# ABSTRACT

Title of dissertation: ESSAYS ON INTERNATIONAL FINANCE AND DEVELOPMENT

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Motivated by exposure to different financing programs from the International Finance Corporation (IFC), in this dissertation I explore three relevant topics from the perspective of a Development Finance Institution (DFI), focusing on outcomes that spam across the development of local capital markets, attraction of foreign direct investment, poverty reduction and firm growth in developing economies.

The first chapter studies the pioneering role of DFIs in issuing local currency bonds in several developing economies' domestic capital markets, investigating the potential effects on capital markets development and attraction of foreign direct investment flows. Results on bonds markets show an increase on number of listings of both public and domestic corporate bonds following a pioneer issuance, while also pointing to an increase in the number of domestic corporate bond issuers. The analysis of effects on the equity markets of local exchanges shows an increase in the number of domestic companies with listed equities following the pioneer issuances, and an even stronger increase in the number of foreign companies with listed equities in the domestic exchange, suggesting that the potential signaling effect from the pioneer local currency bond issuances is stronger for international agents than for domestic agents. Lastly, the analysis of the effects on the attraction of FDI shows that FDI net inflows decrease after such pioneer issuances, which suggests that FDI and capital markets development would be substitutes. However, when I disaggregate sample countries by different stages of market development, as proxied by countries' income

level, I find that the decrease in FDI is mostly seen in low and lower-income countries, while in upper-middle countries FDI inflows and capital market development would be less of a substitute, pointing to a transition from substitutability to complementarity as capital markets and institutions become more mature.

The second chapter analyzes – through an innovative structural simulation modeling approach that links investments in one or more industries to the World Bank Group (WBG) twin goals of ending extreme poverty and improving shared prosperity – the expected impacts that private investment strategies could have in the Philippines, focusing on impacts on poverty and inequality, while also including standard macroeconomic effects like economic growth and employment. A key factor in this model is the presence of both formal and informal markets, which captures the high and persistent job informality observed in the data. While FDI inflows drive the growth of formal activity in the economy and creates higher paying direct jobs, the indirect and induced effects are weakened by the high presence of informal firms in the supply chain, which are less productive and pay smaller wages. By comparing FDI investments into manufacturing, agriculture, services, and tourism, results show that a “trickle-down” growth approach based on the continuation of the status quo does not deliver the poverty and shared prosperity targets of the WBG twin goals. While poverty declines due to additional investment, considerably higher investments would be needed to reach the 3 percent WBG (global) poverty target. Moreover, inequality increases over time and no substantial progress is observed in terms of shared prosperity in any of the investment-driven scenarios.

Finally, the third chapter estimates the relationship between working capital and firm growth for a large sample of companies across developing economies, underlying the rationale and expected impact of providing working capital financing in these countries. The paper presents a measure of excess working capital – the difference in the level of working capital for a firm relative to the median of its relevant peers by sector and economic context – and finds evidence of a non-linear relationship between excess working capital with firm growth. Companies with relatively lower levels of working capital but closer to industry and economic environment norms would benefit the most in terms of sales growth, followed by firms with the lowest levels of working capital. Companies with working capital levels above the norm benefit the least from additional working capital. These facts constitute evidence of the existence of a notional optimal level of working capital, conditional to industry and economic context, consistent with existing literature, mostly

focused on developed countries. Additional results show that the marginal impact of increasing working capital on growth is larger for firms in more developed countries. Along these lines, these findings can serve as a basis to explain (partially, at least) firm performance during the COVID-19 crisis and going forward, as well as being an input to improving the allocation of working capital financing in the recovery and beyond.

# ESSAYS ON INTERNATIONAL FINANCE AND DEVELOPMENT

by

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# Dedication

*To Sarah, Beatriz, and Isabella*

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# Chapter 1: The Catalytical Effects of Pioneer Local Currency AAA Bonds in Emerging Markets

## 1.1. Introduction

Until the late 1990's, multilateral Development Financial Institutions (DFIs), such as the International Finance Corporation (IFC), the Asian Development Bank (ADB), the African Development Bank (AfDB), the Inter-American Development Bank (IADB) and the European Bank for Reconstruction and Development (EBRD), traditionally provided financing in foreign currency (FC) to their borrowers. However, the currency crises in Latin American and Asian countries in the 1990's brought to light the dangers of excessive FC borrowing when facing currency depreciations [Krugman (1999), Chang and Velasco (2000)]. Hence, those DFIs recognized the importance of avoiding currency mismatch between assets and liabilities, which most of the time was caused by the inability of countries/corporations to borrow in their own currency [Eichengreen and Hausmann (1999)], and launched or expanded their local currency (LC) funding programs, having a pioneering role in issuing LC bonds in domestic capital markets in several developing economies.

This paper defines a pioneer[1] LC bond issuance as the first LC bond issued by a AAA-rated entity in a given domestic[2] capital market. These pioneer issuances happened in two waves. First, in the 2000's, AAA LC bonds were issued in larger Emerging Markets in Latin America, Asia, Europe and in a few major African markets, such as in Morocco, South Africa and two regional exchanges that operate for the West CFA Franc (XOF) and Central CFA Franc (XAF) currency unions' countries. Then, in the 2010's, smaller Emerging Markets in Central America, Eastern Europe, Africa and Southeast Asia had the first pioneer bonds issued in their currencies.

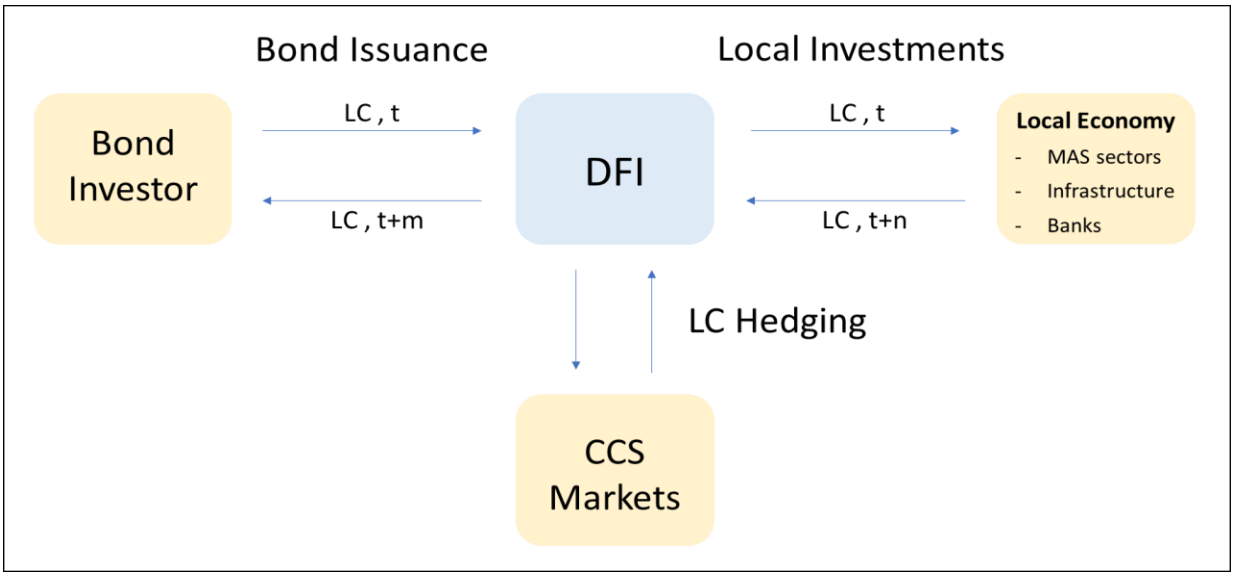
[1] Some papers and reports refer to these first-time issuances as *inaugural* bonds. However, since this term is also used by some institutions to refer to their first-time bond issuance only, irrespective of the existence of a previous issuance by another institution, this paper uses the term pioneer to avoid any confusion.

[2] This paper is not interested in Eurobonds or Global Bonds issuances, which do not need to comply to local regulations, and hence would probably not help attracting investors and further developing local capital markets.

Issuing a LC bond for the first time in a local capital market is not a straightforward process to a DFI, as it often involves negotiating regulatory changes. The issuing institution generally needs approval from the government to issue the bond in the domestic market, as well as approval for foreigners to be allowed to invest in the bond (or in the local market, more broadly). Moreover, the negotiations may also involve discussions about improved governance in local markets, tax exemptions for the DFI, reduction of transactions costs, and removal of restrictions on currency convertibility[3].

After getting all the necessary approvals, the DFIs would then announce the bond issuance for a non-distant future date and proceed to sell the LC bonds ideally to both domestic and foreign investors. The raised proceeds would generally be used to make loans to domestic entrepreneurs that would not have access to LC financing otherwise, or at least not at that cost, or to financial intermediaries that would target the funds as new loans to specific purposes, such as for SMEs. The overall issuance and lending processes can be summarized in figure 1 below.

Figure 1: Local Currency Bond Issuance Diagram




It is interesting to point out that some DFIs may only be able to issue LC bonds if cross-currency swap (CCS) markets already exist – or if they set up those CCSs in the first place - due to their own regulations[4]. For example, some DFIs' charters prevent them from taking on exchange rate risk, which is

[3] See Wolff-Hamacher (2007), Luengnaruemitchai, and Ong (2005).
[4] See Wolff-Hamacher (2007).

the case for the World Bank Group – including IFC – and the IADB, for example. Hence, in the absence of opportunities for on-lending all the LC funds raised at financial terms attractive to the clients, these DFIs would need to swap the remaining portion of the issuance into any of the currencies demanded on loans by their borrowers - generally US Dollars, Euros, Yen or other "strong" regional currencies, such as the South African Rand for bonds issued by AfDB in smaller African markets.

Besides the straightforward benefit that LC financing, as an alternative to FC borrowing, reduces the balance sheet currency-mismatch risk of domestic firms, these LC bond issuance programs also contribute to the diversification of funding sources beyond banks and equity markets, supporting major demand trends that stem from economic and financial growth. Infrastructure development, privatization, securitization, and government decentralization, for example, create demand for bond issuance, as does the growth of insurance and social security systems, which creates institutional investors that have an appetite for long-term assets such as bonds. Moreover, these AAA-rated LC bonds represent a new high-quality asset class for domestic investors to diversify their portfolios.

Beyond these benefits, the DFIs claim that their pioneer LC bond issuances can help develop local capital markets[5] by: (i) providing, or expanding, a triple-A credit curve that gives corporations wishing to access the market an alternative pricing benchmark to the government curve; (ii) allowing new investors to gain exposure to the local market, particularly international investors, by contributing to the dissociation of credit and currency allocation risks, which is often a precursor to these investors participating in the local government and corporate/bank debt market; (iii) paving the way for new issuances, by encouraging changes in regulations and testing and improving domestic processes for bond issuance, i.e., via demonstration effects[6]; (iv) creating a catalytic impact for future corporate bond issuances and facilitating financing through signaling effects[7].

[5] See IFC (2019), Wolff-Hamacher (2007).

[6] Demonstration effects can be thought of as showcasing that it is possible to issue in the local market, and potentially sharing know-how, facilitating the issuing process for following issuers.

[7] Signaling effect can be thought of as bringing, with the issuance, positive attention from other potential foreign issuers and investors, by strengthening the confidence in the stability and safety of the domestic bond market.

However, there is not much empirical research done on the matter, except for a few case studies on specific countries or some papers and reports that rely mainly on descriptive statistics and trends[8]. Hence, it is important to have a rigorous cross-country study to analyze those claims econometrically.

Therefore, the broad goal of this paper is to analyze empirically the impacts of first-time AAA-rated LC bond issuances in developing countries, answering two main questions. First, the paper investigates if the main goals advertised by DFI's from their LC bond issuance programs are achieved, with respect to capital market development. In other words, is there a catalytical effect from pioneer LC AAA-bond issuances on capital market development? To address this question, the paper uses a newly compiled database from different global, regional and national sources on main capital markets indicators related to government bonds, corporate bonds, equity markets, and institutional investors.

Second, as a follow-up question on catalytical effects, the paper investigates another potential impact, not claimed by DFIs: is the signaling effect from pioneer LC bond issuances strong enough to attract additional foreign direct investment (FDI) into developing countries? The intuition behind this hypothesis comes from the dissociation between credit and currency risks[9] resulting from the pioneer AAA LC issuance. Under the assumption that the credit risk of a AAA-bond is virtually zero, the issuance of a LC bond by a AAA-rated DFI would send a signaling effect on the benchmarking for currency risk pricing. Hence, foreign investors would have a better information set on LC risks and could be more willing to enter a new market[10].

The remaining of the paper is organized as follows: section 2 presents a literature review on credit and currency risks, the importance of LC bond markets and the determinants of both LC bond market growth and foreign direct investment inflows; section 3 describes the data; section 4 discusses the empirical methodology, section 5 presents the results, and section 6 concludes.

[8] See EIB (1999), Hoschka (2005), BIS (2006) and Chan et. al. (2011).

[9] Didier and Garcia (2003), Garcia and Lowenkron (2005) and Korinek (2010) discuss how these two risks are not independent, but can actually reinforce each other.

[10] One can think of this as an application of Knightian Uncertainty to price theory: under uncertainty, defined by Knight (1921) as referring to events for which it was not possible to specify numerical probabilities, a foreign investor might choose not to enter a market. This would be the case if the investor cannot estimate a probability distribution to the currency risk, from not knowing by how much credit risk can affect currency risk.

## 1.2. Literature Review

This paper builds on different areas of economics literature. First, its basic motivation is based on the currency risk literature. As previously mentioned, Krugman (1999) and Chang and Velasco (2000) showcase the dangers of currency mismatch between assets and liabilities in the balance sheet when facing episodes of currency depreciation, as seen in several countries in the mid-to-late 1990's. Eichengreen and Hausmann (1999) then argued that excessive FC exposure was in some cases the result of what they called Original Sin, which is the inability of countries or corporations to borrow in their own currency: instead of simply choosing FC debt over LC debt, due to lower pricing, certain firms or countries didn't even have access to LC borrowing – a pattern that has changed since the 2000's.

Although the LC bond issuance programs by the DFIs were motivated by those findings, their arguments for local capital market development go beyond that. One key concept is the attraction of foreign investors through a signaling effect by the disassociation between credit and currency risks. Kaminsky and Reinhart (1999) analyze the links between banking and balance-of-payments problems, showing that problems in the banking sector typically precede a currency crisis, and that the currency crisis deepens the banking crisis, activating a vicious spiral in which the crises reinforce each other: the *twin crises*. Korinek (2010) argues that emerging market economies that borrow in foreign currency are prone to severe financial crises that involve financial amplification – a feedback loop of depreciating exchange rates, deteriorating balance sheets and declining aggregate demand – and shows that financial amplification effects create an externality that induces individual borrowers to undervalue the social risks of FC debt and take on too much of it, by not internalizing that the resulting reduction in aggregate demand leads to further depreciations in the exchange rate, which further damage balance sheets and tighten borrowing constraints across the economy, hurting other borrowers.

Didier & Garcia (2003) observe a harmful positive correlation between country and currency risk premia in Brazil, which would hurt the economy twice under a negative international liquidity shock, and argue that these risks can have a common root cause, calling them *cousin risks*. Garcia and Lowenkron (2005) identify the extent of this phenomenon by first separating a sample of countries into two groups – those with and without this positive correlation – and then investigating the determinants of cousin risks,

indicating that currency mismatch and low financial deepening are strongly associated with the phenomenon, which points to the importance of fostering the development of local capital markets.

There is vast literature in the last decade on the importance of the development of LC bond markets for macroeconomic stability. Turner (2012) shows that the development of deeper domestic bond markets has contributed greatly to a reduction in currency mismatches in the major EMEs since 2000, and argues that, when the 2008 GFC severely tested these new markets with flight of international investors, those with a substantial domestic investor base withstood this intense pressure well. Du and Schreger (2021) analyze the evolution of the currency composition of sovereign and corporate external borrowing by emerging markets over the past fifteen years and show that a higher reliance on foreign currency debt by the corporate sector is associated with higher sovereign default risk. Rose (2014) shows that inflation-targeting countries with a local currency bond market experience inflation approximately three to four percentage points lower than those without a bond market, arguing that the political lobby from investors in the LC bond market reduces the chances of the countries choosing to inflate the debt away.

Regarding the determinants of LC bond market growth, which will guide the choices for control variables in the first set of panel regressions, Eichengreen and Luengnaruemitchai (2006) show that stronger institutions, less volatile exchange rates, and more competitive banking sectors tend to be positively associated with bond market capitalization in Asian countries. Burger and Warnock (2007) find that countries with stable inflation rates and strong creditor rights have more developed local bond markets and rely less on foreign-currency-denominated bonds, while Burger, Warnock and Warnock (2012) show that countries with investor-friendly institutions and policies attract more US investment into their LC domestic bond markets. Bae (2012) finds GDP per capita to be the most important factor in determining the development of capital markets, while Park (2016) finds that, besides inflation and GDP, other important determinants include the rule of law, the sovereign credit rating and the level of bank lending.

Regarding the relationship between FDI and capital market development, there are two opposing views in the literature. On one side, there is a view that FDI is a substitute for stock market development, with FDI flowing to riskier and financially underdeveloped countries to overcome the difficulties of investing

through capital markets, and hence being negatively correlated with capital market development.[11] On the other side, there is the argument that FDI flows into countries with good institutions and fundamentals, helping develop the domestic financial system and being a complement of capital market development.[12]

Lastly, on the determinants of FDI attraction – which will feed into the regressions specification to address the second question of this paper – an extensive literature has investigated the relationship of FDI with several macroeconomic variables[13]. Some variables that might be thought to have a connection to FDI flows include the size and growth potential of the host market, economic stability (proxied by inflation and exchange rates), the host economy's openness, the income level, and the quality of institutions.

## 1.3. Data

### 1.3.1. Local Currency Bond Issuance Data

The data for LC bond issuances are taken from different sources, following these steps: (i) first, a list of all LC bonds issued by IFC was compiled[14] from IFC Treasury's reports, starting in 2003, when IFC initiated its LC bond issuance program in developing markets, through 2020; (ii) next, the *pioneer* LC bonds, as previously defined, were identified from IFC reports and announcements[15]; (iii) next, for any IFC first-time LC issuance in a given country that was not announced as a pioneer, a search was conducted to identify the first LC bond issued in that country by a AAA-rated institution (from ADB, AfDB, EBRD); (iv) lastly, other pioneer LC issuances from ADB, AfDB, EBRD, EIB and IADB were extensively searched in several reports and papers from those institutions and others, such as BIS[16].

Hence, the sample in this paper includes all countries in which IFC has issued LC bonds, and some additional countries, but *not necessarily* all countries that have had LC bond issued by a AAA-rated institution since 2003. The final sample includes 38 countries and 26 different stock exchanges.[17]

[11] See Hausmann and Fernández-Arias (2000) and Fernández-Arias and Hausmann (2011).
[12] See Claessens et. al. (2002)
[13] See Wilhelms (1998), Resmini (2000), Walsh and Yu (2010), Canh et. al. (2020).
[14] See (most of) these issuances in a map in figure A.1 (Appendix A).
[15] IFC advertises any type of pioneering in bonds issuances.
[16] Wolff-Hamacher (2007) has a preliminary list of issuances from those institutions until 2006.
[17] There are 14 countries in Africa that are part of two currency unions and do national exchanges. Instead, there is one regional exchange for each of the currency unions, one using the West CFA Franc (XOF), with 8 countries, and one using the Central CFA Franc (XAF), with 6 countries.

### 1.3.2. Local Capital Markets Data

The main source for data related to local capital markets is the World Federation of Exchanges, which offers unbalanced panel data for several equity, bonds and derivatives market indicators since January 2003. Although being the most comprehensive global source for local capital markets data, it still has gaps, both in time series within country and for a given year across countries. Hence, to fill these gaps, WFE data was first complemented with data from other global sources, such as World Bank (Finstats, WDI and GFD), IMF and OECD, [18] as well as with regional databases from ADB, AfDB, ASEA (African Securities Exchange Association) and FIAB (Federacion Iberoamericana de Bolsas). Lastly, data was also collected through desk research from national/regional sources, such as countries' capital market regulators, stock exchanges and central banks.

The collected indicators can be divided under three categories: government bonds, corporate bonds, and the equity market.[19] Government bond indicators include the *value of listed domestic public bonds* and the *number of domestic public bonds* listed on local exchanges. The corporate bonds category includes data on the *value of listed domestic corporate bonds*, the *value of listed foreign corporate bonds*, the *number of listed domestic corporate bonds,* the *number of listed foreign corporate bonds*, the *number of domestic corporate bond issuers* and the *number of foreign corporate bond issuers*. Lastly, the equity section of the database comprises the following indicators: *equity market capitalization*, the *stock market turnover ratio*, and the *number of listed domestic (and foreign) companies*.

### 1.3.3. Foreign Direct Investment Data and Control Variables

The data on foreign direct investment – net inflows[20] as a share of GDP – was collected from the World Bank's WDI (World Development Indicators), as were most of the control variables used in the

[18] Data from Thompson Reuters' Refinitiv was also collected, but not used due to incompatibility with other sources.
[19] Data on variables related to institutional investors (buy side), such as the *value of pension funds' assets under management*, the *value insurance firms (life and total) assets,* and the *value mutual funds' assets*, all as a percentage of GDP, was also collected, but initially for a shorter time-spam (2015-2020). The increase in the time dimension of this database will allow for an expansion of the analysis of this paper.
[20] Following Forbes and Warnock (2012), in an attempt to use gross FDI flows for more granularity, data on gross FDI (cross-border investment) was collect from FDI Markets - Financial Times. However, the coverage was not ideal for several low- and lower-middle income countries, especially in Africa. Hence, this paper uses net FDI flows.

regressions. Additionally, six institutional quality indicators were collected from the WGI (Worldwide Governance Indicators), also from the World Bank, and an index was built as an average of their ranking.

### 1.4. Empirical Strategy and Methodology

To answer the first question – whether pioneer LC bond issuances by the DFIs promote development of local capital markets – I run OLS pooled fixed-effect panel regressions, using for each of the capital market-related variables described above as the dependent variable:

$$CMD_{i,t} = \alpha_i + \theta_t + \beta.Pioneer_{i,t} + \gamma_1.X_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

where $CMD_{i,t}$ represents an indicator of Capital Market Development for country $i$ at time $t$, $Pioneer_{i,t}$ is a dummy variable equal to 1 for the first n periods[21] after the pioneer bond is issued and 0 otherwise, $X_{i,t}$ is a vector of country-specific macroeconomic controls,[22] $\alpha_i$ is a country-fixed effect, $\theta_t$ is a time-fixed effect, and $\varepsilon_{i,t}$ is a residual.

Similarly, to address whether the issuance of a AAA-rated LC bond in an emerging market increases FDI, I will use monthly data from pioneer LC bond issuances in developing countries and FDI data to run a pooled OLS panel regression:

$$FDI_{i,t} = \alpha_i + \theta_t + \beta.Pioneer_{i,t} + \gamma_1.X_{i,t-1} + \varepsilon_{i,t} \qquad (2)$$

where $FDI_{i,t}$ represents FDI as a share of GDP for country $i$ at time $t$, $Pioneer_{i,t}$ is a dummy variable equal to 1 for the first n periods after the pioneer bond is issued and 0 otherwise, $X_{i,t}$ is a vector of country-specific macroeconomic controls, $\alpha_i$ is a country-fixed effect, $\theta_t$ is a time-fixed effect, and $\varepsilon_{i,t}$ is a residual. The macroeconomic variables include trade openness, the log level of the real exchange rate, inflation, stock of FDI, real GDP growth and the log level of GDP per capita.

[21] I use 6 possible values for n: 1, 2, 3, 4, 5 or "post", where the latest assigns a value of 1 for all the subsequent periods after the bond issue.

[22] I have run robustness regressions including more lags in the independent variables, but results did not change in a significant way. Moreover, as lags increased, the number of observations decreased, due to missing data in the time series for certain countries or by construction, in the case of issuances in the initial years of the time series in our sample.

## 1.5. Results

### 1.5.1. Local Capital Markets' Development

Starting the analysis with bond market variables,[23] the regression using the log *number of domestic corporate bonds listed* as the dependent variable shows a positive impact on bond listings after pioneer LC bond issuances by DFIs, especially after the third year, when the respective dummy coefficients become significant and larger, implying a 35% increase in issuances, as can be seen in table 1 below:

Table 1: Effect of Pioneer Bond Issuances on the Number of Domestic Corporate Bonds Listed

| # of Domestic Corporate Bonds Listed | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | 0.1868 | 0.2423* | **0.3554*** ** | **0.3596*** ** | **0.3504*** ** | **0.8005*** ** |
| | (0.1942) | (0.1419) | (0.1242) | (0.1131) | (0.1033) | (0.1497) |
| | 0.96 | 1.71 | 2.86 | 3.18 | 3.39 | 5.35 |
| *Exchange Rate Depreciation* | -0.5622 | -0.4608 | -0.3290 | -0.2721 | -0.3378 | -0.4457 |
| | (0.6494) | (0.6494) | (0.6422) | (0.6402) | (0.6345) | (0.6039) |
| | -0.87 | -0.71 | -0.51 | -0.42 | -0.53 | -0.74 |
| *GDP Per Capita* | 4.1132*** | 4.1426*** | 4.1913*** | 4.2087*** | 4.1742*** | 4.1382*** |
| | (0.4988) | (0.4962) | (0.4892) | (0.4868) | (0.4841) | (0.4627) |
| | 8.25 | 8.35 | 8.57 | 8.65 | 8.62 | 8.94 |
| *Inflation Rate* | -0.0285* | -0.0269 | -0.0249 | -0.0238 | -0.0225 | -0.0230 |
| | (0.0166) | (0.0165) | (0.0162) | (0.0161) | (0.0161) | (0.0153) |
| | -1.72 | -1.63 | -1.54 | -1.47 | -1.40 | -1.50 |
| *Dom. Cred. to Priv. Sector by Banks (% of GDP)* | 0.0103 | 0.0101 | 0.0104 | 0.0108 | 0.0119 | 0.0128* |
| | (0.0076) | (0.0076) | (0.0075) | (0.0074) | (0.0074) | (0.0071) |
| | 1.35 | 1.32 | 1.39 | 1.45 | 1.61 | 1.81 |
| *Institutional Quality Index* | 0.1957 | 0.1962 | 0.2204 | 0.1559 | 0.1369 | 0.3367 |
| | (0.4581) | (0.4552) | (0.4484) | (0.4465) | (0.4450) | (0.4259) |
| | 0.43 | 0.43 | 0.49 | 0.35 | 0.31 | 0.79 |
| Observations | 218 | 218 | 218 | 218 | 218 | 218 |
| R-squared | 0.520 | 0.525 | 0.539 | 0.544 | 0.547 | 0.585 |
| Number of Countries | 21 | 21 | 21 | 21 | 21 | 21 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[23] For the regressions involving dependent variables related to Capital Markets, 12 countries that are part of regional stock exchanges, but are not the host country of such exchange, were dropped from the sample, to avoid having multiple repeated values on the left had side of the equation. Hence, the maximum sample size for these regressions is 26 countries.

This uptake in bond issuances is also seen for government bonds, especially after 4 years of the pioneer issuances, as can be seen in table 2. For foreign corporate bond listings, the dummy coefficients are mostly positive, but insignificant, possibly due to the reduced sample size of this variable, which has only about half the number of observations for government and domestic corporate bonds.[24]

Table 2: Effect of Pioneer Bond Issuances on the Number of Public Bonds Listed

| # of Domestic Public Bonds Listed | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_1* | 0.1408 | 0.2626 | 0.2371 | **0.3405**** | **0.3224**** | 0.4219* |
| | (0.2665) | (0.1925) | (0.1714) | (0.1541) | (0.1385) | (0.2145) |
| | 0.53 | 1.36 | 1.38 | 2.21 | 2.33 | 1.97 |
| *Exchange Rate Depreciation* | -1.8020** | -1.6750* | -1.6497* | -1.5287* | -1.6202* | -1.7628** |
| | (0.8655) | (0.8670) | (0.8691) | (0.8628) | (0.8557) | (0.8560) |
| | -2.08 | -1.93 | -1.90 | -1.77 | -1.89 | -2.06 |
| *GDP Per Capita* | 3.5076*** | 3.5560*** | 3.5618*** | 3.6130*** | 3.5830*** | 3.5116*** |
| | (0.6685) | (0.6654) | (0.6656) | (0.6598) | (0.6574) | (0.6592) |
| | 5.25 | 5.34 | 5.35 | 5.48 | 5.45 | 5.33 |
| *Inflation Rate* | -0.0168 | -0.0142 | -0.0139 | -0.0116 | -0.0121 | -0.0137 |
| | (0.0225) | (0.0223) | (0.0224) | (0.0221) | (0.0220) | (0.0221) |
| | -0.75 | -0.64 | -0.62 | -0.52 | -0.55 | -0.62 |
| *Dom. Cred. to Priv. Sector by Banks (% of GDP)* | 0.0051 | 0.0051 | 0.0058 | 0.0064 | 0.0076 | 0.0075 |
| | (0.0110) | (0.0109) | (0.0110) | (0.0109) | (0.0109) | (0.0109) |
| | 0.47 | 0.46 | 0.53 | 0.59 | 0.70 | 0.68 |
| *Institutional Quality Index* | -1.0627 | -1.0991 | -1.0518 | -1.1080 | -1.1175 | -1.0333 |
| | (0.6985) | (0.6935) | (0.6915) | (0.6861) | (0.6851) | (0.6872) |
| | -1.52 | -1.58 | -1.52 | -1.61 | -1.63 | -1.50 |
| Observations | 205 | 205 | 205 | 205 | 205 | 205 |
| R-squared | 0.378 | 0.384 | 0.384 | 0.395 | 0.397 | 0.392 |
| Number of Countries | 21 | 21 | 21 | 21 | 21 | 21 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Regarding the number of bond issuers, I find a positive and significant increase in the number of domestic corporate bond issuers when using the “pioneer_post” dummy specification, in which the dummy equals 1 for all years following the pioneer LC bond issuance. For the other dummy specifications, the coefficients are positive but not significant (table A.1, appendix A). In the case of foreign bond issuers, the pioneer dummy coefficients are positive, but insignificant, for all dummy specifications. As in the case of foreign corporate bonds listings, the sample size for this variable is small, with only around half of the

[24] Results can be seen in table A.1. in the Appendix A.

number of observations for domestic corporate bond issuers. All regressions using the value of listed bonds (public, domestic and foreign) as dependent variable produced statistically insignificant dummy coefficients.

Next, I investigate if pioneer LC bond issuances have any impacts on local equity markets. First, analyzing the number of domestic companies with listed equities in the local exchange, I find a positive and significant effect following the pioneer issuances (table 3), especially after the second year, as was the case for the number of domestic corporate bond issuances. It makes sense to think that such effects would take some time to materialize, as companies would need to go through internal and/or regulatory processes to issue a bond or list a stock in the local exchange. Also, it is worth noticing that there is no lag in the dummies in these specifications, so the first year means the year of issuance, while the second year means the next year.

Table 3: Effect of Pioneer Bond Issuances on the Number of Domestic Companies with Listed Equities[25]

| # of Domestic Companies with Listed Equities | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| | 0.0139 | 0.0634* | **0.0853*** ** | **0.1017*** ** | **0.1028*** ** | **0.2190*** ** |
| | (0.0490) | (0.0362) | (0.0310) | (0.0284) | (0.0267) | (0.0390) |
| | 0.28 | 1.75 | 2.75 | 3.59 | 3.84 | 5.62 |
| Observations | 358 | 358 | 358 | 358 | 358 | 358 |
| R-squared | 0.268 | 0.275 | 0.285 | 0.297 | 0.301 | 0.336 |
| Number of Countries | 25 | 25 | 25 | 25 | 25 | 25 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

One could speculate that an increase in appetite for LC assets from international investors following the signaling from the pioneer issuance could be a contributing factor to an increase the number of companies with equity listings. Unfortunately, the buy-side data is not available. However, when analyzing the effects of such pioneer bond issuances on the number of foreign companies with listed equities in the domestic exchange, I find an increase in foreign listings (table 4). In fact, the dummy coefficients are not only positive and significant in all specifications, but also much larger (6 to 10 times larger) than the coefficients for domestic equity listings. This suggests that the potential signaling effect from the pioneer LC bond issuances is stronger, as expected, for international agents than for domestic agents, since, in theory, the pioneer issuance generates additional information on exchange rate risk/pricing.

[25] Full regression results can be seen in table A.2 in the Appendix A.

Table 4: Effect of Pioneer Bond Issuances on the Number of Foreign Companies with Listed Equities[26]

| # of Foreign Companies with Listed Equities | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| | 0.5735* | **0.6211*** ** | **0.8408*** ** | **0.7449*** ** | **0.6432*** ** | **0.9604*** ** |
| | (0.2900) | (0.2172) | (0.1886) | (0.1784) | (0.1705) | (0.2037) |
| | 1.98 | 2.86 | 4.46 | 4.17 | 3.77 | 4.72 |
| Observations | 156 | 156 | 156 | 156 | 156 | 156 |
| R-squared | 0.148 | 0.177 | 0.247 | 0.233 | 0.214 | 0.259 |
| Number of Countries | 15 | 15 | 15 | 15 | 15 | 15 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Lastly, regressions using equity market capitalization (% of GDP) and the equity market turnover ratio as the dependent variable provided insignificant coefficients for the pioneer dummy variables, suggesting that any effect from pioneer local currency bond issuances is not strong enough to affect the total volume and trading velocity of the domestic equity markets in a significant way.

### 1.5.2. Foreign Direct Investment

Next, I analyze the potential impacts from pioneer LC bond issuances on FDI flows. Differently from the regressions on capital markets variables, and following the previously mentioned literature on the determinants of FDI flows, here I include trade as a share of GDP as well as GDP growth as independent variables, and exclude domestic bank credit to private sector as a share of GDP.[27]

At first, the result seems counter-intuitive: I find that, following a pioneer LC bond issuances by DFIs, there is a reduction of FDI net inflows into the country, with negative coefficients being significant for pioneer dummies 3 to 5, as seen in table 5 below.

This could imply that not only the signaling effect from the bond issuance is not strong enough to attract FDI, but also that there is a substitution effect between investing directly in a country through FDI

[26] Full regression results can be seen in table A.3 in the Appendix A.

[27] I have run robustness regressions with the same control variables for both capital market variables and FDI as the dependent variable, but the coefficients of pioneer dummies did not change significantly. Moreover, both GDP growth and trade as a share of GDP were insignificant in the regressions on capital market development, while domestic credit to private sector as a share of GDP was insignificant in the FDI regressions. Hence, I have included the controls following the cited literature for each dependent variable of interest.

and investing in its local capital market, from an international investor's perspective. This result is aligned with the point of view of Fernández-Arias and Hausmann (2011), mentioned in the literature review section.

