# **PROJECT TITLE:**

# **Capital inflows and growth in developing countries: Do flows affect capital goods imports?**

# **PROJECT DESCRIPTION**

## **Introduction**

**A.1. Motivation**

There is an ongoing debate among researchers and policy makers how international financial integration affects the growth of recipient countries. On the one hand, financial integration can allow countries to finance productive investment using external funds and to import foreign technology, thus boosting economic growth. This has motivated many developing countries to offer incentives (such as tax exemptions) to attract more foreign funds. On the other hand, if the host countries suffer from weak institutions and poor investment environment, capital inflows can potentially amplify the misallocation of resources, increase the probability of financial crises, and thus reduce growth (Alfaro and Hammel, 2007). The available empirical studies similarly paint a complex and mixed picture about the effects of international financial integration (e.g. see Contessi and Weinberger, 2009 and Prasad et al. 2003, for an overview). Given the lack of consensus regarding the direct links to growth, recent literature has focused on the channels through which capital inflows affect growth, such as the improvement in total factor productivity (TFP) or the increase in capital allocation efficiency (Bonfigliol, 2008; Bekaert et al, 2011). The presence of such indirect channels could explain the mixed evidence on the direct effect.

The mixed results in the previous literature could also be attributed to the fact that most studies use very heterogeneous samples, usually comprising both industrialized and less developed economies. This could diminish the estimated growth effects of capital inflows because the positive effects are more likely to be observed among developing countries. These economies have more volatile output growth than their advanced counterparts and thus are in a better position to gain more from international risk sharing. Additionally, developing countries are relatively capital scarce and labor rich, so that they benefit more from improvement in access to capital (Kose et al. 2011). Thus, looking at developing countries apart from their developed counterparts may better enhance our knowledge about the impact of capital inflows.

The current project aims to add to the above debate on the growth contribution of capital inflows by exploring one of channels by which capital inflows affect growth, in an analysis comprising only developing countries. Specifically, we investigate whether cross-border capital inflows lead to more imports of capital goods by the manufacturing sector, as this sector is particularly dependent on external finance and imports more capital goods than other economic sectors. The motivation behind this is the fact that production of capital goods is concentrated in a few R&D-intensive countries. In fact, about 80 percent of world capital goods are produced only by 10 advanced countries (Mutreja et al. 2018) and other countries import bulk of their capital from them. Rather than investigating the broad correlation between capital inflows and economic growth, we thus examine a specific microeconomic channel through which capital inflows can accelerate economic growth. If capital inflows facilitate the imports of capital goods by providing additional and competitive financial resources then this should be more pronounced for those sectors that are technologically more dependent on external sources of finance.

Firms in developing countries can enhance their performance and growth in the long run through acquisition of productivity-enhancing technology (Fauceglia, 2014). By improving the quality of capital stocks, imports of capital goods can boost total factor productivity (TFP) and thus economic growth. Moreover, modern machinery and equipment that utilize cost-effective technologies can in turn become a source of innovation in less developed countries (Bas and Berthou, 2012). Thus, foreign capital goods can affect economic growth in developing countries through, at least, two mechanisms. First, by importing more capital goods from industrialized countries, developing countries improve their TFP by allocating their resources more efficiently. Second, access to foreign capital goods reduces the relative price of investment in such countries and thus increases their investment rate and capital productivity.

