Understanding Import Diversification: An Empirical Analysis

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Abstract

This paper analyzes import diversification in an aggregated perspective. Using a dataset for 60 countries covering the period 1995-2010, we study the main determinants of import diversification. We expect to contribute to the current literature, taking into account that there have been few empirical studies addressing import diversification and more specifically, at the cross-country level. We take into account variables classified into four categories: Structural factors, macroeconomic factors, international trade factors and political factors. We find robust evidence that total factor productivity (TFP), capital stock, real exchange rates and terms of trade are key drivers of import diversification. On the other hand, domestic consumption and trade openness exert an effect leading to import concentration. We interpret this finding, taking into account the theoretical framework provided by the international trade and growth theories.

JEL Classification: F10 F14, O57, F13

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1 Introduction

Export diversification has been proposed as a policy mechanism that could contribute to stabilize export earnings in those countries where the share of commodities in the export basket is particularly pronounced (Mejía, 2011). As stated by Agosin et al. (2012), the evidence leads to the conclusion that export concentration is mostly a feature of developing economies. Taking into account that primary-products exports have been characterized by relatively low income elasticity of demand and inelastic price elasticity, a structural transformation of the economy should be joined by a diversification of the export mix (Todaro and Smith, 2006). Hence, export diversification has been considered as a possible developmental strategy, which would contribute to the achievement of stability-oriented and growth-oriented policy objectives (Ali et al., 1991).

While the literature has focused on the role of export diversification and its possible contribution for economic growth, import diversification has not been widely studied or considered as a developmental strategy.

Based on a sensitivity analysis, Levine and Renelt (1992) identified the macroeconomic variables that affect the economic growth, finding that the impact of both exports and imports on growth is the same. They stated that imports, as well as exports, could explain the empirical finding that trade boosts growth. However, only recently –thanks to the renewed emphasis placed on imports by the New Growth Theory and the release of firm and plant-level data– the role of import diversification has been studied in more detail.

The influential study by Imbs and Wacziarg (2003) provides evidence that economies grow through two stages of diversification: First, sectoral diversification increases, until a level of per capita income is reached beyond which the sectoral distribution of economic activity starts concentrating again. Hence, the authors propose that sectoral concentration follows a U-shaped pattern in relation to per capita income (Imbs and Wacziarg, 2003). This seminal work focuses on the export perspective.

Understanding how import diversification evolves as economies grow, and identifying the factors that drive this dynamic process, becomes relevant for advancing towards the goal of understanding the relationship between economic growth and trade diversification –both from the export and import perspectives–. While a theoretical solid ground has been built to approach

the analysis of this relationship, the existing empirical literature has focused on the relationship between export diversification/concentration and economic growth (Cadot et al., 2011b; Hesse, 2006; Imbs and Wacziarg, 2003). On the other hand, the possible linkage between economic growth and import diversification has not been widely analyzed. The works of Krugman (1979), Grossman and Helpman (1991), and Aghion and Howitt (1992) have provided arguments and explained the way that a wide range of imported goods may contribute to additional gains from trade for both firms and consumers.

Inspired by the approach of Imbs and Wacziarg (2003) and also, by the work of Agosin et al. (2012), the objective of this study is to analyze which are the main long-run determinants of imports diversification, and to investigate the evolution of import diversification along the growth path in an aggregated perspective. We are especially interested in providing evidence related to the process in which countries with higher total factor productivity (TFP) tend to import more varieties of goods. On the other hand, importing more varieties is supposed to raise productivity. Studies conducted at the firm level have found that productivity rises when firms import a wider variety of inputs.(Halpern et al., 2015; Kasahara and Rodrigue, 2008; Goldberg et al., 2009b)

This paper is organized as follows: In the second section, a literature review is carried out, in order to revise and discuss the main empirical studies related to export and import diversification. In section three, we describe the methodology and our empirical strategy and presents the data. Section four contains the estimation results. the section five will show the robustness checks that we carried out, and finally at section six the conclutions.