Table 5: Effect of Pioneer Bond Issuances on FDI Net Inflows

| FDI Net Inflows (% GDP) | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | 0.0281 | -0.3558 | **-0.6321*** | **-0.7626**** | **-0.8273***** | -0.4814 |
| | (0.5554) | (0.4091) | (0.3465) | (0.3148) | (0.2964) | (0.4487) |
| | 0.05 | -0.87 | -1.82 | -2.42 | -2.79 | -1.07 |
| *Trade (% GDP)* | 0.0110 | 0.0112 | 0.0119 | 0.0119 | 0.0123 | 0.0116 |
| | (0.0116) | (0.0116) | (0.0116) | (0.0116) | (0.0116) | (0.0116) |
| | 0.94 | 0.96 | 1.02 | 1.02 | 1.06 | 1.00 |
| *Exchange Rate Change* | 1.4898 | 1.5192 | 1.4614 | 1.4413 | 1.5718 | 1.5028 |
| | (1.7728) | (1.7718) | (1.7679) | (1.7643) | (1.7617) | (1.7710) |
| | 0.84 | 0.86 | 0.83 | 0.82 | 0.89 | 0.85 |
| *GDP Growth* | 0.0012 | 0.0004 | -0.0024 | -0.0033 | -0.0016 | 0.0004 |
| | (0.0339) | (0.0339) | (0.0338) | (0.0338) | (0.0337) | (0.0339) |
| | 0.04 | 0.01 | -0.07 | -0.10 | -0.05 | 0.01 |
| *GDP Per Capita* | -6.8416*** | -6.8285*** | -6.8251*** | -6.8584*** | -6.8480*** | -6.9970*** |
| | (1.1827) | (1.1820) | (1.1794) | (1.1770) | (1.1752) | (1.1904) |
| | -5.78 | -5.78 | -5.79 | -5.83 | -5.83 | -5.88 |
| *Inflation Rate* | -0.0363** | -0.0378** | -0.0385** | -0.0382** | -0.0385** | -0.0377** |
| | (0.0176) | (0.0177) | (0.0176) | (0.0176) | (0.0175) | (0.0177) |
| | -2.06 | -2.13 | -2.18 | -2.18 | -2.20 | -2.13 |
| *Institutional Quality Index* | 3.8290*** | 3.9070*** | 4.0235*** | 4.1384*** | 4.1998*** | 3.8602*** |
| | (0.9269) | (0.9292) | (0.9292) | (0.9300) | (0.9293) | (0.9252) |
| | 4.13 | 4.20 | 4.33 | 4.45 | 4.52 | 4.17 |
| Observations | 675 | 675 | 675 | 675 | 675 | 675 |
| R-squared | 0.089 | 0.090 | 0.094 | 0.098 | 0.101 | 0.091 |
| Number of Countries | 38 | 38 | 38 | 38 | 38 | 38 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

As an additional exercise, I dig a bit deeper into this last result and ask if there is any difference in the FDI effects among countries in different stages of capital markets development, which could imply different motivations for investing through FDI in different countries, depending on their level if risk. Hence, I use dummies for countries' income level (low income, lower-middle income, and upper-middle income), as a proxy for different levels of development and interact the upper-middle income (UMI) group dummy $D_{UMI}$ with the pioneer dummy, as follows:

$$FDI_{i,t} = \alpha_i + \theta_t + \beta_1 . Pioneer_{i,t} + \beta_2 . Pioneer_{i,t} * D_{UMI} + \gamma_1 . X_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

The results show an interesting pattern: for different specifications of the pioneer dummy variable, the coefficient $\beta_1$, which represents the reference group "low and lower-middle income countries", is more negative than when including the whole sample in model 2 (as seen in table 5), and significant for pioneer dummies 3 to 5, while the coefficient for the UMI interaction is either positive and insignificant (most cases) or positive and significant, for the cases of n=3 and n=4 years, but never negative, as can be seen in the table 6 below:

Table 6: Effect of Pioneer Bond Issuances on FDI Net Inflows by Income Groups[28]

| FDI Net Inflows (% GDP) | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | -0.1836 | -0.7592 | **-1.1768**** | **-1.3853***** | **-1.3080***** | -0.4012 |
| | (0.7887) | (0.5805) | (0.4872) | (0.4403) | (0.4115) | (0.5434) |
| | -0.23 | -1.31 | -2.42 | -3.15 | -3.18 | -0.74 |
| *Pioneer_n * $D_{UMI}$* | 0.4184 | 0.7794 | 1.0611 | **1.2164**** | **0.9465*** | -0.1584 |
| | (1.1059) | (0.7956) | (0.6679) | (0.6027) | (0.5629) | (0.6045) |
| | 0.38 | 0.98 | 1.59 | 2.02 | 1.68 | -0.26 |
| Observations | 675 | 675 | 675 | 675 | 675 | 675 |
| R-squared | 0.089 | 0.092 | 0.098 | 0.104 | 0.105 | 0.091 |
| Number of Countries | 38 | 38 | 38 | 38 | 38 | 38 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

This result brings some flavor to this discussion, suggesting potentially different effects of pioneer LC bond issuance on FDI for countries at different stages of capital markets development. More precisely, given the previous positive results on the impact of pioneer issuance on capital market development, FDI seems to be a substitute to capital markets development in underdeveloped countries, while in more mature markets is seems to behave as less of a substitute to capital markets development.

This result becomes even more interesting when combined with Claessens et. al. (2002), who found that FDI and capital market development are complementary for a sample with more developed countries, which points to a transition from substitutability to complementarity as countries' capital markets evolve.

[28] Full regression results can be seen in table A.4 in the Appendix A.

## 1.6. Conclusion

This chapter analyzed the potential catalytic effects of pioneer LC bond issuances by Development Financial Institutions on different aspects of local capital market development and on attraction of FDI flows by developing countries.

Results for bonds markets show an increase in the number of listings of both public and domestic corporate bonds following a pioneer issuance, while results on the number of foreign bond listings were inconclusive, perhaps due to a small sample. My findings also point to an increase in the number of domestic corporate bond issuers, while the result for foreign corporate bond issuers is also inconclusive.

When analyzing the effects on local equity markets, I find an increase in the number of domestic companies with listed equities following pioneer issuances. Moreover, the number of foreign companies with listed equities in the domestic exchange also increases, and, in fact, increases significantly more than the number of domestic equity listings, which suggests that the potential signaling effect from the pioneer LC bond issuances is stronger for international agents than for domestic agents.

Lastly, the analysis of FDI shows that FDI net inflows decrease after pioneer issuances, which suggests that FDI and capital market development are substitutes. However, when I disaggregate sample countries by different stages of market development, as proxied by countries' income level, I find that the decrease in FDI is mostly seen in low and lower-income countries, while in upper-middle countries FDI inflows and capital market development would be less of a substitute, pointing to a transition from substitutability to complementarity as capital markets and institutions become more mature.

# Chapter 2: Is FDI Enough? Private Sector Investment, Informality and Poverty Reduction in The Philippines*

## 2.1. Introduction

In 2013, the World Bank Group (WBG) embarked on a new era in its development agenda by setting twin goals to benchmark the performance of its operations: end extreme poverty and promote shared prosperity. More specifically, ending extreme poverty implies reducing the share of people living below the World Bank's international poverty line (1.90 U.S. dollars per day based on 2011 PPP) to 3 percent by 2030, from 11 percent in 2013, and promoting shared prosperity implies raising the income share of the poorest 40 percent of the population in any given country.

However, measuring investments' dynamic impacts (until 2030) on poverty and inequality of client countries was not a feasible task with the models in hand at the WBG at that time. Models such as MAMS,[29] a recursive-dynamic CGE model developed at the World Bank for analysis of country strategies, can capture the medium- to long-run macro effects of such investments, but lack the necessary heterogeneity on households to compute effects on the poverty rate and inequality at a granular level. On the other hand, micro-simulation models have the capability of providing a very detailed snapshot of the distributional effects of a given intervention, but lack dynamic effects, due to their static nature.

To tackle this issue, this paper presents a pilot modeling initiative, the EPIQ *(Economy-wide Private Impact Quantification)* model, with the objective of linking private sector interventions from the International Finance Corporation (IFC) with the WBG twin goals. EPIQ aims to provide a rigorous modeling framework to assess the impact of IFC industry sector-focused interventions on the twin goals, as well as on the recently announced Sustainable Development Goals (SDGs) that are relevant to IFC operations. In this

* Co-authored with Jan Imhof and Camilo Mondragón-Vélez – International Finance Corporation (IFC), World Bank Group (WBG). The views expressed in this paper are those of the authors and do not necessarily represent those of IFC/WBG.

[29] Lofgren et al (2013): "MAMS – A Computable General Equilibrium Model for Developing Country Strategy Analysis"

regard, EPIQ was envisioned as a tool to help IFC quantify its economic impact and provide insight in the design of country-level strategies. In this context, job creation and effects on the labor market are a central focus of EPIQ, as the main channels through which industry sector interventions in a country translate into impacts on the income distribution.

The effects of private sector interventions take place over time: direct effects are followed by indirect impacts through supply chains and distribution channels, which finally expand to the overall economy through the induced effects on consumption and investment cycles that involve households and firms interacting in labor and capital markets. In order to model these relationships and functions of the economy, EPIQ is built as a structural dynamic micro-founded macroeconomic simulation model that reflects the interactions between different types of households and firms (grouped within 10 industry sectors) through labor and goods & services markets over time.[30] Therefore, EPIQ can provide simulated paths of GDP and (formal and informal) job creation by industry, household income, price adjustments (including wages), and the poverty rate, among other indicators, over specific time periods, making it possible to quantify direct, indirect, and induced effects of interventions over time. In addition, the model is built in an environment that facilitates modeling specific industry sectors of the economy in greater detail to better reflect the reality of their operations, well beyond what the traditional reduced-form production function approach implies. Finally, its micro-foundation allows one to assess impacts on the income distribution, making it possible to explore relationships between investment activities across industry sectors and labor markets, and their ultimate effects on the WBG twin goals.[31]

In order to quantify the impact of investments on the WBG twin goals, it is necessary to go beyond the capabilities of most standard modeling approaches used to assess such efforts. EPIQ does this by introducing heterogeneous households that represent the Philippine society with the appropriate resolution. Households in this modeling approach differ in their level of education, location (rural or urban), household

[30] The model follows the rigorous approach of structural macroeconomic frameworks through endogenous price determination for non-tradeable sectors, but allows prices and markets to converge dynamically to their steady state equilibrium over time, in the absence of exogenous shocks. This implies that the time dimension is reflected naturally, without requiring abstract definitions of short or long term closures. The EPIQ framework also includes a demographic module calibrated to observed trends from years 2000 to 2015.

[31] This is possible thanks to the fact that the model generates a (partly) endogenous income distribution across heterogeneous household types over time.

size, the number of wage earners in a household, age of the wage earners, labor (in)formality status, remittances flows and capital ownership. This heterogeneity is necessary to compute endogenous poverty rates and distributional impacts of policies and investment interventions.

Along these lines, the main purpose of this paper is to present an analysis of the impacts that alternative sector-focused investment strategies could potentially imply – in terms of growth, poverty, and inequality – for the Philippine economy over the 2016-2030 period, through the implementation of the EPIQ model.

The Philippines was selected to pilot this modeling framework as it presents a particularly interesting case to analyze the potential impacts of alternative investment strategies going forward. As described in Section 2, the relatively rapid economic growth in the Philippines since 2000 has not been inclusive. This is partly explained by relatively high fertility rates combined with high informality[32] – and therefore low productivity – across all industry sectors, especially in agriculture. As a consequence, the country has shown little progress in poverty reduction while facing high emigration due to the lack of domestic (high quality) employment opportunities.

In addition, other factors motivating the Philippines as the pilot country to implement the EPIQ model include the availability of rich data (both micro and macro), significant existing research on nationwide and industry-specific issues, and IFC's investment track record in the country. High-frequency micro-economic surveys, including the Family Income and Expenditure Survey (FIES) and the Labor Force Survey (LFS), provide the necessary details to study various issues such as the sectoral composition of households' consumption of goods and services, informality, migration, and remittances, among others. Regarding the macroeconomic data, national accounts statistics, several input-output tables, and other sources provide sufficient time series data to understand the latest developments and establish empirically recent facts about the functioning of the economy for the past 15 years.

To assess the impact of any investment strategy scenario for the Philippines, three major steps are needed from the modeling perspective. First, the model needs to be structured and calibrated to reflect key

[32] A literature review on the relevance of informality, as well as details on definitions and measurement of informality in our model can be found in the Appendix B, section B.3.

features of the Philippines economy. In this regard, Section 2 describes a series of industry-sector focused empirical facts, used not only to describe the structure and characteristics of the Philippines economy, but also to serve as a calibration benchmark for a recent historical period. Section 3 provides a description of the EPIQ model structure while Section 4.1 elaborates on the model calibration for the defined historical period (2000-2015) for the case of the Philippines.

The second major step is to define a baseline case (scenario) for the future that will serve as a benchmark to measure the relative impact of alternative investment strategies implemented during the projection period (2016-2030 in this case). Section 4.2 reviews the main assumptions that define the baseline used for the analysis in this paper. The final step is to design a set of future investment scenarios for the projection period and implement them in the model. Thus, section 5 describes the assumptions and results implied by these alternative scenarios, which consider investments in particular sectors with differentiated characteristics, as well as those that put more pressure on existing infrastructure (such as manufacturing), or that have great potential for poverty reduction if they are accompanied with the necessary investments in infrastructure (such as tourism).

The main results of these simulations show that under the designed baseline case, which maintains the status quo regarding demographic trends, the structure of the economy, technology parameters across sectors as well as investment trends, poverty would be reduced from 19% in 2012 to 12% by 2030. This is mainly driven by a "trickle-down" approach based on steady annual GDP growth of around 6% for the period 2016-2030. However, without significant structural change in the economy or significant transfer programs, shared prosperity fails to improve, while inequality rises[33].

We then compute various scenarios in which additional investments of 0.5% of GDP enters the economy annually as FDI inflows. Due to the additional inflow of foreign financing, GDP grows more quickly in all scenarios. Most promising in terms of GDP growth is investment in the manufacturing sectors. Such stimulus can lead to an additional 0.7 percentage points of annual GDP growth over the projection period. However, while the economy only grows by an additional 0.3 percentage point under an agricultural

[33] Current model results suggest that inequality, measured as the income share of the bottom 40%, increases over time. This is in contrast to the development reported on povcalnet. The income distribution module is currently under improvement.

stimulus program, the poverty rate would drop more. An investment in agriculture can decrease the poverty rate to 10.6% by 2030, while investment into other sectors only decreases the poverty rate to just above 11%. This is mainly driven by a decrease in rural informality, which leads to higher wages earned by more people under an investment into agriculture. Finally, the income share of the bottom 40% fails to increase under all considered scenarios. However, all scenarios with additional investment can slow down the increase of the income gap between the poorest 40% of the society and the rest of the population.

In sum, the analysis presented in this paper sheds some light on the different impacts that private sector development strategies focused on alternative sectors of the economy imply, not only for the labor market, but also on poverty and shared prosperity. The model results are quite granular, including estimated impacts on job creation, wages, and labor demand (by area and education types). All in all, this pilot work for the Philippines provides more elements to improve our understanding of the relationship between industry-specific investment and growth, labor market dynamics, and poverty.

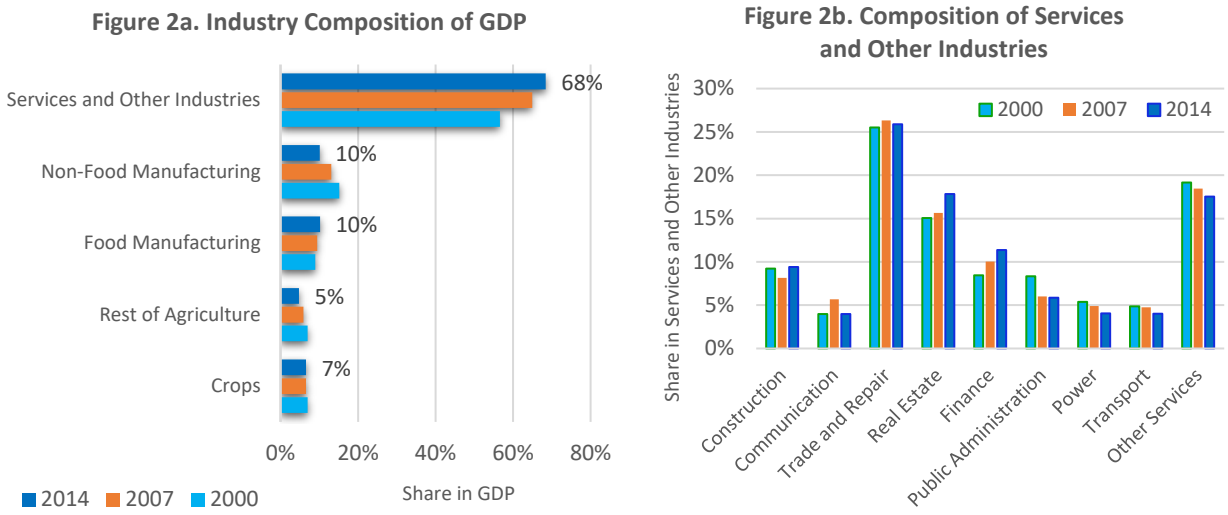
## 2.2. Facts on Structure, Trends and Constraints of the Philippine Industry Sectors

### 2.2.1. Economic Structure, Growth Trends and Firm Size

The Philippines economy is dominated by the service sector (68% of GDP in 2014), while manufacturing and agriculture generated only 32% of total value-added during the same period (Figure 2a). In agriculture, insecure property rights, insufficient investments in public goods such as infrastructure and agricultural research and extension, the failure to liberalize key agricultural markets, and protectionist policies have been among the top impediments to growth.[34] The under-performance of the manufacturing sector has been a result of policy distortions such as protectionist measures, restrictions on foreign ownership, complex and cumbersome business and labor regulations, and weak infrastructure that reduces their competitiveness. Among services and other industries, trade and repair, real estate, finance, construction, and public administration accounted for the highest shares in total, and this pattern has remained relatively unchanged since 2000 (Figure 2b). Having a high share of services comprising GDP is typical for many advanced economies with services concentrated in high-skill and high-productivity

[34] The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013.

branches. Instead, in the case of the Philippines, labor-intensive sectors that employ low-skill manual labor and have low productivity, such as trade, repairs and construction, account for the largest share of the value added in services.



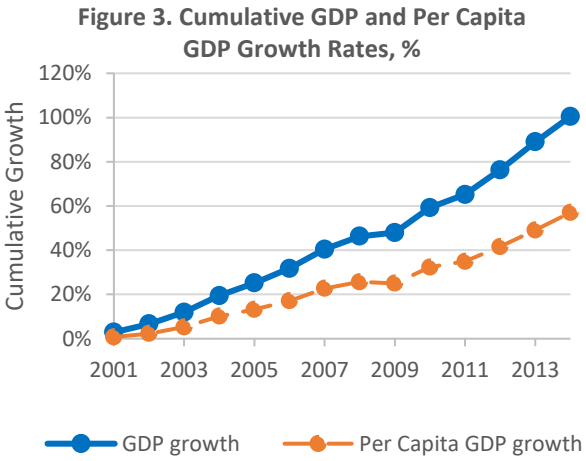

Source: Authors' calculations using the National Accounts of the Philippines.

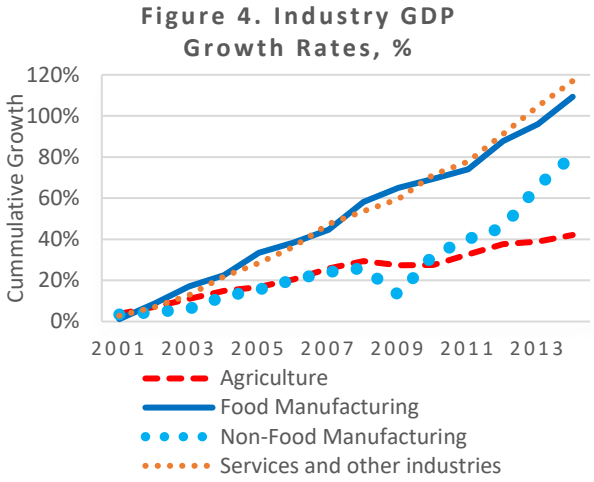
The Philippines' economy has been growing rapidly (more than 5% GDP growth per year) and nearly doubled over the period 2000-2014. However, GDP per capita only increased by 60% during the same period (Figure 3). This was mainly due to high fertility rates in the country – the highest compared to other developing countries in the region, especially among the most vulnerable groups of the population. For instance, the fertility rate for the poorest quintile of the income distribution was 5 births per woman, compared to 1.8 births per woman for the wealthiest quintile.

Services have been the primary driver of growth given their significant share in GDP (Figures 2a and 4). Food manufacturing also experienced high growth, but accounts only for 10% of GDP. Non-food manufacturing and agriculture lagged as a consequence of distortionary policies, low investments, and weak infrastructure, as mentioned before.[35] Labor productivity improvements were the highest in non-food manufacturing and services, which respectively experienced 48 and 35 percent increases in the value added per worker. However, labor productivity declined for agriculture by five percent. Labor productivity in food manufacturing lagged behind and improved only by 28 percent over the same period. This slow growth

[35] The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013.

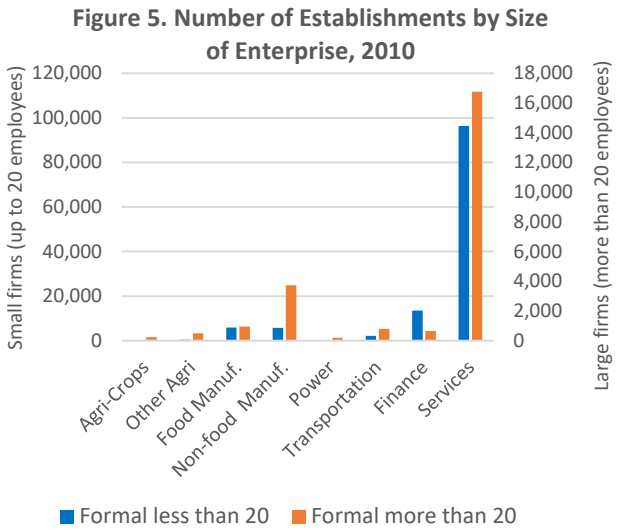
pattern reflects close linkages of this sector with agriculture. Considering that agriculture provides jobs to the most vulnerable groups of the population, deteriorating labor productivity has had a direct adverse impact on poverty and shared prosperity in the country.

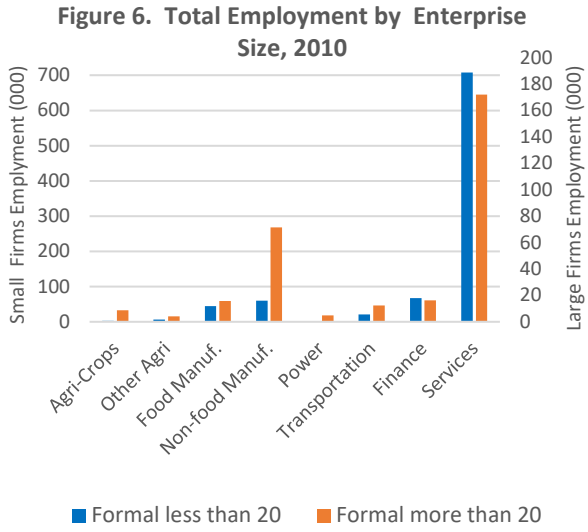



Source: Authors' calculations using the National Accounts of the Philippines.

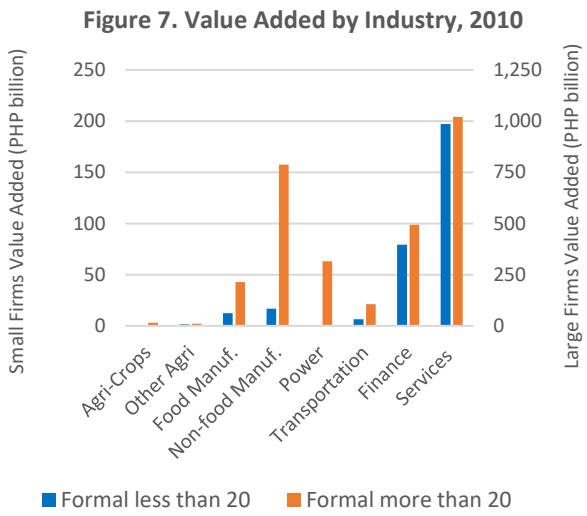
Among formal enterprises, the number of small firms (those employing less than 20 workers, following the available categorization from business survey data) significantly exceeds the number of medium and large enterprises (those employing more than 20 employees) across all sectors, except for power and other agriculture (Figure 5). The bulk of formal establishments and employment (small, medium and large) are in the service sector (Figures 5 and 6). In addition, the concentration of formal small firms, measured as their share in the total number of firms, is the highest in finance (95 percent), food manufacturing (86 percent), and services (85 percent), which could be signaling higher competition in these sectors. In terms of employment, formal medium and large companies provide many more jobs than small firms, with the highest number of jobs concentrated in services and non-food manufacturing, followed by food manufacturing, finance and transportation. Similarly, most of the employment generated by small formal firms is in services, followed by finance, food and non-food manufacturing.

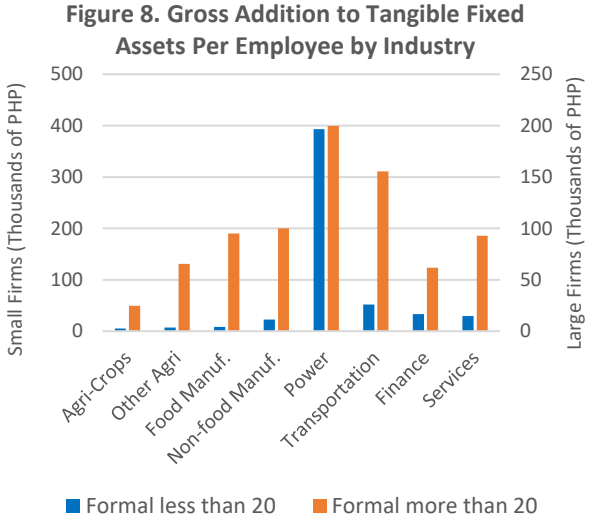



Source: Authors' calculations using 2010 Annual Survey of Philippine Business and Industry.

Large companies generate 90% of the total formal sector value added. Large firms in services, non-food manufacturing, finance, and power show the highest shares of the value added (see Figure 7). Across small formal firms, services and finance are the biggest contributors to GDP. Capital intensity varies across sectors and firm size (Figure 8). Large firms are, not surprisingly, more capital intensive than small firms, except in the power sector, which has the highest capital per employee for both small and large formal firms. In addition, large firms in transportation, followed by services, food and non-food manufacturing, show the highest capital intensity across all industry sectors. Among small formal firms – aside from power – the highest capital intensities can be observed in transportation, followed by finance and services.




Source: Authors' calculations using 2010 Annual Survey of Philippine Business and Industry.

### 2.2.2. Employment

A key feature of the Philippines economy, as in many other developing countries, is the existence of a large informal sector. The informal sector has accounted for more than half of the country's GDP since 2001 (Figure 9) and its share has even increased over time. Among formal sector enterprises, medium and large companies produced most of the remaining share of GDP, with micro and small enterprises accounting for at most for 7% of the total value-added since 2001.

Figure 9. Formal and Informal Sectors GDP

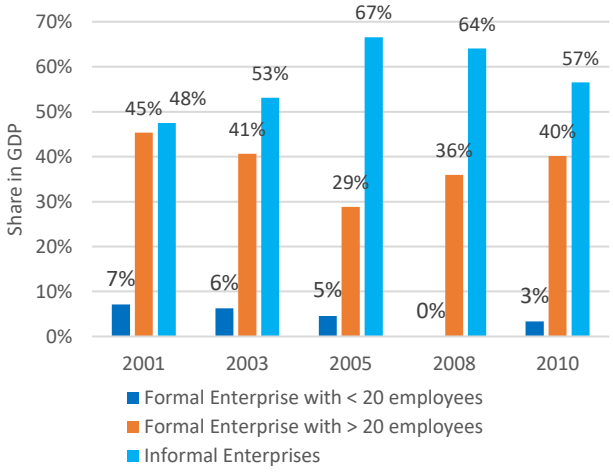
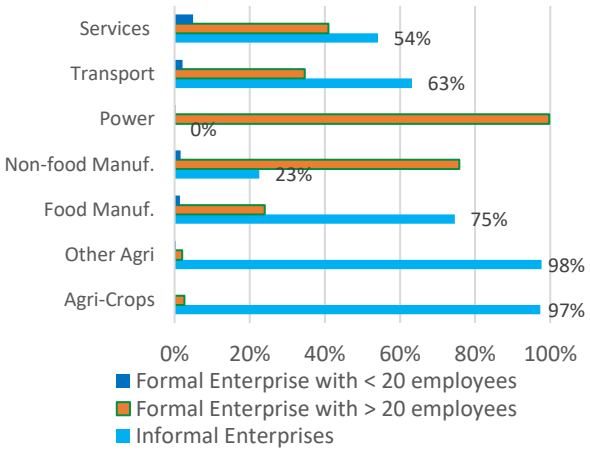



Figure 10. Formal and Informal GDP by Industry Sector (2010)




Source: Authors' calculations using 2010 Annual Survey of Philippine Business and Industry.

Furthermore, as shown in Figure 10, informal sector GDP exceeded formal sector production across most industries, with the highest shares concentrated in agriculture (97%) and food and beverages manufacturing (75%). These sectors require mostly low-skilled manual labor and generate a significant amount of self-employment. For instance, in agriculture, most workers are either subsistence or small farmers operating under large credit constraints and weak infrastructure, among other growth impediments.

The distribution of employment across sectors has remained relatively stable since 2000: services and agriculture employ more than 80 percent of the population (Figure 11). Despite a small share in GDP (about 10%), agriculture hires nearly 30 percent of all workers, of which 26 percent were engaged in crop production in 2013. At the same time, services and other industries employed almost half of all workers as of 2013. Considering that both agriculture and services are among the sectors with the highest level of informal employment (95% and 68%, respectively), the majority of their workers receive wages that are

relatively low – often below the minimum wage – and are excluded from the social benefits system, which puts them below the poverty threshold (Figure 12). Indeed, 69% of all households whose head works in agriculture and 47% of households whose head works in the informal sector workers are considered poor in the Philippines.[36] In contrast, industries that provide better-quality and higher-paid jobs, like manufacturing, finance, and electricity, each account for less than 10 percent of total employment.

**Figure 11. Employment Composition by Industry Sector**

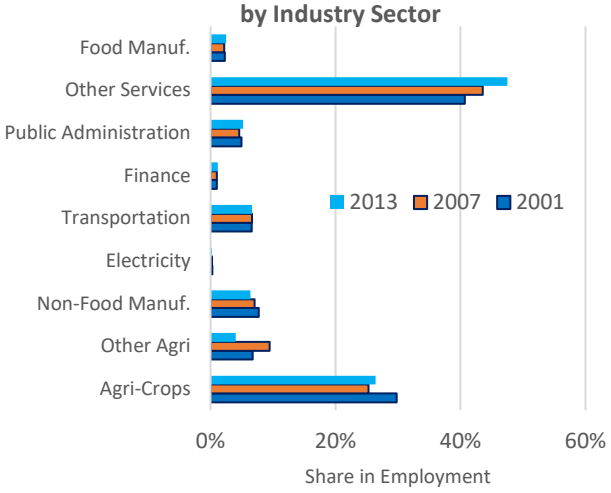
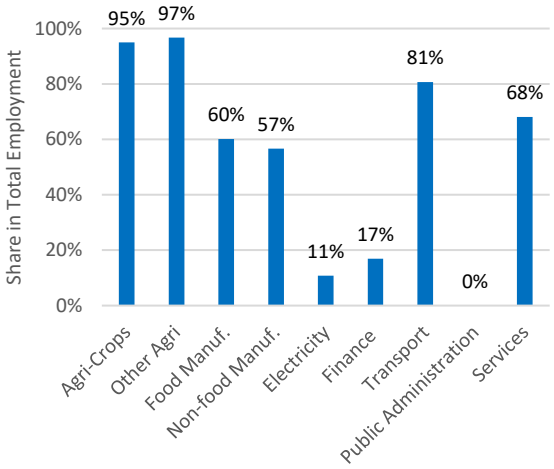



**Figure 12. Informal Employees in 2008**




Source: Authors' calculations using Labor Force Surveys of the Philippines and 2008 Informal Sector Survey.

A high share of informal employment across most industry sectors in the Philippines follows from the significant number of self-employed, especially in crops (34 percent), other agriculture (53 percent), transport (47 percent), and services (24 percent). In addition, crops and other agriculture have a significant proportion of non-paid workers who are primarily family workers and are (by our definition) informal (Figure 13). Moreover, industries with high levels of informality hire mostly low-skill labor for manual tasks. In particular, the agricultural workforce consists predominantly of individuals with only primary and secondary education; a similar pattern is observed in transport and services (Figure 14). On the other hand, manufacturing, finance, and power tend to hire more workers with secondary and post-secondary degrees, but account for a small share of total employment. A scarcity of good or productive jobs reflects a stangnat labor demand in sectors that have high productivity but slow growth, such as manuafcturing. This has

[36] The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013.

generated a significant pool of self-employed individuals, who are absorbed by low-productivity sectors that constitute the bulk of informal employment in the country.[37]

Figure 13 . Employment Status by Industry Sector (2013)

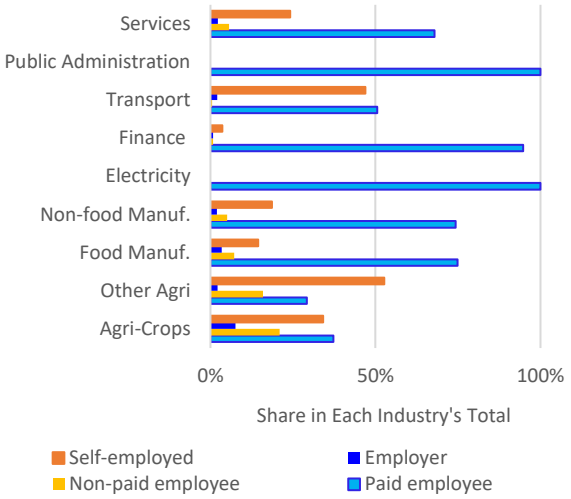
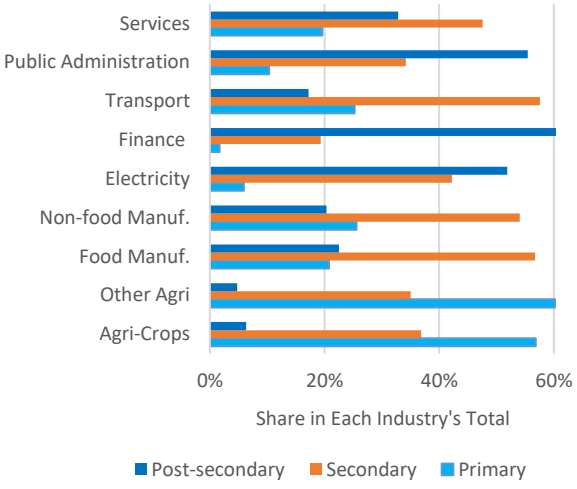



Figure 14. Employment by Education and Industry Sector (2013)



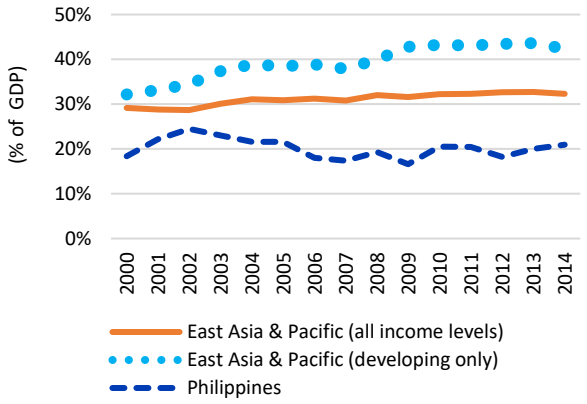

Source: Authors' calculations using Labor Force Surveys of the Philippines.

### 2.2.3. Growth Constraints

High labor costs and an unfavorable business environment reduce the competitiveness of the Philippines economy and imply lower investment as a share of GDP relative to other countries in the region. Investment as a share of GDP in the Philippines has been low since 2000, at around 20 percent, compared to more than 40 percent in other peer countries of the East Asia and Pacific region (Figure 15). High labor costs and a weak business environment help explain this pattern. From the standpoint of international competitiveness, labor costs in the Philippines, especially the minimum wage, remain high compared to other countries in the region (Figure 16). When compared to regional peers, the country ranks relatively low on both the Doing Business Ranking (focused on regulations) and the Global Competitiveness Index (covering a broader range of business environment dimensions).

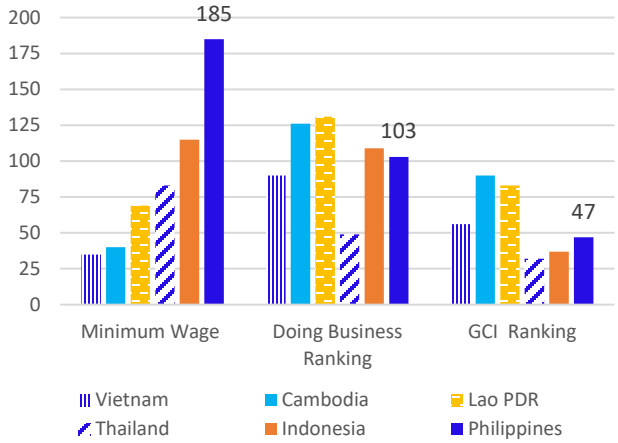
[37] The World Bank. Employment and Poverty in the Philippines. Philippine Labor Market review. 2015.

Figure 15. Investment to GDP Ratio




Source: World Development Indicators, World Bank.

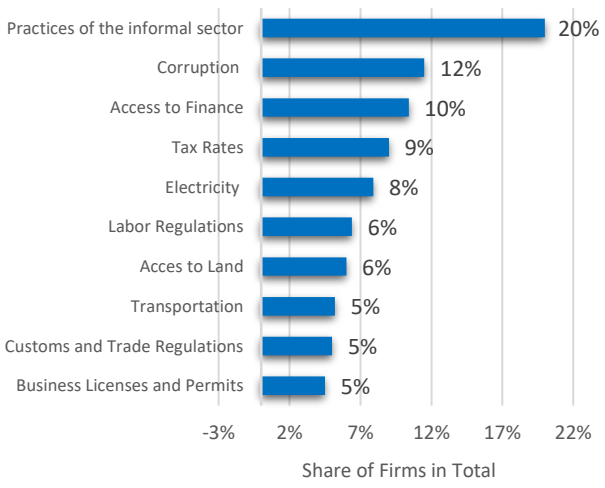
Figure 16. Business Environment Indicators




Source: Doing Business 2016 and GCI 2015-2016.