However, credit constraints in developing countries can prevent firms from upgrading their capital stock (Fauceglia, 2014; 2015). We ask whether foreign capital inflows mitigate this obstacle. According to the literature, capital inflows can increase imports of capital goods for several reasons (Alfaro and Hammel, 2007). First, by augmenting financial resources, international capital inflows improve the domestic firms’ access to international financial markets to import capital goods. Second, capital inflows increase liquidity and facilitate risk diversification and hence decrease the cost of capital. This should improve firms’ investment in productive projects by importing more machinery and equipment. Third, capital inflows play an important role in transmitting technological advances and facilitating knowledge spillover across borders . We expect that these three mechanisms are more important for financially dependent industries in developing countries. For example, Leblebicioğlu and Madariaga (2015) show that the effect of financial flows on the quality of capital stocks is stronger for developing countries. This is because the production of capital goods in these countries is relatively small, leading to the need to import the bulk of capital goods from advanced economies. Besides, financial markets are not well developed in these countries and thus domestic financial resources are both scarce and expensive. Consquently, we conjecture that financiall dependent industries in developing counties benefit disproportionately more form the flows of foreign capital, by importing more capital goods.

Yet not all forms of capital inflows may facilitate imports of capital goods and thus foster developing-country growth. For instance, recent studies find that capital flows show a great degree of heterogeneity across borrower types (Cerutti et al. 2015; Avdjiev et al. 2018). It could be argued that a large share of inflows, in particular debt, may be terminated in the financial sector, which is not necessarily the best vehicle for increasing foreign capital goods in the manufacturing sector. This is especially the case when finance companies recycle a significant amount of foreign capital. This suggets that when considering the real effect of capital inflows one must seperate flows to the financial sector from flows to corporate sector and accordingly examine the impact of each type on capital goods imports.

To quantify the effect of capital inflows on imports of capital goods, this project intends to use a panel data for manufacturing sectors in a large number of developing countries over the period 1990–2017. Due to the disruptions in world financial integration during the recent global financial crisis, we differentiate between the pre-crisis period up to 2007 and the crisis period afterwards. To identify the causal effects of capital inflows on the quality of investment (that is more imports of capital goods), our empirical approach is to test whether sectors that are regular users of external sources of finance (because of inadequate internal cash flows) import more capital goods if they are located in countries experiencing significant amount of capital inflows. Put differemtly, if capital inflows influence access to financing for domestic corporations and hence imports of capital goods, then we would expect them to have a larger effect on those industries that are financially more dependent on external finance. This hypothesis follows the commonly-used Rajan and Zingales’ (1998) approach. Rajan and Zingales study the effect of finance on growth, by examining whether in countries with deeper financial sector and financially dependent industries grow faster. To overcome the common issue of identification problem that usually persists in the cross-country regressions, Rajan and Zingales propose a novel specification by introducing the interaction between a country characteristic (financial development) and an industry characteristic (external financial dependence). In this project, we follow a similar empirical approach by interacting a proxy for a country’s capital inflows and a proxy for the sector’s reliance on external finance. The outcome variable is the relative imports of capital goods.

The contributions of the project can be summarized as follows. First, we use one specific channel – that is imports of capital goods – through which capital inflows affect economic development. Second, we focus only on developing countries where the imports of advanced technology embodied in machinery and equipment can improve the quality of their capital stocks and hence growth. Third, we consider only the manufacturing sector because it produces tradable goods that need more external funds. In addition, in manufacturing firms, capital goods are usually the major components of the assets, for which the bulk of finance is raised through external sources of funds. Thus, industrial data offer a more accurate view about the potential effects of foreign capital inflows on growth. Fourth, we investigate the growth effects of different types of capital inflows. Rather than considering only aggregate capital inflows, we examine whether breaking down capital flows (by instrument and, more importantly, by borrower type) leads to different effect of capital inflows on imports of capital goods. Finally, we contribute to the existing literature by arguing that capital inflows may affect growth differently by various aspects of a country’s absorptive capacity. It is argued that a number of domestic factors, such as the performance of financial sector and institutional arrangements, define an economy’s capacity to render foreign capital into domestic investment and growth. For instance, Leblebicioğlu and Madariaga (2015) find that the growth effect of financial flows through capital goods is more significant in countries with more developed financial sectors.

