and girls | 85.8 | 93.5 | 66.8 | 46.5 |
| Districts | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2411 |

Notes: Each coefficient is from a separate regression. Standard errors clustered at the kabupaten level in parentheses. Sample is 2005-2012 unbalanced panel of Indonesian districts in the World Bank Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration intensity is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data sources as described in Appendix A.1. All regressions include district and year fixed effects. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.8: Effects on Household Assets Ownership

|  | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
|  | Motorbike | Car | Bicycles | Fridge | LPG 12kg |
| Migration x $XRShock^{t-1}$ | 0.03** | 0.04 | 0.07*** | 0.15*** | 0.10*** |
|  | (0.02) | (0.04) | (0.02) | (0.02) | (0.02) |
| mean(y) | 0.59 | 0.07 | 0.35 | 0.31 | 0.14 |
| Districts | 327 | 253 | 327 | 327 | 327 |
| Observations | 907 | 506 | 907 | 907 | 907 |

Notes: Standard errors clustered at the kabupaten level in parentheses. Sample is 2005-2012 unbalanced panel of Indonesian districts in the World Bank Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration intensity is the natural log of ratio between the total migrant and total population from the 2005 village census. Outcomes data sources as described in Appendix A.1. All regressions include district and year fixed effects. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table A.9: Use of increased remittances

|  | (1) | (2) | (3) Migration | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | Electronics | Durables | loan | School | Consumption | Other |
| XR shock | 0.58*** | 0.43** | 0.44* | 0.15 | -0.10 | 0.96** |
|  | (0.21) | (0.19) | (0.26) | (0.32) | (0.39) | (0.39) |
| mean(y) | 1.0 | 0.7 | 2.4 | 4.8 | 7.6 | 5.8 |
| FE | hh | hh | hh | hh | hh | hh |
| HH | 183 | 183 | 183 | 183 | 183 | 183 |
| Observations | 418 | 418 | 418 | 418 | 418 | 418 |

Notes: Standard errors clustered at the individual level in parentheses. Sample is migrant household panel from Doi et al. (2014) who reported receiving remittances in more than one follow-up surveys (March 2011-January 2012). Remittances are total received remittances since migrant departure in the first follow-up, and the difference with previous response in subsequent follow-ups. Remittances are expressed in log Indonesian rupiah (IDR), and XR shock is the exchange rate to IDR relative to March 2011. Exchange rate data from Refinitiv Datastream. Standard errors are clustered at the household level. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table A.10: Major trading partners for Indonesia

|   | Country | Export value 2007 US\$ |   | Country | Import value 2007 US\$ |
|---|---------|------------------------|---|---------|------------------------|
| 1 | Japan | 23,632,796,842 | 1 | Singapore | 9,839,794,842 |
| 2 | USA | 11,614,229,704 | 2 | China | 8,557,877,121 |
| 3 | Singapore | 10,501,617,286 | 3 | Japan | 6,526,673,892 |
| 4 | China | 9,675,512,723 | 4 | Malaysia | 6,411,927,287 |
| 5 | South Korea | 7,582,734,443 | 5 | USA | 4,787,174,352 |
| 6 | Malaysia | 5,096,063,502 | 6 | Thailand | 4,287,065,396 |
| 7 | India | 4,943,905,977 | 7 | Saudi | 3,372,825,227 |
| 8 | Australia | 3,394,557,284 | 8 | South Korea | 3,196,686,587 |
| 9 | Thailand | 3,054,275,983 | 9 | Australia | 3,004,011,966 |
| 10 | Netherlands | 2,749,459,736 | 10 | Germany | 1,982,022,283 |
| 11 | Taiwan | 2,596,730,725 | 11 | Brunei | 1,864,720,849 |
| 12 | Germany | 2,316,013,330 | 12 | Kuwait | 1,705,790,311 |
| 13 | Spain | 1,906,222,913 | 13 | India | 1,609,606,816 |
| 14 | UK | 1,454,164,863 | 14 | France | 1,443,687,264 |
| 15 | Italy | 1,380,002,074 | 15 | Canada | 1,055,580,227 |
|   | Total | 114,100,890,751 |   |   | 74,473,430,118 |
|   | Subtotal top 15 | 81% |   |   | 80% |