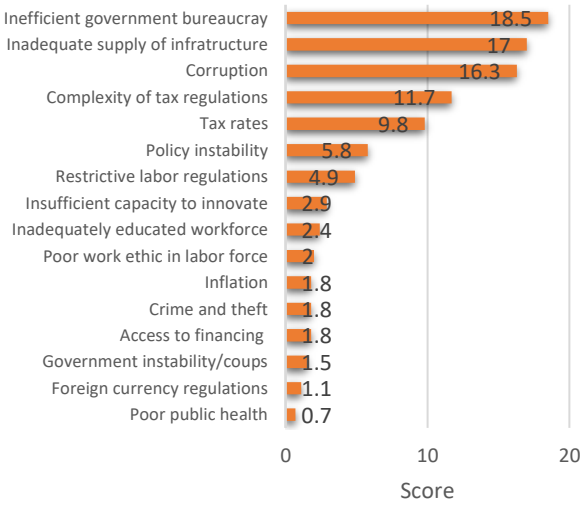
Given the high level of informality in the country, informal sector practices pose constraints for 20% of the World Bank Enterprise Survey respondent firms, which compete with informal firms that hire cheap labor, and avoid taxes and other cumbersome costly regulations (Figure 17). In addition, 10% of firms identified access to finance as a key constraint to firm entry and expansion, which affects mostly SMEs and farmers. High labor costs and tax rates are also identified as key impediments to private sector growth. The lack of adequate transport infrastructure affects the most vulnerable groups residing in remote rural areas, while high tariffs in the competitive energy market constrain 8% of the firms surveyed. Finally, the Philippines' unfinished land reforms and complex labor regulations, such as high minimum wages, hurt competitiveness in the private sector. These obstacles are also listed in the Global Competitiveness Report as some of the most problematic factors for doing business, with inefficient government bureaucracy, inadequate supply of infrastructure, and corruption topping the list (Figure 18).

**Figure 17. Ranking of the Top Business Environment Obstacle for Firms**




Source: Enterprise Surveys, WBG. 2014-2016.

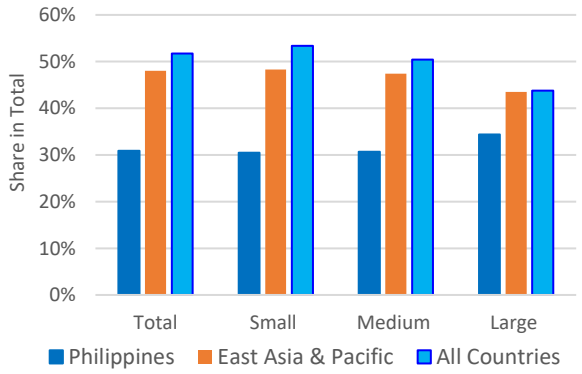
**Figure 18. The Most Problematic Factors for Doing Business**




Source: The Global Competiveness Report 2015-2016.

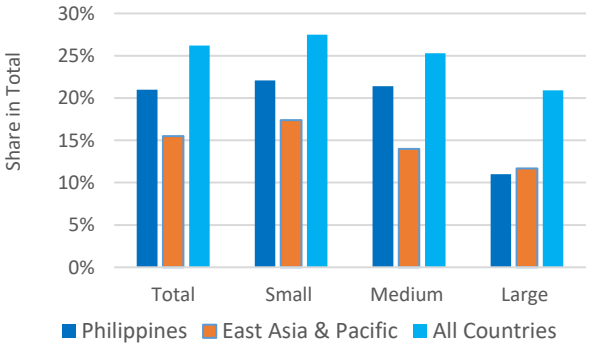
The share of (mostly SME) firms that identify themselves in the Enterprise Survey as competing against unregistered or informal firms is about 30%. Although this indicator is relatively low when compared to the World and other East Asian and Pacific countries, it tops the list of obstacles in the firms' business environment assessment, with a higher share of firms listing it as a major constraint compared to other countries in the region. This indicator is higher for small and medium sized firms, as nearly 20 percent of the total Enterprise Survey respondent firms listed it as a major constraint compared to only 10 percent of large firms surveyed (Figures 19 and 20).

**Figure 19. Fraction of Firms Competing against Unregistered or Informal Firms %**




Source: Enterprise Surveys, WBG. 2014-2016.

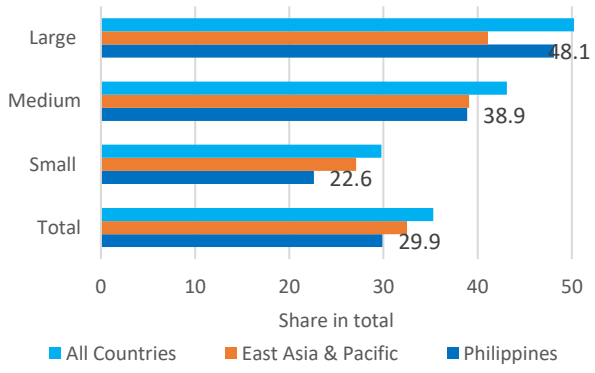
**Figure 20. Fraction of Firms Identifying Practices of Competitors in the Informal Sector as a Major Constraint**




Source: Enterprise Surveys, WBG. 2014-2016.

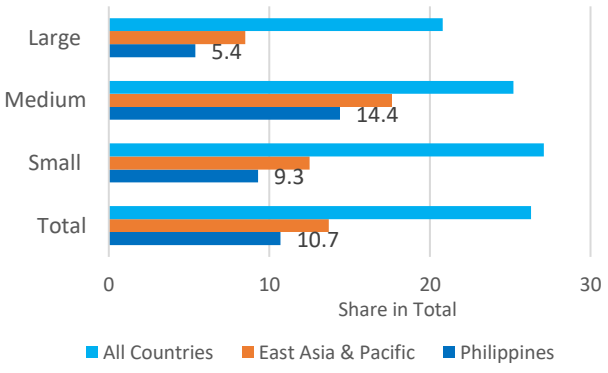
According to data from the 2015 World Bank Enterprise Survey, 29.9% of Filipino firms had a bank loan or line of credit, compared to 34.6% globally and 27.9% in the East and Asia Pacific region (Figure 21). At the same time, a higher proportion of large firms had loans or other credit (48.1%) when compared to medium (38.9 %) and small firms (22.6%). According to a 2011 World Bank report, micro, small and medium enterprises (MSMEs) – and particularly agricultural borrowers – face significant challenges in obtaining credit, as financial products such as leasing and factoring, which in principle serve SME clients, are not yet fully developed in the Philippines.[38] Indeed, in the 2015 Enterprise Survey, 9.3% of small firms and 14.4% of medium firms identified access to finance as a major constraint, compared to 5.4% of large firms (Figure 22). Similar findings emerged from a recent survey on the barriers faced by 101 SMEs from the electronics, automotive, garments, and food sectors. Financing constraints, such as a shortage of working capital to finance new business plans, difficulties in obtaining credit from suppliers and financial institutions, insufficient equity, and the high cost of credit, have remained some of the most critical barriers affecting SME growth.[39] Considering that MSMEs account for 99.6% of all firms (92% were microenterprises), provide 70% of total employment, and contribute an estimated 30% of GDP in the Philippines, financial constraints might have significant implications for job creation and overall welfare.[40] [41]

**Figure 21. Fraction of Firms with a Bank Loan/Line of Credit**




Source: Enterprise Surveys, WBG. 2014-2016.

**Figure 22. Fraction of Firms Identifying Access to Finance as a Major constraint**

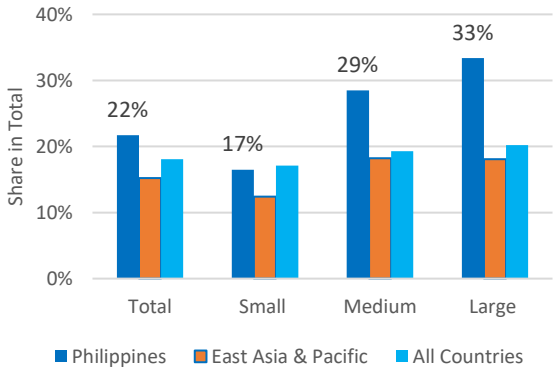



Source: Enterprise Surveys, WBG. 2014-2016.

[38] The World Bank. Financial Sector Assessment Program Update: Philippines. July 2011.
[39] Philippine Institute for Development Studies (PIDS). SMEs Access to Finance: Philippines. September 2011.
[40] The World Bank. Financial Sector Assessment Program Update: Philippines. July 2011.
[41] The 2013 IFC Jobs Study "Assessing Private Sector Contributions to Job Creation and Poverty Reduction", included a micro case study done in Sri Lanka, which estimated that the annual job growth rate among SME's that received financing from an IFC bank client was 12% between 2009 and 2012, doubling the nationwide job growth rate. This was also accompanied by growth in labor productivity as the two main channels of job creation were the business expansion and investment in technology.

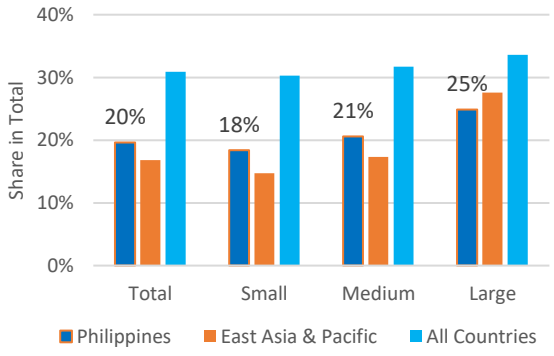
The Philippines lags behind the East Asia and Pacific region and the world in terms of transport infrastructure: 22% of firms identified transportation as a major constraint to growth, compared to 15% and 18% in the region and in the world, respectively (Figure 23). In addition, inadequate supply of infrastructure was listed as a top constraint on growth in the Philippines in a survey conducted by the Global Competitiveness Index. Several studies have found that lower investments in rural infrastructure, including roads, contributed to the decline in agricultural productivity.[42] In particular, the supply chain for agriculture is characterized by high transportation costs due to low quality roads, especially farm-to-market roads connecting small farms to urban markets. The lack of competition in the local shipping and trucking industries add to the list of inefficiencies. Overall, the national road infrastructure, especially the national arterial road and expressway network outside of industrial zones, is fragmented, underdeveloped, and under-maintained, despite some progress in increasing the paved roadway network. All this results in high overall logistics costs, which reduce the competitiveness of the country's private sector. [43]

**Figure 23. Fraction of Firms Identifying Transportation as a Major Constraint**




Source: Enterprise Surveys, WBG. 2014-2016.

**Figure 24. Fraction of Firms Identifying Electricity as a Major Constraint**



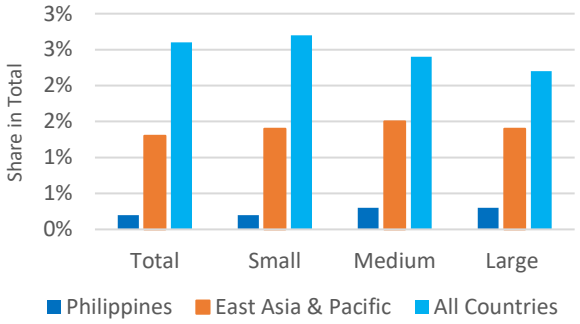

Source: Enterprise Surveys, WBG. 2014-2016.

Electricity was identified as a major constraint by 20% of firms in the 2015 World Bank Enterprise Survey. As firms grow in size, their capital intensity and energy demand rise as well, reflecting a higher proportion of larger firms that are energy constrained compared to medium and small firms (Figure 24). Regarding electricity reliability, the country performs well compared to the world but lags behind the East

[42] The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013.
[43] Cambridge Systematics, Inc. Philippine Transport Infrastructure Development Framework Plan: Final Interim Report. May 2014.

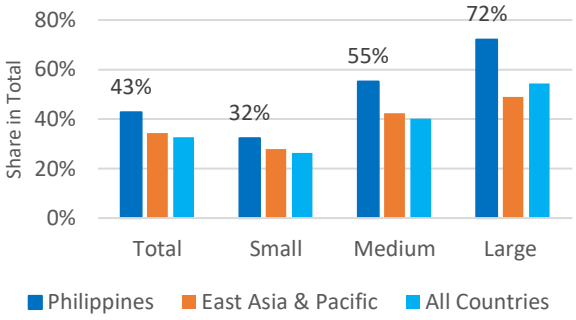
Asia and Pacific region, with the exception of large firms. Despite being energy constrained, firms' losses due to electrical outages account for only 0.2% of annual sales, compared to 3.2% and 4.7% for the region and the world, respectively (Figure 25). A high proportion of firms of all sizes own or share a generator (42.7% compared 34.4% in the region and 32.6% globally), which partly explains the lower outage losses (Figure 26). In addition, the power sector in the Philippines is characterized by high tariffs, even after the privatization of the electricity generation market. Indeed, the Philippines' energy tariffs increased considerably after the liberalization reforms that were expected to bring them down, and they currently are comparable with Singapore and Japan, countries with much higher income levels.[44]

**Figure 25. Losses Due to Electrical Outages (% of Annual Sales)**




Source: Enterprise Surveys, WBG. 2014-2016.

**Figure 26. Fraction of Firms Owning or Sharing a Generator by Firm Size**



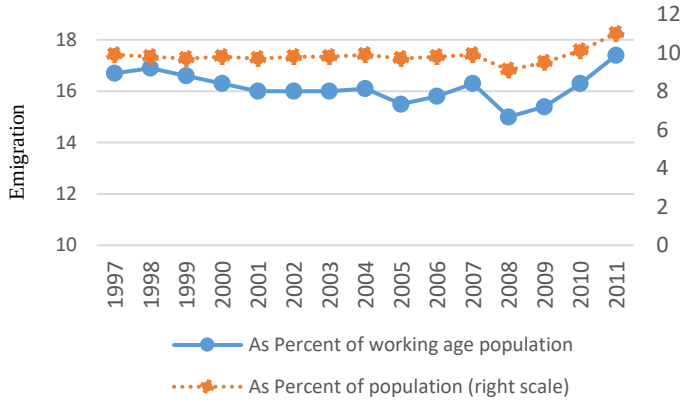

Source: Enterprise Surveys, WBG. 2014-2016.

Sizable emigration, reflecting the lack of domestic labor opportunities, has brought significant remittances flows but has not necessarily led to direct poverty alleviation. More than 10 million Filipinos and their families have left the country to work abroad as of 2012 (Figure 27). Around six million Filipinos, equivalent to 12% of the active labor force, are working overseas under fixed-term contracts, while six million more reside abroad permanently. While the high level of overseas migration is an indication of the competitiveness of Filipino workers in the global market, it is also a reflection of a domestic economy that is unable to provide quality jobs to most of its people. Among labor-exporting countries in 2010, the Philippines was the fourth-largest recipient of remittances (totaling USD 20 billion, nearly 10% of GDP). Remittances are higher than the value-added of merchandise exports and have helped fuel consumption

[44] IFC. Economic Impact of IFI Investments in Power Generation in the Philippines. June 2015.

and growth. It is important to note that, given the skill requirements of overseas jobs, most Filipino migrants are not from the poorest households. Hence, most of the remittance inflows do not directly reach the poor.

**Figure 27. Migration in the Philippines**



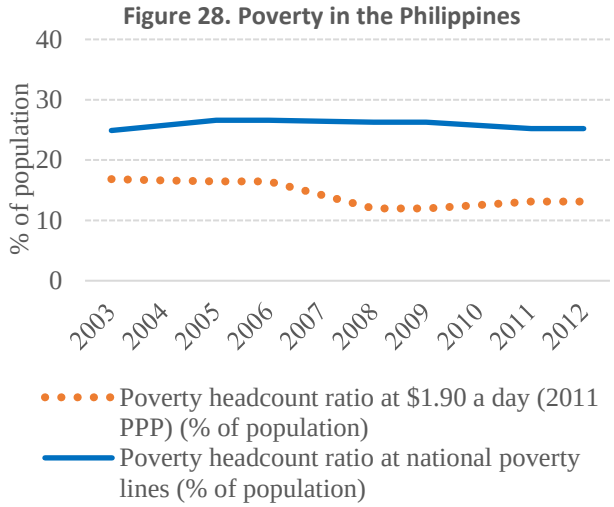

Source: World Bank Development Indicators

### 2.2.4. Recent Facts on Poverty, Shared Prosperity and Demographics in the Philippines

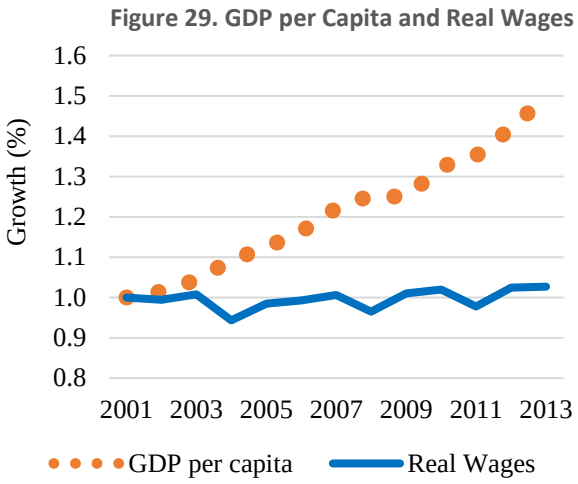
The Philippines' strong economic growth (averaging 5% since 2000) has not been inclusive and did not improve the welfare of the most vulnerable groups of the population. The poverty headcount, measured both at the 1.90 dollar per day and national poverty lines, remained stable between 2003 and 2012 (Figure 28). In 2009, about 23 million people lived below the national poverty line, accounting for 26.5% of the population, while poverty levels remained unchanged in 2012. While GDP per capita has increased with GDP growth, average real wages have stagnated since 2001 (Figure 29). This is partially explained by the lack of industrialization and the expansion of low-productivity services sectors that absorbed the excess labor supply from agriculture through mostly low-paid informal jobs.

Despite an insignificant reduction in poverty, the Philippines experienced some progress with regard to the shared prosperity goals of the World Bank Group. According to the World Development Indicators, the annualized growth in mean consumption or income per capita of the bottom 40 percent of the population was 1.1 percent as opposed to 0.4 percent growth for the total population during the period of 2006-2012. However, this growth in income of the bottom 40 percent was relatively lower than in other countries of the region, such as Laos, Indonesia, Thailand, Vietnam, China, and Camobodia[45].

[45] The World Bank. Ending Extreme Poverty and Sharing Prosperity: Progress and Policies. October. 2015

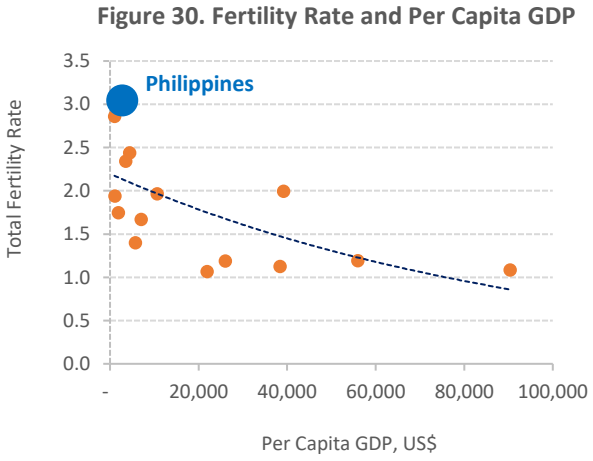



Source: World Bank Development Indicators.




Source: World Bank Development Indicators.

Demographic trends in the Philippines have also contributed to the lack of progress in poverty reduction. High fertility rates, especially in low-income households, have contributed to an excess supply of (generally low-skilled) labor that has kept average real wages stagnant for the past decade. The fertility rate among the poorest quintile of the income distribution was 5 births per woman, compared to 1.8 births per woman for the wealthiest quintile. In addition, Philippines has the highest fertility rate among other developing countries in the region. Figure 30 shows a negative correlation between GDP per capita and fertility rates among these countries.




Source: World Bank Development Indicators

Poverty is widespread among employed individuals, who are more likely to be poor than those who are unemployed[46]. According to WB (2016), 60.9 percent of the poor population are employed, while only 3.8 percent of the poor are unemployed[47] (Figure 31). The latter have, on average, a higher education and are from well-off families with high reservation wages. Poverty among the employed is primarily driven by a high share of informality in the Philippines: nearly three-quarters of all workers are engaged in the informal sector. The informal jobs pay salaries lower than the minimum wages (values differ by regions) and provide insufficient income for households to move out of poverty. Many of these informal workers engage in agriculture, which hires predominantly informal employees as discussed above. In particular, 36.1 percent of workers engaged in the agriculture sector are poor, while only 10.7 and 7.6 percent of workers in the industry and service sector, respectively, are considered poor (Figure. 32).

**Figure 31. Poverty among Working Age Population by Labor Force Status**

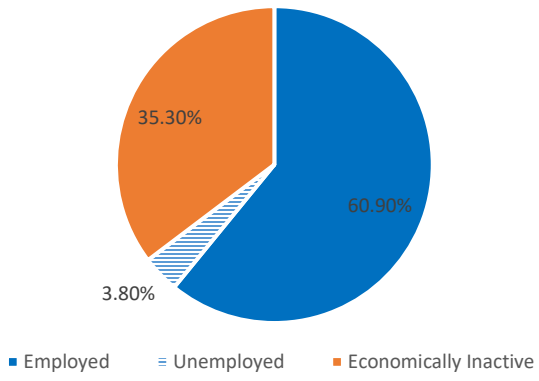
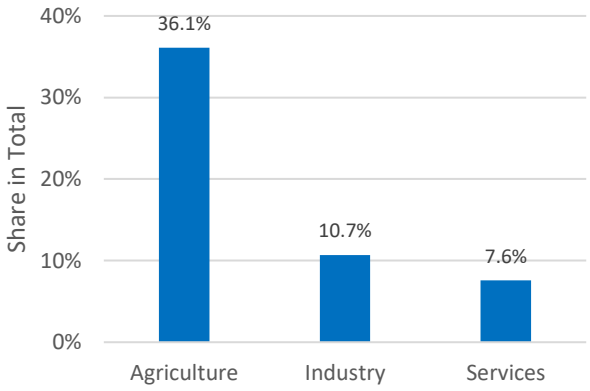



**Figure 32. Poverty Incidence Rates by Sector, %**




Source: The World Bank. Republic of the Philippines, Labor Market Review, Employment and Poverty. January 2016

A high share of poor workers concentrated in agriculture and the informal sector generates a significant gap between rural and urban poverty rates. In 2009, 41.2 percent of the rural population was below the poverty threshold as opposed to only 11.6 percent of the urban population (Figure. 33). This trend has been persistent over time and is also consistent with the stagnant poverty levels in the country. The skill composition of workers is closely linked with informality and job location, and generates labor market segmentation, which affects workers' wages and, hence, households' welfare. In particular, informal

[46] The World Bank. Republic of the Philippines, Labor Market Review, Employment and Poverty. January 2016.
[47] Poor people here are defined as those who are in the bottom quintile of income distribution.

and rural sectors hire low-educated and low-skilled workers, while formal and urban sectors employ more educated and better skilled individuals and offer higher wages than the former. Education and skills are responsible for much of the inter-sectoral differences in wages. This labor market segmentation creates substantial wage inequality. An average formal worker earns twice as much as an informal worker, and 92 percent of all low-paid jobs are informal jobs. Hence, poverty levels are higher among those with no education (39.1 percent), only primary education (23.8 percent), and incomplete secondary education (22 percent) than for others (Figure 34).

**Figure 33. Urban and Rural Poverty Incidence Rates, %**

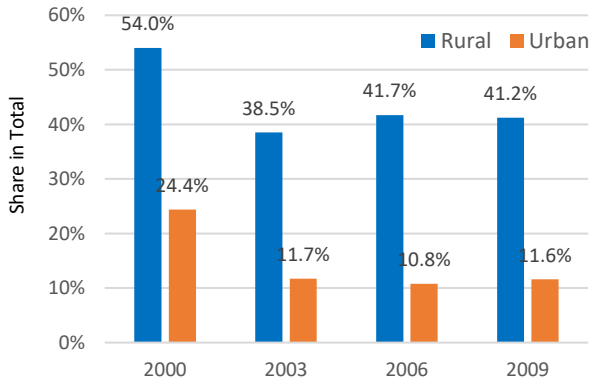
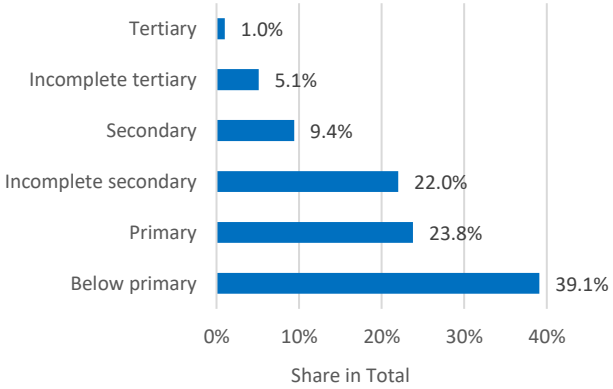



**Figure 34. Poverty Incidence Rates by Education Attainment, %**




Source: (1) The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013, and (2) The World Bank. Republic of the Philippines, Labor Market Review, Employment and Poverty. January 2016

## 2.3. General Model Description

As EPIQ is a recursive dynamic model, this sections discusses the “within" and “between" period behavior of all economic agents and their interactions. The economic representation of the model can be broken down into household decisions, the behavior of firms, the government, markets and prices, investment, other determinants of economic growth, and the modeling of societal evolution. While many of the basic aspects of economic behavior are derived from a neoclassical general equilibrium structure, the model deviates from the assumption of instantaneous equilibria across all markets. Namely, commodity and factor prices are not necessarily market clearing, resulting in annual demand and supply not necessarily being equal. Hence, involuntary non-employment of factors can occur. However, the formulation ensures that in the absence of shocks the economy reverts to an equilibrium in the long run.

Model dynamics are introduced by means of sub-structures for the evolution of demographics, labor endowments, capital formation, total factor productivity, and assumptions on the response of prices to supply-demand imbalances, plus other stock-flow constructions included in the model. The model is recursive dynamic and covers a historical and a forecasted period of time in discrete (monthly) time steps. Critically, agents do not have perfect foresight. Instead, they observe the values of relevant variables (i.e. prices, income and costs) at every point in time and make decisions (i.e. consumption, output and factor demand) that optimize their objective functions. The economy may be out of equilibrium at the end of a given period, due to uncertainty about prices and markets at the time of decision making, delays in price adjustment, delays in the decision-making process, and the presence of stocks. Agents revise their decisions at every point in time based on the information at hand.

In this section, we touch on all core aspects of the model. The outline of this section is as follows. We first touch on the households' decision problem, followed by a discussion of firms' planning and production problems. We then discuss the representation of the government. Fourth, we touch on EPIQ's representation of investment, followed by subsection 2.3.5 explaining the functioning of factor and intermediate markets. The sixth subsection lays out price formation. Subsection 2.3.7 sheds light on determinants of growth. And, finally, we document the evolution of the population by discussing the transition matrix and the modeling of additional endogenous domestic migration.

### 2.3.1. Households

As one of the main goals of EPIQ is to investigate the impact of different private sector investment strategies on the attainment of the WBG twin goals, the model allows us to map counterfactual outcomes to highly disaggregated household level consumption and income effects. EPIQ ensures this by disaggregating private households into 7,680 different types. Households differ by age of the household head (in 5 year time steps), the education level of the household head (primary, secondary, tertiary), the number of people in the household ($hhsize_h$), the number of working age people in the household, whether the household is located in a rural or urban area, whether the household receives remittances, and how much capital the household is initially endowed with. In order to aggregate households to the macro level, each household has an associated weight $\theta_h$ that represents the number of households of a specific type

in the current year. Weights change over time, both, exogenously and endogenously, to reflect changes in population size and population composition with respect to household characteristics. The exogenous and endogenous change in household weights over time is explained in sections 3.8 and 3.9, respectively.

Households maximize a *Stone-Geary* utility function (1) in each period subject to their budget constraint (2). The utility function can be written as

$$U_h = \prod_c (QH_{ch} - hhsize_h \gamma_c)^{\eta_c} \quad (1)$$

where $QH_{ch}$ is the consumption of commodity $c$ by household $h$, $\gamma_c$ is the minimum required consumption of commodity $c$ per person, and $\eta_c$ is the household's expenditure share of good $c$.

While income levels of households differ across household types and time, we keep minimum consumption of commodities per capita constant. All households have identical expenditure shares for consumption beyond minimum expenditure levels. Minimum consumption $\gamma_c$ is estimated using data from household expenditure surveys. The household's budget constraint is

$$\sum_c PQ_c(\, QH_{ch} - hhsize_h \gamma_c) = (1 - MPS)(1 - \tau_h) DY_h \quad (2)$$

where $DY_h$ is total disposable income of household $h$ before savings and taxes, but after minimum expenditures are deducted. $MPS$ is the marginal propensity to save,[48] $PQ_c$ is the consumer price of commodity $c$ and $\tau_h$ is the household's income tax rate. Solving the household's utility maximization problem, we obtain the Marshallian demand function

$$QH_{ch} = hhsize_h \gamma_c + \frac{\eta_c (1 - MPS)(1 - \tau_h) DY_h}{PQ_c} \quad (3)$$

The disposable income of the household is defined as

$$DY_h = HHY_h - hhsize_h \, MIS \quad (4)$$

where minimum expenditure necessary to survive, $MIS$, is given by

[48] While the current pilot model applies a single MPS to all households, it is important to note that, first, the formulation could easily accommodate an income dependent variation in saving rates, and second, the realized MPS measured on total income differs already across households, as the single MPS is applied to income after taxes and after minimum consumption has been accounted for.

$$MIS = \sum_c \gamma_c \, PQ_c \tag{5}$$

while total household income $HHY_h$ is

$$HHY_h = FY_h + Remittances_h^t + Transfers_h^t \tag{6}$$

and factor income $FY_h$ in turn is

$$FY_h = \sum_l \sum_r [\min(\sigma_{rl}, 1) \, . \, hhlabor_{hl} \, . \, hhurb_{rh} \, . \, PL_{rl}] + \min(\sigma_k' \, ,1) \;\; k_h \, PK \tag{7}$$

where $hhlabor_{hl}$ is household $h$'s effective labor endowment of type $l$, $\sigma_{rl}$ is the labor demand to supply ratio[49] in area $r$ for education level $l$, $hhurb_{rh}$ is a matrix of 0s and 1s, where the households' regions of residence are indicated by a 1, $PL_{rl}$ is the wage rate[50] in region $r$ for skill level $l$, $k_h$ is financial capital held by household $h$, $\sigma_k'$ is the capital demand to supply ratio[51] in the previous period,[52] and $PK$ is the rate of return to capital.

### 2.3.2. Production

Given the sectoral focus of EPIQ, differentiation across and within industries is a central feature of the model that allows for the analysis of key drivers of sectoral and economy-wide growth, and facilitates a holistic approach to assess the overall impact of country-level strategies and investment programs. This version of the model features ten sectors: agriculture crops, other agriculture, food manufacturing, non-food manufacturing, power, transportation, BPO services, tourism, other tradeables, and non-tradeable services. The choice of sectoral disaggregation is driven by their contributions to GDP and employment, their strategic importance as growth enablers, and our interest in investigating specific scenarios.

[49] As EPIQ does not assume labor markets to clear in every period, demand and supply of labor need not to be equal. Hence, if demand for labor is lower than supply, we assume that only employed workers are earning wages. In addition, we assume that the share of workers not employed is equally spread over all household types supplying a given type of labor.

[50] We assume the labor market to be segmented into 5 markets with no intra-period mobility between them. This results in 5 different wage rates. One for each - primary and secondary - education levels in each region and one tertiary labor market for both regions combined.

[51] Like the labor demand to supply ratio $\sigma_{rl}$, the capital demand to supply ratio $\sigma_k'$ indicates the imbalance in capital markets. If the demand for capital is less than the supply of capital, not all the financial capital can be put at productive use, and hence, households' capital incomes are smaller on average. This adjustment of capital income could be thought of a difference between the rate of return productive capital earns and the rate of return the average financial capital earns hold by households. The satisfaction ratios are discussed in greater detail in section 2.3.5.1.

[52] We refer to past variables using ‘.

While neoclassical economic models assume that firms can change their production decisions instantaneously to react to a change in prices, in reality firms typically make production decisions ahead of time, and thus under uncertainty. Those decisions are made based on observed information and applying expectations of future demand and prices. In this regard, production decisions in EPIQ resemble companies' behavior in the real world: sectors decide on their target output for the next period to meet adaptive expectations of future domestic and export demand, considering domestic commodity inventories. Sectoral production functions exhibit fixed expenditure shares for the different labor types and physical capital, and production requires fixed quantities of intermediate inputs besides value added. In a second step, firms decide on their physical capital and labor to minimize costs based on their expectations on future factor prices. As wages and interest rates are sticky, a sector might not be able to acquire all required factors of production, and thus actual realized production might fall short of planned output.

#### 2.3.2.1. Domestic Production

The model allows for combined production of goods. This means that a sector might not only produce the good immediately associated with it, but also other additional goods. The output of a sector, $OUTPUT_a$, is split between a set of commodities in fixed shares $\varphi_{ac}$ according to a constant elasticity of transformation (CET) of 0. Therefore, domestic production of commodity c, $QX_c$, can be written as

$$QX_c = \sum_a \varphi_{ac}\, OUTPUT_a \tag{8}$$

Following the Armington (1969) specification for the determination of exports, domestic production $QX_c$ can be either exported or sold domestically following a CET function:

$$QX_c = at_c \left[\delta_c^E QE_c^{\rho_c^E} + (1-\delta_c^E) QD_c^{\rho_c^E}\right]^{\left(1/\rho_c^E\right)} \tag{9}$$

where $at_c$ is a productivity (shift) parameter, $QE_c$ is production towards exports, $QD_c$ is production towards domestic supply, $\delta_c^E$ is an export share parameter and $\rho_c^E$ is the elasticity of transformation between domestic supply and exports. From profit maximization, it follows that exports $QE_c$ can be written as

$$QE_c = \left[\frac{\delta_c^E}{(1-\delta_c^E)} \frac{PE_c}{PD_c}\right]^{\frac{1}{\rho_c^E - 1}} QD_c \tag{10}$$

#### 2.3.2.2. Output Planning

Equations describing the production sectors are derived from a planning problem assuming cost minimizing behavior. Firms' production decisions reflect how these decisions are made in reality. Companies must make decisions upfront, under uncertainty on prices and factor availability. Thus, we assume that sectors decide on the amount they want to produce based on past demand for their product. Therefore, target output $\boldsymbol{T}[OUTPUT_a]$ is derived using adaptive expectations on future demand that define target domestic supply $\boldsymbol{T}[QD_c]$ based on expected demand and targeted adjustments to commodity stocks:

$$\boldsymbol{T}[QD_c] = QDD_c(1 + \boldsymbol{E}[grQDD_c]) + \boldsymbol{T}[\Delta S_c] \tag{11}$$

where $QDD_c$ is domestic demand for good $c$, $\boldsymbol{E}[grQDD_c]$ is the expected growth rate of demand, and the targeted change in the stock of inventories $\boldsymbol{T}[\Delta S_c]$ is

$$\boldsymbol{T}[\Delta S_c] = (\boldsymbol{T}[S_c] - S_c)\ .\ \psi_s \tag{12}$$

where $S_c$ denotes the current inventory stock of commodity $c$, $\boldsymbol{T}[S_c]$ is the ideal stock, which is defined as a fraction of annual demand, and $\psi_s$ represents the speed of adjustment of the stocks towards their preferred level. Taking into account expectations of future domestic demand and expectations on export demand, targeted overall supply $\boldsymbol{T}[QX_c]$ follows the Armington assumption.

$$\boldsymbol{T}[QX_c] = at_c\left(\delta_c^E \boldsymbol{E}[QE_c]^{\rho_c^E} + (1 - \delta_c^E)\boldsymbol{T}[QD_c]^{\rho_c^E}\right)^{(1/\rho_c^E)} \tag{13}$$

where $\rho_c^E$ represents the elasticity of transformation between domestic supply and exports and $\boldsymbol{E}[QE_c]$ is expected export demand for good $c$. While each sector $a$ has a corresponding good c that is mainly produced by this sector, the model allows for co-production of other commodities. $\varphi_{ac}$ describes the fixed share of output of each commodity $c$ in the total output of sector $a$, and hence, co-production has to be taken into account to compute target output. This results in target output for sector $a$ being

$$\boldsymbol{T}[OUTPUT_a] = \left(\boldsymbol{T}[QX_c] - \sum_{\underline{a}}(\varphi_{\underline{a}c}\ .\boldsymbol{T}\left[OUTPUT_{\underline{a}}\right])\right)/\varphi_{ac} \tag{14}$$

where $c$ describes the corresponding good to sector $a$, and $\underline{a} \in A \backslash a$ contains all other sectors.[53]

[53] Of course, if there is a one-to-one mapping between sectors and commodities, the formula below becomes much simpler. Indeed, in that case $OUTPUT_a = QX_a$ and equation (14) collapses to $\boldsymbol{T}[OUTPUT_a] = \boldsymbol{T}[QX_a]$.