The findings of this study will help determine which financial globalization policies encourage the adoption of foreign technologies that could support strategies for development in less developed countries and what form such effects take. Capital inflows play an important role here as they are associated with incentives to modernize industrial sectors by purchasing most sophisticated machinery lines and the utilization of knowledge efficiently. For instance, by decreasing the cost of borrowing, capital mobility encourages firms to launch new investment projects that were previously not profitable before the flow of foreign funds and now are so (Alfaro and Hammel, 2007). Furthermore, the findings could also offer lessons on relaxing barriers on cross-border trade. International trade can disseminate the benefits of technological advances across countries by importing capital goods. This project would show how capital inflows can facilitate this channel in developing countries by reducing credit constraint. Our findings therefore will have the potential to inform policy making on questions relating to the liberalization of capital flows and international trade in less developed countries.

**A.2. Preliminary Literature Review**

Foreign capital complements insufficient domestic savings in financially deficient economies and, by lowering the cost of borrowing, allows investment to increase. For instance, equity market liberalizations that encourage capital inflows give firms in emerging economies access to new financing sources and decrease cost of borrowing and thus enhancing investment opportunities (Bekaert et al. 2005; Gupta and Yuan 2009). Thus, capital inflows are expected to improve economic performance in recipient countries. However, empirical literature on the direct link between capital inflows and growth does not offer the same conclusion (Aizenman et al., 2013). Accordingly, some researchers focus on the channels through which capital inflows may affect growth.

Capital inflows can affect growth in host countries through capital accumulation and TFP. Capital inflows enhance productivity growth by transferring technology and managerial techniques. Foreign capital flows foster development of the financial sector of the recipient county. This increases the liquidity as well as efficiency of capital allocation. Additionally, new financial techniques and practices brought by foreign capital can be applied in the domestic financial markets of developing countries. Capital inflows can also impose discipline on macroeconomic policies of recipient countries, causing more stable policies and improvements in institutions and better governance. These so-called “collateral benefits” of foreign capital inflows could result in a high level of growth, especially via gains in allocative efficiency and TFP (Kose et al. 2009a). Using de jure measures of capital inflows, Bonfiglioli (2008) find a positive association between financial openness and TFP. Similarly, Bekaert et al. (2011) report a positive effect on both TFP and capital accumulation. Using de facto measures, Kose et al. (2009a) also show that equity inflows affect positively TFP growth.

There is also a link between the quality of capital goods and TFP where the former affects positively the latter (Caselli and Wilson, 2004). This indicates that capital goods can be a mechanism by which capital inflows affect TFP and consequently growth. Despite the importance of this channel, only two studies investigate the impact of financial globalization on the quality of capital goods. [Alfaro and Hammel (2007)](https://www.sciencedirect.com/science/article/pii/S0022199617300260%22%20%5Cl%20%22bb0020) find that those countries that liberalize their capital market gain the economic benefits of acquiring advanced technology transferred from imported capital goods, and thus, tend to have a positive effect on economic growth. The growth-boosting relationship between international financial flows, capital goods and economic growth is also emphasized by [Leblebicioğlu and Madariaga (2015)](https://www.sciencedirect.com/science/article/pii/S016726811830372X%22%20%5Cl%20%22bib0054) who find evidence on the positive effect of international financial integration on growth through the capital stock quality. The above two studies build on the observation by Eaton and Kortum (2001) that only a few countries produce and export capital goods and the rest of countries in the world are users and importers of such goods.

Imports of capital goods are critical for economic development in developing countries. The role of trade in capital goods in economic growth and related outcomes has been documented by a growing body of literature (Burstein et al. 2013; Parro, 2013; and Raveh and Reshef, 2016). Trade in capital goods allows developing countries to benefit from efficient technologies that reduce relative prices of capital goods and increase productivity. By importing more foreign capital goodsgoods, less developed countries can also use their comparative advantage and enhance their capital allocation efficiency and TFP, which are all essential for economic growth. In this respect, some studies find evidence on the growth-enhancing effect of foreign capital goods (Lee, 1995; Mazumdar, 2001; Eaton and Kortum, 2001; Caselli and Wilson, 2004; Busse and Groizard, 2008; Herrerias and Orts, 2010; Herrerias and Orts, 2013; Mutreja et al, 2018). The findings of these studies thus suggest that in developing countries that have to import most of the machinery and equipment, the economic growth relies on their capacity to imports more capital goods.