Table A.11: Migration destination and trade countries

|   | (1) Export weight 2007 (kg) | (2) Export weight 2007 (kg) | (3) Export value 2007 (USD) | (4) Export value 2007 (USD) |
|---|------|------|------|------|
| Migrants 2008-2010 | 5160.48 | -12237.45 | 2946.94 | -1425.55 |
|   | (12286.29) | (11807.95) | (3755.16) | (3705.65) |
| Africa |   | -7.41e+09*** |   | -1.97e+09*** |
|   |   | (1.43e+09) |   | (4.47e+08) |
| Oceania |   | -7.28e+09*** |   | -1.85e+09*** |
|   |   | (1.74e+09) |   | (5.45e+08) |
| Americas |   | -7.27e+09*** |   | -1.71e+09*** |
|   |   | (1.46e+09) |   | (4.59e+08) |
| Europe |   | -6.94e+09*** |   | -1.74e+09*** |
|   |   | (1.42e+09) |   | (4.46e+08) |
| Constant | 1.57e+09*** | 7.52e+09*** | 5.17e+08*** | 2.01e+09*** |
|   | (4.89e+08) | (1.09e+09) | (1.49e+08) | (3.42e+08) |
| Observations | 215 | 215 | 215 | 215 |

Notes: Standard errors in parentheses. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.10.

Table A.12: Correlation between commodity production and migration

|   | (1) Oil and Gas Revenue 2005 (log IDR) | (2) Oil and Gas Revenue 2005 (log IDR) | (3) Palm oil Area 2003 (log Ha) | (4) Palm oil Area 2003 (log Ha) |
|---|------|------|------|------|
| Migration Intensity | 0.34 | 0.15 | -0.22 | 0.16 |
|   | (0.68) | (0.090) | (0.18) | (0.11) |
| FE |   | prop |   | prop |
| Clusters | 31 | 31 | 31 | 31 |
| Observations | 384 | 384 | 384 | 384 |

Notes: Standard errors clustered at the province level in parentheses. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.13: Effects on Development and Education Outcomes, Interaction with pre-period commodity production

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | A. Development Indicators | | | | | |
|  | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. With Oil and Gas Revenue Share 2005* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.16*** | 0.20*** | 0.02 | -3.77*** | 0.06 | 0.13** |
|  | (0.06) | (0.05) | (0.02) | (1.04) | (0.06) | (0.07) |
| $Migration_d^o \times XRShock_{dt-1} \times OilGas_d^o$ | -0.01*** | -0.01*** | 0.00 | -0.02 | 0.00 | -0.00 |
|  | (0.00) | (0.00) | (0.00) | (0.07) | (0.01) | (0.00) |
| *A2. With Palm Oil Plantation 2003* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.05 | 0.10*** | 0.03** | -4.69*** | 0.11*** | 0.15*** |
|  | (0.04) | (0.03) | (0.01) | (0.77) | (0.04) | (0.04) |
| $Migration_d^o \times XRShock_{dt-1} \times PalmOil_d^o$ | -0.00 | 0.01 | 0.01** | 0.30 | -0.01 | -0.01 |
|  | (0.01) | (0.01) | (0.00) | (0.22) | (0.02) | (0.01) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |

|  | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
|---|---|---|---|---|---|---|
|  | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. With Oil and Gas Revenue Share 2005* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.77 | 6.47** | 11.37*** | 1.33*** | 0.63*** | 0.05 |
|  | (0.95) | (2.90) | (2.77) | (0.46) | (0.13) | (0.04) |
| $Migration_d^o \times XRShock_{dt-1} \times OilGas_d^o$ | 0.01 | -0.19 | -0.36* | -0.04* | -0.03*** | -0.00 |
|  | (0.06) | (0.18) | (0.19) | (0.02) | (0.01) | (0.00) |
| *B2. With Palm Oil Plantation 2003* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.56 | 5.91** | 9.38*** | 0.92*** | 0.32*** | 0.04 |
|  | (0.71) | (2.37) | (2.06) | (0.29) | (0.09) | (0.02) |
| $Migration_d^o \times XRShock_{dt-1} \times PalmOil_d^o$ | 0.19 | -0.78* | -0.91* | -0.07 | -0.03* | -0.01*** |
|  | (0.16) | (0.43) | (0.47) | (0.06) | (0.02) | (0.00) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition of baseline trends on the right hand side. In Panel A the baseline trend is the 2004 Agriculture GDP per capita interacted with a set of year dummies. In Panel B the baseline trend is 2004 public schools per 10,000 population interacted with a set of year dummies, each level of schooling added separately. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p$\leq$ 0.10, ** p$\leq$ 0.05, *** p$\leq$ 0.01. Standard errors clustered at the district level in parentheses.