#### 2.3.2.3. Factor Employment

Once the target level of output is defined, firms try to minimize production cost. The production function of a standard sector is a nested CES function, where, on the first tier, intermediate inputs are aggregated with value added in a Leontief function. On the second tier, labor and capital are combined in a Cobb-Douglas function. The production function can therefore be written as

$$OUTPUT_a = min\left(II_{ac}/ica_{ac}\ , \xi_a^t(QK_a/\max(\sigma'_{cap},1))^{\alpha_a}\prod_l(QL_{al}/\max(\sigma_{al},1))^{\beta_{al}}\right) \quad (15)$$

where $OUTPUT_a$ is output of sector $a$, $II_{ac}$ are intermediate inputs of good $c$, $ica_{ac}$ are leontief coefficients for the intermediate inputs, $\xi_a^t$ is exogenous total factor productivity, $QK_a$ is capital employed, $\alpha_a$ is the value share of capital in value added, $QL_{al}$ is employed labor of skill type $l$ and $\beta_{al}$ is the value share of labor type $l$ in sector $a$. Since the labor market does not necessarily clear in every period, cost minimizing labor and capital demands might not be satisfied by supply, and hence, labor and capital inputs might be subject to a factor satisfaction ratio $1/\max(\sigma_{al},1)$ that is smaller than one.[54] [55]

From the above production function and target output, we can derive cost minimizing labor and capital demands. We assume that firms are not able to immediately adjust their production to the market, as production and factor employment decisions are made for the following time period. Therefore, from the cost minimization problem we arrive at the following Hicksian demand functions for labor and capital [56]

$$QF_{af} = \frac{\boldsymbol{T}[OUTPUT_a]}{\xi_a^t}\cdot\prod_{\underline{f}\neq f}\left(\frac{PLF'_{a\underline{f}}}{PLF'_{af}}\cdot\frac{\beta_{af}}{\beta_{a\underline{f}}}\right)^{\beta_{a\underline{f}}} \quad (16)$$

where target output $\boldsymbol{T}[OUTPUT_a]$ replaces $OUTPUT_a$ , as factor demand depends on planned rather than realized output, and, $PLF'_{af}$ represent past rates of return for physical capital[57] and past labor prices[58], as firms exhibit static expectations on factor prices.

---

[54] The factor satisfaction ratio is the inverse of the demand to supply ratios $\sigma_{al}$ and $\sigma'_{cap}$ that have been introduced in equation (7) and are discussed in greater detail in section 2.3.5.1.

[55] It is important to note that in order to segregate the labor market, and given data limitations, we assume that agricultural sectors demand rural labor, while all non-agricultural sectors demand the labor of urban workers.

[56] $QF_{af}$ stands for factor demand and replaces $QL_{al}$ and $QK_a$ to allow for simpler notation.

[57] While we typically refer to the value share of capital as $\alpha_a$, here we use $\beta_{a'cap}$, to simplify the notation.

[58] Factor prices $PLF'_{af}$ are not necessarily different for every sector. $PLF'_{a'cap}$, stands for the rate of return to capital $PK'$, the same for all sectors. Labor prices are different for rural and urban sectors, but identical within areas.

Demand of intermediates can be written as

$$II_{ac} = ica_{ac} OUTPUT_a \tag{17}$$

where $II_{ac}$ is the intermediate demand of commodity $c$ for sector $a$'s production and $ica_{ac}$ describes the Leontief technology inputs for the sector. In contrast to the factor inputs, we assume that intermediate inputs are bought at the time of production. Hence, intermediate input demand depends on actual output realized.

### 2.3.3. Government

The government in EPIQ generates revenues through collecting taxes and spends its income on transfers to households, general government expenditures and investments. The tax income comes from direct and indirect taxes. The direct tax revenue $INCTAXREV$ is

$$INCTAXREV = \sum_h \theta_h \tau_h DY_h \tag{18}$$

where $\tau_h$ is the income tax rate that is levied on household $h$'s disposable income $DY_h$.[59] To aggregate total taxes levied from all households we apply the household weight $\theta_h$ and sum over all household types. Besides direct taxes the government levies indirect taxes on sales and imports. The sales tax revenue from commodity $c$ can be written as

$$SALESTAXREV_c = \tau_c^s [PD_c QD_c + PM_c QM_c] \tag{19}$$

where $\tau_c^s$ is the ad valorem sales tax rate on commodity $c$, $PD_c$ and $PM_c$ are the domestic and import prices of the commodity, and $QD_c$ and $QM_c$ are the quantities produced and sold domestically and imported, respectively. To get to total tax revenue, one must sum over all commodities c.

Import tax revenues are

$$IMPORTTAX_c = \tau_c^m pwm_c^t EXR \,.\, QM_c \tag{20}$$

where $\tau_c^m$ is the ad valorem import tax rate, $pwm_c^t$ is the import price of commodity $c$ denoted in foreign currency and $EXR$ represents the exchange rate to local currency.

[59] Since the current version assumes that the amount of financial and physical capital is the same, and that households invest all their savings, all capital is ultimately owned by households. Therefore, all tax income from taxing capital comes from household income taxes.

While imports are taxed, exports are often subsidized. We take this into account, and hence, allow for export tax rates to be negative, if appropriate. Therefore, export tax income, or, depending on the policy, subsidy expenditures are written as

$$EXPORTTAX_c = \tau_c^e pwe_c^t EXR \,.\, QE_c \tag{21}$$

where $\tau_c^e$ is the ad valorem export tax rate, $pwe_c^t$ is the export price in foreign currency, and $QE_c$ is the quantity exported. As noted above, the export tax rate $\tau_c^e$ is often negative, representing an export subsidy.

Government transfers to households $Transfers_h^t$ follow an exogenous path and total expenditure for transfers can be computed as

$$GOVTR = \sum_h \theta_h \, Transfers_h^t \tag{22}$$

General government expenditure depends on exogenous government consumption $govc_c^t$ and commodity prices $PQ_c$

$$GOVCONS_c = govc_c^t \, PQ_c \tag{23}$$

Finally, government investment $GOVI$ is assumed to be exogenous. Eventually all components of the government's budget can be assembled and lead to the following government surplus:

$$\begin{aligned} GOVS = {} & INCTAXREV + \sum_c SALESTAXREV_c + \sum_c EXPORTTAX_c \\ & + \sum_c IMPORTTAX_c - \sum_c GOVCONS_c - GOVTR - GOVI \end{aligned} \tag{24}$$

The model keeps track of government debt, which is calculated as:

$$DEBT \;=\; DEBT' - GOVS \tag{25}$$

### 2.3.4. Investment

Investment in EPIQ comes from 3 different sources. First, private households save according to their marginal propensity to save;[60] second, the government provides investments; and third, foreign direct investment occurs. So, total investment is

$$QINVTOTAL \;=\; HHI \;+\; GOVI \;+\; EXR \,.\, FSAV \tag{26}$$

[60] We assume all household savings are invested and all household financial capital is translated into physical capital.

where government investments $GOVI$ are exogenous (as described above), foreign direct investment $FSAV$ balances the current account and is denoted in foreign currency,[61] and households save according to a fixed marginal propensity to save $MPS$ which applies to after tax disposable income as in

$$INVEST_h = MPS(1 - \tau_h)DY_h \quad (27)$$

Aggregated over all households this results in household investments equal to

$$HHI = \sum_h \theta_h INVEST_h \quad (28)$$

Endogenous FDI flows balance the current account, as follows

$$FSAV = \sum_c [\, pwm_c^t QM_c - pwe_c^t QE_c] - Remittances_h^t \quad (29)$$

Total investment $QINVTOTAL$ is then added to financial capital, which is either sector specific (additional foreign direct investments in the counterfactual scenarios are sector specific) or can be acquired by companies on the capital market. To transform financial capital into physical capital, investment goods (which are mainly machinery and buildings) must be bought. This happens applying a Leontief production function that combines commodities according to the following rule

$$QINV_c = qinv_c^t IADJ \quad (30)$$

where $qinv_c^t$ denotes the exogenous assumption on commodity shares in investment and $IADJ$ denotes the amount of the physical capital good created.[62]

Note that $IADJ$ adjusts such that the total purchased value of new capital equals the new financial capital invested.

$$QINVTOTAL = \sum_c PQ_c QINV_c \quad (31)$$

[61] This assumption is equivalent to assuming an exogenous exchange rate. In the real world, the current account is typically not balanced, and hence, the capital account is changing, and exchange rates adjust. A different, optional, model closure allows for exogenous FDI flows, which will in turn result in an endogenous exchange rate. We apply this closure for certain scenarios.

[62] This is a generic formulation to adjust for characteristics of different countries. For the case of the Philippines, we assume that investment consists completely of non-food manufacturing.

### 2.3.5. Markets

Total demand for goods sold on the domestic market QQc is

$$QQ_c = PRIVCONS_c + QINV_c + govc_c^t + \sum_a II_{ac} \quad (32)$$

and depends on demand for investment goods $QINV_c$, government expenditures $govc_c^t$, intermediate demand $\sum_a II_{ac}$ and private consumption $PRIVCONS_c$, which is the weighted sum of individual households' consumption:

$$PRIVCONS_c = \sum_h \theta_h QH_{ch} \quad (33)$$

At the same time, commodities sold on the domestic market $QQ_c$ have to be provided from either imports $QM_c$ or by domestic goods demanded $QDD_c$. Imports and domestic goods demanded are combined following the Armington logic:

$$QQ_c = aq_c \left[\delta_c^I QM_c^{-\rho_c^I} + (1-\delta_c^I) QDD_c^{-\rho_c^I}\right]^{-1/\rho_c^I} \quad (34)$$

while imports are determined based on relative prices of domestically produced goods and imports:

$$QM_c = \left[\frac{\delta_c^I}{(1-\delta_c^I)} \frac{PD_c}{PM_c}\right]^{\frac{1}{1+\rho_c^I}} QDD_c \quad (35)$$

The resulting demand for domestically produced goods csn be satisfied either by current production or by drawing down inventories. Inventories increase or decrease to fill the gap based on equation (36)

$$S_c = S'_c + QD_c - QDD_c \quad (36)$$

#### 2.3.5.1. Factors Markets and Satisfaction Ratios

Factor markets exhibit some features that are more realistic than what is typically assumed in neoclassical macro models. The supply of labor in every period for each skill type $l$ and area $r$ is given by

$$L_{lr} = \sum_h \theta_h \, hhurb_{rh} \, hhlabor_{hl} \quad (37)$$

where $hhurb_{rh}$ is one if $r$ is the household's location and $hhlabor_{hl}$ denotes the household's endowment of effective labor given its education level $l$.[63] Equally, total financial capital supplied by households is

$$K = \sum_h \theta_h k_h \tag{38}$$

As factor prices in EPIQ are sticky, they will not clear factor markets in every period. While on commodity markets this results in a change in inventories, on factor markets this results in involuntary unemployment of factors or in firms being unable to acquire all factors demanded. This imbalance in factor markets is measured by a factor satisfaction ratio $\sigma_{af}$, which is specified for each sector $a$ and factor $f$ by

$$\sigma_{al} = \begin{cases} \sum_{i \in A_{rur}} QL_{il} / L_{l,rur} & if\ a \in A_{rur}, l \neq tertiary \\ \sum_{i \in A_{urb}} QL_{il} / L_{l,urb} & if\ a \in A_{urb}, l \neq tertiary \\ \sum_{i \in A} QL_{il} / \sum_l L_{lr} & else \end{cases} \tag{39}$$

for labor, and

$$\sigma_{a,cap} = \sum_{i \in A} QK_i / K \tag{40}$$

for capital, respectively.

The factor satisfaction ratios either impact realized production, if they are above one (equation 15), or income, if they are below one (equation 7). While the satisfaction ratios can differ across sectors, they are identical for all sectors that compete in the same factor market. So for labor they differ for rural and urban sectors for primary and secondary education, while they are identical for all sectors for tertiary educated workers and for capital.[64]

[63] Two important simplifying assumptions are embedded in this formulation. First, effective labor depends on the household heads age, and second, the skill level of the supplied labor depends on the household head's education. This means, that we assume that a potential second worker in the household supplies the same amount of labor of the same skill level. While the model formulation would easily allow for more household types and household types with different types of labor supplied, we apply this assumption because of data limitations.

[64] Hence, we are using $\sigma_{r,f}$ in equations (7) and (15) denoted by regions for easier notation.

### 2.3.6. Prices

#### 2.3.6.1. Import and Export Prices

Import and export prices in EPIQ are a function of the import tax rate and the export subsidy rate, the exchange rate and world market prices, as shown in equations (41) and (42).

$$PM_c = (1 + \tau_c^m)\, pwm_c^t\, EXR \tag{41}$$

$$PE_c = (1 - \tau_c^e)\, pwe_c^t\, EXR \tag{42}$$

#### 2.3.6.2. Domestic Producer Price

In EPIQ most prices are not market clearing as, on the one hand, production decisions are made with a time lag, and on the other hand, prices are sticky. However, the domestic producer price $PD_c$ moves slowly, over the course of $1/\psi_{PD}$ periods, towards a market clearing price according to:

$$PD_c = PD'_c + \psi_{PD}\, \Delta PD_c \tag{43}$$

where $PD'_c$ denotes domestic producer price in the previous period. The targeted change in the domestic market price $\Delta PD_c$ must lie in between multiples $\underline{\mu}_c^D$ and $\overline{\mu}_c^D$ of the current price:

$$\Delta PD_c = \begin{cases} \underline{\mu}_c^D PD'_c & if\ PD_c^* < \underline{\mu}_c^D PD'_c \\ PD_c^* & if\ \underline{\mu}_c^D PD'_c \le PD_c^* \le \overline{\mu}_c^D PD'_c \\ \overline{\mu}_c^D PD'_c & else \end{cases} \tag{44}$$

The ideal market price $PD_c^*$ is set such that market imbalances must be corrected over time. The price increases (decreases) if demand is higher (lower) than supply according to the supply elasticity $\epsilon_S$ and the demand elasticity $\epsilon_D$

$$\Delta PD_c^* = \frac{(QDD_c - S_c - QD_c) PD'_c}{\epsilon_S (S_c + QD_c) - \epsilon_D QDD_c} \tag{45}$$

#### 2.3.6.3. Domestic Market Price

We assume that the domestic price in the first period is one and we can therefore determine the weighted average price of the domestic good in this benchmark period, $PQ_c^0$, as

$$PQ_c^0 = (1 + \tau_c^S)(PD_c QD_c + PM_c QM_c)/QQ_c \tag{46}$$

which is the market clearing, general equilibrium price of domestic demand. However, in later periods, $PQ_c$ is sticky and only adjusts slowly to changes in the producer price $PD_c$.

The movement of the consumer price $PQ_c$ is bounded by two effects. On the one hand, we assume that the consumer price only adjusts by half of the distance to the market clearing price in every period (given by equation 47), and, on the other hand, we assume that the price can only adjust by a multiple $\underline{\mu}_c^Q$ downwards or $\overline{\mu}_c^Q$ upwards in every period. So, the equilibrium price $PQ_c^*$ can be written again as

$$PQ_c^* = (1 + \tau_c^S)(PD_c QD_c + PM_c QM_c)/QQ_c \tag{47}$$

However, we assume that the targeted price $\boldsymbol{T}[PQ_c]$ can only adjust within boundaries as described below:

$$\boldsymbol{T}[PQ_c] = \begin{cases} \left(1 - \underline{\mu}_c^Q\right) PQ'_c & if\ PQ_c^* > \left(1 - \underline{\mu}_c^Q\right) PQ'_c \\ PQ_c^* & if\ \left(1 - \underline{\mu}_c^Q\right) PQ'_c \le PQ_c^* \le \left(1 + \overline{\mu}_c^Q\right) PQ'_c \\ \left(1 + \overline{\mu}_c^Q\right) PQ'_c & else \end{cases} \tag{48}$$

And the price $PQ_c$ takes $1/\psi_{PQ}$ periods to adjust. Therefore, the price can be written as

$$PQ_c = PQ'_c + \psi_{PQ}(\,\boldsymbol{T}[PQ_c] - PQ'_c\,) \tag{49}$$

#### 2.3.6.4. Factor Prices

Factor prices are also sticky. Hence, wage rates $PL_{lr}$ move slowly towards a market clearing price:

$$PL_{lr} = PL'_{lr} + \psi_{PL}\Delta PL_{lr} \tag{50}$$

The change in the wage rate $\Delta PL_{lr}$ is subject to upper and lower bounds. In each period, the wages are only allowed to change by a multiple of $\underline{\mu}_{lr}^{W}$ downwards – while being also constrained by the regional minimum wages in the case of formal wages – or by $\overline{\mu}_{lr}^{W}$ upwards:[65]

$$\Delta PL_{lr} = \begin{cases} \underline{\mu}_{lr}^{W} PL'_{lr} & if\ \Delta PL_{lr}^{*} < \underline{\mu}_{c}^{W} PL'_{lr} \\ \Delta PL_{lr}^{*} & if\ \underline{\mu}_{lr}^{W} PL'_{lr} \leq \Delta PL_{lr}^{*} \leq \overline{\mu}_{lr}^{W} PL'_{lr} \\ \overline{\mu}_{lr}^{W} PL'_{lr} & else \end{cases} \tag{51}$$

The targeted change in the wage rate $\Delta PL_{lr}^{*}$ depends on the market imbalance, with elasticity $\epsilon_L$

$$\Delta PL_{lr}^{*} = \frac{(L_{lr} - \sum_{a \in A_r} QL_{al}) PL'_{lr}}{\epsilon_L L_{rl}} \tag{52}$$

The price for financial capital $PK$ follows a similar law of motion as laid out before for wage rates:

$$PK = PK' + \psi_{PK}\Delta PK \tag{53}$$

$$\Delta PK = \begin{cases} \underline{\mu}_{'cap,r}^{K} PK' & if\ \Delta PK^{*} < \underline{\mu}_{'cap,r}^{K} PK' \\ \Delta PK^{*} & if\ \underline{\mu}_{'cap,r}^{K} PK' < \Delta PK^{*} < \overline{\mu}_{'cap,r}^{K} PK' \\ \overline{\mu}_{'cap,r}^{K} PK' & else \end{cases} \tag{54}$$

$$\Delta PK^{*} = \frac{(K - \sum_{a} QK_a) PK'}{\epsilon_K K} \tag{55}$$

To use the factor prices $PL_{lr}$ and $PK$ in sector specific formulas we define $PLF_{af}$ as

$$PLF_{af} = \begin{cases} PL_{l,rur,} & if\ a \in A_{rur}, f \in L \\ PL_{l,urb,} & if\ a \in A_{urb}, f \in L \\ PK & else \end{cases} \tag{56}$$

[65] The boundaries of adjustment for wages $\underline{\mu}_{lr}^{W}$ and $\overline{\mu}_{lr}^{W}$ are chosen differently for different wage rates. The boundaries reflect that wages for low skilled laborers have adjusted at a slower pace in the past than wages for higher educated people.

### 2.3.7. Economic Growth

Economic growth in EPIQ results from different sources. On the one hand, population grows exogenously, in line with UN estimates, and so does labor supply. Meanwhile, total factor productivity increases and capital is accumulated.

Sectoral total factor productivity $\xi_a^t$ is exogenous and grows at rate $\upsilon_a^t$ over the model horizon. The growth rate of sectoral total factor productivity $\upsilon_a^t$ varies between sectors and over time.[66] The law of motion for sectoral total factor productivity can thus be written as

$$\xi_a^{t+1} = \upsilon_a^t \, \xi_a^t \tag{57}$$

while TFP in the first period $\xi_a^0$ is calibrated to replicate base year production in each sector.

Financial capital is accumulated through private savings, government investments and foreign direct investment, which add up to total investment $QINVTOTAL$ as in equation (26). Hence, capital accumulation follows as

$$K = QINVTOTAL + K' \, (1 - \delta) \tag{58}$$

where $K$ represents capital stock and $\delta$ is the depreciation rate of capital.

In the scenarios presented in this report, private savings are endogenous and depend on the income of the private households together with an exogenously fixed marginal propensity to save. Government investments are exogenous and follow historical data and grow in line with GDP over the projection horizon. Foreign direct investment endogenously balances the current account balance along the baseline, but additional foreign investments are realized in the stimulus counterfactuals.

### 2.3.8. Transition Matrix

Demographics in the model are represented by household types with different characteristics and associated household weights $\theta_h$. A full picture of country demographics is assembled when households are aggregated using their respective weights. While initial household weights in the first period can be

[66] The TFP growth rates $\upsilon_a^t$ are calibrated to replicate the historical growth pattern of the sectors.

constructed using disaggregated UN population and country census data, a mechanism that determines future weights is required. To this end, the model applies a transition matrix $\Gamma$ that contains the evolution of individual household weights over the model horizon. We use this approach to avoid having to model different societal growth and transition decisions on the micro level, such as marriages, living independently or with others, having children, etc.[67]

The transition matrix is estimated through an algorithm that matches the resulting weights to disaggregated United Nations (UN) population data over the historic period, and to UN estimates for the projection period.[68] The transition matrix $\Gamma$ is then used to determine the evolution of household weights as in equation (59), translating the household weights in one period ${\theta'}_h$ into household weights in the next period $\theta_h$. It is important to note that the transition matrix is fixed over the model horizon.

$$\theta_h = \Gamma\ {\theta'}_h \tag{59}$$

### 2.3.9. Endogenous Migration

While the transition matrix results in exogenous demographic trends that follow UN estimates and data, EPIQ does not assume that all demographic trends are completely independent of economic impacts. Urbanization depends on economic pressure -or the lack of- to move to a different area to improve economic wellbeing. In the model, urbanization increases if urban sectors are exhibiting faster economic growth than rural areas. The function governing urbanization is calibrated such that UN urbanization trends are realized along the baseline, while deviations from that baseline may result in a faster or slower pace of urbanization, depending on economic growth in the respective areas. The sensitivity of urbanization to regional GDP is estimated using time series data for urban and rural regions of the Philippines, through:

$$\Delta\theta_h = \varepsilon^{pop}\left(\Delta GDP_{urb}^{scen} - \Delta GDP_{urb}^{base}\right){\theta'}_h \tag{60}$$

$\Delta\theta_h$ describes how much the weight of urban households $h$ changes in year $t$ due to a quicker or slower change of the urban share of GDP, $\Delta GDP_{urb}^{scen}$, compared to the baseline value based on exogenous

[67] While the current approach simplifies the calibration of all individual decisions, future model versions could treat specific decisions, such as education, that are of high relevance, differently and outside of the transition matrix.
[68] A detailed description of the minimization problem solved to estimate the transition matrix can be found in the Appendix B.2.

trends coming from the transition matrix, $\Delta GDP_{urb}^{base}$. $\varepsilon^{pop}$ is the estimated elasticity of urban population growth with respect to the urban share of GDP. We assume that the change in a specific urban household's weight is reflected in the opposite rural household with the otherwise same characteristics, but with the opposite sign. The resulting adjustments to the exogenous weights are then accumulated and applied to the model weights.

### 2.3.10. Informality

Informality in EPIQ is modeled as labor market segregation and differences in productivity between formal and informal sectors. We introduce a formal and an informal version of each of the existing region and education specific labor markets. Wages for informal labor are generally lower than salaries in the formal economy. This has direct welfare implications for households depending on whether they are able to secure formal employment or not. Second, we introduce an informal and a formal subsector for each modeled sector of the economy. While both sectors are assumed to produce identical goods, the informal and the formal counterpart of each sector differ in their contributions to sectoral output, value added and technology. We assume that informal sectors are less capital-intensive but more labor-intensive than their formal counterparts. In addition, labor employed by the formal sector will be paid formal wages, which are at least above minimum wages, and are higher than wages paid in the informal economy. We calibrate the size and technology of the formal and informal sectors for the first modeled period to represent existing country data.

To model the functioning of and differences in the economic market impacts of formal and informal sectors, we split the target output per sector into an informal and a formal target. We assume that any FDI inflow will always materialize as an increase of capital, and hence output, of the formal sector. We then assign the remaining increase in total target output in any given period to the subsectors with respect to the previous shares of formal and informal output. Once sectors determine their demand for factors based on prices and subsectoral target output, we assume that labor and capital demand of the formal sectors are satisfied first. Any remaining labor and capital will then be employed by the informal sector until their respective demand is satisfied.

## 2.4. Modeling the Philippine Economy: The Baseline Case

### 2.4.1. Model calibration for the historical period (2000-2015)

The EPIQ modeling framework is comprised of three separate components:

i) A standard static CGE model to estimate initial unobserved parameters that define the structure of the economy (household preferences, firms' technologies, and relative prices, among others), so as to make the model representative of the Philippines for the initial historical year (2000).[69]

ii) A numerical estimation of a demographic transition matrix that resembles the evolution of the distribution of household types and population growth. This calculation uses available household survey micro data during the defined historical period (2000, 2003, 2006, 2009, and 2012).[70]

iii) A dynamic structural model that fits the behavior of the economy over time for both the historical (2000-2015) and the projection (2016-2030) periods. This model component follows a similar underlying economic structure as i), but also includes features that resemble the dynamic behavior of the economy over time. It is built in a system dynamics environment that facilitates modeling such structures over time.[71]

We now describe the main features, data, assumptions and results of the historical period calibration for each of these components.

#### 2.4.1.1. Estimation of economic structure parameters for year 2000

The static CGE model is estimated using data from the 2000 Input-Output (I-O) table and National Accounts data generated by the Philippines National Statistics Office. The original 2000 I-O table includes more than 240 industry sectors, which are aggregated into the ten sectors mentioned before for the current version of the model. The model's characterization of household types and weights is based on data from the Philippines Income and Expenditure Survey (FIES) from year 2000. Labor productivity of individual

[69] The static CGE model is estimated using GAMS, a standard software used by economists to find numerical solutions to structural simultaneous equations models.

[70] The demographic transition matrix is also estimated using GAMS, as it is a powerful tool for the massive numerical estimation that this calculation entails.

[71] The model is built in Vensim, a standard system dynamics software that contains several graphic features to represent the structure of complex systems and analyze the behavior of (and relationship between) variables over time. It is a quite flexible and modular modeling environment.

workers is assumed to vary with age and education.[72] Data on minimum wage levels for the year 2000 are also used to calibrate the model.[73]

The particular data points from the I-O table used in the estimation include total value added, net exports, household consumption shares, intermediate sector consumption, and formal/informal value added shares by industry sector. The set of variables generated by this model component that are then used to feed the dynamic model component include technology parameters, intermediate consumption, and capital and labor (by education) demand for all industry sectors; consumption baskets, investment and savings for all household types; an estimated distribution of capital by household type consistent with observed income and output; and equilibrium prices for all goods and services, capital, and wages by labor (education) and business types (formal/informal); among others.[74]

#### 2.4.1.2. Replication of 2000-2015 demographic trends

The demographic transition matrix is estimated to match the observed population data by area (rural/urban) as closely as possible, as well as the household types distribution observed in the household-level FIES survey data available for the historical period (2003, 2006, 2009, 2012). Figures 35 and 36 show observed and estimated total population, as well as population by area, for the 2000-2015 period.

Figure 35. Philippines Total Population

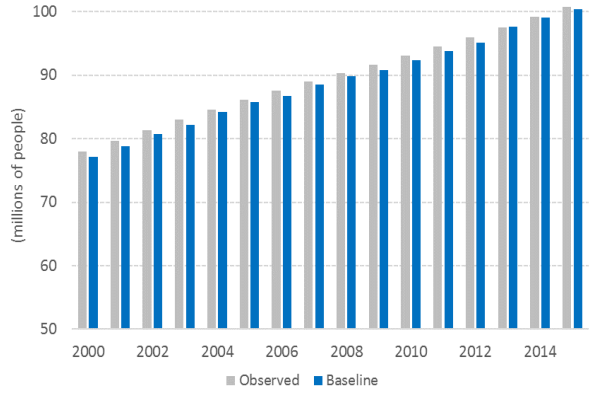
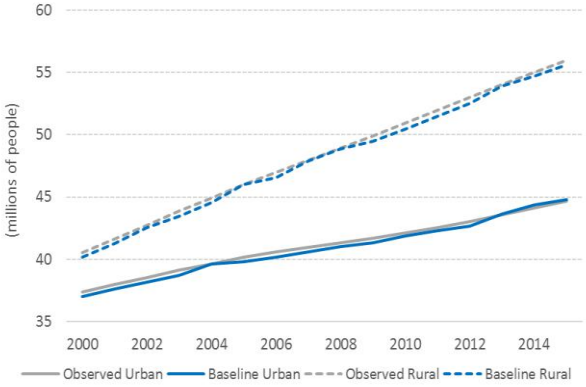



Figure 36. Philippines Urban and Rural Population




[72] Individual labor productivity is modeled through an econometric estimation of Mincerian regressions on wages that generates life cycle wage profiles by education levels. This is done by using individual level data from the Labor Force Surveys (LFS) available between 2000 and 2015.

[73] Given that in the Philippines the minimum wage is defined at the regional level, we use averages for the most representative urban and rural regions as a reference.

[74] Wage gaps by education are calibrated to match observed data from the Labor Force Survey in year 2000. In addition, wage gaps between the formal and informal sectors are calibrated using 2008 informality survey data, the only micro-data on informality available for the Philippines during the historical period, as a reference.

### 2.4.1.3. Replication of 2000-2015 macroeconomic trends

Following the early growth theory of Solow, the main drivers of economic growth over time are growth in the factors of production (labor and capital) and productivity. In EPIQ, the growth of labor is given by the replication of demographic trends, which also determine total consumption growth. The evolution of capital is the result of private saving and investment decisions. This is modeled through a calibrated parameter determining the average marginal propensity to save by households (20.6%, which is consistent with the historical fixed capital formation to GDP ratio as shown in figure 37) that have income above the cost of a minimum survival consumption basket. In other words, households will only have savings after having satisfied the minimum survival consumption of all of its individual members.[75] In the current model, the MPS is constant across household types and over time, but we have the ability to vary the MPS in either the calibration or projection period.

Figure 37. Philippines Fixed Capital Formation

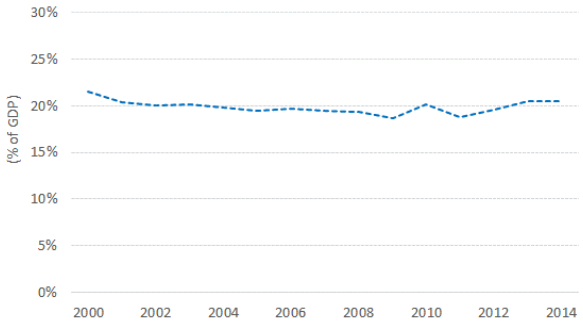
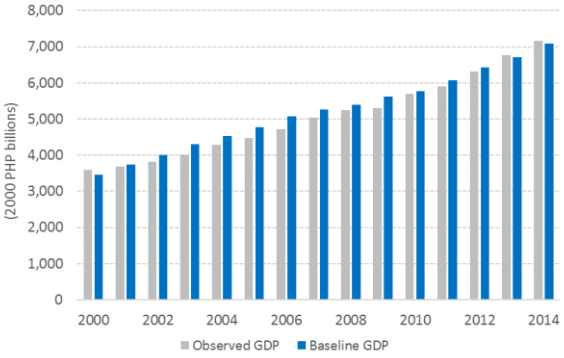



Figure 38. Philippines Real GDP




Productivity growth across industry sectors is calibrated to match the observed GDP trends across sectors for years 2000-2015, while assuming stable labor and capital share parameters over the historical period for most sectors.[76] Figure 38 shows the estimated and observed total GDP trend, while figures 39

[75] The per-capita minimum survival consumption basket is determined through the estimation of a Linear Expenditure System (LES) model, using household level survey data. The minimum survival consumption basket for any particular household is then computed by taking into account the number of individuals within the specific household type.

[76] Labor and capital shares by sector are derived from available Input-Output tables and National Accounts for years 2001, 2003, 2005, 2008 and 2010. Using data from business surveys, labor and capital shares are derived for the formal sector across industries. This analysis shows that labor and capital shares in the formal sector are relatively stable across all sectors, except for transportation and other services, which show increasing capital intensity during the period 2001-2010. Thus, for these two sectors, a gradual trend is reflected in the model parameters. The corresponding shares for the informal sector (by industry) can be derived as residuals from the total economy figures and the formal sector ones. These show increasing labor intensity in general, but are modeled as constant in EPIQ.

and 40 show the estimated and observed GDP trends for selected industries. It is worth noting that the observed annualized growth for the period 2000-2014 for the agricultural sectors and transportation services is about 2.5%, compared to 4.0% to 5.5% for the manufacturing sectors, power, and other services.

Figure 39. Agri Crops and Transport Real GDP

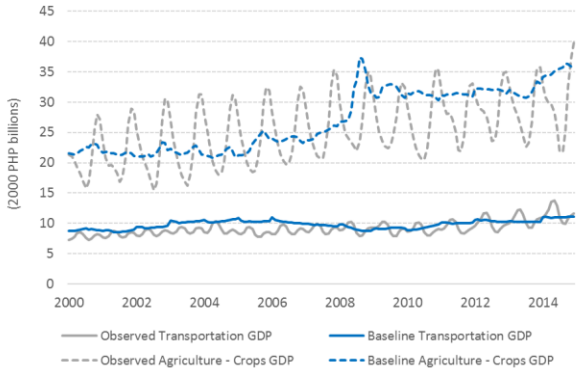
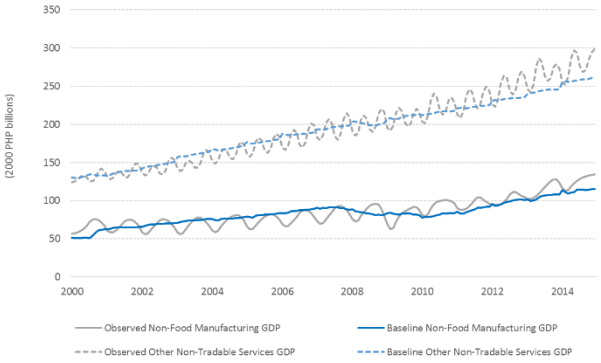



Figure 40. Non-Food Manufacturing and Other Non-Tradable Services Real GDP




The model generates market prices based on supply and demand signals for non-tradeable sectors, allowing for equilibrium convergence over time.[77] This includes some constraints on the allowed price variation (per month) so as to reflect gradual price changes observed in the data. This endogenous price determination mechanism applies across factors of production (labor and capital) and non-tradeable goods and service markets. Prices of tradeable goods and services are assumed to follow global price trends.[78] Figure 41 shows the behavior of market prices across all industry sectors, except power, in the baseline case, and how most prices in the economy had a similar growth trend during the historical period. Figure 42 shows the behavior of power prices following the power generation market liberalization that started after year 2006. Power prices are more volatile than in other sectors, given the seasonal nature of this market reflected in the detailed power module. As has been documented over the past years, power prices have been on an upward trend in the Philippines, impacting the competitiveness of all other sectors and the economy in general. The prices generated by the model increase by 40% in the period 2007-2014, compared to an increase of around 60% from historical prices reported by the Philippines Wholesale Electricity Spot Market (WESM).

[77] This is in contrast to the standard CGE model assumption of full market closure in every time period. Prices that are not market clearing imply that the model needs to allow for stock accumulation.

[78] Tradeable sector prices are indexed by an assumed global annual inflation of 3%. This is in line with the most recent global inflation forecast by Consensus Economics.

Figure 41. Baseline Price Index by Sectors

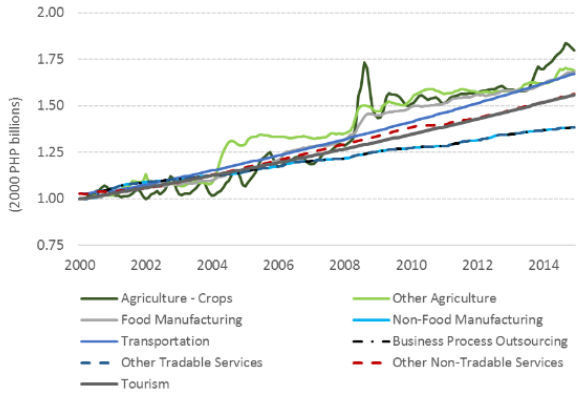
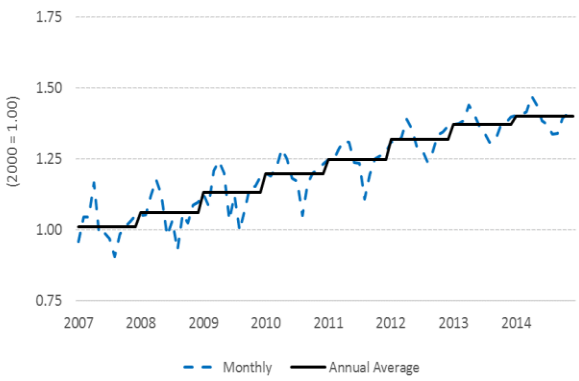



Figure 42. Baseline Price Index for Power




Labor informality remains high during the historical period, slightly declining from about 81% in 2000 to 80% in 2015, which is consistent with the levels of magnitude of labor informality reported by the World Bank (see Section 2). In the case of wages, limits on wage growth, reflecting market frictions and wage stickiness, are calibrated to match the observed historical pattern.[79] Figures 43 and 44 show the behavior of wages across education levels in rural and urban areas over time. First, wages for tertiary educated workers are identical in the rural and urban sectors. This is due to the assumption of full mobility for this type of labor across locations. Second, urban formal wages are significantly higher than formal rural wages for both primary and secondary educated workers (around 40% higher by year 2014), which resembles the empirical facts from historical data. With regard to the informal sector, while the wage differential for primary educated workers between the urban and the rural sector is about 40% (as in the formal sector), secondary urban informal wages are about 2 times higher than those in the rural sector.