However, firms require a substantial amount of financial resources in order to import capital goods needs. A new line of literature shows how credit constraints reduce firm imports of capital goods in developing countries. Tybout (2000) states that firms in less developed countries that are credit constrained can import capital goods from advanced economies only at an extra cost. Firms that invest in sophisticated production technologies therefore need a substantial amount of external financing. This suggests that firms with limited domestic financial resources cannot upgrade technologies. Bas and Berthou (2011) find that Indian firms with a poor position in liquidity are less likely to import capital goods. Similarly, Bas and Berthou (2012) show that those firms with a high level of liquidity and/or a low level of leverage import more capital goods. Fauceglia (2014) find that credit constrained firms in developing countries do not invest in capital goods. Fauceglia (2015) also find that the lack of access to finance in developing countries has an adverse impact on firms’ capital goods imports, especially where institutions are weak. Yet, these studies do not determine whether foreign capital can mitigate the adverse impact of credit constraint on capital goods imports.

Our project distinguishes itself from the above studies in three aspects. First, we use *de facto* measure of capital inflows. Most previous studies (including Alfaro and Hammel, 2007) use *de jure* measures of capital account openness and financial liberalization – minoring legal restrictions on cross-border capital movements – to investigate their growth effects. However, as Kose et al. (2009b) point out, the collateral benefit of financial globalization are more likely to be perceived through *de facto* integration. Many developing countries around the world have rigid capital controls but at the same time are recipients of a significant amount of foreign flows. Second, they usually focus only on aggregate capital inflow and hence neglect heterogeneous nature of foreign capital flows that justifies decomposition of capital inflows when considering their impact on the real economy. Foreign capital can flow through different instruments such as equity and debt, and more importantly reaching different borrowers in host countries such as public, financial and corporate sectors (which are ignored by most existing studies including Leblebicioğlu and Madariaga, 2015). Third, mixed findings in these studies might also be due to the use of aggregate output growth indicators. The responses of different economic sectors to capital inflows may be heterogeneous. For example, sectors depending more on external sources of finance for growth may respond to capital inflows differently from their counterparts that are less dependent. This is especially true for less developed countries where credit constraint is major obstacle for firms to growth. Aggregate growth data do not allow one to control for such sector-specific factors (Contessi and Weinberger, 2009). In addition, aggregate growth indicators may increase the likely endogeneity between capital inflows and growth if growth encourages more foreign capital ([Li and Liu, 2005](http://www.sciencedirect.com/science/article/pii/S0304387809000121#bib37)). Overall, the approach of this project differs from existing literature, because it tests a microeconomic channel through which different types of capital inflows (by instrument and by borrower type) affect growth trough capital goods imports.

## **Goals & Objectives**

Developing countries can stimulate their economic growth by importing more capital goods from advanced economies. The growth rate in these countries is positively associated with more use of foreign capital goods relative to domestic ones for the production of capital stock (Lee, 1995). However, credit constraints in less developed countries is a major impediment for firms wishing to import better technology. The main goal of this research project is to investigate whether foreign capital inflows can mitigate this problem. A potentially important benefit of capital inflows to host countries is the relaxation of credit constraints, augmentation of investment resources, and, accordingly, the facilitation of growth (Harrison et al, 2004). In addition, capital flows can also provide new opportunities for developing countries to improve their trade activities and hence facilitate imports of foreign capital goods (Ding et al. 2019). This research project studies whether capital inflows can relax credit constraints in developing countries by facilitating imports of capital goods. To our best knowledge, there are only two papers addressing similar questions (Alfaro and Hammel 2007 and Leblebicioğlu and Madariaga 2015), but they analyze this issue at the aggregate country level and rely on a mix of both developed and developing countries. This project is the first one to investigate the effect of capital inflows on sectoral-level imports of capital equipment goods in devloping countries.