2 Import Diversification and Economic Growth: what we know, and what we still need to learn.

The postulation that the pattern of economic development is associated to a structural change in exports and increased exports diversification has been proposed by Mejía (2011). On the one hand, a vast number of empirical studies have investigated the relationship between export diversification and economic growth, suggesting that the benefits of export diversification are susbtantial (Cadot et al., 2011a; Lederman and Maloney, 2003; Mejía, 2011) among others.

Another strand of the literature focuses on the determinants of export diversification, concluding that some underlying aspects including factor endowments, schooling conditions, income levels, or attitudes toward international trade are needed. (Agosin et al., 2012; Parteka and Tamberi, 2013; Jetter and Ramírez Hassan, 2015) among others.

In contrast, the literature and studies related to import diversification and its relation to economic growth has been less abundant. Jaimovich (2012) found a positive correlation between the degree of import diversification and the income of importers, suggesting that the non-homothetic preferences and fixed cost involved in trade relations are the two main mechanisms that allow this positive correlation.

Recent studies related to intermediate input imports have provided strong evidence in favor of a positive relationship between imports and productivity growth at the firm level. Using a panel data of Hungarian firms, Halpern et al. (2015) argues that the import of inputs has a significant and large effect on domestic firm productivity, due to imperfect substitution between foreign and domestic goods. Kasahara and Rodrigue (2008) found that by switching from being a non-importer to an importer of foreign intermediates, a plant can immediately improve its productivity. In the same line of argumentation, Colantone and Crinò (2014) –using a panel of 25 European countries– showed that new imported inputs stimulate the introduction of new domestic goods, as new imported inputs allow countries to benefit from a wider and better sets of intermediate products.

In recent times, another stream of the literature has analyzed the link between imports of intermediate inputs and export performance. Using data of Chinese manufacturing firms, Feng et al. (2012) found that firms that expanded the value or variety of their intermediate input imports expanded the value and scope of their exports. The strength of this relationship rarely varies, suggesting that export performance improves when imports provide local firms with intermediate inputs of superior quality or technology. Le Bris et al. (2013) state that the value of imported intermediate inputs has a positive and highly significant impact on the number of exported products and the number of markets, (in other words, at the intensive and extensive margins). Using a panel dataset of French firms, Bas and Strauss-Kahn (2014a) provide robust evidence that an increase in the set of input varieties significantly raises the variety of exported goods. By using more varieties of imported inputs, firms reach a better complementarity of

inputs and therefore, increase their productivity. More productive firms are also more likely to export a wider variety of goods, as they are able to bear the export fixed costs and survive in competitive export markets.

The literature is not very clear when it comes to the link between import diversification and economic growth at an aggregated perspective. Most studies –as previously mentioned—have dealt with the role of intermediate inputs imports at the firm level and its impact on export performance. Whereas the relationship between export diversification and economic growth has been widely analyzed, when it comes to import diversification, we identified a gap in the literature regarding the possible relationship between import diversification and economic growth at the macro level.

When analyzing international trade and economic growth, the diversity of goods and the heterogeneity of firms are of utmost importance. In a domestic economy, the demand for foreign goods is mainly determined by the production (supply side) and consumption (demand side). Recent literature on trade and growth suggests the potential benefits derived from import diversification, associated both to the domestic supply and demand.

On the demand side, traditional trade models identify that trade liberalization increases consumers' welfare, since they have access to a wider range of goods at lower prices. In addition, if consumers exhibit a Love for Variety in the sense of Dixit and Stiglitz (1977), and if some countries do not have the capacity to produce so many varieties and goods as demanded by their nationals –due to the high fixed costs of production–, consumers would gain from trade, because this represents a possibility of having a greater range of choice. Furthermore, Broda and Weinstein (2006) argue that globalization has had a substantial impact on consumers' welfare, derived from the wider variety of imported goods. Their study reports that U.S consumers' welfare increased by 2.6 percent due to the gains derived from the import of new varieties.