Table A.14: Effects on Development and Education Outcomes, Robustness Podes 2005, 2008, 2011 migrant count

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
|  | | | A. Development Indicators | | | |
|  | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates - Podes 2005 migrant count only* | | | | | | |
| Migration$^o_d$ × XRShock$_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. Podes 2005, 2008, 2011 migrant count* | | | | | | |
| $Migration_{dt-1} \times XRShock_{dt-1}$ | 0.06 | 0.10*** | 0.02* | -3.61*** | 0.13** | 0.13*** |
|  | (0.04) | (0.03) | (0.01) | (0.83) | (0.06) | (0.05) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |
|  | | | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | |
|  | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates - Podes 2005 migrant count only* | | | | | | |
| Migration$^o_d$ × XRShock$_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
|  | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. Podes 2005, 2008, 2011 migrant count* | | | | | | |
| $Migration_{dt-1} \times XRShock_{dt-1}$ | 0.93 | 4.67** | 7.11*** | 0.74** | 0.23** | 0.02 |
|  | (0.70) | (2.14) | (2.42) | (0.30) | (0.09) | (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition island trends on the right hand side. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table A.15: Effects on Development and Education Outcomes, Robustness Podes 2005 village plurality destinations

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | A. Development Indicators | | | | | |
| | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates - Migrant Terminal data for destination exposure* | | | | | | |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
| | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. Podes 2005 village plurality destination* | | | | | | |
| $Migration_{t-1} \times XRShock_{dt-1}^{2005dest}$ | -0.01 | 0.05 | 0.04*** | -4.50*** | 0.06 | 0.12** |
| | (0.04) | (0.04) | (0.02) | (0.98) | (0.05) | (0.05) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |
| | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
| | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates - Podes 2005 migrant count only* | | | | | | |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
| | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. Podes 2005, 2008, 2011 migrant count* | | | | | | |
| $Migration_{t-1} \times XRShock_{dt-1}^{2005dest}$ | 0.52 | 5.89*** | 4.29* | 0.67* | 0.34*** | -0.03 |
| | (0.80) | (2.25) | (2.32) | (0.35) | (0.11) | (0.05) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition island trends on the right hand side. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table A.16: Effects on Development and Education Outcomes, Robustness with Lagged Outcome Variables

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | | | A. Development Indicators | | | |
| | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates* | | | | | | |
| Migration$^o_d \times$ XRShock$_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
| | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. with Lagged Outcome Variables* | | | | | | |
| $Migration^o_d \times XRShock_{dt-1}$ | 0.05 | 0.11*** | 0.08* | -2.06*** | 0.10*** | 0.09*** |
| | (0.04) | (0.03) | (0.04) | (0.33) | (0.03) | (0.03) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |

| | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
|---|---|---|---|---|---|---|
| | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates* | | | | | | |
| Migration$^o_d \times$ XRShock$_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
| | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. with Lagged Outcome Variables* | | | | | | |
| $Migration^o_d \times XRShock_{dt-1}$ | 0.65 | 2.29 | 3.87* | 0.81*** | 0.23*** | 0.03 |
| | (0.73) | (2.08) | (2.08) | (0.21) | (0.07) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition island trends on the right hand side. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table A.17: Effects on Development and Education Outcomes, Two-way Clustering Checks

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | A. Development Indicators | | | | | |
| | Household Expenditure | Household exp bottom 20% | Asset Index | Poverty Rate | GDP Total | GDP Agriculture |
| *A1. Main Estimates* | | | | | | |
| Migration$_d^o \times$ XRShock$_{dt-1}$ | 0.04 | 0.10*** | 0.03*** | -3.93*** | 0.09* | 0.13*** |
| | (0.04) | (0.03) | (0.01) | (0.76) | (0.05) | (0.04) |
| *A2. Two-way clustering at district and year* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.04 | 0.10 | 0.03 | -3.93*** | 0.09 | 0.13 |
| | (0.06) | (0.06) | (0.01) | (1.08) | (0.05) | (0.07) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.83 | 12.08 | 0.19 | 15.13 | 15.50 | 13.98 |
| Districts | 350 | 350 | 327 | 350 | 350 | 350 |
| Observations | 2060 | 2060 | 907 | 2392 | 2399 | 2399 |