The objectives of this research project are threefold:

**1. Gap in empirical research:** This project addresses a significant gap in empirical research by investigating whether the industrial sectors that are financially vulnerable import more capital goods. In particular, while other studies usually focus on the importance of capital inflows for growth in developing countries through the channel of TFP, this project analyses the effect through the mechanism of capital goods imports using industry data.

**2. A comparative study:** Does the impact of capital inflows on economic activity differ across developing countries based on their institutional quality? We systematically compare two groups: those with high institution and those with less. This informs us about the institutional arrangements that need to be addressed before attracting more foreign funds. Specifically, we systematically distinguish developing countries with high better institutions from those with poor ones, in order to examine whether the responsiveness of the real economy to cross-border capital inflows in developing countries, differs based on their absorbing capacity, given the different types of financial systems and institutions. We do this by employing data for a large panel of developing countries.

**3. Policy advice:** By investigating the impact of capital inflows on economic growth through the channel of capital goods imports, the project will identify policy implications which may be useful in encouraging both capital flows and international trade in capital goods.

## **Broader Impacts and Indicators**

The project is part of our effort concerning a better understanding of the association between finance and economic growth in developing countries. A substantial increase in foreign capital that flows to developing countries on the one hand and the need for importing more technology on the other hand call for a better understanding of the interaction between capital inflows and capital goods. The findings of the proposed project should be of interest to policymakers and international organizations (such as the World Bank). The quantity and quality of financial resources are crucial factors for sustainable economic growth in developing countries. In this regard, we believe that the study of the growth impact of capital inflows on economic activity should be of interest.

Furthermore, this project is established based on the PI’s previous publications on the effect of finance on growth (see for example, Liu et al., 2014; Igan et al., 2016; Mirzaei and Moore, 2019; Mirzaei and Grosse, 2019). Besides, we aim to develop this project from two aspects in the future. First, we intent to extend our project by studying whether capital goods imports affect positively growth and structure of industrial sectors. The importance of capital goods for economic development at the aggregate level has been studied but not at the sectoral level. Funding the current research project would thus help us to achieve this goal as well. Second, we are interested to investigate how capital inflows affect Islamic bank performance in countries with dual banking system. Specifically, by developing our project, we examine the response of Islamic banks’ lending activities to international financial flows. Capital inflows are expected to raise access to finance, but at the same time they may be complementary to conventional banks and thus providing opportunities for Islamic banks to grow faster. There is no literature on this issue. Our dataset on capital inflows could be used to achieve this goal as well. Thus, this project would help us in understanding better the linkage between financial constraints and economic performance in developing countries. The findings of this research will also foster our future projects in the same areas. Finally, our research project would involve under and graduate students and would thus enrich our students’ research skills.

## **Proposed Project & Work Plan**

This research project aims to examine the economic impact of foreign capital inflows in developing countries. In particular, we examine whether industries that are financially more dependent on external finance import disproportionately more capital goods if they are domiciled in countries receiving considerable amount of capital inflows. We do so by using a panel data for manufacturing sectors for a large number of developing countries over the period 1990–2017. By employing the widely-used Rajan and Zingales’ (1998) approach, we use an interaction term between a proxy for capital inflows and a proxy for the sector’s dependence on external finance. Overall, our empirical model and data collection strategies can be summarized as follows:

**D.1. Model specification**

Our main empirical strategy is to examine whether capital inflows facilitate capital goods imports in financially-dependent industries. Thus, our model specification is given by the following equation:

$$Imp\_{j,c,t}=∅+α.S\_{j,c,t-1}+β.CF\_{c,t}×D\_{j}+φ.X\_{c,t}×D\_{j}+ε\_{j,c,t} (1)$$

where $Imp\_{j,c,t}$ refers to imports of capital goods in sector $j$ in country $c$ in the period $t$. Following Alfaro and Hammel (2007), we use as dependent variables both the percentage of capital goods imports to value added and the percentage of capital goods imports to total imports. $S$ is the share of value added of each industry to total value added of all industries in a country, with one period lag. We control for this industrial share of total value added, due to the heterogeneous degrees of development across different industries within one country. $D\_{j}$ is a proxy for each industries’ dependency on external finance (Rajan and Zingales, 1998). $CF\_{c,t}$ is a vector of capital inflow variables for country $c$ in year $t$. To examine how pattern of capital inflows affects relative imports of capital goods of industries that are financially dependent, we use an interaction between a proxy for capital inflows variable and a proxy for external dependence ($CF\_{c,t}×D\_{j}$). We aim to use seven variables as proxies for capital inflows (aggregate and disaggregate by borrower type and by instrument) as follows: total private capital inflows ($CF$) are made up of flows to financial institutions ($CF^{1}$) through equity ($CF^{1-1}$) and debt ($CF^{1-2}$), and flows to corporations ($CF^{2}$) through equity ($CF^{2-1}$) and debt ($CF^{2-2}$), where$ CF=CF^{1}\left(CF^{1-1}+CF^{1-2}\right)+CF^{2}\left(CF^{2-1}+CF^{2-2}\right)$.

According to the literature (e.g. Rajan and Zingales, 1998), financial development of a country affects industry growth through the channel of firm financial dependence. Also, the effects of credit constraints on capital goods imports are recognized by literature (Fauceglia, 2014). Furthermore, trade liberalization can facilitate imports of machinery and equipment and hence investment. Thus, to disentangle the effect of capital inflows, we must control for (i) a proxy for overall availability of domestic credit interacted with external financial dependence and (ii) a proxy for a potential change in trade liberalization policy interacted with external financial dependence (shown as $X\_{c,t}×D\_{j}$).

Eq. (1) can include a rich set of industry, country, year, and their interactions dummies ($∅$). Following Dell’Aricia et al. (2008), our goal is to use the most rigid specification, in terms of degree of freedom, where we include three types of fixed effects: industry-country ($∅\_{jc}$), industry-year ($∅\_{jt}$) and country-year ($∅\_{ct}$) fixed effects. We do so to control for all types of unobservables: $∅\_{jc}$ control for cross-industry cross-country fixed effects, such as industrial policies in each country; $∅\_{jt}$ capture time-variant industry-specific factors that influence cross-industry imports of capital goods, such as industrial R&D investment; and finally $∅\_{ct}$ account for time variant country-specific factors that might drive cross-country differences in investment, such as institutional and legal environment. Thus, one key advantage of our three-dimensional (industry–country–year) panel is that it allows us to use interacted fixed effects to control for a wide array of omitted variables (Hsu et al. 2014). Indeed, the only shocks not controlled for are those varying simultaneously across industrial sectors, countries, and time.

Furthermore, we estimate Eq. (1) using OLS estimator. Residuals from OLS estimations of panel data may be correlated across both industries and countries, resulting in biased standard errors. Thus, following the procedure proposed by Petersen (2009), we use double ways industry and country level clustering to account for correlations among different industries in the same country and different countries in the same industry. The coefficient of interest is $β$, which measures the difference between the imports of capital goods in financially vulnerable sectors in countries attracting high and low foreign capital inflows.