On the supply side, the endogenous growth models developed by Romer (1990),Lucas (1988), Aghion and Howitt (1992) and Grossman and Helpman (1991) –which explain that the diversification of inputs is directly associated to increases in productivity and economic growth– must be considered. For the purpose of our work, it is essential to consider these theoretical concepts, since they present approaches widely recognized to describe the long-term relationship between imports and growth. At this level, international trade spill-over effects should be considered as

a new and dynamic trade gain. They imply an important source of productivity growth for the economies, since they lead to a better complementarity of inputs, the possibility of having access to inputs of higher quality, and the availability of more and better technologies incorporated in the imported goods.

There are three main channels through which a wider variety of imports may exert a positive impact on supply. The first one is related to competition: Grossman and Helpman (1991) and Helpman and Krugman (1985) propose models where imports boost productivity through their impact on competitiveness. Competitive pressures promote improvements within the firms through the reorganization and elimination of inefficiencies, and provides incentives to innovate. Heterogeneous-firm models, such as Melitz (2003) and Bernard et al. (2003), also show that import competition leads to an average productivity increase, as most productive firms expand while the less productive domestic firms exit.

A second channels is associated to the access to better inputs. In this line of argumentation, Grossman and Helpman (1991), Rivera-Batiz and Romer (1991) and Romer (1990) have stated that imports give firms access to better, cheaper, and domestically unavailable inputs and equipment. As a result, they boost productivity and reduce production costs, making the production of new goods possible and profitable.

Finally, a third channel is related to the technology transfer. Due to Grossman and Helpman (1991), Aghion and Howitt (1992), and Coe and Helpman (1995), imports allow access to foreign technology embodied in imported inputs and equipment.

3 Empirical methodology and Data

In the literature, there is not a specific model to explain imports diversification and its evolution along the growth path. Taking that into account, we will trust in the econometric specifications to identify the factors or variables that drive the import diversification process.

As a methodological starting point, we try to identify how the relationship between import diversification and the development level of countries evolves. Our hypothesis is based on the work of Jaimovich (2012), which states that higher levels of import diversification may be associated with higher levels of per-capita income of importing countries. Thus, the basic model

takes the form:

$$ID_{it} = \alpha + F(GDPpc_{it}) + \varepsilon_{it} \tag{1}$$

Where ID_{it} is the import diversification index for country (i) at the year (t), and $GDPpc_{it}$ is the income level of country (i) at year(t), measured by the real per-capita income. We expect the estimated sign for the per-capita income to be negative, meaning that countries with higher development levels tend to have a more diversified import basket. Specific effects for each country –non observable heterogeneity- may be relevant for the import diversification process. Hence, model (1) can be extended including this variable

$$ID_i t = \alpha + F(GDPpc_i t) + C_i + \varepsilon_i t \tag{2}$$

To identify in an accurate way the variables that drive the import diversification level, we include all variables in four different categories: structural variables, macroeconomics variables, international trade variables and political variables. The full version of our model exploring the determinants of import diversification can be specified as:

$$ID_i t = \alpha ID_{it-1} + F(GDPpc_{it}) + \sum_{k=1}^{K} \beta_k X_{k,it} + \sum_{l=1}^{L} \theta_l X_{li} + C_i + D_t + \varepsilon_{it} \tag{3}$$

Where remember that ID_{it} is the import diversification-concentration for the country (i) at the year (t), which is explained as a function of its lag value $(t-1)$ –the reason to lag the endogenous variable is to capture the dynamic process behind the import diversification-concentration and also due to the import diversification index high persistence through time- a set of explained variables (X), which may determine the diversification process, in this set of variables we consider, time variant variables denote by $X_k(k = 1 \ldots K)$, and time invariant variables denote by $X_l(l = 1 \ldots L)$, a time dummy (D_t) We include these variables as a way to eliminate the economic cycles in our results, approach commonly used in the literature. Finally an idiosyncratic error term ε_{it}.