Figure 43. Rural Wages by Education and Firm Type

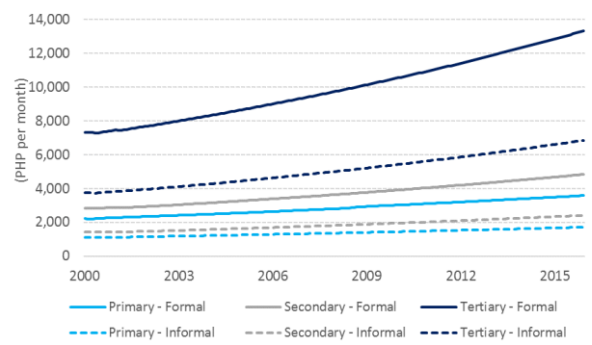
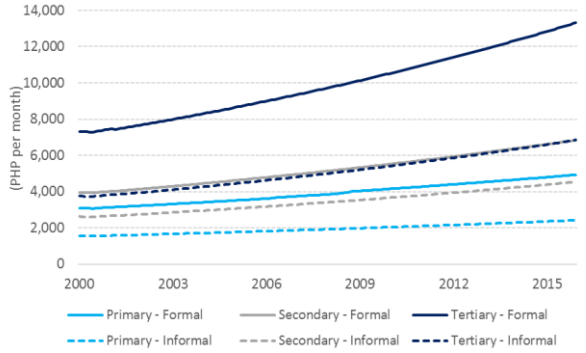



Figure 44. Urban Wages by Education and Firm Type




[79] Wage growth calibrated to match observed mean wages by 2014, from labor force data.

The poverty line is calibrated to match the poverty rate as of the initial year 2000 and is indexed by the CPI for years 2000-2015. For years 2001 onwards, the poverty rate is a fully endogenous calculation that compares the poverty line each period with the distribution of per-capita household incomes. It is important to note that household income in the model varies across household types by the number of adult workers along with their education, age, and location (urban/rural); and within household types by the fractions of households that: i) work in the formal and informal sectors, ii) own or do not own capital, and iii) receive or do not receive remittances. Figure 45 shows the estimated poverty rate over time relative to the observed poverty rate measured through household survey data every three years. The results show that the model is capable of generating a slow decreasing trend in the poverty rate as observed in the Philippines between years 2000 and 2012.

As documented in section 2, poverty is predominantly a rural phenomenon. While the poverty rate for rural areas implied by the model was about 28% in years 2013-2015, poverty in urban areas was about 6% (Figure 46). Moreover, the main decline in the overall poverty rate is driven by the progress made in rural areas, where poverty declined from 41% in year 2000 to 27% in year 2014. Given the way poverty is computed and the relatively flat GDP for agriculture (Figure 39), the drivers behind this decline have more to do with a decline in the fertility rate over time and internal migration from rural to urban areas. Both of these phenomena are captured in the model through the transition module based on household survey data.

Figure 45. Philippines Poverty Rate

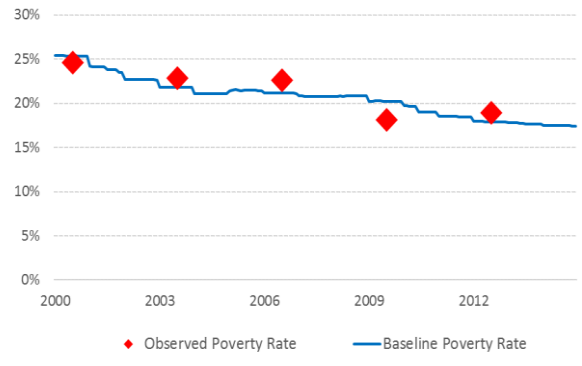
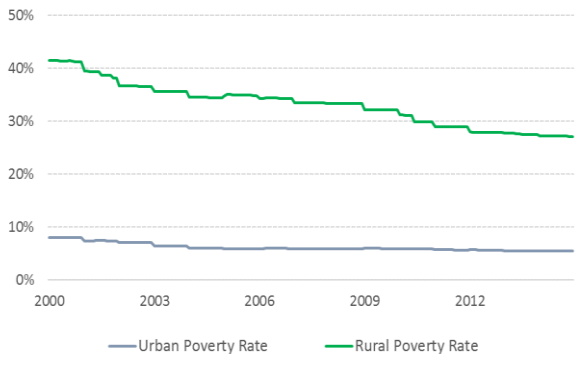



Figure 46. Philippines Urban and Rural Poverty Rate




Finally, the model generates a measure of shared prosperity to analyze the impact on the second of the WBG twin goals. The model computes the annualized growth of mean real income for households at

the bottom 40 percent of the income distribution and compares it to the annualized growth of mean real income for the total population. The results show that inequality was persistent in the Philippines in our sample period (see Figure 47). While average real income in the country grew by 4.0% (annually) between years 2000 and 2005, that of the bottom 40% grew by just 1.4%, which is only around one third of the growth of mean income for the total population. The corresponding mean income growth ratio improved somewhat to 2.4 times during the years from 2005 to 2010, as the negative impact of the global financial crisis destroyed a lot of wealth and diminished capital incomes. In the five years following the crisis (2010-2015), average annual mean income growth for the bottom 40 was 1.9%, compared to 3.5% for the total population. Thus, the mean income growth ratio improved to 1.8 times, although the income growth gap between the bottom 40 and the rest of the population is still large. Solid GDP growth and the government's cash transfer program may partially explain such improvement.

We also look at the share of total income that goes to the bottom 40 percent of the income distribution as an alternative measure of inequality. The results in Figure 48 show that this share decreased from 8.6% in 2000 to 7.6% in 2005, and further declined to 7.2% in 2010 and to 6.7% by 2015.[80]

Figure 47. Philippines Shared Prosperity

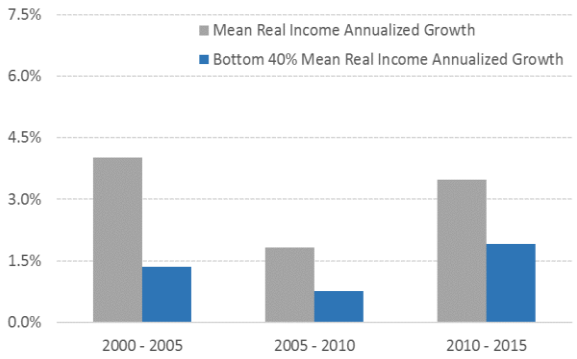
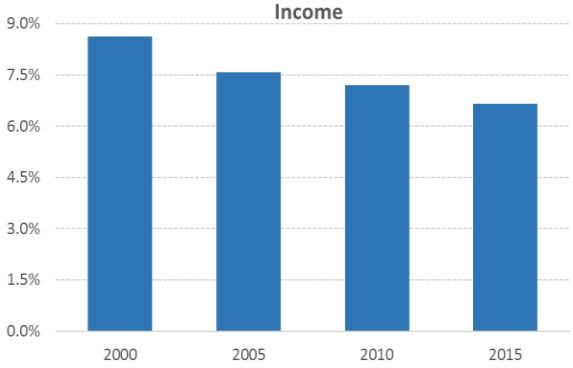



Figure 48. Philippines Bottom 40% Share of Total Income



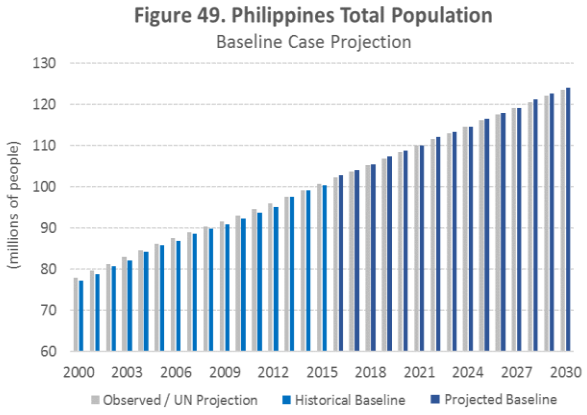

[80] As the model computes the income for 7680 different household types it is capable of reporting income distributions over time in great detail. It is also possible to draw Lorenz curves and compute Gini coefficients, Theil indices and other distributional measures. However, the income distribution module is currently under revision and will be further improved.

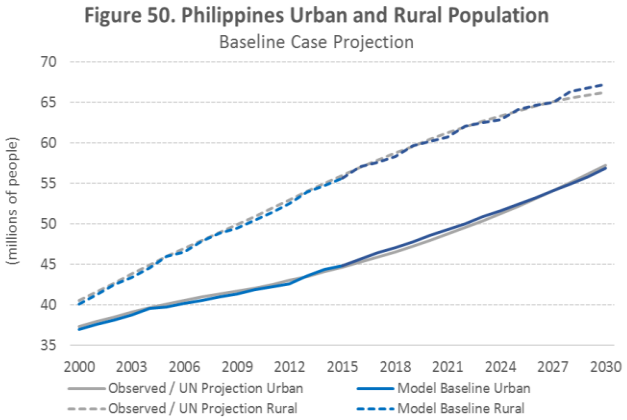
### 2.4.2. Baseline Case for the projection period (2016-2030)

The following are the main assumptions that define the baseline case for years 2016 to 2030:

1. *Population growth follows the mid-variant case projection of the 2012 United Nations World Population Prospects.*

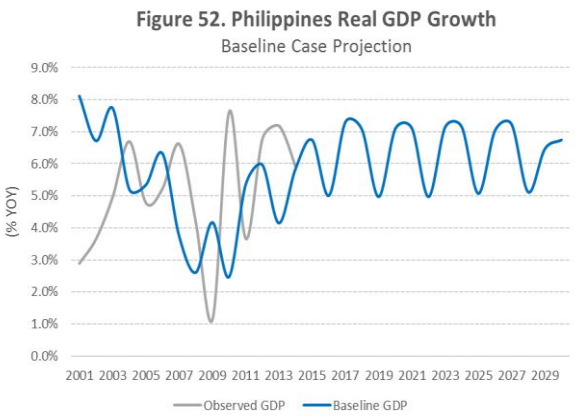
This is done by setting total population targets by 2030 in the estimation procedure of the demographic transition matrix, which affects most of the implicit fertility rates across household types. All other features defining the household structure as well as those related to life-cycle individual labor productivity profiles remain unchanged from those used in the historical period. Figures 49 and 50 below show that the model baseline population matches that of the UN mid-variant projection closely.



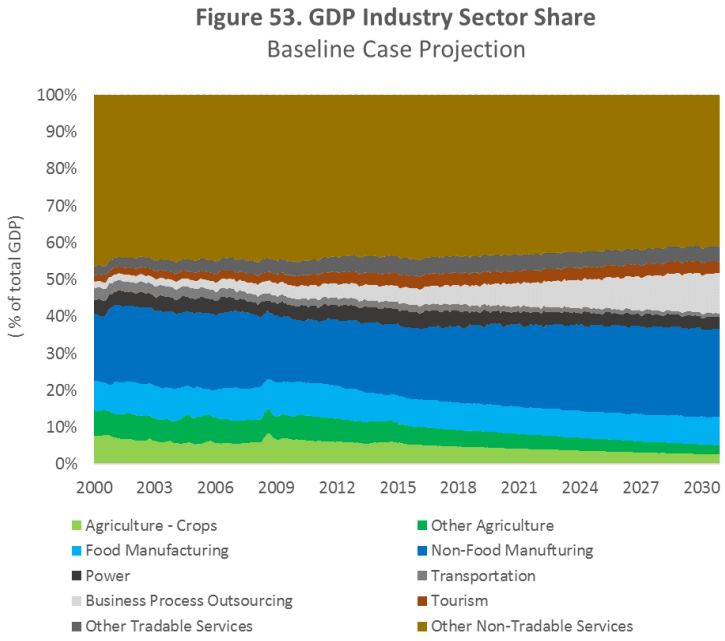

2. *The economy grows at an average rate of around 6.1% up to 2030. This is consistent with WB and IMF forecasts up to year 2021. This solid growth is assumed to continue for the following decade.*

Aside from productivity, which is assumed to be the main driver of growth going forward, capital and labor shares as well as formal/informal shares by industry sector are kept unchanged from those used in the historical calibration. Figure 51 shows how the model's long term projected Real GDP in the baseline case preserves the observed historical trends, and figure 52 shows the strong rate of GDP growth assumed for the projection period: 5.6% between 2016-2020 (consistent with latest IMF and WB forecasts) and up to 6.3% between 2021 and 2030.


3. *While the dominance of services continues to increase (to 60% by 2030), the GDP share of agricultural sectors declines sharply (to 5%), while that of manufacturing increases slightly (to 32%).*

The GDP share of services increases from 54%, on average for the historical period 2000-2015, to an average of about 58% between 2016 and 2030. Agriculture, on the other hand, declines from 13% in 2000-2015 to 7% over the projection period, while the GDP share of manufacturing increases slowly from 26% and 31% over the model horizon. These results are mainly driven by the differences in productivity growth across industry sectors observed in the historical period and preserved into the projection period, which show relatively low to negative productivity growth rates for agricultural sectors. Figure 53 shows the trends of these shares for the ten sectors included in the current model.



4. *Power capacity almost doubles in the period 2015-2020 thanks to projects already commissioned by 2016. Thereafter, there is a gradual increase in capacity that keeps power prices roughly constant.*

Projects already commissioned by year 2016, mostly coal plants, imply the doubling of the country's power generation capacity between 2015 and 2020 (Figure 54). Going forward, the baseline case assumes an increase in capacity of about 10% per year, which is enough to keep up with the growth in demand implied by the assumed growth rate of the economy, under stable prices growing more slowly than the overall inflation rate (Figure 55).

**Figure 54. Power Generation Capacity**
Baseline Case Projection

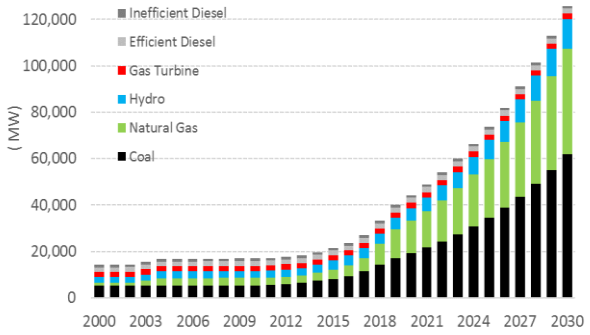
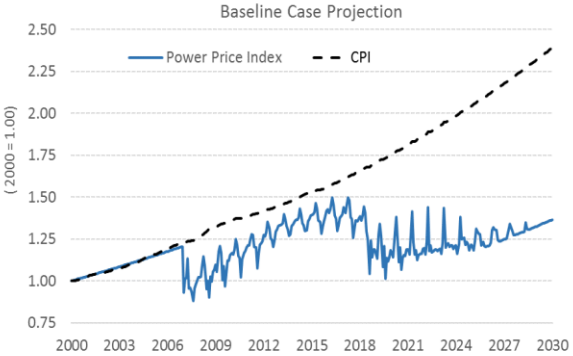



**Figure 55. Power Price Index**
Baseline Case Projection

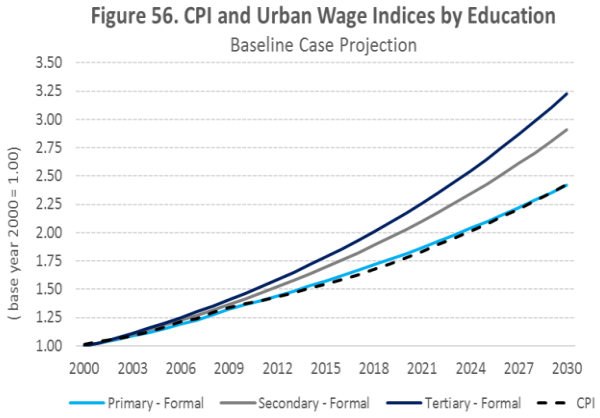


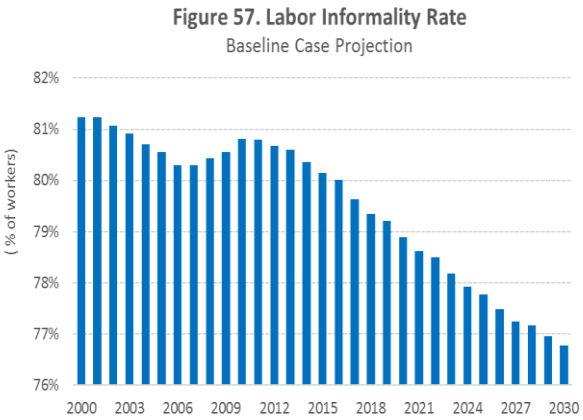

5. *No fundamental changes in market price determination in factor goods and services markets.*

Wage growth constraints, within the dynamic labor market price determination mechanism, are adjusted as necessary to accommodate the assumed GDP growth rate, but all other assumptions on the structure and functioning of labor markets used to calibrate the model for the historical period are preserved. Minimum wages indexed by CPI inflation remain in place as the main mechanism segmenting formal and informal markets. All parameters related to the goods and services market price determination mechanism remain unchanged. Figure 56 shows how the overall trends for the projected CPI and wages in the baseline case generated by the model are consistent with their observed historical 15-year trends. In addition, the graph compares CPI growth with that of formal wages in urban areas, which also preserve historical relative behavior: growth in primary educated formal wages is in line with CPI inflation and wage gaps continue to increase over time for secondary and tertiary educated formal wages. A separate calculation of wage gaps between formal and informal sector wages by education level also shows that gaps persist over time. For

instance, while formal primary wages are more than two times those observed for informal workers with primary education, this ratio is only 1.2 for secondary educated workers and 1.5 for tertiary workers.

A fundamental assumption underlying our projected labor market dynamics is a permanent high level of labor informality. This implies limited upward pressure for wages in the formal sector. As shown in Figure 57, informality only declines slightly in the historical period (from 81.2% in 2000 to 80.1% in 2015) and continues declining gradually in the projection period, driven by stable and solid economic growth, towards 76.8% by 2030. However, the decline in informality in the projection period is not even across worker types and segments of the labor market. While the decline in informality is around 1 percentage point for primary educated workers, secondary educated workers make virtually no gains. The largest gains in formalization are observed for those with tertiary education in urban areas, showing a decline in average informality rates for the projection period of 7 percentage points.




*6. Consumption and savings preferences follow historical trends.*

Household consumption baskets and the marginal propensity to save are the same as in the historical period. At the macro level, about 80% of the total income received by households is consumed; and from the remaining 20%, about 14% is invested domestically and 6% invested overseas. In addition, the capital distribution across household types continues to evolve endogenously, and within household types, the capital distribution assumptions remain unchanged.

*7. Remittances and FDI follow historical trends.*

Remittances are projected at 10% of GDP from 2016 onwards based on the observed historical remittances to GDP ratio in years 2000-2015 (see Figure 58). The distribution of remittances across and within household types remains unchanged. Similary, FDI is projected at 1.4% of GDP from 2016 onwards based on FDI to GDP ratios observed in the historical period (see Figure 59).[81]

**Figure 58. Philippines Remittances Inflows**
Baseline Case Projection

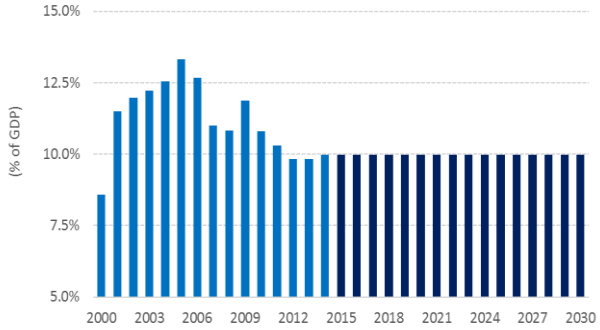
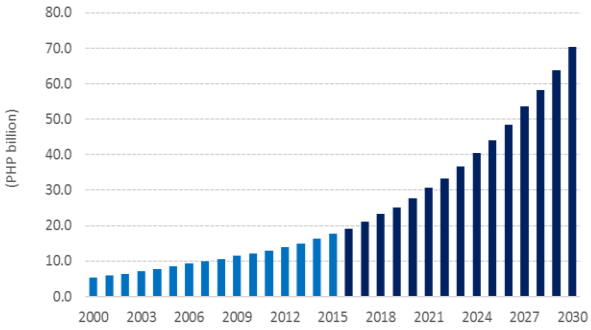


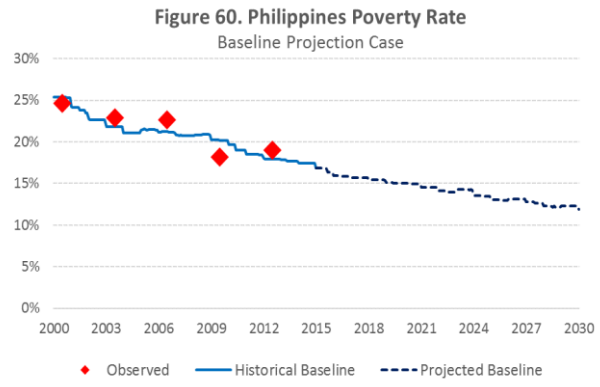

**Figure 59. Philippines Foreign Direct Investment**
Baseline Case Projection

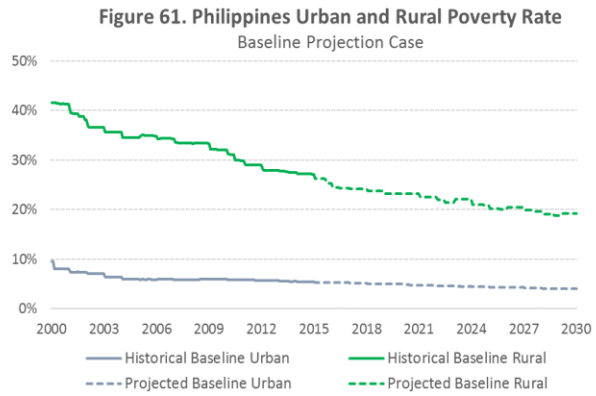



*8. Under solid GDP growth, poverty decreases gradually and falls just below 12% by 2030, but no significant progress is observed in terms of shared prosperity. On the contrary, inequality continues to increase.*

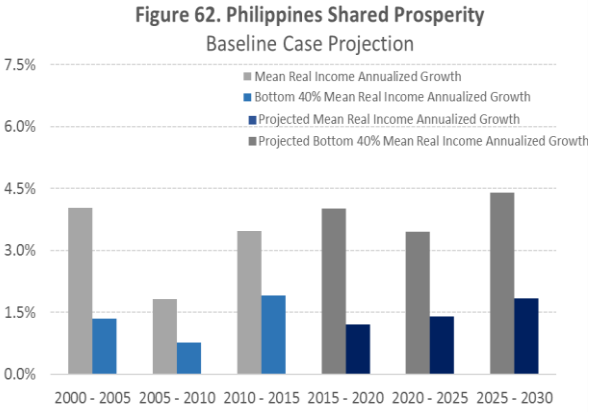
The baseline case implies a gradual decline in the poverty rate to just below 12% by 2030, which is about half its level at the beginning of the historical period (years 2000-2001) and implies a reduction of about one third from the observed value of 19% in 2012 (see Figure 60). However, the main implication of the baseline simulation is that the continuation of the status quo, under solid growth between 5.0% and 6.0% on average for the projection period 2016-2030, is not enough to bring poverty down to the WBG twin goals' target of 3%. In addition, Figure 61 shows that this aggregate result is mainly driven by a reduction in the rural poverty rate, which declines from 27% in 2015 to 19% in 2030, while the decline in urban poverty is relatively limited (4.0% by 2030 compared to 5.5% in 2015).

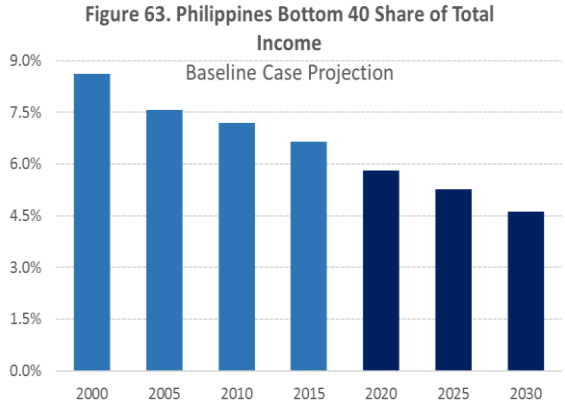
[81] This compares to average values between 3.0% and 5.0% of GDP during the historical period for countries like Lao PDR, Malaysia, Thailand and Vietnam.




With regard to shared prosperity, the annualized growth rate of mean income for the bottom 40 percent remains between 1.2% and 1.8% during the projection period, and continues to be one third to one half of the mean income growth rate for the total population (Figure 62). Hence, the share of total income earned by the bottom 40 percent continues its downward trend. These results are mainly explained by persistent productivity and wage gaps between rural (i.e. agriculture) and urban sectors.



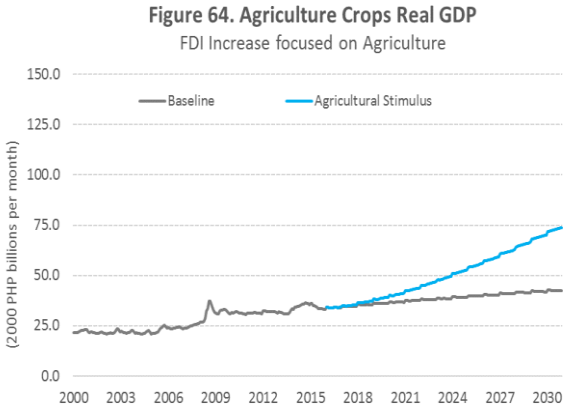

## 2.5. EPIQ Model Simulations

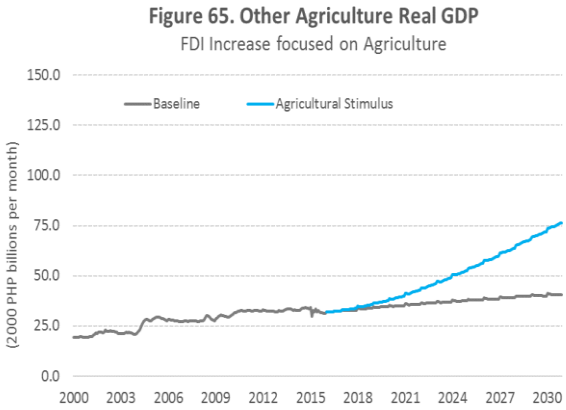
We now use the model to simulate the expected impacts of alternative investment strategies. In all but one of the cases, the shock is driven by an increase in foreign direct investments (FDI) into formal firms in specific sectors. The analysis first considers FDI targeting specific industry sectors (agriculture, manufacturing, and BPO), followed by two different simulations looking at the role of investments in infrastructure (power and airports/tourism).

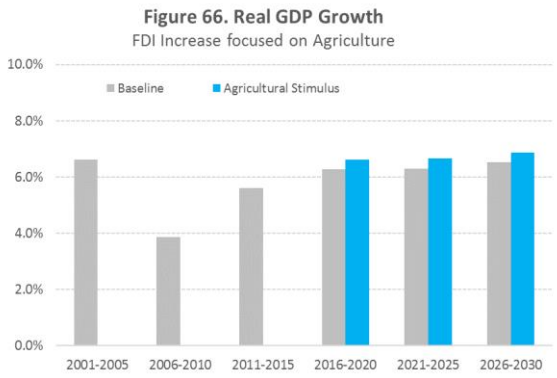
### 2.5.1. Agriculture

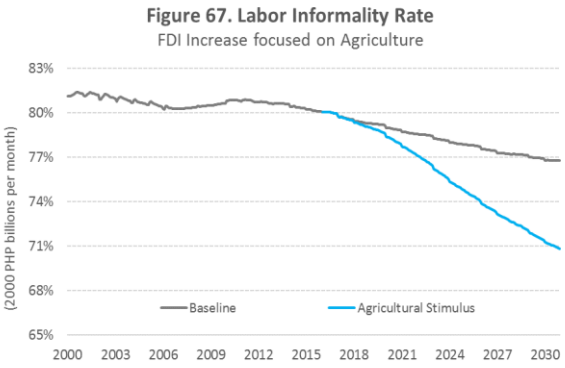
The simulated stimulus is an increase in FDI targeting the agricultural sectors (crops and rest of agriculture) equivalent to 0.5% of GDP annually from 2017 forward. This would be a sizeable increase of FDI, roughly increasing total FDI flows by one third. The simulated increase would still leave the Philippines behind the levels of FDI observed for peer countries in the region (i.e. Malaysia and Vietnam). The FDI targets formal firms in both agricultural sectors (50% going into crops and the remaining 50% to rest of agriculture) and are assumed to be mainly oriented towards the export markets.

The results show significant growth for the agricultural sectors. Agriculture crops output reaches an average annual growth rate of 5.2% between years 2016-2030, compared to 1.7% average growth under the baseline. Other agriculture output would grow by 5.7% in the projection period, compared to 1.7% in the baseline (see Figures 64 and 65). For the total economy, this stimulus would imply a GDP average annual growth rate of 6.7% for the period 2016-2030, compared to 6.4% under the baseline case (see Figure 66). Despite the significant impact on sectoral growth under this scenario, agriculture would still not be able to maintain its share of total GDP. The results show that total agriculture would account for about 9.3% of total GDP by 2030, which is lower than the 2015 level of 10.5% but still almost two times its estimated level under the baseline case (5.5%).



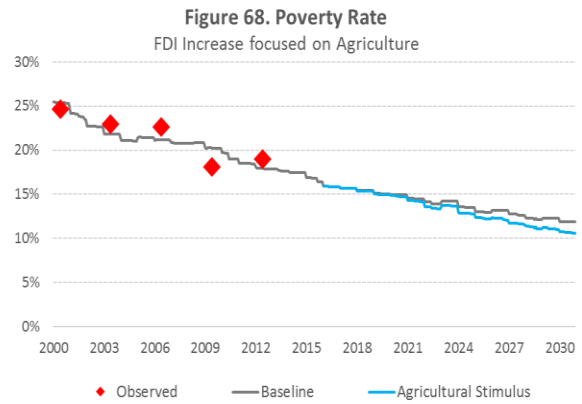



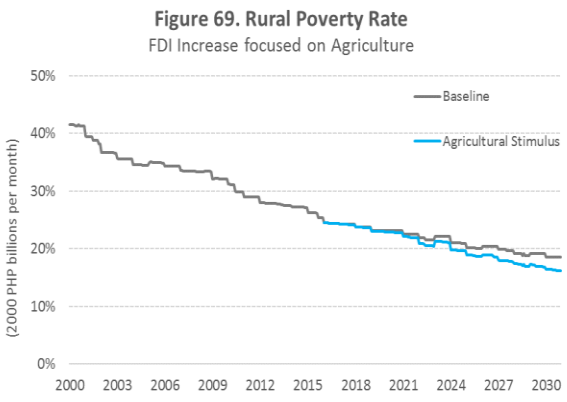



Regarding informality, the results show significant improvements (Figure 67). Labor informality in the economy declines to about 71% by 2030, significantly below the 77% level estimated for the baseline case. This implies the creation of 532 thousand formal jobs per year (on average) during the period 2016-2030, compared to about 232,000 in the baseline case. Improvements in informality in this case are mainly driven by the conditions of rural labor markets. Rural labor informality drops to 85% by 2030 for primary and secondary educated rural workers, compared to levels around 99% in 2015 and to limited declines under the baseline case. Tertiary rural employees would benefit most under this scenario as their informal employment drops to 74%.

As the rural informality rate drops, more people are employed in the formal economy, hence, raising income and decreasing poverty. As shown in Figure 68, poverty in the Philippines could fall below 11% by 2030 under this scenario – still very much above the WBG poverty goal of 3%. As in the case of informality, this is mainly due to significant progress in reducing poverty in rural areas (see Figure 69).



### 2.5.2. Manufacturing

The simulated investment in this case is the same as for Agriculture in terms of total FDI, increasing by 0.5% of GDP annually after 2017. The increase in FDI targets manufacturing sectors in proportion to their size in terms of value added (roughly 40% to food and 60% to non-food manufacturing) and is also assumed to be mainly oriented towards export markets.

The effects of the stimulus on the manufacturing sector are shown in Figures 70 and 71. Overall growth over the projected period increases from an annual average of 6.4% along the baseline to 7.7%. This is mainly driven by GDP increases in the manufacturing sectors. Food manufacturing grows by 10.8% over the projected period instead of only by 5.1%. Non-food manufacturing grows by 10.3% on average instead of 7.3% in the baseline.

Figure 70. Food Manufacturing Real GDP
FDI Increase focused on Manufacturing

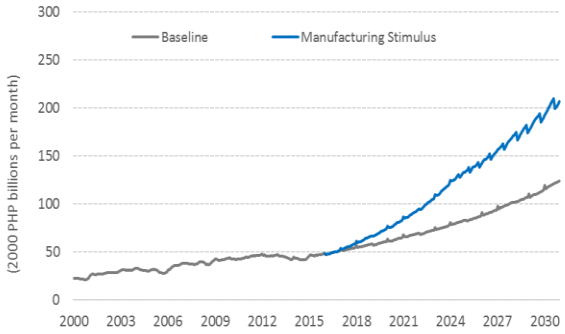
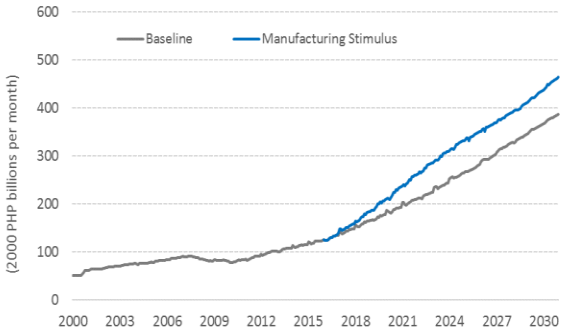
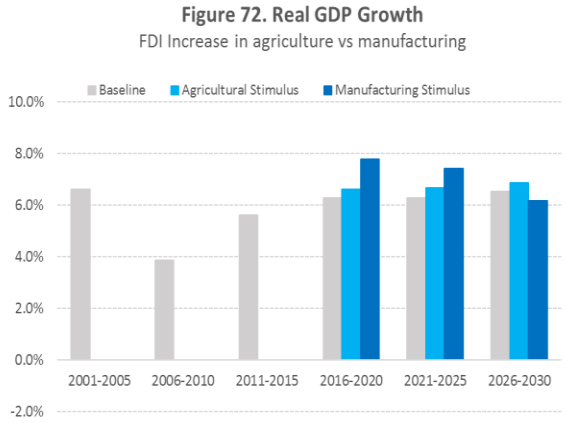


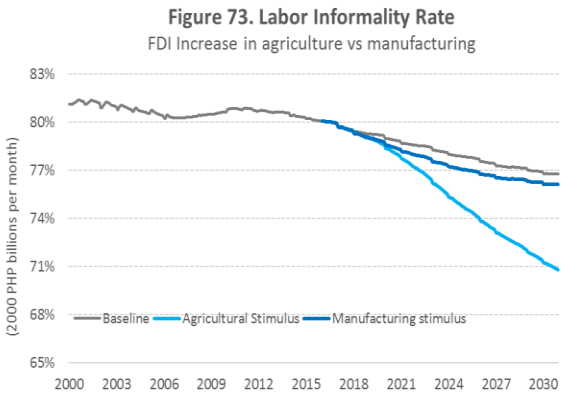

Figure 71. Non-Food Manufacturing Real GDP
FDI Increase focused on Manufacturing



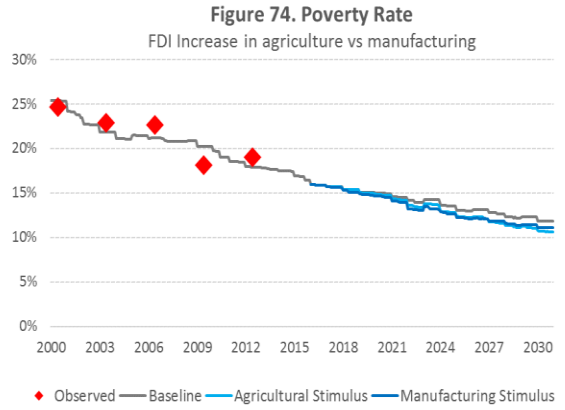

While the initial stimulus on manufacturing is the same size as the stimulus on the agricultural sectors before, Figure 72 shows that the anticipated effect on GDP is much larger under the manufacturing stimulus. The compound average growth rate for the period from 2016 to 2030 increases from 6.4% under the baseline and 6.7% under the agricultural stimulus to 7.7% under the manufacturing stimulus. This difference is mainly explained by larger supply chain effects in the manufacturing sector.