| | B. Net Enrollment Rate (%) and Education Facilities (per 10,000 people) | | | | | |
|---|---|---|---|---|---|---|
| | Elementary enrollment (age 7-12) | Junior Secondary enrollment (age 13-15) | Senior Secondary enrollment (age 16-18) | Elementary school (grade 1-6) | Junior Secondary school (grade 7-9) | Senior Secondary school (grade 10-12) |
| *B1. Main Estimates* | | | | | | |
| Migration$_d^o \times$ XRShock$_{dt-1}$ | 0.83 | 4.37** | 7.48*** | 0.85*** | 0.27*** | 0.02 |
| | (0.67) | (2.14) | (2.21) | (0.28) | (0.09) | (0.03) |
| *B2. Two-way clustering at district and year* | | | | | | |
| $Migration_d^o \times XRShock_{dt-1}$ | 0.83 | 4.37 | 7.48* | 0.85** | 0.27** | 0.02 |
| | (0.89) | (2.85) | (3.48) | (0.30) | (0.09) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 93.48 | 66.76 | 46.55 | 6.39 | 1.18 | 0.31 |
| Districts | 353 | 353 | 353 | 353 | 353 | 353 |
| Observations | 2411 | 2411 | 2411 | 2417 | 2417 | 2417 |

Notes: This table reports estimates of equation (6) with the addition island trends on the right hand side. Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. GDP per capita are expressed in log of 2010 Indonesian rupiah. Other outcomes data sources and details as described in Appendix A.1. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01. Standard errors clustered at the district level in parentheses.

Table A.18: Correlation between Transfers from Household Members Abroad and Expectations of Future Outcomes for Children in the Household

|  | (1) In school | (2) Years of education | (3) Better life |
|---|---|---|---|
| Abroad transfer (log IDR) | 0.01 | 0.43** | 0.03* |
|  | (0.02) | (0.18) | (0.02) |
| Observations | 170 | 92 | 170 |

Notes: Sample is household in Indonesia Family Life Survey (2007) panel who reported receiving non-zero transfer from parent(s)/child(ren) abroad in the past 12 months. Dependent variable is the average expectations for children 7-24 years old in the household in three dimensions. Expectation of better life is surveyed as a question with a five-point Likert scale and recoded as an indicator of slightly better or much better life. Years of education is surveyed as the expectation of the highest level of education completed and the highest grade. Expectation of years of education is only asked for children who are still/will be at school Transfer is expressed in log Indonesian rupiah. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table A.19: Effects of Remittances on Village Informal Taxation

|  | (1) Household manpower for building village | (2) Household contribute money/ goods for building | (3) Money/ goods contribution for building log(IDR) | (4) Household manpower for maintenance in village | (5) Household contribute money/ goods for maintenance | (6) Money/ goods contribution for maintenance log(IDR) |
|---|---|---|---|---|---|---|
| Migration x $XRShock^{t-1}$ | 0.0341 | 0.0514** | 0.489** | 0.00852 | 0.0369 | 0.361 |
|  | (0.96) | (2.23) | (2.06) | (0.26) | (1.59) | (1.60) |
| mean(y) | 0.2 | 0.1 | 0.9 | 0.6 | 0.1 | 1.3 |
| Clusters | 611 | 611 | 611 | 611 | 611 | 611 |
| Observations | 55975 | 55975 | 55975 | 55975 | 55975 | 55974 |

Notes: Data from Generasi SPKP survey (Olken et al, 2014). Respondents are household. Table presents regression coefficients of outcome variables on the remittance proxy, i.e., the interaction of migration intensity and currency exchange rate changes lagged by one year from migrant destinations recorded in Podes 2005. Outcomes are participation and contribution in building and maintenance activities in the village All regressions include village fixed effects, survey wave fixed effects, and subdistrict-trend terms. Standard errors are clustered at the subdistrict level. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table A.20: Effects of Remittances on Voting Behavior

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | | | Complaints to Village |
| | | District | Village | Head |
| | | Election | Head | on Anti- |
| | Presidential | in past | Election | Poverty |
| | Election | two years | in past | Programs |
| | 2009 | | two years | |
| Migration x $XRShock^{t-1}$ | -0.0162 | -0.0260** | -0.00250 | -0.0969* |
| | (-0.95) | (-2.21) | (-0.15) | (-1.65) |
| mean(y) | 0.98 | 0.97 | 0.97 | 0.58 |
| Clusters | 605 | 520 | 549 | 589 |
| Observations | 18539 | 16636 | 12079 | 5301 |

Notes: Data from Generasi SPKP survey (Olken et al, 2014). Respondents are household for columns 1-3 and village head in column 4. Table presents regression coefficients of outcome variables on the remittance proxy, i.e., the interaction of migration intensity and currency exchange rate changes lagged by one year from migrant destinations recorded in Podes 2005. Outcomes are voting turnout in presidential, mayoral, and village head elections in columns 1-3, and complaint to village head about the implementations of anti-poverty programs in column 4. Presidential elections are cross-section regression in 2009 with subdistrict fixed effect. Regresssions of mayoral and village head elections use survey waves 2009 and 2013, using subdistrict fixed effects and survey wave fixed effects. Regression of complaints to village head use survey waves 2009 and 2013, using village fixed effects, survey wave fixed effects, and subdistrict-trend terms. Standard errors are clustered at the subdistrict level. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.21: Effects of Remittances on Household Participation in Community Groups