In what concerns the estimation methods, the data availability allows us to use standard panel data techniques to solve two econometric problems: First, to eliminate and correct the

non-observable time-invariant characteristics –specific to each country– that may be correlated with the explanatory variables and may explain the differences between countries. Second, the inherent endogeneity of our exogenous variables, that naturally arises when we work with macroeconomic and aggregated variables. To correct these problems, Arellano and Bond (1991) propose an estimator based on the generalized method of moments (GMM), that instruments the differenced variables that are not strictly exogenous with all their available lags in levels. The model uses first-differences to transform equation (3) into:

$$\Delta ID_i t = \Delta\alpha ID_{it-1} + \Delta GDPpc_{it} + \Delta\beta_k X_{k,it} + \Delta\varepsilon_{it} \tag{4}$$

The transformation by first differences removes the fixed country-specific effects, because it does not vary with time. In equation 4, ΔID_{it} is correlated with $\Delta\varepsilon_{it}$. To correct the endogeneity problem, Arellano and Bond suggest using the lagged levels of the endogenous regressors as instruments. However, Blundell and Bond (1998) argue that using the lagged value levels of the endogenous regressors are poor instruments for the first-differenced equation. As an alternative, they propose the augmented version, the System GMM estimator, which combines the GMM conditions both at the level form and the first difference form of the dynamic panel data model, in order to find the interest parameters of both time-variant and time-invariant explanatory variables. To address the endogeneity problem they suggest using the level values of the endogenous variables as instruments in the difference equation. Moreover, in the level equation, they propose using as an instrument the first difference of the endogenous variables, since past changes may be more predictive of current levels than past levels are of current changes, so that the new instruments are more relevant, supposing that the error term is not serially correlated.

Since these are GMM estimators, the Arellano-Bond and Blundell-Bond estimators have one- and two-step estimation options. In the one-step estimation option, the robust estimator of the covariance matrix of the estimated parameter is calculated, and the resulting standard errors are consistent in the presence of any pattern of heteroscedasticity and autocorrelation within panels. However, the two-step estimation is asymptotically more efficient, the standard covariance matrix is already robust, and standard errors tend to be severely downward biased (Arellano and Bond, 1991; Blundell and Bond, 1998). For addressing this problem, Windmeijer (2005) proposes a correction for the two-step covariance matrix, making the two-step estimation

more efficient.

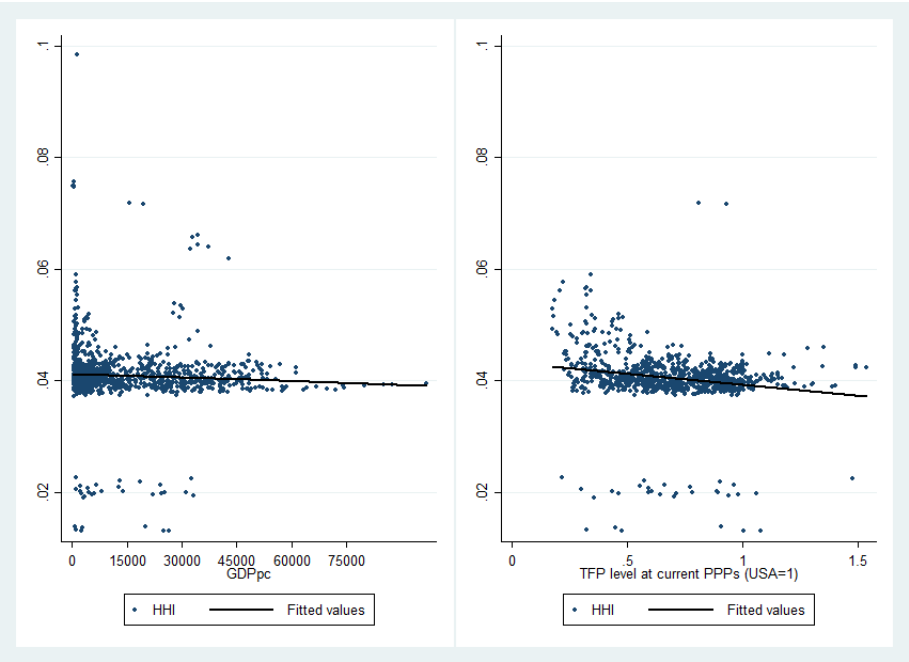
The most important assumption for applying GMM estimations is related to the instruments, which must be exogenous, in order to accomplish the orthogonality conditions. With the purpose of testing the exogeneity of the used instruments, Sargan (1958) indicates that an over identifying restrictions test should be conducted with a null hypothesis that the group of instruments are exogenous and valid. The Sargan statistic is not robust to heterocedasticity or autocorrelation. Similarly, Hansen (1982) test had to be significant to accept the null hypothesis which states that the instruments are strictly exogenous. However, as the number of instruments increases, the test loses power. Considering that the validity of the instrument depends on the error structure and the harmful situation –for accurate statistical inference- in which we may have correlation in the residuals, we will also report the Arellano and Bond (1991) AR (1) and AR (2) test, which allows us to identify first and second order autocorrelation of the error in level and the first-differences equations. While first-order correlation of residuals is expected, second-order correlation would suggest that the endogenity problem remains. Therefore, we will only use one lagged value -either in difference or level- as instrument, in order to avoid over-fitting of the instrumented variables and weaken Hansen tests.