One might argue that the typical issue of endogeneity may continue to exist in Eq. (1). We expect that the problem of reverse causality is not critical here, because we use sectoral level data and it is hard to believe that capital flows to countries because of growth in imports of capital goods in a specific industry. However, it might be more serious that the correlation may come about because of omitted variables. For instance, industries in more politically stable countries or in countries with a high degree investment freedom may attract more foreign capital and firms in such countries may also import more capital goods. Additionally, it may be because countries with better institutions experience more both capital inflows and imports of capital goods. To mitigate the omitted variables bias, we control for observable characteristics – especially at the country/industry level – that may affect relative imports of capital goods and then use selection on these observable factors to determine the possibility that our estimates are being driven by unobserved heterogeneity across countries/industries (Altonji et al. 2005). Finally, Eq. (1) will be adjusted, developed and saturated further as we complete literature review and data analysis. We also perform a series of sensitivity tests to mitigate endogeneity issue further.

**D.2. Data**

We use a range of sectoral-level and country-level data as follows:

*Data on industries*

The manufacturing data are from the United Nations Industrial Development Organization (UNIDO) Industrial Statistics Database. The UNIDO reports disaggregated yearly data on industrial sectors. The database contains data on value added, output, number of establishments, gross fixed capital formation, and number of employments. However, data on capital goods imports are not available from this dataset and we need to merge UNIDO data with the data from other databases. Our aim is to check the following databases. First, we consider the UN Comtrade database that contains annual bilateral merchandise trade for all countries up to 5 digit SITC. The second database we explore is the OECD Bilateral Trade in Goods. We also check the World Bank and the WTO to further examine availability of data. Our initial assessment suggests that capital goods imports by industry appear to be attainable from the OECD.

The degree of financial dependence of each industry on external source of finance come from Rajan and Zingales (1998). They assume that financial markets in the US are relatively frictionless and informative and thus industry characteristics based on US firm data reflects only technological characteristics rather than US industry norms. As a result, they employed U.S. firm-level data to measure the external finance dependence of each industry, by computing the share of investment not financed with internal cash flows.

*Data on capital inflows*

We aim to establish a comprehensive dataset of capital inflows for a large number of developing countries at an annual frequency. Since we are interested in examining whether breaking down cross-border capital flows by type (and if available by industry) differently affect growth of financially dependent industries in the recipient countries, we conduct this by checking important databases that report international capital flows. First, we consider the Institute for International Finance (IIF) dataset. Second, we check the OECD databases. Third, we check the Balance of Payment (BOP) data from the IMF database, the one that used commonly by researchers who study international capital flows. And fourth, we examine the BIS cross-border bank capital inflow data. Overall, we check these databases to see whether we can obtain data preferably at the industry level or at least by borrower type. Our initial assessment indicates that capital inflows data by borrower are obtainable, but data by industry needs to be researched further.

*Data on countries*

Other country-level data retrieved from the standard databases such as the IMF- IFS database and the World Bank database.

Note that the choice of the final sample is dictated by the availability of data, especially data on capital goods at the sectoral level. In addition, in order to engage in data collection, we may need to visit and use databases of external sources such as the IMF, BIS, UNIDO, and/or US/European universities.

**D.3. Work plan**

The project is expected to take approximately two years. In year 1, we intend to review literature, collect and analyze data: about 4 months on the literature review and 8 months on data collection, choosing appropriate methodology and analyzing the data. In year 2, we provide an initial draft (4 months), present it in international conferences and then provide the final draft (7 months) before submitting to a journal (1 month).

**Team Commitment:**

The PI takes main responsibility of the project. The role of the PI is do the literature review, collect research data, and do the analysis. The PI is qualified to do so, according to his past publications and his current working papers as presented in his CV below. The PI has also the responsibility to visit academic, and international institutions and/or attending conferences, in order to obtain data, exchange ideas with other researchers, and disseminate results. Overall, 80% of research work will be taken by the PI.

The main role of Co-I is to help the PI in motivating the topic, establishing empirical strategies, and improving the working paper(s). Given his past publication on topic related to emerging/developing countries, he is qualified to improve the overall quality of the working paper(s), exchange the ideas with other leading researchers and perhaps presenting results in international conferences. Overall, the Co-I contribution is about 20%.