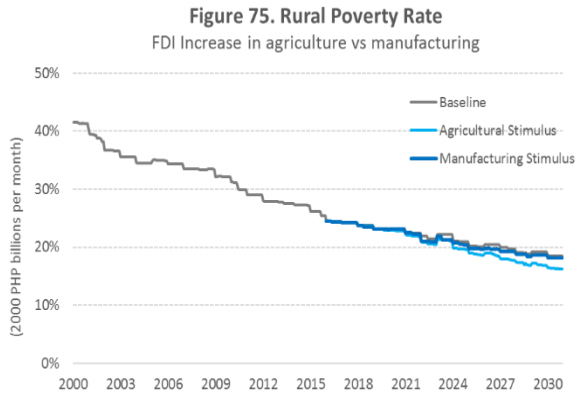
Figure 73 shows the informality rate under the three scenarios. As IFC investments target exclusively formal companies, the investment in the manufacturing sector leads to more formal employment than under the baseline. However, the effect is less pronounced than if the additional investment went into the agriculture sector, where informal employment is much larger than in the manufacturing sector.

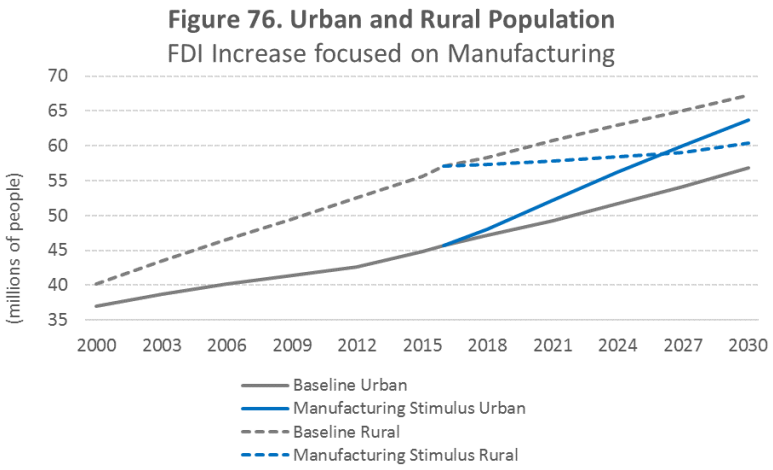



While the impact on GDP is larger under increased investment in manufacturing, the impact on the poverty rate in the two scenarios is quite similar (Figure 74). However, the driver behind the decrease of poverty is quite different. Informality and rural poverty (Figure 75) are much less affected under the manufacturing stimulus counterfactual. Urban informality, and especially informality in manufacturing, is much lower to begin with than informality in rural areas and agriculture, leaving little room for an increase in income due to declining informality. However, investing in the more urban manufacturing sector will lead to an increase in income through two different channels. First, people initially working in agriculture will get better paying jobs in manufacturing, and second, some people move to urban areas. Urbanization (Figure 76), driven by an increase in urban GDP, leads to people moving from poorer, rural areas, with lower paying jobs, to urban areas with higher paying jobs, even if these jobs may still be in the informal economy.



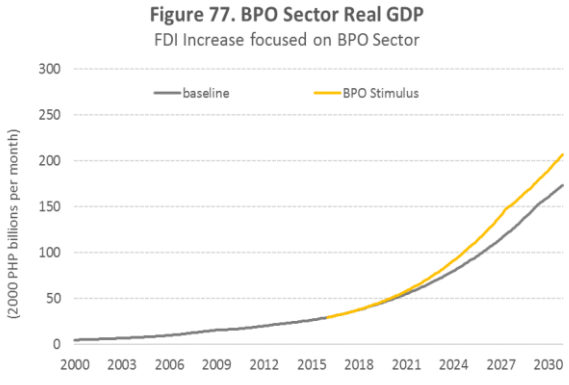



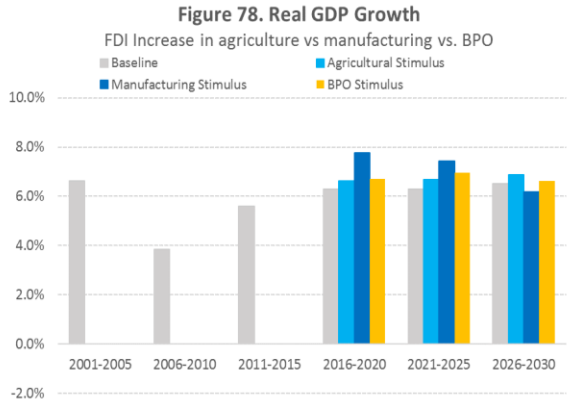



### 2.5.3. Business Process Outsourcing (BPO)

In this scenario, we direct the FDI inflow towards the BPO sector. The size and timing of the FDI increase are the same as in the agricultural stimulus and manufacturing stimulus cases. However, this stimulus only affects one specific part of the economy.

Figure 77 shows the effect on value added in the BPO sector as a result of increased investment. While the BPO sector is already growing at a considerable rate along the baseline, the additional investment accelerates its growth. The average growth rate of the sector between 2016 and 2030 rises from 12.7% under baseline assumptions to 14.0%. Due to large supply chain effects, there is a considerable increase in the growth of the overall economy, beyond the additional growth that can be achieved under a stimulus steered towards agriculture, but still less than the growth under an investment in manufacturing (Figure 78).



GDP growth rates under the BPO stimulus scenario are not as high as under the manufacturing stimulus. While they increase from 6.4% under the baseline to 7.2% under the manufacturing stimulus, they only increase to 6.8% under an increased investment in BPO activities (Figure 78).

**Figure 79. Labor Informality Rate**
FDI Increase focused on BPO Sector

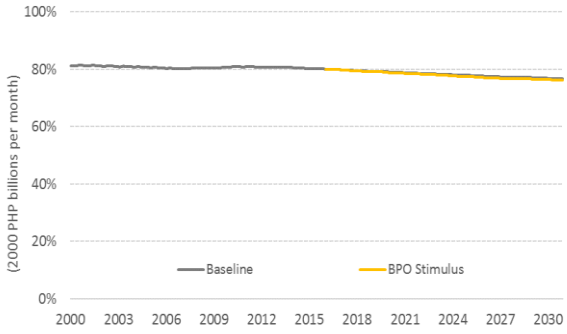
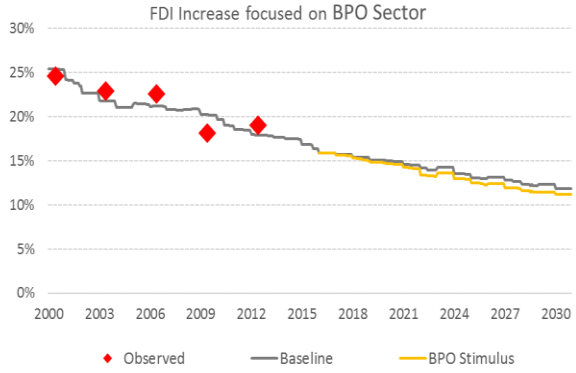
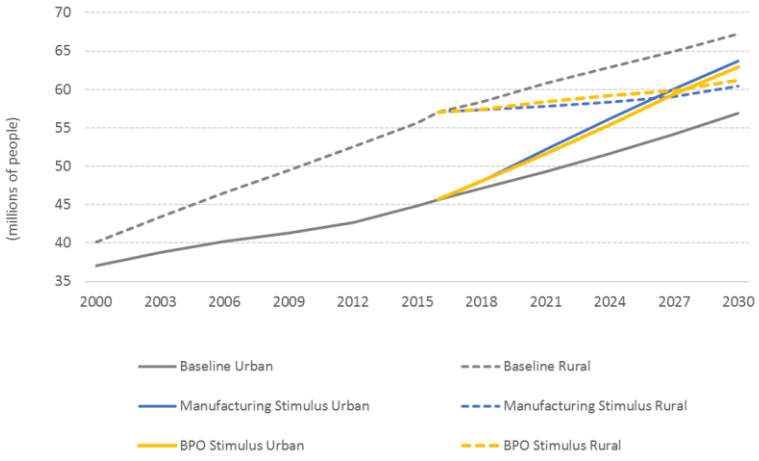



**Figure 80. Poverty Rate**
FDI Increase focused on BPO Sector




While GDP effects are different between the manufacturing and BPO scenarios, the effects on informality and poverty are not (Figures 79 and 80). The channels through which an investment in BPO affects labor informality and poverty are the same as those under the manufacturing stimulus. This leads to a similar reduction in the poverty rate over time. It is the same people who increase their incomes by moving to higher paying occupations either by entering the formal sector or by moving to urban areas (Figure 81).

**Figure 81. Urban and Rural Population**
FDI Increase focused on Manufacturing and BPO



### 2.5.4. Tourism

The tourism sector is considered an engine for development and closely linked to poverty reduction in many developing countries. A strategy that aims at reducing extreme poverty usually aims to create job opportunities for low educated individuals who can enter a career ladder through on-the-job training. The tourism sector is often described as an ideal opportunity for low and middle skilled labor to find job opportunities while at the same time learning skills that will enable them to move beyond their initial occupations[82].

Importantly, the tourism sector in the Philippines has considerable growth potential. There is only limited international tourism currently due to the lack of infrastructure. Mainly, air and ground transportation and water and sewage services are inadequate to support an increase in the tourism sector[83]. While the latter increases the cost of hotel rooms for potential clients, the former renders investments inviable as potential clients are unable to easily reach tourist destinations within the country.

To investigate the importance of investing in infrastructure alongside direct investments in the tourism sector, we compare two scenarios, one in which the increase in FDI by 0.5% of Philippine GDP annually flows entirely into tourism (hotels), and one in which half of the investment is diverted into improving airport capacity in the Philippines.

If all the additional FDI is spent on the hotels sector, then the sector exhibits faster growth in the early years, as more money flows into hotel capacity (Figure 82). However, without investment into critical infrastructure, the tourism sector relies largely on domestic customers, and thus its growth is ultimately limited.

Tourism sector would be larger by the early 2020s if half of the investment were diverted into airport infrastructure, which will in turn open up the sector to additional foreign customers. This is reflected in higher economy-wide GDP growth rates (Figure 83). Investing into air transport infrastructure increases the

[82]"Making tourism a tool to fight poverty: ten years of the ST-EP Initiative" UNWTO.
[83]"National Tourism Development Plan 2016-2020" Department of Tourism of the Philippines.

average annual growth rate from 6.8%, under the hotel-only investment scenario, to 7.0% between 2016 and 2030.

**Figure 82. Tourism Real GDP**
FDI Increase focused on Tourism

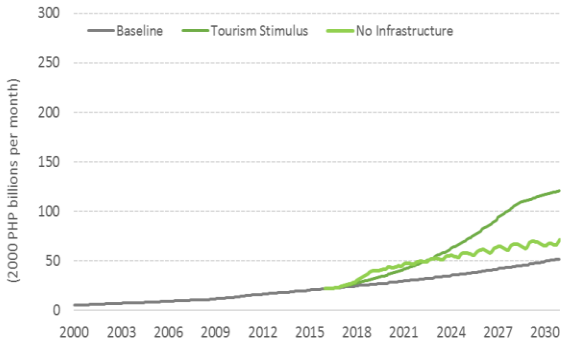



**Figure 83. Real GDP Growth**
FDI Increase in tourism and infrastructure


However, even though GDP growth and informality rates (Figure 84) are more favorable if infrastructure is also enhanced, overall poverty rates react very similarly in both scenarios, as can be seen in Figure 85.[84]

**Figure 84. Labor Informality Rate**
FDI Increase in Tourism vs No Infrastructure

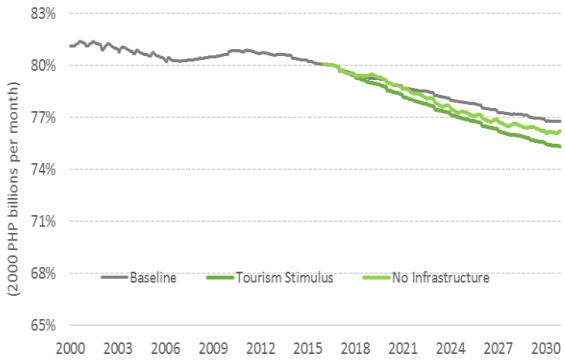
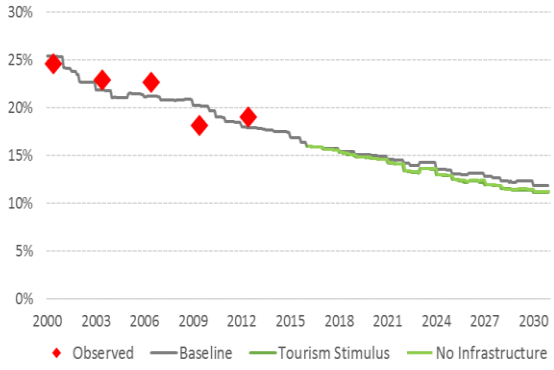


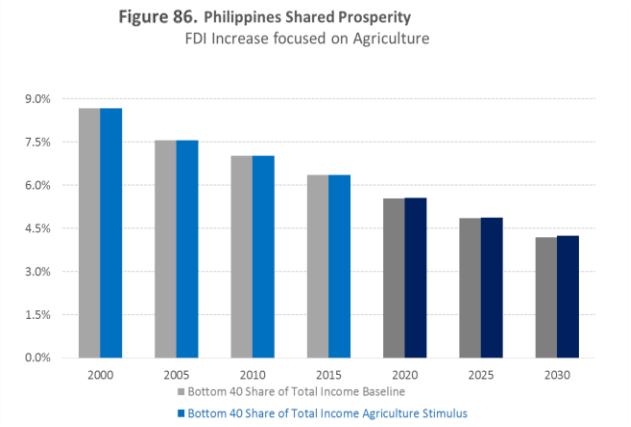

**Figure 85. Poverty Rate**
FDI Increase in Tourism vs No Infrastructure

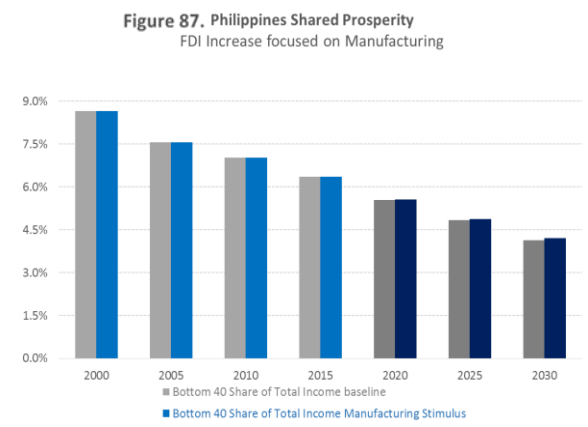



[84] Results for shared prosperity are more mixed across scenarios. While no investment strategy is able to reverse the negative trend on income distribution, where , the income of the average grows quicker than the income of the bottom 40%, all investment stimuli can at least slow down the negative trend. The simulations reveal that this gap grows less when additional FDI inflows are applied. While poverty might be reduced more under an agricultural stimulus, the effect on the bottom 40% is more favorable between 2015 and 2020 if the investment is targeted towards manufacturing, BPO or tourism. In later periods the effect is reversed and the gap increases slower under the agricultural stimulus.

### 2.5.5. Shared Prosperity

Results on shared prosperity are less impactful than on poverty. No investment strategy is able to reverse the negative trend on income distribution seen in the baseline simulation (figure 68), only marginally reducing the pace of increase in inequality, as can be seen in figures 86 and 87 for stimuli in agriculture and manufacturing sectors, respectively. A similar pattern is also seen when simulating FDI stimuli on BPO and Tourism sectors. In fact, the ratio between the average growth rate of income across all income groups and the income growth of the bottom 40% is greater than one in all periods and across all scenarios. This implies that the income of the average is growing quicker than the income of the bottom 40%.




Hence, most of the benefits of an increase in FDI are reaped by households in the top three quintiles of the income distribution. The persistent large share of informal employment prevents wages for informal and less skilled workers from rising by as much as formal and high-skilled workers (figures 43 and 44), as economic growth accelerates. Moreover, individuals in the top quintiles own more capital, on average, compared to households in the bottom 40% of income distribution, and are also able to acquire more capital over time, through higher savings, which results in an increase in the gap of capital income between those groups as well.

While FDI increases economic growth, creates formal and better paying jobs, and thus helps to reduce overall poverty in the Philippines, it seems not to be enough to overcome the increasing income inequality in the country. Hence, social policies seem to be necessary for the World Bank to reach its goal of increasing shared prosperity in the country.

## 2.6. Conclusion

This paper introduces the Economy-wide Private Impact Quantification model (EPIQ), a structural economic model of the Philippine economy that helps to link IFC's private sector investments to the twin goals of the WBG. It models the Philippine economy disaggregated into 10 sectors using intermediate inputs, capital, and labor to produce final and intermediate goods. Labor markets are segregated into 3 different skill levels, urban and rural markets, and informal and formal employment. Distinguishing labor based on education, location, and formality is important, since these three factors determine salary levels to the largest extent, and hence, influence income distribution and poverty rates. On the demand side, the model considers 7,680 different household types. Each group differs in their labor and capital endowments, household size, number of working individuals, age of household head, education obtained, and location. These distinctions are important in order to endogenously compute distributional impacts such as changes in the income of the bottom 40% and poverty rates.

EPIQ represents the Philippine economy in a recursive dynamic setup. The model's horizon stretches from 2000 to 2030. We incorporate population growth and decomposition by applying an exogenously estimated transition matrix that updates the number of households of each type between periods. The periods are further linked through investment decisions and capital stock evolution. Households save a fixed share of their disposable income after minimum life essentials have been bought and taxes have been paid.

A wide variety of scenarios are presented, showcasing the abilities of EPIQ to link investment in specific sectors or infrastructure to the World Bank twin goals. Results show that formalizing employment and increasing urbanization can play a crucial role in fighting poverty, but have limited impact on closing income gaps. In addition, we shed light on how investments in different sectors such as agriculture, manufacturing, BPO, and tourism filter through economic feedback mechanisms.

An investment through an additional inflow of FDI of 0.5% of GDP annually can increase average GDP growth rates from 6.4% to up to 7.0% between 2016 and 2030 if the investment targets non-agricultural sectors such as manufacturing or tourism. However, investing in infrastructure is crucial as well. If a growth strategy involves boosting the tourism sector, accompanying investments in the air transport

sector, for example, will unlock a larger growth potential. While GDP effects are largest when investments target non-agricultural sectors, the poverty rate declines more if additional FDI inflows are directed towards the agricultural sector. This result is mainly driven by the large extent of informal employment in agriculture which can greatly be reduced by formal investment. Hence, a large rural population working as subsistence farmers or in informal businesses may greatly benefit from such an investment.

Lastly, shared prosperity is relatively unaffected by investments alone. The increasing inequality pattern remains in the scenarios, at a slightly slower pace, as most of the benefits of an increase in FDI are reaped by households in the top three quintiles of the income distribution. These individuals tend to own and accumulate more capital, through higher savings, hence earning higher capital income in addition to the already higher level of wages income, since the large share of informal employment prevents wages for most Philippine workers from rising as economic growth accelerates. Therefore, while private sector investment increases economic growth, and thus, generates the necessary wealth to improve the life of all the people in the Philippines, social policies appear to be necessary for any successful strategy aiming at improving upon the World Bank Group twin goals of increasing shared prosperity and reducing poverty.[85]

[85] In a follow-up paper, we analyze the distributional effects of the TRAIN income (progressive) tax reform implemented in the Philippines in 2018, as an example of successful public policies that could help further reduce poverty and inequality. Results show that the additional tax revenue partially destined towards an unconditional cash transfer program have a significant direct effect on poverty reduction, while additional investment in public infrastructure indirectly contributes to poverty and inequality reduction via higher economic growth in the medium to long run. The paper is waiting on publication clearance from the Philippine Ministry of Finance and the WBG, and will be included in a forthcoming WBG report on the TRAIN reform in the Philippines.

# Chapter 3: Working Capital and Firm Growth in Developing Economies*

## 3.1. Introduction

Working capital plays an essential role in firms' operations and performance, as a complementary factor of production to physical (or "fixed") capital in determining firms' production capacity over time. Despite the notion that capital as a factor of production in economic analysis refers mainly to physical capital, data shows working capital assets are a sizable fraction of the firm's balance sheet across real sector companies. Firm-level data for companies in the manufacturing and retail trade sectors across developing economies show that working capital accounts, on average, for 20% to 25% of the firm's balance sheet in the past 10-15 years.[86]

The critical role of working capital became evident with the Covid crisis across the globe. Given the sudden large shocks to demand as well as to supply chain dynamics that the pandemic implied, most firms (especially in the real sectors) were subject to liquidity and intermediate input shortages that affected their ability to operate during the initial phase of the crisis. Thus, firms entering the crisis with higher levels of working capital were more resilient to the initial sudden negative shocks. As the pandemic progressed, governments around the world launched emergency programs to provide firms with working capital financing. The differential effects across sectors and firms from these interventions are still to be identified as data becomes available. For many firms with inadequate levels of working capital at the onset of the crisis, as well as those that faced tighter constraints as the crisis evolved, the provision of emergency working capital clearly helped them muddle through – or survive. However, the extent, allocation and

* Co-authored with Yuliya Gosnell, Camilo Mondragón-Vélez and Verónica Navas – International Finance Corporation (IFC), World Bank Group (WBG). The views expressed in this paper are those of the authors and do not necessarily represent those of IFC/WBG.

[86] Authors' calculations using a broad sample of more than 9.5 million companies in the Orbis database. Working capital is defined as inventories plus accounts receivable minus accounts payable.

duration of such interventions would have benefited from a better understanding of the distribution of working capital across firms and its evolution over time. In this regard, some of the stylized facts and findings of this paper (based on pre-crisis data) could contribute to such understanding during the post-crisis recovery period and beyond.

Following standard production function analysis, there is a notional optimal value of working capital for a firm to achieve a certain level of production, conditional on the company's productivity and unit costs of other factors of production such as physical capital and labor.[87] In practice, the corporate finance literature focuses on managing the firm's balance sheet structure, inventory and cash levels, as well as efficient management of receivables (and payables), as ways to operate as close as possible to such an optimal level. Consequently, the level of working capital with which a firm operates should be a critical driver to maximizing profits and ultimately achieving higher productivity.

Firms have different reasons for not being able to operate close to their optimal level of working capital. On the one hand, management capacity and skills may not recognize the importance of managing working capital, or of ways to manage working capital efficiently.[88] On the other hand, working capital financing constraints can curb firms' capacity to reach optimal scale, and adequately respond to changes in demand. Limited access to working capital financing can be the result of a firm's idiosyncratic characteristics and performance that elevate risk flags for financiers, a low level of development of financial markets in the firm's country of operation, or both.

Along these lines, this paper studies the relationship between working capital and firm growth in developing countries. More specifically, the paper explores empirically how the expansion of working capital contributes to firms' growth in the manufacturing sector[89], using available firm-level data across a group of developing countries.

[87] The "optimal" value would be the cost minimizing level of working capital under a standard conditional factor demand optimization, that differentiates working capital from physical capital.

[88] See Cusolito and Maloney (2018) for the central role of the entrepreneurs' human capital and managerial ability as a determinant of firm productivity.

[89] The analysis is currently being replicated to the retail trade sector and will be incorporated to an updated version of this paper.

This research question is particularly relevant for development finance institutions, other investors and domestic financial institutions focused on providing working capital financing across the developing world. As mentioned above, the crisis has highlighted the importance of working capital, while the post-crisis recovery period will benefit from a better understanding of working capital financing needs and allocation. While the rationale and expected economic activity generation implied by greenfield and business expansion investments involving both capex and working capital needs is straightforward, the effects of working capital financing for companies with ongoing operations is less clear. The notion of optimal levels of working capital requires one to determine how far (below or above) any individual company is from such optimum, as well as to estimate the expected impact of working capital expansion.

While there is an ample literature studying the effects of fixed capital on firm performance dating back to Solow (1956), focused studies on working capital are scarce. Furthermore, studies analyzing working capital and firm performance (Aktas et al., 2015; Baños-Caballero et al., 2014; Botoc and Anton, 2017; and Masadeh et al., 2018) are based mostly on data for developed countries.[90] Therefore, this study contributes to the literature by characterizing and quantifying this relationship based on a broader sample of developing economies, focusing on firm growth and expanding the analysis by characterizing the dynamics across country income groups.

This paper uses firm-level data from Bureau Van Dijk's Orbis database.[91] The sample includes companies in the manufacturing sector across 29 developing countries, during years 2007 - 2016. Following a comprehensive data cleaning process, the sample includes about 3.1 million firm-year observations[92].

The identification strategy resembles the approach implemented by Aktas et al. (2015), by generating a measure of excess working capital (to total assets) for each firm-year observation in the sample, using as a baseline the median ratio of working capital to total assets observed for all firms within the same country, sector and year.[93] We then use this measure as one of the covariates that drives firm

[90] The exception is Botoc and Anton (2017), who use firm level data from Emerging Europe.
[91] www.bvdinfo.com/orbis
[92] The retail trade sector data will include additional 6.4 million observations.
[93] We use the same working capital definition (inventories plus accounts receivable minus accounts payable), but we normalize working capital by total assets instead to total sales.

performance, as measured by the change in the ratio of sales to total assets, a normalized measure of firm growth. Other covariates include firm-specific financial variables contributing to growth as well as controls for firm age, macro variables, time- and firm-fixed effects.[94]

The results are consistent with other similar studies, in the sense that they indicate the existence of an optimal level of working capital, above which it is not worth expanding working capital in search of further marginal growth.[95] The correlation between excess working capital (relative to total assets) and firm growth is positive and significant. However, the relationship follows an interesting non-linear path: firms that are well below their relevant peer median show a positive – but not the largest – correlation (perhaps they suffer from other weaknesses); firms below but closer to their peer median show the largest potential effects on firm growth (larger gains for stronger firms capable of getting closer to the optimum level); and firms above but close to the median show a lower (though still positive) correlation; while firms well above the median show no significant correlation. The analysis across country income groups shows that the effect of working capital expansion is larger in high income countries, suggesting that a country's economic context (market sophistication and financial market development) can affect the extent to which increased working capital is related to higher firm growth.

In sum, while the analysis confirms the existence of an optimal level of working capital, with respect to sales growth, it is important to note that the magnitude of the working capital expansion effect on firm growth is conditional on how far behind the firm is relative to its peers as well as on the economic context in which the firm operates.

The chapter is organized as follows: section 3.2 provides a review of the literature discussing the tradeoffs implied by working capital management; section 3.3 describes the data and presents some stylized facts; section 3.4 goes over the empirical methodology and results; and section 3.5 concludes.

[94] Financial variables include lagged leverage, sales to total assets, and firm size measured by total assets; and macro variables include GDP growth, loans to GDP as a measure of financial sector development, inflation, and real exchange rates.

[95] It might be optimal to carry precautionary excess working capital even if it doesn't add to sales. However, this is not within the scope of this paper.

## 3.2. The Economic and Financial Tradeoffs of Working Capital Management

While the relationship between investment in fixed capital and firm production has been prominent in economics (Solow, 1956; Kaldor, 1963; and Acemoglu, 2009), the role of working capital, generally defined as the difference between current assets and liabilities, has received less attention in the literature. Yet, business managers generally understand that managing working capital, and specifically adjustable levels of working capital, is key to increasing operations efficiency, which allows them to effectively respond to demand and supply shocks while optimizing profits.

As an enabler of firm growth, working capital is expected to have a positive effect on sales. For instance, higher levels of working capital are associated with higher levels of inventories, which may be necessary to increase sales when facing surges in demand. In addition, higher inventory levels imply lower risks of stock-out and a protection against fluctuating input prices (Aktas et al., 2015). However, higher inventory levels also imply increasing costs that could impact profit. Meanwhile, accounts receivable (or trade credits given to customers) allow firms to engage in price discrimination and can serve as a quality warranty by allowing customers to pay after testing the product, helping to build long-term relationships (Aktas et al., 2014). For cash constrained customers, receivables provide the means to purchase the firm's outputs and are likely to lead to overall increased sales.[96]

While access to working capital can be associated with improved firm performance, previous research indicates that the relationship is not linear, and that an optimal level of working capital exists (Aktas et al., 2015; Baños-Caballero et al., 2014; Botoc & Anton, 2017). Holding working capital beyond this optimum level results in inefficiencies that impact performance negatively. For instance, higher inventories can also lead to increased costs for warehousing, insurance, and security (Baños-Caballero et al., 2014), and inventories may perish or otherwise become illiquid at times (Masadeh et al., 2018). Excessively high levels of accounts receivable can indicate an inability of customers to pay, inefficient cash collection or a low bargaining power of the firm with its customers (Fabri & Klapper, 2016).

[96] A firm can also receive trade credit from its suppliers in the form of accounts payable. Higher accounts payable imply lower working capital needs, as they represent a source rather than a use of funds to the firm. However increased accounts payable are usually used to finance (at least in part) higher levels of inventories or accounts receivables.

Therefore, effective working capital management is key to maximize profits. Ideally, enough working capital should be available to scale operations, yet no capital should be tied unnecessarily in inventories or accounts receivable, especially when the shelf life of inventories is limited, or storage costs are high. These factors are industry specific. Masadeh et al. (2018) find significant variation in inventory ratios across manufacturing, retailing and service industries in the US.[97] While these ratios do not provide information on the volumes of inventory held in different industries, they show how quickly inventory needs to be turned over and replenished across industries. Therefore, access to financing for working capital is critical in industries where rapid turnover of inventory stocks is required.[98]

The cash conversion cycle is commonly used to measure working capital efficiency. This measure refers to the time it takes for a dollar invested in working capital to turn into revenues.[99] Not surprisingly, most studies find a negative relationship between the cash conversion cycle length and firm profitability (Schilling, 1996; Ukaegbu, 2014; Uremadu et al., 2012), attributable to higher inefficiencies and financing costs. Along these lines, the cash conversion cycle should be as long as necessary, yet as short as possible, to maximize efficiency and profitability. As a firm scales up, it can increase its working capital without compromising efficiency or profitability by ensuring that its cash conversion cycle remains stable.

Another important consideration related to working capital is liquidity. While the cash conversion cycle measures the efficiency of capital employed for day-to-day operations, other elements of working capital play an important role in ensuring liquidity. When defined as the difference between current assets and current liabilities, working capital includes cash as well as short term financial investments and

[97] They find average inventory turnover ratios of 4.4 in the manufacturing, 8.2 in the retail and 1.0 in the services sector. Inventory is thus fastest turned in the retail industry, more than eight times a year, and about once a year in the services industry. Interestingly, current ratios do not vary significantly between the three sectors indicating that only certain components of working capital are industry-specific, not necessarily the overall level of working capital (Masadeh et al., 2018).

[98] Chuan-Guo et al. (2014) show that within the Chinese retail industry different strategies affect the working capital choices firms make. They find significant differences in working capital management between firms that are active in wholesale (middle market, differentiation strategy), retail (terminal market, low-cost strategy) or both (hybrid strategy). In short, more efficient working capital management is associated with higher turnover ratios of inventory and accounts receivable, and with lower levels of working capital.

[99] To measure cash conversion, the average days during which inventory is kept until the final product is sold are added to the average number of days it takes customers to pay outstanding accounts receivable, and the average days of accounts payable are subtracted. The shorter the cash conversion cycle, the more efficient is a firm's working capital management.

obligations that can be used to react to cash flow fluctuations.[100] Yet, a tradeoff exists between liquidity and profitability due to the opportunity cost implied by profitable investment opportunities for resources otherwise held in cash – or additional working capital (Schilling, 1996; Uremadu et al., 2012; and Ding et al., 2013). When considering the effect of cash flow fluctuations on firm performance, financial constraints become an important mediating variable. In perfect capital markets, cash flow fluctuations have no effect on liquidity as short-term credit should be readily available for any profitable firm. In practice, however, and more so in countries with less developed financial systems, access to (short-term) capital may be limited due to information asymmetries and economy-wide shocks (Moro et al., 2015; Lee et al., 2014). In such cases, even highly profitable firms may need to liquidate fixed assets when cash flows temporarily decrease. Fazzari and Petersen (1993) examine a firm's option of using (excess) liquidity provided by working capital as a buffer during cash crises. They argue that it is costly for firms to change their level of fixed investment, inducing them to preserve a stable fixed-investment path whenever possible. Under financial constraints, they find that firms can offset cash flow fluctuations by adjusting working capital.

Unbuffered cash flow fluctuations have not only short-term but also long-term consequences for firms' growth. These become salient in the case of a positive cash shock: in an economic boom, demand for a firm's products may increase faster than its capacity, making investments in fixed and working capital for operations necessary at the same time. Cash-constrained firms, which do not possess a sufficiently high buffer, may be unable to invest in both simultaneously, and consequently they face a trade-off between long-term investments in capacity expansion and more immediate investments in working capital to directly increase production. Chan (2014) evaluates the impact of financial constraints on economic activity through a dynamic model of the firm, which explicitly incorporates working capital by introducing a delay between factor payments and the receipt of revenue. This model predicts that firms under binding constraints will substitute between labor and capital in response to demand shocks. In this model, investments in capital serve as proxies for long-term capital investments, while labor captures short-term investments in the firm including actual labor as well as working capital. Investments in fixed capital are therefore countercyclical;

[100] For instance, when cash levels are reduced due to sales decline short term assets can be liquidated to cover immediate cash needs. This allows the firm to maintain its liquidity position and continue operating without disruption.

that is, when prices for a firm's output rise, a firm with limited access to financing is unable to react with increased investment in both short and long-term capital in order to increase production. Therefore, output growth is constrained in response to positive economic shocks. The main theoretical prediction of the model is that financial constraints will curb production for constrained firms precisely when demand rises, forcing constrained firms to disinvest at a time when long-term investment should be happening.[101]

In a similar context of positive cash flow shocks (i.e. an unexpected increase in sales which requires additional working capital), Botoc and Anton (2017) examine the importance of working capital for high growth firms in continental Europe. Fast growing firms have significant working capital needs to finance their expansion. At the same time, capital markets in continental Europe are mostly bank-based, and not as well developed as in Anglo-Saxon countries. Access to financing is not always available to small and medium sized enterprises, making trade credit a potential source of funding. By optimizing their amount of working capital, firms can generate the funds needed for growth and increase their profitability.[102]

Ding et al. (2013) show how financially constrained firms in China use working capital as a buffer to avoid adjusting investments in fixed assets when cash is scarce. Comparing unconstrained state-owned enterprises with foreign- and domestically-owned private firms, they show that working capital is significantly more sensitive to cash flow fluctuations than fixed assets for private firms, while no effect exists for state-owned enterprises. The effect changes when initial levels of working capital are low; in this case, private firms react to financial constraints by adjusting their fixed and current assets. In short, they show that firms use working capital as a buffer when they are financially constrained and have enough working

[101] Chan's predictions were tested with survey data for manufacturing firms in Bangladesh. Simulations confirm that in the event of positive price shocks, financial constraints keep average production at 60% of the optimal output level. When including working capital, average production is reduced to 38% of the optimal level. These results highlight the importance of working capital availability to reduce scale and production inefficiencies. Under financial constraints, short- to long-term capital ratios are beyond the optimal level and the cost of generating a dollar of revenue is greater. These factors lead to a loss in producer surplus as a result of countercyclical investments and less than optimal output levels, which in combination imply a lower growth path. The study uses two different measures for financial constraints: Managers' assessment of whether or not the firm faces problems to access financing (*access to finance*), and the source of funding being exclusively internal and some problem with access to financing being reported (*internal finance*).

[102] Botoc and Anton (2017) find the optimal ratio of working capital to sales to be at 79%. Beyond this level, further increases in working capital imply a decline in profitability.

capital.[103] On the other hand Baños-Caballero et al. (2014) find that financial constraints can result in firms holding low levels of working capital. Examining non-financial firms in the UK, they show that financially constrained firms hold less working capital. They also show that for firms below the optimal level, increasing working capital leads to higher sales and lower purchasing costs due to discounts for early payment. Above the optimum, opportunity and financing costs dominate and decrease firm performance.[104]

Thus, access to working capital plays a key role in enabling firms to produce at efficient levels and react optimally to changes in demand and prices. However, the relationship between working capital and firm performance is not straightforward, as there is a tradeoff between holding high levels of working capital (and, therefore, improved liquidity), and financing and opportunity costs of holding high levels of inventories and cash. Along these lines, this study contributes to the literature by quantifying and characterizing the relationship between working capital and growth for firms across developing countries, where less sophisticated capital markets and financial systems can imply larger financing constraints for firms that can force too many companies to operate at suboptimal levels, negatively impacting their productivity.