We estimate a dynamic panel data model based on information for 60 countries and covering the period 1995-2010, accounting for 960 observations. We build our endogenous variable -the Import Diversification Index- as a measure that is also applied for export diversification and is well accepted by the related empirical literature. The diversification index shows the difference between the import shares calculated at different disaggregation levels, based on the Standard International Trade Classification. The finer the disaggregation share used, the better the measure of the diversification-concentration index will be. Although there are three main diversification/concentration measures that are frequently used in the related literature – Herfindahl-Hirschman, Gini and Theil indices– , we use the Herfindahl-Hirschman. Our decision is based on the data availability and also, taking into account that we focus our analysis in a broad measure of diversification/concentration rather than on the surge of new lines of imports. The Herfindhal-Hirschman index is calculated as:

$$HHI = \frac{\sum_{i=1}^{n}(S_i)^2 - \frac{1}{n}}{1 - \frac{1}{n}} \quad \text{where } S_i = \frac{x_i}{\sum_{i=1}^{n} x_i} \tag{5}$$

Where S_i is the share of import line i at a specific disaggregation level, and X_i denotes the amount imported of line i, and n is the number of import lines. This index takes values between 0 and 1.Values close to 1 represent high concentration, while values close to 0 represent low concentration. Imports statistics were taken from the United Nation's Commodity Trade Statistics Database (UNComTrade), which provides information of annual imports at the 6-digit level of disaggregation according to the Standard International Trade Classification –SITC rev 3- for a country (i) at time (t).