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | Religious groups | Social service groups | Credit groups | Production groups | Governance groups | Recreation groups | Political groups |
| Migration x $XRShock^{t-1}$ | -0.0414 | 0.0455 | 0.0799* | -0.0470* | -0.0114 | 0.0268* | 0.00874 |
| | (-0.88) | (1.01) | (1.67) | (-1.66) | (-0.43) | (1.79) | (1.15) |
| mean(y) | 0.58 | 0.30 | 0.29 | 0.09 | 0.09 | 0.02 | 0.01 |
| Clusters | 611 | 611 | 611 | 611 | 611 | 611 | 611 |
| Observations | 45518 | 45518 | 45518 | 45518 | 45518 | 45518 | 45518 |

Notes: Data from Generasi SPKP survey (Olken et al, 2014). Respondents are household. Table presents regression coefficients of outcome variables on the remittance proxy, i.e., the interaction of migration intensity and currency exchange rate changes lagged by one year from migrant destinations recorded in Podes 2005. Outcomes are participation in various community groups. All regressions include village fixed effects, survey wave fixed effects, and subdistrict-trend terms. Standard errors are clustered at the subdistrict level. * p≤ 0.10, ** p≤ 0.05, *** p≤ 0.01.

Table A.22: Impact on Employment Outcomes

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | A. LFP and Employment Status | | | | | | |
| | Total Labor Force (log) | Employed (log) | Unemployed (log) | Underemployed (log) | Employed (% TLF) | Unemployed (%TLF) | Underemployed (%TLF) |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | -0.17*** | -0.17*** | -0.38*** | -0.03 | 0.00 | -0.00 | 0.04** |
| | (0.05) | (0.05) | (0.10) | (0.08) | (0.01) | (0.01) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 12.24 | 12.16 | 9.41 | 11.02 | 0.93 | 0.07 | 0.33 |
| Districts | 350 | 350 | 350 | 350 | 350 | 350 | 350 |
| Observations | 1905 | 1905 | 1905 | 1905 | 1905 | 1905 | 1905 |
| | B. Sectoral employment (%) | | | | | | |
| | Agriculture | Trade | Social | Industry | Transport | Construction | Finance |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | -0.04 | -0.01 | -0.03*** | 0.01 | 0.01 | 0.00 | 0.01** |
| | (0.03) | (0.01) | (0.01) | (0.01) | (0.00) | (0.00) | (0.00) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 0.46 | 0.18 | 0.14 | 0.09 | 0.05 | 0.05 | 0.01 |
| Districts | 350 | 350 | 350 | 350 | 350 | 350 | 347 |
| Observations | 1903 | 1901 | 1899 | 1881 | 1900 | 1892 | 1733 |
| | C. Sectoral employment (log) | | | | | | |
| | Agriculture | Trade | Social | Industry | Transport | Construction | Finance |
| $\text{Migration}_d^o \times \text{XRShock}_{dt-1}$ | -0.17*** | -0.17*** | -0.38*** | -0.03 | 0.00 | -0.00 | 0.04** |
| | (0.05) | (0.05) | (0.10) | (0.08) | (0.01) | (0.01) | (0.02) |
| District FE, Year FE | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dep. Var. Mean | 11.08 | 10.32 | 10.04 | 9.40 | 8.99 | 9.02 | 7.42 |
| Districts | 350 | 350 | 350 | 350 | 350 | 350 | 347 |
| Observations | 1902 | 1901 | 1899 | 1881 | 1900 | 1892 | 1733 |

Notes: This table reports estimates of equation (6). Sample is 2005-2012 panel of Indonesian districts in Indo-Dapoer dataset with recorded returnees from airport arrival data. Interaction variable $\text{Migration}_d \times \text{XRShock}_{t+2}$ proxies for remittances, and is standardized to have mean zero and standard deviation of one. XRShock is district-level yearly average of migrant-weighted foreign currency exchange rate between host country currency and Indonesian rupiah, relative to June 2007. District-level migrant stock abroad for XRshock is reconstructed based on the departure and arrival dates in the migrant terminal data. Migration (intensity) is the natural log of ratio between the total migrant and total population from the 2005 village census. Other outcomes data sources and details as described in Appendix A.1. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$. Standard errors clustered at the district level in parentheses.