### 3.3. Data and Stylized Facts

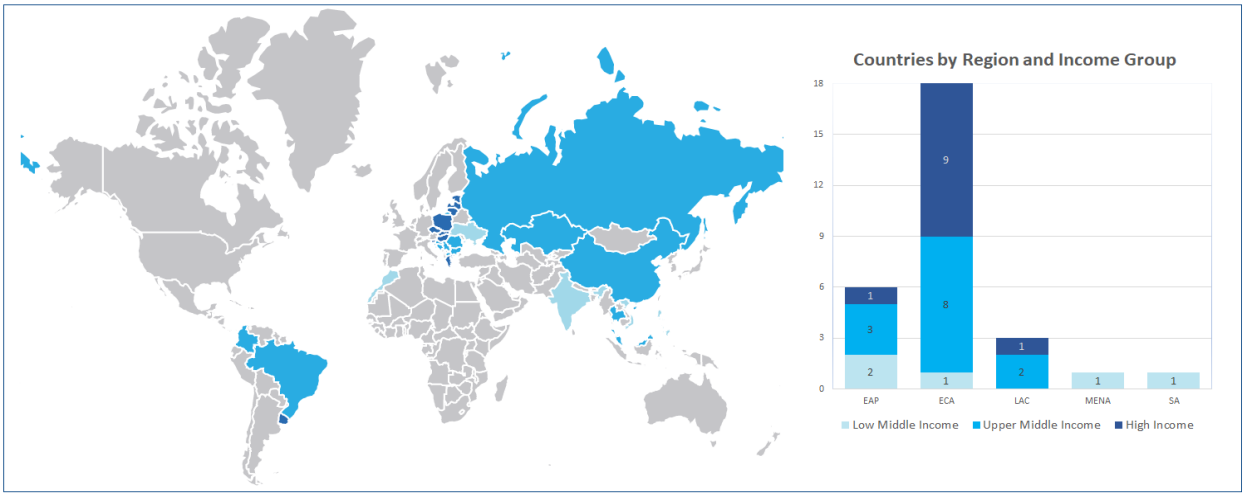
The study uses the Orbis database, which contains financial data (balance sheets and income statements reported over multiple years) for companies across the world. We use firms in the manufacturing sector across developing countries. In preparation for the econometric analysis, the data was reviewed and cleaned to remove duplicate observations, inconsistent entries (such as negative total assets, fixed assets or sales, or cases in which current assets were greater than total assets), and firms not providing required

[103] Lower sensitivity of fixed capital to cash flow variations is associated with higher sales growth, indicating that firms that do not need to adjust fixed assets perform better. Causality can however not be established, since profitable investment opportunities might induce firms to avoid disinvestment.

[104] Baños-Caballero et al. (2014) use various indicators to determine financing constraints: dividends, cash flows, firm size (all negatively related to financing constraints), as well as costs of external financing (positively related with financing constraints), and an external finance constraints index which considers cash flow, dividends, leverage, size, industry and firm sales growth. They argue that their findings are due to higher financing costs that financially constrained firms face. Their definition of working capital is limited to trade credit and inventories. Firms that face higher financing costs certainly have higher incentives to manage working capital more efficiently, in order to decrease their costs. At the same time, these companies might hold more cash and short-term financial assets to react to cash flow fluctuations, as found by Ding et al. (2013).

data for the analysis, such as sales and assets.[105] Following the data cleaning, we used the 10-year span from 2007 to 2016 for which the most of the data was available, and included only countries that had more than 1000 firm-year observations. The resulting sample included firm-level time-series financial data for about 3.1 million observations in the manufacturing sector. The data represented five geographic regions and includes 29 countries across three country income groups (see Figure 88).

Figure 88: Distribution of Countries by Region and Income Group

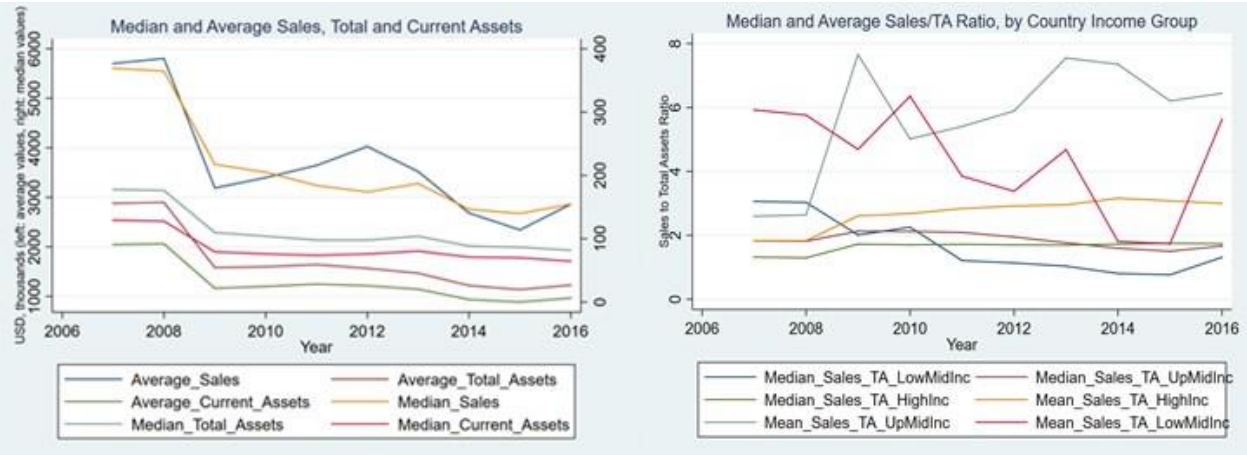



Among the financial variables in the dataset, the most relevant to our analysis are sales, assets (total, current, accounts receivable and inventories), liabilities (accounts payable), and working capital as we define below. Our findings show that sales and assets, both total and current, exhibit a downward trend during the 2007-2016 evaluation period (Figure 89). Unsurprisingly, average levels of both sales and assets decrease substantially in 2009 after the global financial crisis. Average sales exhibit a modest recovery between the years 2010 and 2012, prior to the oil price collapse; median sales, on the other hand, remain on a downtrend for the entire period. Given the differences in the average and median, it is plausible that the increase in average values was influenced by larger firms included in the sample. The decline in sales coincides with a decrease in assets, as shown clearly in the average values of total and current assets. Median asset values decline between 2006 and 2009 and then remain stable.

[105] In cases where assets information was available, but sales data was missing – predominantly in Russia and the Philippines – sales were restored by adding cost of goods sold to gross profit.

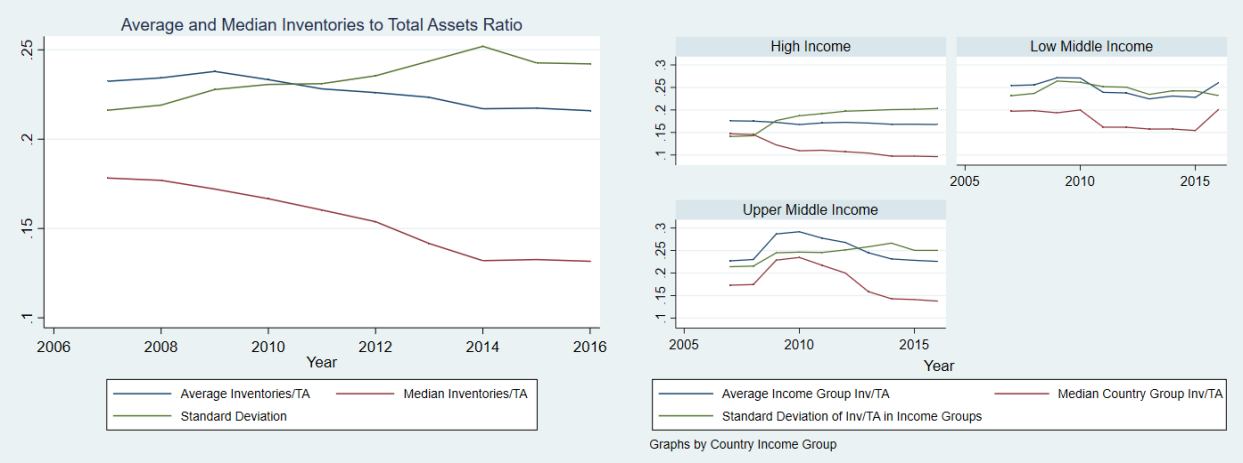
Sales, when viewed as a ratio to total assets, show a mixed picture (Figure 89, right panel). The median and average ratios are the highest in upper middle-income (UMI) countries, with a higher upward sloping average and lower flatter median trends over time. The trends are noteworthy as they show that a fraction of companies in the group, predominately in Russia (which has the largest number of observations) either reported increasing sales to total assets during the evaluation period, or underreported assets. The trends are decreasing in low middle-income (LMI) countries and improve modestly in high-income (HI) countries. Interestingly, the median ratio of sales to total assets is the lowest in HI countries during the first half of the period, and it stays relatively flat; in 2011, the LMI median falls below that for HI countries.

Figure 89: Sales, total assets and current assets trends



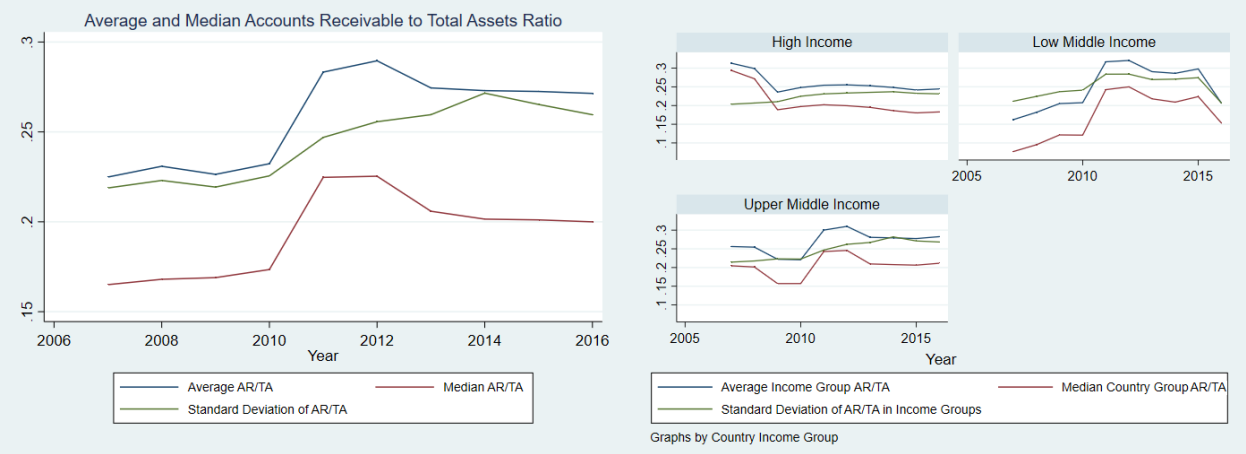

Inventories, a component of current assets, show a global declining trend across the entire period, in line with the overall decreases in sales and assets (Figure 90). Within country income groups, however, trends diverge. In UMI and LMI countries, inventories as a share of total assets increased after the global financial crisis, and then began decreasing after 2010. The increase in inventories was likely the result of slower turnover as sales and production declined, and given the overall declining trends in assets, the share of inventories increased against the backdrop of rapid decreases in other current assets, such as cash and accounts receivable. The largest increase in inventories occurred in UMI countries. In contrast, in HI countries, where inventory management is more likely to adopt a “just-in-time” approach and access to short-term financing is not as constrained, inventories to total assets remained relatively stable, and at all times was lower than in UMI or LMI countries.

Figure 90: Inventories as a share of total assets




Meanwhile, accounts receivable decreased sharply immediately after the 2008 financial crisis in UMI and HI countries (Figure 91). In LMI countries, accounts receivable increased as consumers delayed payments, and companies were forced to use all available cash. After 2010, at the time when firms in UMI and LMI countries managed to lower inventories, accounts receivable began to grow. Growth in accounts receivable (and payable) is evidence of growing financing constraints in UMI and LMI countries in the aftermath of the financial crisis. Levels of accounts receivable eventually stabilized by the end of the evaluation period.

Figure 91: Accounts receivable as a share of total assets




Trends in accounts payable are almost identical to trends in accounts receivable, only the ratios are higher in UMI and LMI countries (Figure 92). In the absence of adequate short-term financing, firms

managed cash by delaying payments to business counterparts. When all firms displayed similar behavior, accounts receivable inevitably increased as well.

Figure 92: Accounts payable as a share of total assets

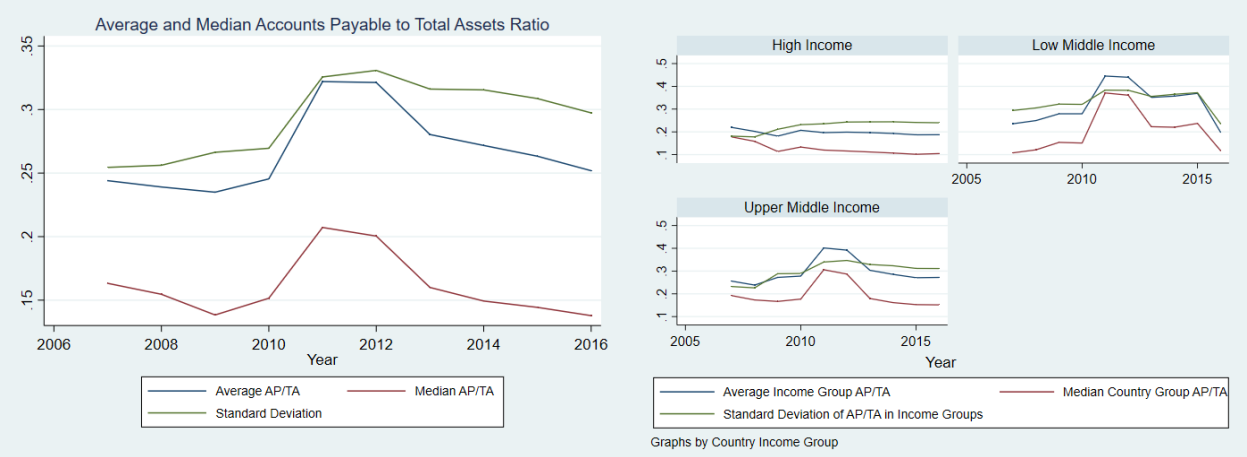


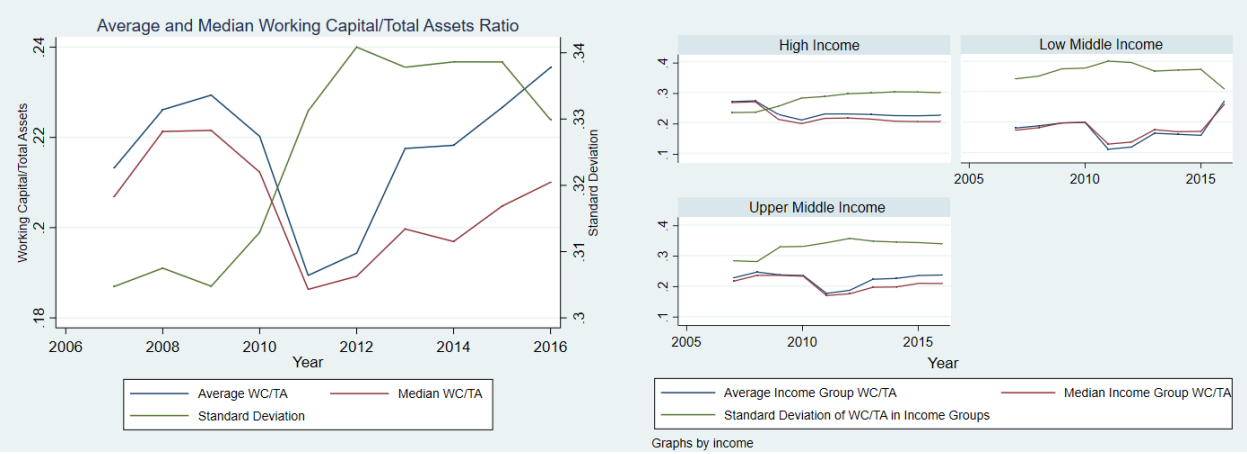

Figure 93 below depicts the trend for the average and median levels of working capital as a share of total assets during the entire period.[106] As expected, in UMI and LMI countries, working capital dips after 2010, with falling inventories and mounting accounts payable. In HI countries, the dip occurred earlier as firms shed inventories at the time the crisis was unfolding. Recovery of working capital levels came earlier than in other income groups as well, with stabilization at lower levels from 2011 onwards. The left panel in Figure 91 presents a close-up view of the trend, which peaks in 2009, reaches its lowest point in 2011 and then recovers. The average level of working capital to total assets has grown quicker than the median during the recovery and the two variables have diverged. This divergence has been the greatest among UMI countries.

The behavior of average levels of working capital reflects a sharp reduction in the average level of inventories held by firms, as well as an increase in the level of accounts receivable. These surged in most regions in 2011 (excluding LAC, where they decreased during the entire period) and stabilized at a higher average level afterwards. Interestingly, the average level of accounts payable has a similar behavior,

[106] Working capital follows the definition used in this paper (inventories plus accounts receivable minus accounts payable).

increasing in 2011, mostly driven by firms in the ECA region, and slowly decreasing in the following years. This trend was almost exclusively observed in middle income countries.

Figure 93: Working Capital as a share of total assets




The relationship between working capital and firm sales isn't necessarily intuitive; sales depend on numerous factors related to both the firm and country context. Firm productivity and competitiveness as well as the country's macroeconomic outlook and strength of demand are all relevant determinants of sales levels. Hence it is difficult to establish high level correlations across countries between working capital levels and sales. Furthermore, different levels of working capital can be interpreted differently across countries as they depend, among other things, on macroeconomic volatility and the firms' ease of access to finance. At an aggregate level we find that average sales as a share of total assets decreased systematically over the period between 2006 and 2016, while the level of working capital as a share of total assets has been rising after a sharp correction observed during the two years that followed the global financial crisis.

## 3.4. Estimation Methodology and Results

This study follows the work of Aktas et al. (2015), who argue that additional investment in working capital is expected to have positive effects on firm performance, particularly for firms with low levels of working capital. Working capital allows firms to grow by increasing sales and earnings. For instance, high inventories reduce supply costs, provide hedging against input price fluctuations, and allow firms to respond quickly to market shocks. However, more working capital doesn't necessarily improve firm outcomes, which

raises the question of whether an optimal level exists, and whether firms can have inefficiently high working capital due to financial constraints and inefficiencies at the firm or market level, at which point the relationship between working capital and sales and earnings weakens. Thus, excessive working capital may have adverse consequences, as it restricts investment in fixed assets, raises financing costs and increases the firm's risks.

Using a sample of U.S. companies, Aktas et al. (2015) found a positive correlation between working capital (defined by the authors as inventories plus accounts receivable minus accounts payable) and firm performance (measured by stock performance, return on assets, capital expenditures, and the standard deviation of firm daily returns, as a proxy for firm risk). They showed that the first three measures of firm performance increased with rising levels of working capital, while firm risk decreased, both up to a certain level. They set this level as the median working capital level in a given industry and year.[107] Thus, the authors showed that the relationship between working capital and firm performance is non-linear: increased levels of working capital are associated with improved performance until they reach industry medians.

This paper expands the work of Aktas et al. (2015) by determining if their findings hold for a sample of firms across developing countries (of varied income levels), and if the median level of working capital can be interpreted as an optimal level, or if the positive relationship between working capital and firm performance holds beyond the median for firms in these countries. We construct our excess working capital variable using the same definition as Aktas et al. (2015), but normalizing it by total assets instead of total sales (*e.g., the ratio of working capital to total assets*), which allows us to use sales as a firm (growth) performance variable. We subsequently estimate median ratios for all sector, year and country income group combinations in the sample. Since our data cover multiple countries in which macroeconomic conditions and access to financing can vary substantially, we separate our sample into country income

[107] Aktas et al. (2015) integrated median year-industry levels of working capital into the main independent variable, which the researchers named Excess Net Working Capital. The variable signified the difference between the observed Net Working Capital to Sales ratios and median Net Working Capital to Sales ratios in respective industries and years. Thus, Excess Net Working Capital showed whether a company had a level of working capital above or below its industry median (and could therefore be positive or negative), and how far above or below the median the level was. Aktas' regression analysis results estimated the relationship of both groups and firm performance.

groups when measuring relative working capital. While we considered calculating medians at country or regional levels, we chose country income groups to have a more even distribution across groups. We estimate the difference between working capital to total assets and the corresponding sector-year-income group median to create the excess working capital variable for each observation in the sample.

We subsequently develop a regression model to estimate the relationship between excess working capital and firm performance. As mentioned above, the model uses the ratio of annual sales to total assets as a dependent variable to proxy firm growth performance. Financial and macroeconomic variables were also included in the model to control for both company specific parameters – firm leverage, size, growth rate of total assets, and age – and specifics of the economic environment in which they operate, including access to finance (using the ratio of loans to GDP as a proxy). The independent variables and financial controls in the model are lagged by one year, given that sales and several financial covariates are simultaneously determined (see Figure 94).

Figure 94: Regression Model Variables

| Dependent Variable | Independent Variable | Financial Controls | Macro Controls |
|---|---|---|---|
| Sales to Assets Ratio, logged | Excess Working Capital Ratio, calculated through steps:<br>1. Ratio of *(Accounts Receivable + Inventories - Accounts Payable)/Total Assets*<br>2. Median of the Ratio by Country Income Group, Sector, Year<br>3. Difference between the observed ratio of *(Accounts Receivable + Inventories - Accounts Payable)/Total Assets* and the corresponding Median<br>4. Lagged Difference | logged and lagged<br>• Cash to Total Assets Ratio<br>• Current Liabilities to Total Liabilities and Equity Ratio<br>• Sales to Total Assets Ratio<br>• Total Assets<br>• Age* | • GNI per Capita<br>• GDP Growth<br>• Loans to GDP<br>• Exchange Rate<br>• Inflation |

**Variable "Age" is not logged or lagged*

We implement three estimation approaches:

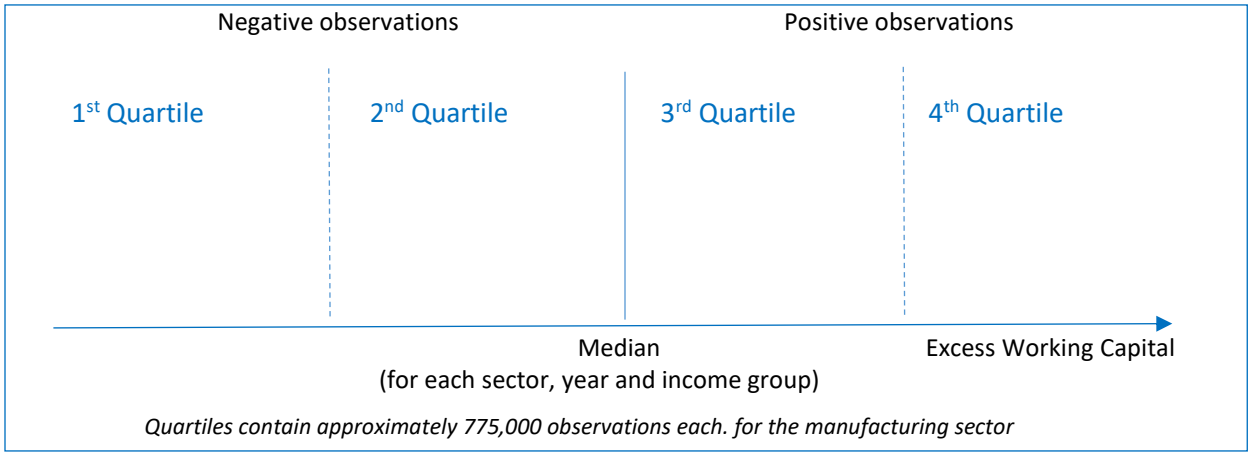
1. We develop a model to measure the elasticity of sales to working capital levels for a group of companies with levels of working capital that were below the median in a respective country income-sector-year group. The model has the following specification:

$$V_{it} = \alpha_t + \eta_i + \beta_1 ExcessWC_{i,t-1} + \beta_2 ExcessWC_{i,t-1}.D_{neg} + \beta_3 FC_{t-1} + \beta_4 MC_{t-1} + \varepsilon_{i,t} \quad (1)$$

where $V_{it}$ is the ratio of sales to total assets for company $i$ in year $t$; $\alpha_t$ and $\eta_i$ represent time and firm fixed effects; $ExcessWC_{i,t-1}$ is the excess working capital measure, and $D_{neg}$ is a dummy variable with a value of 1 for all observations with negative excess working capital, and 0 for all others.[108] Consequently, $\beta_2$ measures the additional percentage increase (decrease) in the dependent variable associated with a one unit increase in excess working capital for firms with negative values. Financial and macro controls refer to variables known to affect firm growth, as listed in Figure 94.

2. To determine if the relationship between excess working capital and sales changes as the company's working capital approaches the sector and income group median, and whether such a relationship eventually dissipates, we sort firms according to the distance between their level of working capital and the industry median: from the most negative excess of working capital to the most positive. The sample was then divided into quartiles, as shown in Figure 95.

Figure 95: Analysis by Excess Working Capital Quartiles




We then re-estimate our regression, creating three new dummy variables with a value of 1 for all firms in one of the first three quartiles and 0 for all other observations. The second regression model measures the incremental effects of excess working capital on sales in the first three quartiles of excess working capital:

[108] Given the panel structure of the dataset, the use of fixed effects and logarithmic expression of the dependent variable, a positive (or negative) β1 coefficient measures percentage increase (decrease) in the ratio of sales to total assets associated with one unit increase in excess working capital across time.

$$V_{it} = \alpha_t + \eta_i + \beta_1 ExcessWC_{i,t-1} + \beta_2 ExcessWC_{i,t-1}.D_{Q1-3} + \beta_3 FC_{t-1} + \beta_4 MC_{t-1} + \varepsilon_{i,t} \quad (2)$$

where $D_{Q1-3}$ are dummies indicating the quartile of excess working capital. The regression model includes a total of three interactions of excess working capital with dummy variables, one for each of the first three quartiles, where the fourth quartile is the reference group. The $\beta_2$ coefficient of each of these interactions, therefore, estimates the incremental positive (or negative) effect of a one unit increase in the excess working capital variable for each of the first three quartiles relative to the reference effect for the fourth quartile.

3. We also explore whether the relationship between excess working capital and sales varies between different country income groups. Namely, our objective is to establish whether the effect of additional working capital on sales depends on country economic context. The model has the following specification:

$$V_{it} = \alpha_t + \eta_i + \beta_1 ExcessWC_{i,t-1} + \beta_2 ExcessWC_{i,t-1}.D_{Q1-3} + \beta_3 ExcessWC_{i,t-1}.D_{IG1-2} + \beta_4 ExcessWC_{i,t-1}.D_{Q1-3}.D_{IG1-2} + \beta_5 FC_{t-1} + \beta_6 MC_{t-1} + \varepsilon_{i,t} \quad (3)$$

where $D_{IG1-2}$ represents dummies for LMI and UMI country groups, while the HI country group is chosen as the reference group.

### 3.4.1. Results

The three models produce a robust positive relationship between excess working capital and sales. As shown in table 7, which summarizes the results for the first two model specifications, a one unit increase in excess working capital for the reference group is associated with a 6% (in the first model) or 5% (in the second model) increase in the sales to assets ratio, and the additional effects from dummy interactions for the other groups are all positive and significant. The first model specification shows that the relationship is stronger for companies with working capital levels below industry and income group medians: each unit increase in excess working capital is associated with an additional 6% increase in the sales to total assets ratio, on top of the 6% increase for the reference group. This suggests that companies with low levels of working capital relative to peers have the potential to increase sales at a higher rate when they add working

capital to their balance sheets. This also indicates that below-average levels of working capital could be considered as inefficiently low.

Table 7: Effect of Excess Working Capital on Sales Growth:

| | ExcessWC | ExcessWC x Neg | ExcessWC x Q1 | ExcessWC x Q2 | ExcessWC x Q3 |
|---|---|---|---|---|---|
| Model 1 | 0.0595*** | 0.0602*** | | | |
| Model 2 | 0.0516*** | | 0.0666*** | 0.1608*** | 0.0411*** |

* *5% significance level* ** *1% significance level* *** *0.1% significance level.*

The results of the second regression model reveal further insights. The model goes beyond the division into groups of companies with working capital below and above medians to see if companies in different quartiles of the distribution would benefit differently from added working capital. Indeed, on top of the 5% increase in sales to total assets ratio in the reference group ($4^{th}$ quartile firms), the results show an additional 6% increase in this ratio for firms in the first quartile of the working capital distribution, a 16% additional increase for firms in the second quartile and a 4% additional increase for firms in the third quartile. Hence, the shape of the relationship is clearly non-linear.

These results lead to several conclusions. First, it suggests again that firms with working capital levels below industry and income group medians can increase their sales by bringing their working capital ratio up closer to their respective median. Second, this effect may be stronger for companies in the second quartile, perhaps due to their relative overall strength and ability to access resources, manage the firm, reach markets and convert working capital into sales. Companies in the first, most “negative” quartile, still benefit from additional working capital, but at a lower rate. Furthermore, the positive effect of increased levels of working capital on sales does not dissipate as levels reach local industry medians. The effect does, however, gradually weaken for the firms with the highest level of working capital. This suggests the existence of decreasing returns from additional working capital on sales after a certain level of working capital – namely, the second quartile of the distribution – above which additional working capital has lower effects upon sales, even though still positive.

The third regression model investigates whether the response of sales to levels of working capital differs across LMI, UMI and HI country groups. Table 8 shows that each income group demonstrates the

same pattern shown for model 2: a positive and significant relationship in the first quartile, a stronger relationship in second quartile, and a weaker relationship in the third and fourth quartiles. However, there are significant differences of magnitudes in the level of coefficients across income groups: regression coefficients are the highest for the HI group, and the lowest in the UMI group, for all quartiles.

Table 8: Effect of Working Capital on Sales Growth by Income Group:

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| Lower Middle Income | 0.1548*** | 0.3172*** | 0.1040*** | 0.1264*** |
| Upper Middle Income | 0.0702*** | 0.1353*** | 0.0461*** | 0.0239*** |
| High Income | 0.2246*** | 0.3320*** | 0.1637*** | 0.0933*** |

* *5% significance level* ** *1% significance level* *** *0.1% significance level.*

While there are limitations to comparing estimated elasticities across the different country income groups (such as sample representativeness), the differences suggest that country economic context can affect the extent to which higher levels of working capital can be transformed into higher levels of sales. A possible interpretation is that the response is the strongest in HI countries, due to the efficiency and sophistication of markets, and therefore the more readily available access to financing. Established and efficient supply chains and marketing channels, for example, make it easier to reach markets and transform production into sales. Efficient markets, ceteris paribus, allow more flexibility for firms to respond to market shocks, scaling up production more easily when opportunities arise. Having adequate access to short-term financing to increase inventories and finance quick scaling up of production allows for improved firm performance, in terms of higher sales. Given the stronger demand and more productive firms, on average, in HI countries, it is not surprising that the contribution of working capital to sales is stronger.

In less developed markets – UMI and LMI countries – the impact of working capital on sales is lower, which suggests that it is more difficult for firms to transform additional working capital into increased sales. In addition, in an environment with limited access to short-term financing and, thus, limited opportunity to quickly adjust levels of working capital, firms tend to keep higher levels of inventories than in developed markets, which raises industry working capital medians. Given a higher median of working capital, firms in the third and fourth quartiles already hold very high levels of working capital, making it more difficult to transform additional working capital into higher sales as compared to firms in lower quartiles.

Indeed, data analysis shows that among the firms with below median working capital levels, the ratio of inventories to total assets in UMI and LMI countries is significantly higher than in HI countries (table 9).

Table 9: Excess Summary Statistics for Manufacturing Firms

| Inventories/Total Assets | | | |
|---|---|---|---|
| Group | Obs. | Mean | Std. Err. |
| **WC Below Median** | 1,050,401 | 0.1428 | 0.0002 |
| *High Income* | 278,315 | 0.0905 | 0.0002 |
| *Upp. Mid. Income* | 662,802 | 0.1623 | 0.0003 |
| *Low Mid. Income* | 108,656 | 0.1581 | 0.6671 |
| **WC Above Median** | 1,050,493 | 0.3019 | 0.0003 |

| Accounts Payable/Total Assets | | | |
|---|---|---|---|
| Group | Obs. | Mean | Std. Err. |
| **WC Below Median** | 1,050,401 | 0.3817 | 0.0004 |
| *High Income* | 278,315 | 0.2543 | 0.0006 |
| *Upp. Mid. Income* | 662,802 | 0.4173 | 0.0005 |
| *Low Mid. Income* | 108,656 | 0.4927 | 0.0012 |
| **WC Above Median** | 1,050,493 | 0.1601 | 0.0002 |

| Quick Ratio | | | |
|---|---|---|---|
| Group | Obs. | Mean | Std. Err. |
| **WC Below Median** | 1,034,387 | 8.0183 | 0.2566 |
| *High Income* | 275,184 | 4.6254 | 0.0863 |
| *Upp. Mid. Income* | 641,565 | 7.1640 | 0.3214 |
| *Low Mid. Income* | 106,872 | 6.3099 | 0.6671 |
| **WC Above Median** | 1,057,973 | 4.7798 | 0.1099 |

This could suggest that more limited access to finance leads to firms holding a level of inventories that can be considered inefficiently high. In addition to holding higher levels of inventories, firms in UMI and LMI countries have higher levels of accounts payable – a substitute for short-term debt.[109] While this can be considered too high when compared to firms in HI countries, it can be interpreted as an efficient response to moderately developed financial markets where short term debt can be difficult to access for certain firms, or too expensive. Accounts payable in such firms represent the largest share of current liabilities – larger than short-term debt, current maturities of long-term debt and other liabilities. And overall, current liabilities on the balance sheets of firms in less developed markets are several times lower than current assets (as expressed by the Quick Ratio), much lower than in developed markets (table 9). Low current liabilities indicate limited availability of short-term financing (and higher accounts payable are an attempt to manage shortages of financing). The shortage is more pronounced among firms with levels of working capital below industry medians – those that according to our estimations would benefit from short-term debt the most given estimated effect working capital on sales.

[109] Higher accounts payable reduce working capital per the formula used in this study: working capital = inventories + accounts receivable – accounts payable. Yet, the current assets portion of working capital on the balance sheets of firms in developing markets is still higher than also elevated accounts payable, which still makes levels of working capital higher than comparators in developed markets (an argument made earlier in the narrative).

### 3.4.2. Potential implications of the empirical results for the evolution of working capital and firm performance during the Covid crisis

Ideally, the effects of working capital on firm performance during the crisis would be analyzed using firm-level information for years 2020-2021. However, the Orbis data used for this study is not yet available for this period, as Orbis usually reports with a lag of 1.5 to two years. Despite this shortcoming, the stylized facts and results discussed in previous sections, along with observed shocks to economies around the world and country responses, could inform some expectations about the behavior of working capital and its impact on firm performance during the crisis.

Working capital levels most likely faced a rapid decrease in the second and third quarters of year 2020 for most firms, across most sectors. Firms that were able to continue operating until lockdowns were imposed, or that benefited from exemptions, still faced in most cases a combination of decreasing revenues (and thus cash inflows), increasing receivables and tighter conditions on payables. This would be consistent with the observed behavior during the 2009 financial crisis documented in section 3. In terms of the distribution of working capital across firms, most of those firms that held low levels of working capital at the onset of the crisis were more prone to face high levels of financial stress, liquidity crises and closure. Firms located in the higher quartiles were most likely to extend their operations and performance longer, and those at the highest quartile of the working capital to assets distribution – despite the marginal inefficiencies for growth documented in this paper – were likely those that benefitted the most in terms of extending their operations without the need of further financial support. While similar inefficiency arguments are made for such firms as for individuals holding high levels of precautionary savings in the literature, the benefits become evident in the presence of such a negative and sudden shock. All in all, the documented distributions of working capital most likely shifted to lower levels and became wider (higher standard deviations), at least for some period of time.

There are two key drivers of expected variations to the path described above, given by specific firm sub-sectors and country of operation. While most real sectors faced decreasing demand, disruptions in their supply chain and tighter credit conditions, there was a group of specific sub-sectors – for instance, those supplying certain critical products to the healthcare sector – which on the contrary faced a sudden

increase in demand and special support to their supply chain and operations. As the pandemic progressed and country policies evolved, different sectors started enjoying financial and logistics support, and special exemptions. On the other hand, countries' emergency responses varied greatly in terms of timing, intervention design and magnitude (conditional on fiscal capacity). Thus, certain groups of firms enjoyed different levels of support from governments, driven by differences in conditions and priorities. These differences in financial and other kinds of support by sector and country most likely implied greater variability in the distribution of working capital as the crisis unfolded and prolonged towards the last quarter of year 2020 and during year 2021.

As data becomes available, these potential implications can be tested, and differences between the pre-crisis evidence in terms of the distribution of working capital and firm performance documented in this paper can be benchmarked against the facts observed during the crisis. Furthermore, documenting and understanding the changes in the distribution of working capital and firm performance in the aftermath of the crisis will also inform policy and direct financial support interventions for the recovery period, along with the recent evidence about this relationship through crisis, recovery and growth cycles.

## 3.5. Conclusion

While a positive relationship between working capital and sales growth was to be expected, this paper provides insights of the strength and shape of this relationship, and how it depends on firm and country characteristics. Our results indicate that there is a positive relationship between increases in working capital and the ratio of sales to assets in the manufacturing sector, and that the strength of the relationship varies depending on how far away the firm stands compared to the median working capital within its country income group for a given sector and year. The relationship is stronger as firms approach the median working capital levels and becomes weaker when exceeding the median, suggesting there are decreasing returns to scale after a certain level of working capital. These results can serve as an input to improving the allocation of working capital financing, especially from the perspective of development financial institutions.