Figure 1: Import Diversification, TFP and GDPpc

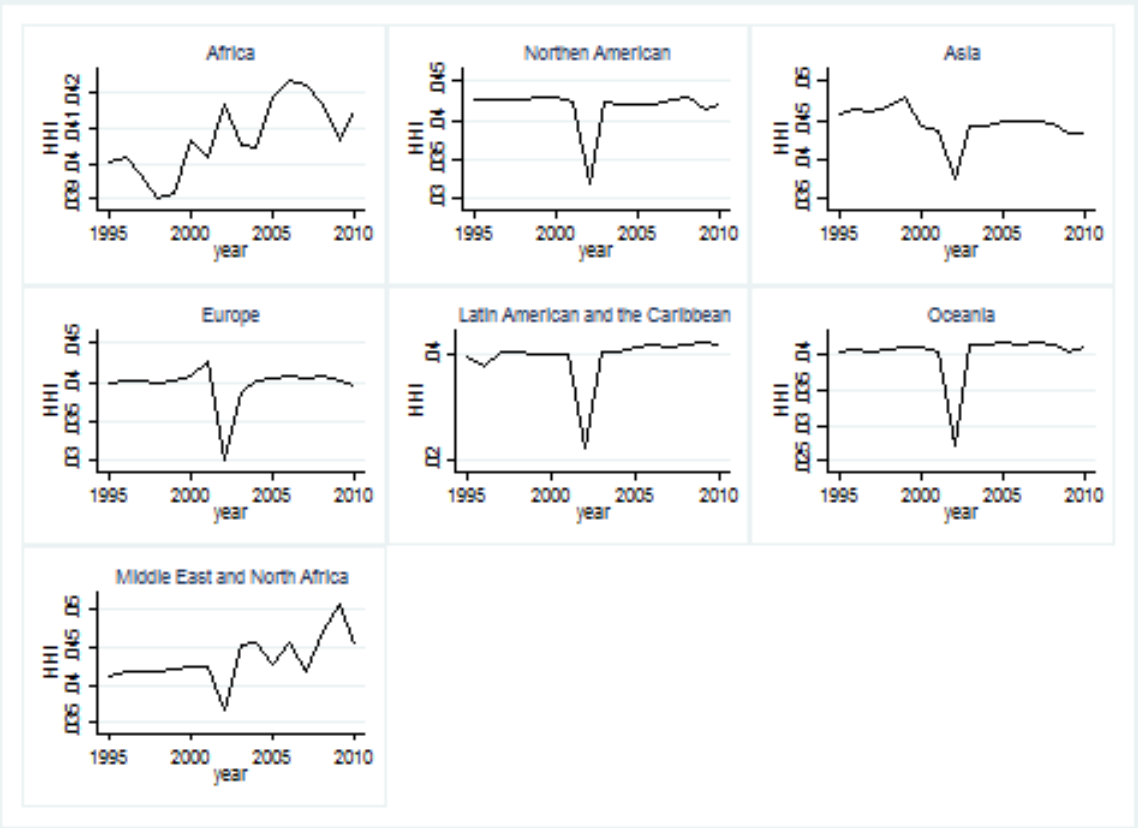


Source: Author's own calculation. Data comes from UN-COMTRADE and World Bank

Before finding the long-run determinants that drive the import diversification process, we need to get more information related to our endogenous variable, the import diversification index. As depicted in Figure 1, the level of import diversification for the economies in our sample is relatively high and stable over time. The Herfindahl-Hirschman index used in this work gives us an idea of the differences in import values as a percentage of the total import value for a specific country and year. When we aggregate countries over time, we get as a result a high import diversification –the HHI value is close to zero–meaning that all countries tend to have

a balanced import demand. This goes in line with the so-called strictly convexity preferences described in the microeconomic theory, which allow individuals to reach higher utility curves by choosing a balanced consumption basket.

Figure 2: Import Diversification by World Regions



Source: Author's own calculation. Data comes from UN-COMTRADE and World Bank

In regard to our exogenous variables, we classify them in four categories: Structural factors, macroeconomic factors, international trade factors and political factors. Although some variables may belong to a different category, the reason to introduce this classification is to identify the extent to which a variable can be influenced by governments or the private sector. Political and macroeconomic factors are the most receptive to policy changes. Thus, depending on which variables exert a significant effect on import diversification, we get an idea as to what extent the level of diversification is potentially modifiable by policies.

The justification for the inclusion of these variables follows the main implications of New-New

Table 1: Data source and Calculations

Variable	Description	Calculations
		Structural Factors
Labproduc	Labor Productivity°	the share of labor income in GDP
TFP	Total Factor Productivity°	Solow (1957) residual
Capitalstock	Capital Stock°	Cumulating and depreciation past investments using (PIM).
Humancapital	Human Capital°	Barro and Lee (2010) human capital index.
		Macroeconomic Variables
ExpHigTech	Export High Tecnology*	High-technology exports are products with high R&D intensity.
DomInvestment	Domestic Investments*	Gross capital formation as % of GDP
XR	Real exchange rate*	Currency against a average of several foreign currencies divided by deflator.
GDPpc	GDP per-capita*	The GDP divided by midyear population. In constant 2005 U.S. dollars.
HousCons	Household Consumption*	Household final consumption expenditure, etc. (% of GDP)
		International Trade
Openness	Trade Openness*	Total imports and total exports, as % of GDP
Termstrade	Terms of trade*	Net barter terms of trade index (2000=100)
		Political factors
Goverexp	Government Expenditure*	Government share of real GDP per capita
EnrollprimEdu	Enrollment rate primary education*	Total enrollment in primary education, net %

Source: °Penn World Table 8.0 and *World Bank, World Development Indicators

Trade Theory which present theory trade models with heterogeneous firms (Bernard et al., 2003; Melitz, 2003) and also from the endogenous growth theory, related with knowledge spillovers (Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991; Romer, 1990; Aghion and Howitt, 1992).

The first group of variables considers the effect of structural factors on import diversification. Under this category we included variables that account for factor endowments of each country, such as labor productivity, capital stock, human capital, and the total factor productivity (TFP). We included these variables taking into account that along the trade theory, practically all models consider factor endowments as a fundamental component that describes the productive capacity of an economy and therefore, plays a key role in setting up its trade relations. Specifically, according to Melitz's model (2003), we expect a positive effect of human capital on import diversification, since human capital accumulation allows countries to produce a wider variety of goods. We use the Barro and Lee (2010) human capital index as the variable that denotes human capital, which is defined as the average year of schooling of the population aged 15 and above. In growth models, labor productivity is considered as the real wage, which denotes the labor force's purchasing capacity. Hence, we expect labor productivity to positively affect import diversification. The empirical literature has provided evidence for what theoretical models have argued (Rivera-Batiz and Romer, 1991; Grossman and Helpman, 1991), about the dynamic and virtuous relationship between aggregated productivity growth and import varieties. (Melitz, 2003; Melitz and Ottaviano, 2008). Imported goods boost overall productivity through competitive pressure and the expansion in the productivity of the firms. This postulate has been confirmed by Goldberg et al. (2009b); Goldberg and Campa (2010); Amiti and Konings (2007) Based on the literature, we consider TFP as one of our main explaining import diversification variables. In this regard, we expect that higher TFP will favor import diversification. TFP data comes from the Penn World Table (PWT) 8.0, which has been calculated following the Solow growth model[1] .

The second group of variables is comprised of macroeconomic factors, since they may exert an influence upon imports. Data for these variables have been taken from the World Bank Development Indicators Database. In this group we include the domestic household consumption

[1]Further detail and explanations, see Inklaar and Timmer (2013).

–which accounts for the final private consumption expenditure and is measured as the market value of all goods and services (including durable goods) purchased by households–. We expect that higher household consumption leads to higher import diversification. The domestic investment –Gross Capital Formation– consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories (World Bank). Furthermore, we expect an appreciated real exchange rate to have a positive effect on import diversification. In line whit Jaimovich (2012), we expect higher import diversification to be related with higher income levels. Here, GDP accounts for countries' income and development level. All variables included in the macroeconomic category are closely related to international trade and have been considered –both in the literature, as well as in previous studies—as potential determinants of export diversification. Taking that into account, we also expect these variables to exert a significant influence upon import diversification (Agosin et al., 2012; Parteka and Tamberi, 2013; Jetter and Ramírez Hassan, 2015).

In our empirical analysis, we consider the value of high-technology exports[2] as a proxy variable that captures high-quality exports. The significance of this variable is related to the fact that it allows to account for countries' productive capacity to export high technology goods. Based on recent theoretical approaches (Kugler and Verhoogen, 2012; Hallak and Sivadasan, 2013; Baldwin and Harrigan, 2011) showing that producing these high-quality products require high-quality inputs. We expect that higher values of high-technology exports will lead to an import concentrating force, specifically towards high-quality inputs.

The third group of determinant factors of import diversification is comprised of variables that are related to international trade. In this group of variables we include openness to international trade –measured as the sum of exports and imports of goods and services as a share of the gross domestic product- and the terms of trade. The latter were calculated as the percentage ratio of the export unit value indices to the import unit value indices, measured relative to the base year 2000.