The relationship also seems to be stronger in high income countries, indicating that more developed markets may contribute to a more efficient transformation of working capital into sales.

When firm level data becomes available to study this relationship during the Covid crisis (and its aftermath), some stylized facts and evidence from this paper can inform potential implications for firms during the crisis and the recovery period. In addition to further studying this relationship during the unprecedented crisis of the past two years, there are also some limitations in the current analysis which could be addressed by future research. While we find that working capital above a certain level might deliver limited benefits in terms of sales, we don't know why firms would choose to hold such levels of working capital and incur in what might be a costly decision. High levels of working capital can be explained by high input prices (which by definition makes them less successful), for instance, or the need to accumulate inventories given price or exchange rate uncertainty in a country, or due to seasonality, as can be the case in the farming sector. Hence, an "inefficiently high" level of working capital, as compared to the country income group median, may be the result of strategic decisions at the firm level.[110] In addition, the Covid crisis has shown how such precautionary behavior pays off under such negative shocks, which may impact generalized decision making in this regard going forward.

[110] A detailed assessment of the determinants of working capital from a microeconomic standpoint, however, is beyond the scope of this study.

## Appendix A: Appendix for Chapter 1

Figure A.1: IFC Local Currency Bond Issuances

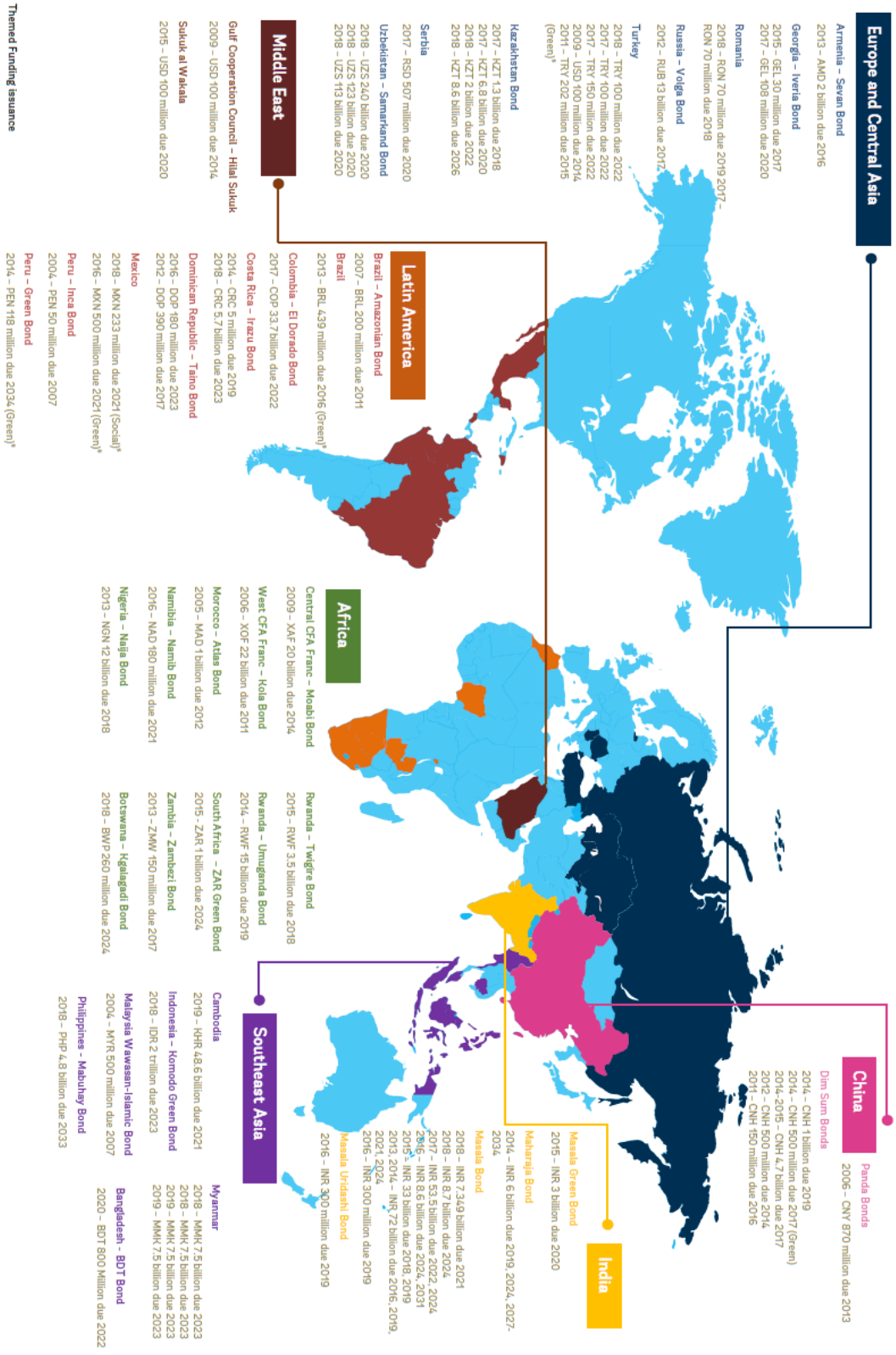


Table A.1: Effect of Pioneer Bond Issuances on the Number of Foreign Companies with Listed Equities

| # of Domestic Companies with Listed Equities | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | -0.0478 | -0.1673 | 0.0289 | 0.1281 | 0.1345 | 0.1998 |
| | (0.2560) | (0.1779) | (0.1619) | (0.1415) | (0.1227) | (0.2089) |
| | -0.19 | -0.94 | 0.18 | 0.91 | 1.10 | 0.96 |
| *Exchange Rate Change* | -0.5370 | -0.6281 | -0.4965 | -0.3324 | -0.3566 | -0.3695 |
| | (0.7277) | (0.7301) | (0.7477) | (0.7543) | (0.7376) | (0.7410) |
| | -0.74 | -0.86 | -0.66 | -0.44 | -0.48 | -0.50 |
| *GDP Per Capita* | -7.1622*** | -7.3501*** | -7.0780*** | -7.0099*** | -7.1338*** | -7.3638*** |
| | (1.2310) | (1.2241) | (1.2225) | (1.2044) | (1.1960) | (1.2260) |
| | -5.82 | -6.00 | -5.79 | -5.82 | -5.96 | -6.01 |
| *Inflation Rate* | -0.0493*** | -0.0503*** | -0.0488*** | -0.0470** | -0.0462** | -0.0457** |
| | (0.0182) | (0.0181) | (0.0183) | (0.0182) | (0.0182) | (0.0184) |
| | -2.71 | -2.77 | -2.67 | -2.58 | -2.53 | -2.48 |
| *Dom. Cred. to Priv. Sector by Banks (% of GDP)* | -0.0345* | -0.0344* | -0.0343* | -0.0348* | -0.0347* | -0.0299 |
| | (0.0181) | (0.0180) | (0.0181) | (0.0180) | (0.0179) | (0.0186) |
| | -1.91 | -1.92 | -1.90 | -1.93 | -1.94 | -1.60 |
| *Institutional Quality Index* | -1.7058** | -1.6998** | -1.7091** | -1.7081** | -1.6972** | -1.6860** |
| | (0.6864) | (0.6817) | (0.6856) | (0.6819) | (0.6804) | (0.6820) |
| | -2.49 | -2.49 | -2.49 | -2.50 | -2.49 | -2.47 |
| Observations | 115 | 115 | 115 | 115 | 115 | 115 |
| R-squared | 0.559 | 0.564 | 0.559 | 0.563 | 0.566 | 0.564 |
| Number of Countries | 15 | 15 | 15 | 15 | 15 | 15 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Effect of Pioneer Bond Issuances on the Number of Domestic Companies with Listed Equities

| # of Domestic Companies with Listed Equities | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | 0.0139 | 0.0634* | 0.0853*** | 0.1017*** | 0.1028*** | 0.2190*** |
| | (0.0490) | (0.0362) | (0.0310) | (0.0284) | (0.0267) | (0.0390) |
| | 0.28 | 1.75 | 2.75 | 3.59 | 3.84 | 5.62 |
| *Exchange Rate Change* | 0.1523 | 0.1566 | 0.1663 | 0.1766 | 0.1678 | 0.1833 |
| | (0.1532) | (0.1525) | (0.1514) | (0.1503) | (0.1497) | (0.1460) |
| | 0.99 | 1.03 | 1.10 | 1.18 | 1.12 | 1.26 |
| *GDP Growth* | 0.0064 | 0.0073 | 0.0081 | 0.0092* | 0.0097* | 0.0104** |
| | (0.0054) | (0.0053) | (0.0053) | (0.0053) | (0.0053) | (0.0051) |
| | 1.20 | 1.37 | 1.53 | 1.74 | 1.84 | 2.02 |
| *GDP Per Capita* | 1.3336*** | 1.3396*** | 1.3414*** | 1.3485*** | 1.3465*** | 1.3919*** |
| | (0.1423) | (0.1416) | (0.1406) | (0.1395) | (0.1390) | (0.1359) |
| | 9.37 | 9.46 | 9.54 | 9.67 | 9.68 | 10.24 |
| *Inflation Rate* | 0.0002 | 0.0004 | 0.0006 | 0.0008 | 0.0009 | 0.0013 |
| | (0.0020) | (0.0020) | (0.0020) | (0.0020) | (0.0020) | (0.0019) |
| | 0.09 | 0.19 | 0.31 | 0.43 | 0.46 | 0.66 |
| *Dom. Cred. to Priv. Sector* | -0.0060*** | -0.0057*** | -0.0052*** | -0.0047*** | -0.0042** | -0.0041** |
| *by Banks (% of GDP)* | (0.0018) | (0.0018) | (0.0018) | (0.0018) | (0.0018) | (0.0017) |
| | -3.41 | -3.25 | -2.97 | -2.67 | -2.38 | -2.44 |
| *Institutional Quality Index* | -0.0993 | -0.1141 | -0.1193 | -0.1262 | -0.1254 | -0.0989 |
| | (0.1054) | (0.1050) | (0.1041) | (0.1032) | (0.1029) | (0.1001) |
| | -0.94 | -1.09 | -1.15 | -1.22 | -1.22 | -0.99 |
| Observations | 358 | 358 | 358 | 358 | 358 | 358 |
| R-squared | 0.268 | 0.275 | 0.285 | 0.297 | 0.301 | 0.336 |
| Number of Countries | 25 | 25 | 25 | 25 | 25 | 25 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Effect of Pioneer Bond Issuances on the Number of Foreign Companies with Listed Equities

| # of Foreign Companies with Listed Equities | *Pioneer_1* | *Pioneer_2* | *Pioneer_3* | *Pioneer_4* | *Pioneer_5* | *Pioneer_post* |
|---|---|---|---|---|---|---|
| *Pioneer_n* | 0.5735* | 0.6211*** | 0.8408*** | 0.7449*** | 0.6432*** | 0.9604*** |
| | (0.2900) | (0.2172) | (0.1886) | (0.1784) | (0.1705) | (0.2037) |
| | 1.98 | 2.86 | 4.46 | 4.17 | 3.77 | 4.72 |
| *Exchange Rate Change* | 0.8680 | 0.8633 | 1.0573 | 1.0255 | 0.9068 | 0.8697 |
| | (0.7712) | (0.7571) | (0.7265) | (0.7327) | (0.7397) | (0.7177) |
| | 1.13 | 1.14 | 1.46 | 1.40 | 1.23 | 1.21 |
| *GDP Growth* | -0.0062 | -0.0032 | 0.0107 | 0.0180 | 0.0164 | 0.0318 |
| | (0.0318) | (0.0313) | (0.0301) | (0.0307) | (0.0311) | (0.0307) |
| | -0.20 | -0.10 | 0.35 | 0.59 | 0.53 | 1.04 |
| *GDP Per Capita* | 1.9740 | 1.4410 | 0.5625 | 0.7907 | 0.9771 | 2.4702* |
| | (1.4133) | (1.4124) | (1.3764) | (1.3801) | (1.3928) | (1.3081) |
| | 1.40 | 1.02 | 0.41 | 0.57 | 0.70 | 1.89 |
| *Inflation Rate* | -0.0144 | -0.0138 | -0.0127 | -0.0154 | -0.0154 | -0.0177 |
| | (0.0181) | (0.0177) | (0.0169) | (0.0170) | (0.0173) | (0.0167) |
| | -0.79 | -0.78 | -0.75 | -0.90 | -0.89 | -1.06 |
| *Dom. Cred. to Priv. Sector by Banks (% of GDP)* | 0.0106 | 0.0120 | 0.0161 | 0.0162 | 0.0154 | 0.0149 |
| | (0.0116) | (0.0114) | (0.0110) | (0.0111) | (0.0112) | (0.0109) |
| | 0.92 | 1.05 | 1.46 | 1.46 | 1.38 | 1.38 |
| *Institutional Quality Index* | 0.3182 | 0.3793 | 0.4977 | 0.2501 | 0.0957 | -0.0787 |
| | (0.8580) | (0.8439) | (0.8081) | (0.8139) | (0.8251) | (0.8035) |
| | 0.37 | 0.45 | 0.62 | 0.31 | 0.12 | -0.10 |
| Observations | 156 | 156 | 156 | 156 | 156 | 156 |
| R-squared | 0.148 | 0.177 | 0.247 | 0.233 | 0.214 | 0.259 |
| Number of Countries | 15 | 15 | 15 | 15 | 15 | 15 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.4: Effect of Pioneer Bond Issuances on FDI Net Inflows by Income Groups

| FDI Net Inflows (% GDP) | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Pioneer_n* | -0.1836 | -0.7592 | -1.1768** | -1.3853*** | -1.3080*** | -0.4012 |
| | (0.7887) | (0.5805) | (0.4872) | (0.4403) | (0.4115) | (0.5434) |
| | -0.23 | -1.31 | -2.42 | -3.15 | -3.18 | -0.74 |
| *Pioneer_n*UMI* | 0.4184 | 0.7794 | 1.0611 | 1.2164** | 0.9465* | -0.1584 |
| | (1.1059) | (0.7956) | (0.6679) | (0.6027) | (0.5629) | (0.6045) |
| | 0.38 | 0.98 | 1.59 | 2.02 | 1.68 | -0.26 |
| *Trade (% GDP)* | 0.0109 | 0.0107 | 0.0104 | 0.0098 | 0.0103 | 0.0115 |
| | (0.0116) | (0.0116) | (0.0116) | (0.0116) | (0.0116) | (0.0117) |
| | 0.94 | 0.91 | 0.89 | 0.85 | 0.89 | 0.98 |
| *Exchange Rate change* | 1.4809 | 1.4882 | 1.4446 | 1.5488 | 1.7475 | 1.4704 |
| | (1.7742) | (1.7722) | (1.7658) | (1.7607) | (1.7622) | (1.7767) |
| | 0.83 | 0.84 | 0.82 | 0.88 | 0.99 | 0.83 |
| *GDP Growth* | 0.0007 | -0.0002 | -0.0030 | -0.0054 | -0.0025 | -0.0003 |
| | (0.0339) | (0.0339) | (0.0338) | (0.0337) | (0.0336) | (0.0340) |
| | 0.02 | -0.01 | -0.09 | -0.16 | -0.08 | -0.01 |
| *GDP Per Capita* | -6.8285*** | -6.8056*** | -6.8091*** | -6.8719*** | -6.8910*** | -6.9296*** |
| | (1.1841) | (1.1822) | (1.1780) | (1.1741) | (1.1737) | (1.2188) |
| | -5.77 | -5.76 | -5.78 | -5.85 | -5.87 | -5.69 |
| *Inflation Rate* | -0.0365** | -0.0385** | -0.0395** | -0.0393** | -0.0386** | -0.0379** |
| | (0.0177) | (0.0177) | (0.0176) | (0.0175) | (0.0175) | (0.0177) |
| | -2.07 | -2.17 | -2.24 | -2.24 | -2.21 | -2.14 |
| *Institutional Quality Index* | 3.8168*** | 3.8890*** | 4.0096*** | 4.1504*** | 4.2200*** | 3.8460*** |
| | (0.9281) | (0.9294) | (0.9281) | (0.9277) | (0.9280) | (0.9275) |
| | 4.11 | 4.18 | 4.32 | 4.47 | 4.55 | 4.15 |
| Observations | 675 | 675 | 675 | 675 | 675 | 675 |
| R-squared | 0.089 | 0.092 | 0.098 | 0.104 | 0.105 | 0.091 |
| Number of Countries | 38 | 38 | 38 | 38 | 38 | 38 |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

## Appendix B: Appendix for Chapter 2 – Microeconomic Data and Empirical Approach

### B.1. Household Heterogeneity

The Philippines EPIQ model characterizes household types using several criteria, such as age, education, marital status of the household head, number of children, and residence. The EPIQ model diverges from the representative household framework and introduces household heterogeneity to be able to account for demographic changes of the population and dynamics of their income distribution. It chooses several heterogeneity dimensions that are necessary for modeling demographic changes over time and are identified as significant determinants of household per capita income in empirical estimations. These dimensions are age, education, marital status, and residence of household head and number of children in the household that is less than five. Accounting for children is essential for computing per capita income and, hence, poverty rates. In addition, for married household heads, the spouse is assumed to be in the same age and education group as the household head to ensure computational simplicity. To compute weights for each household type in the population, the study uses data provided by the Philippines National Statistical Office that contains merged data from Labor Force Surveys (LFS) and Family Income and Expenditure Surveys (FIES) for every three years during the period of 2003-2012.

The model uses estimation results of a Mincerian equation to select heterogeneity dimensions for households types. The model selects heterogeneity dimensions discussed above based on empirical estimation that found them significant in determining household incomes. These empirical estimations include the Mincerian equation for the Philippines to understand the significance and scale of various factors on income or wages and, hence, welfare and poverty. According to the estimation results, workers with secondary and tertiary education earn respectively 35 and 89 percent more than those with no education. Also, wages in rural areas are 18 percent lower than in urban locations. The strong presence of the poor population in rural areas and their involvement in agriculture reflects the labor market segmentation in the Philippines, which generates a significant gap in wages and, hence, welfare between urban and rural areas. Also, distinguishing between rural and urban household residences in the model allows one to analyze internal migration as labor mobility from rural to urban areas, which becomes important with an increase in income. In addition, a higher dependency ratio reduces wages by nearly four percent.

Table B.1. Selected Estimation Results of Mincerian Equation

| ***Explanatory Variables*** | ***Coefficient*** |
|---|---|
| Education (No grade as reference) | |
| *Primary education* | 0.14 (0.009)*** |
| *Secondary school* | 0.35 (0.008)*** |
| *Post-secondary* | 0.89 (0.008)*** |
| Dependency ratio | -0.04 (0.001)*** |
| Rural/Urban (Urban as reference) | |
| *Rural* | -0.18 (0.002)*** |
| Number of Observations | 426,655 |
| R-squared | 0.38 |

The numbers in parentheses are heteroskedasticity robust standard errors of the coefficients and (*) indicates significance level at 10, (**) at 5, and (***) at 1 percent.

## B.2. Estimation of the Transition Matrix

While in the model all variables are indexed by household types $h$, in the transition matrix problem, as in the underlying data, variables are indexed by their respective characteristics shown in table B.2.

Table B.2: Set Definitions in Data and Transformation Matrix Estimation

| *Name* | *Description* | *Elements* |
|---|---|---|
| $t$ | *Time periods* | *0, 1, 2, …, T* |
| $t_e$ | *Historical period to specify working age population shares* | *1, 2, …, E* |
| $t_s$ | *Year for which household surveys are available* | *Depends on availability* |
| $t_h$ | *Historical period w/ specified working age population shares* | *1, 2, …, H* |
| $a$ | *Age group of household head* | *15-20, 20-25, …, 90-95* |
| $p$ | *Number of working age population in household* | *1, 2* |
| $c$ | *Number of children in the household* | *0, 1, 2, 3* |
| $l$ | *Highest education obtained by household head* | *Up to primary, secondary, tertiary* |
| $r$ | *Location of household* | *Rural, urban* |

The transition matrix $\Gamma$ is found by solving a minimization problem, as in equations (b.1) to (b.13).

$$\min SSE = \sum_{a,p,c,l,t,r} \varepsilon^2_{t,a,p,c,l,r} \tag{b.1}$$

$$\text{s.t.} \quad \varepsilon_{t_s,a,p,c,l,r} = \overline{\theta}_{t_s,a,p,c,l,r} - \theta_{t_s,a,p,c,l,r} \qquad \forall t_s, a, p, c, l, r \tag{b.2}$$

$$\theta_{t+1,j} = \sum_i \Gamma(i,j)\theta_{t,i} \qquad \forall t, j \tag{b.3}$$

We minimize the sum of the squared errors (b.1), defined as the difference between the weights resulting from the transition matrix $\theta_{t_s,a,p,c,l,r}$ and the weights observed in the available household surveys, denoted as $\overline{\theta}_{t_s,a,p,c,l,r}$ (b.2). The resulting weights over the model horizon are computed by applying the law of motion for household weights (b.3), where $i$ and $j$ stand for indices $a, p, c, l$ and $r$. While we try to minimize the difference between the estimated weights and the observed ones, we also ensure that the transition matrix exhibits some other important characteristics. First, we ensure that the population by area fits the UN mid-variant estimates. To this end we define $\Theta_{t,r}$ as the model population in year $t$ in area $r$. And we then define that the resulting regional population has to be within a certain range of the UN estimates $\overline{\Theta}_{t,r}$[111]

$$\Theta_{t,r} = \sum_{a,p,c,l} hhsize_{c,p} \cdot \theta_{t,a,p,c,l,r} \qquad \forall t, r \tag{b.4}$$

$$\Theta_{t,r} \geq \overline{\Theta}_{t,r}/1.01 \qquad \forall t, r \tag{b.5}$$

$$\Theta_{t,r} \leq \overline{\Theta}_{t,r} \cdot 1.01 \qquad \forall t, r \tag{b.6}$$

We further ensure that regional populations, as well as regional working age populations for every education level, are growing constantly over the model horizon

$$\Theta_{t,r} \leq \Theta_{t+1,r} \qquad \forall t, r \tag{b.7}$$

$$\sum_{a,p,c} ord(p) \cdot \theta_{t,a,p,c,l,r} \leq \sum_{a,p,c} ord(p) \cdot \theta_{t+1,a,p,c,l,r} \quad \forall t, r \tag{b.8}$$

In addition, the transition matrix has to ensure that working age population by region and education level stays within a certain range of observed values[112] over the historical period for which data is available.

$$\sum_{a,p,c} \theta_{t_e,a,p,c,l,r} \cdot ord(p) = shareworkers_{t_e,l,r} \cdot \sum_{a,p,c} \theta_{t_e,a,p,c,l,r} \cdot ord(p) \ \forall t_e, l, r \tag{b.9}$$

$$shareworkers_{t_h,l,r} \geq shareworkers_{t_h,l,r} / \left(1 + \underline{\mu}^{T_s}\right) \ \forall t_h, l, r \tag{b.10}$$

$$shareworkers_{t_h,l,r} \leq shareworkers_{t_h,l,r} \cdot \left(1 + \overline{\mu}^{T_s}\right) \ \forall t_h, l, r \tag{b.11}$$

[111] The range currently used is within 1% of the UN estimates.

[112] We set $\underline{\mu}^{T_s}$ and $\overline{\mu}^{T_s}$ to be 0.2, such that the estimated shares fall within 20% of observed values.

Since the Philippine population is growing over the model horizon, the total numbers of households are likely to increase as well. Therefore, we allow for households to multiply within certain boundaries. Or stated differently, the sum over the new weights coming from a specific household has to be smaller than $\underline{\mu}^{Tm}$ (equation b.12).[113] Further, to rule out illogical and unlikely results, we restrict all entries in the transition matrix to be non-negative and below $\overline{\mu}^{Tm}$ (equations b.13 and b.14).[114]

$$\sum_j \Gamma(i,j) \leq \underline{\mu}^{Tm} \quad \forall i \tag{b.12}$$

$$\Gamma(i,j) \geq 0 \qquad \forall i,j \tag{b.13}$$

$$\Gamma(i,j) \leq \underline{\mu}^{Tm} \quad \forall i,j \tag{b.14}$$

Finally, we restrict our solution further to impose a logic structure upon the transition matrix. Namely, we restrict the movement of households from one type to another by assuming that households can only get from one age class to the next, that the number of children in a household can only increase or decrease by up to 2 in a given year, and that the education level can only increase by one in any period. This is done by assuming that only certain entries in matrix $\Gamma$ are allowed to differ from zero.

## B.3. Informality

### B.3.1. Relevance of Informality

The EPIQ model for the Philippines includes the informal sector in the modeling of selected industries given its growing importance for economies of developing countries and necessity to understand reasons behind it. Literature widely discusses the significance of the informal economies in developing countries. In particular, according to a study on informal economy from ILO (2013), the informal sector continues to grow and constitutes nearly 72 percent of non-agricultural employment in sub-Saharan Africa, 71 percent in Asia, 51 percent in Latin America and 47 percent in the Middle East and North Africa. The results are even more striking when agriculture is included in the estimations. Also, according to the World

[113] Currently, $\underline{\mu}^{Tm}$ is set to 1.5.

[114] Currently, $\overline{\mu}^{Tm}$ is set to 2.

Bank (2007)[115], informal employment in the Latin America and Caribbean (LAC) countries accounted for 54 percent of total regional urban employment and included two groups: informal independent workers, accounting for 24 percent of total urban employment, and informal salaried workers, with 30 percent share in total regional urban employment. There is a substantial variation in the degree of informality among developing countries, which increases with quantity of labor and product market regulations and corruption, and decreasing with quality of governance (World Bank, 2007). Also, evidence suggests that improvement of market support institutions - the courts, financial markets, and the development of links between small and large firms can help shrink the informal sector while simplified tax and registration systems for micro firms can lead to statistically significant increases in the number of new formally registered firms but not the expense of unregistered businesses.

Studying the informal sector is critical given its link to poverty. The informal sector primarily employs individuals with low earning capacity that belong to the vulnerable groups of population. According to estimations, in LAC countries the informal employment is strongly correlated with working in micro firms with less than 10 employees; having secondary education; engaging in construction, agriculture, retail, and transport; having less than one year tenure; being a young worker for predominantly informal salaried and an older worker for self-employed; and being a married woman with children (World Bank, 2007). At the same time, informal workers have limited access to social security systems as so-called truncated welfare systems in most LAC countries provide generous social security contributions only to formal sector workers while the informal employees remain excluded from the social security systems. This further exacerbates their vulnerability.

Informality can constraint productivity and growth by limiting the size of firms, slowing creative destruction, and reducing access to markets and services. Capp, Elstrodt, and Jones (2005), Elstrodt, Lenero, and Urdapilleta (2002), Farrell (2004), Kenyon and Kapaz (2005), and Palmade (2005) found that informality is among key factors driving productivity differences between developing and developed countries by affecting investment decisions and reducing growth potential of economies. Studies conducted by the McKinsey Global Institute indicate that informality accounts for around 50 percent of the productivity

[115] The World Bank: “Flagship Report on Informality in Latin America and Caribbean Countries”. 2007.

gap between countries like Turkey, Portugal, and the United States; and for 30 percent of the productivity gap between Brazil and the United States (Farrell, 2004). According to the WB report, formalizing unregistered firms could bring overall productivity improvement through various channels. First, if there are increasing returns to scale and a large number of small informal firms, then the formalization of the latter might lead to firm expansion and, hence, higher productivity. Next, the creative destruction process, when inefficient firms are replaced by more productive ones, might slow down in the economy given competition of less productive informal firms being able to operate by avoiding formal costs. Finally, increased access to markets and services are growth conducive.

Informality accounts for a substantial share of the Philippines economy and is responsible for poverty among employed population. The Philippines economy is characterized by a high level of informality: around three-quarters of all jobs are informal and in urban areas, outside agriculture, two-thirds of jobs are informal according to the WBG report (forthcoming). Informality along with job location generates labor market segmentation: informal and rural sectors hire low-educated and low-skilled workers, while formal and urban sectors employ more educated and better skilled ones. Education and skills are, to a large extent, responsible for inter-sectoral differences in wages. This labor market segmentation creates a substantial wage inequality: an average formal worker earns three times as much as an informal worker and 92 percent of all low-paid jobs are informal jobs. Informality is highly associated with poverty as risk of poverty is substantially higher among employed than unemployed. In-work poverty is driven by a high share of subsistence agriculture and low-paid jobs in the informal urban sector. Thus, discussing the informal sector in the Philippines is important as it has both poverty and productivity implications.

**B.3.2. Definition and Measurement of Informality**

The literature uses different measurements of informality that vary based on data availability and countries' unique circumstances. This study adopts an approach similar to the World Bank (2016) report on the Philippines' labor market,[116] using three criteria to determine informal workers among paid employees or wage workers: (i) having a written contract, (ii) payment of social security contributions by the employer,

[116] The World Bank. Republic of the Philippines, Labor Market Review, Employment and Poverty. January 2016.

and (iii) protection from job dismissal. The job is considered formal if at least two of these three criteria are met. In the case of self-employed, the enterprise is considered formal when it maintains proper bookkeeping and accounting practices. By assumption, unpaid family workers are considered informally employed. This paper considers paid employees formal if they satisfy the same three criteria applied in the above-mentioned report and classifies unpaid workers as informal (Table B.3). However, it deviates from the WB report by defining formal enterprise as those that are registered in any national or local government agency. Finally, all self-employed individuals with less than a post-secondary education are considered informal.

Table B.3. Categories of Informal Sector Workers

| |
|---|
| ***1. All Non-paid Employees are classified as informal*** |
| ***2. Paid Employees are considered informal if they do not meet two criteria below:*** |
| *-Terms of employment covered by a written contract (Contract),* |
| *-Employer contributes payments to Social Security (Contribution),* |
| *-Employment cannot be terminated by an employer without advance notice (Protection).* |
| ***3. Employers and Self-Employed are considered informal if:*** |
| *-The enterprise was not registered in any national/local government agency (Registration).* |
| *-All self-employed individuals with less than a post-secondary education are considered informal.* |

The obtained shares of informal workers based on the definition of informality in this paper are consistent with the WB's results, despite minor differences in the definition. We find that nearly 73% of Filipino workers are occupied in the informal sectors, which is in line with 75% of informality computed in the WB's Philippine Development Report. Also, 56.7% of paid employees are hired by the informal sector, which is also broadly consistent with the 59.9% mentioned in the Philippine labor study. The latter uses a similar definition of informality for paid workers. A substantial number of self-employed and non-paid workers accounting for a total of 43 percent of the workers in the Philippines explain the large share of informal employment in the country.

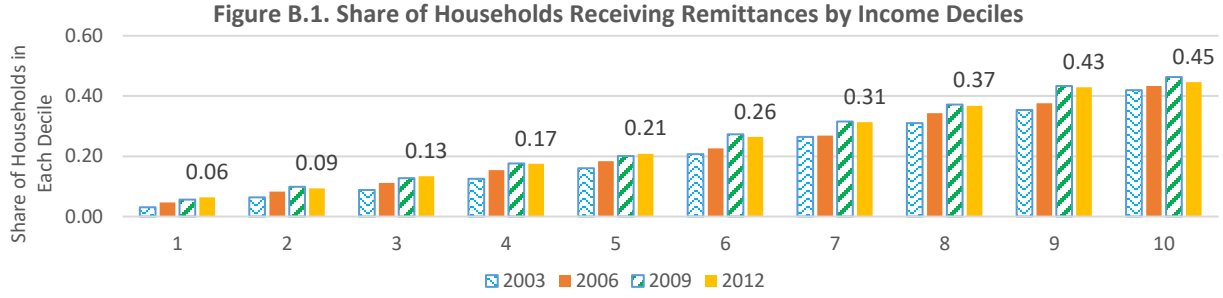
### B.4. Migration and Remittances

Remittances and migration in the Philippines are at the center of economic development and have important implications for the country's development. The Philippines has one of most elaborate system of institutions managing migration flows or labor exports in the world. More than 10 million Filipinos and their

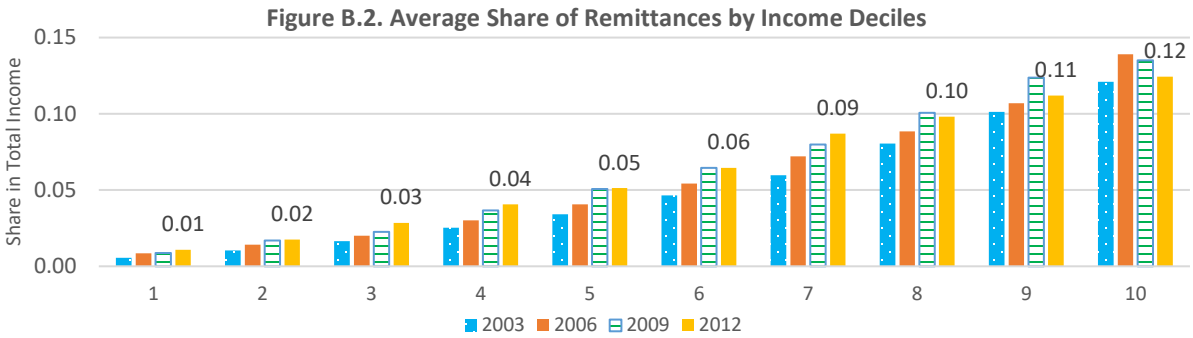
families had left the country to work abroad as of 2012. Around six million Filipinos (equivalent to 12 percent of the active labor force) are working overseas under fixed-term contracts, apart from about six million permanent migrants. Between 1975 and 1985, overseas employment grew by over 20 percent annually while domestic unemployment rate fell from around eight to five percent. Among labor-exporting countries in 2010, the Philippines was the fourth-largest recipient of remittances, which amounted to some USD 20 billion (nearly 10 percent of GDP), more than the value-added of merchandise exports.

Despite substantial flows of remittances, their direct impact on poverty in the Philippines might not have been considerable: fewer households in the lowest income deciles have been receiving remittances and their share of remittances in income has been much less compared to the richest groups of the population. Figure B.1 shows that only a small fraction of households in the bottom income deciles have been receiving remittances, while the richest groups of the population have benefited greatly from money transfers abroad. For example, the share of households receiving remittances in the lowest four deciles ranged from 6 to 17 percent compared to 43 and 45 percent in the highest two deciles. In addition, the average share of remittances in the total income of the poorest four deciles was relatively low, constituting 1-4 percent, while remittances accounted for 11-12 percent of the income in the richest two deciles. These findings are consistent with the fact that migrants have, on average, higher education levels and, hence, come from richer groups of the population. According to the WB[117] development report, 60 percent of oversees Filipino workers have college or university degrees and 25 percent have high school degrees. Thus, migrant remittances benefit families that have higher standards of living.

**Figure B.1. Share of Households Receiving Remittances by Income Deciles**




[117] The World Bank. Philippine Development Report. Report No. ACS5842. September, 2013.




Source: Authors' Calculations based on the Family Income and Expenditure Surveys of the Philippines.

## B.5. Description of Micro Data

This study uses two types of household surveys to compute the household and individual-level variables used in the model. The construction of these variables is generally consistent with WBG's approach as described in detail below. Household and individual-level data in the model are constructed using two main surveys: quarterly LFS data for 2001-2013 and merged LFS and FIES data for 2003, 2006, 2009, and 2012. The data management for the LFS surveys is conducted following WBG's I2D2 approach and deviates only in some instances to better fit the purpose of this study.

The LFSs are nationally representative quarterly surveys that provide data on employment and wages in different industries and education categories. The National Statistics Office of the Philippines conducts quarterly surveys of the labor force that cover a nationally representative sample of households, which is necessary to measure the levels of employment and unemployment at the national and regional levels. This study uses January data for each year during the period of 2001-2013 to provide data on the employment and wages of sectors and education categories. As mentioned above, the model uses three education categories: primary, secondary, and post-secondary. It also includes 10 sectors of the economy, which are selected based on several criteria, such as the importance of the industry in terms of share of GDP and employment in total, and IFC's strategic engagement areas.

Households are identified using several variables that vary across years. Since the obtained data A.4 shows the list of variables used to identify households across years. Once households are identified,

individual identification numbers are computed by assigning a sequential number to all individuals in the household.

Table B.4. List of Variables Used for Household Identification, 2001-2013

| Year | Variables used to construct household identification number |
|---|---|
| *2001* | *Primary sampling unit, stratum and household control number* |
| *2002* | *Primary sampling unit, stratum and household control number* |
| *2003* | *Sample household unit, enumeration area, stratum and Barangay* |
| *2004* | *Household unique sequential number* |
| *2005* | *Household unique sequential number* |
| *2006* | *Sample household serial number, household control number, enumeration area, primary sampling unit, strata, replicate, rotation group, number of households in the housing unit and barangay* |
| *2007* | *Province, municipality, Barangay, enumeration area, sample household serial Number and household control number* |
| *2008* | *Household unique sequential number* |
| *2009* | *Sample household serial number, household control number, enumeration area, primary sampling unit, strata, replicate, rotation group, number of households in the housing unit and barangay* |
| *2010* | *Household unique sequential number* |
| *2011* | *Household unique sequential number* |
| *2012* | *Household ID* |
| *2013* | *Household unique sequential number* |

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