[2]High-technology exports are products with high R&D, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Data are in current U.S. dollars

Table 2: Summary Statistics. Overall, Within and Between Statistics

Variable	Mean	Std. Dev	Min	Max
HHI overall	.0409329	.0063133	.0130703	.0984259
between		.0033468	.0372141	.0545488
within		.0053695	.0146081	.0964972
HousCons overall	4.15e+11	1.11e+12	3.07e+09	9.26e+12
between		1.09e+12	5.20e+09	7.94e+12
within		1.60e+11	-1.57e+12	1.74e+12
Domest t overall	1.60e+11	3.84e+11	6.05e+07	3.11e+12
between		3.74e+11	1.46e+09	2.58e+12
within		8.04e+10	-5.82e+11	1.14e+12
Openess overall	75.69646	35.46962	15.58034	220.4074
between		34.00546	23.20144	194.3985
within		11.25534	29.00441	112.7906
tfp overall	.6970497	.2487391	.1731015	1.535433
between		.2418355	.2382994	1.23017
within		.0662176	.3752643	1.002313
XR overall	367.6817	1945.758	.0458451	18612.92
between		1940.601	.6071954	14770.74
within		282.7471	-3370.477	4209.856
GDP overall	6.80e+11	1.69e+12	4.65e+09	1.37e+13
between		1.68e+12	7.28e+09	1.20e+13
within		2.32e+11	-1.94e+12	2.52e+12
capita k overall	2603905	5681020	31174.76	4.06e+07
between		5550001	45974.1	3.50e+07
within		1400516	-8835256	2.29e+07
goverexp overall	16.72444	4.61036	5.465202	28.38975
between		4.490782	6.395443	25.16455
within		1.339102	10.71054	23.8891
Enr mEdu overall	103.3049	8.109072	55.88283	134.1416
between		6.872995	73.1729	118.1644
within		4.290277	80.3188	123.1244
TermsT e overall	2.76e+10	1.02e+13	-1.52e+14	6.97e+13
between		7.90e+12	-4.61e+13	3.76e+13
within		6.36e+12	-1.05e+14	4.62e+13
humanc overall	2.768481	.439814	1.588198	3.618748
between		.4339368	1.736183	3.55511
within		.0907506	2.445651	3.014688
ExpHig h overall	1.91e+10	4.13e+10	247748	4.06e+11
between		3.64e+10	3919152	1.74e+11
within		1.96e+10	-1.17e+11	2.76e+11
labpro c overall	.5321881	.1073968	.2116463	.7487706
between		.1049073	.240644	.7187764
within		.026641	.3893001	.6916193
Popula n overall	7.58e+07	2.14e+08	1331475	1.34e+09
between		2.15e+08	1372600	1.28e+09
within		1.23e+07	-6.13e+07	2.09e+08
tariff overall	10.22529	17.45516	0	97.56077
between		16.93508	0	67.75947
within		8.256873	-44.7585	54.01325

Finally, the political factors describe the political context of countries. We include in this group government size –measured by government's expenditure as a percentage of GDP–. We also include variables that characterize education systems, specifically the enrollment rate in primary education. Precisely this variable has been identified by Jetter and Ramírez Hassan (2015) as one relevant factor behind export diversification. In that line of argumentation, we are interested in identifying the possible effect of early education upon import diversification.

Finally, we include two controls variables, the first one is the tariffs to imported goods as a proxy variable that accounts for the imports tariff level. The reason for including this variable is based on the fact that some economies may protect specials industries or sectors that are sensible at the national level. We also took this variable into account following the argumentation of Ardelean and Lugovskyy (2010) -who found that the sensitivity of the demand for imported varieties to trade barriers increases in the within-country elasticity of substitution between varieties and in the similarity of domestic and imported varieties– . The second control variable, was the population size of each country. These variables were taken from the World Development Indicators Database.

Table 3: List of Countries

List of Countries		
Albania	Finland	Philippines
Argentina	France	Poland
Australia	Germany	Portugal
Austria	Greece	Republic of Korea
Azerbaijan	Hungary	Russia
Belgium	India	Saudi Arabia
Bolivia	Ireland	Senegal
Brazil	Israel	Slovenia
Bulgaria	Italy	South Africa
Canada	Japan	Spain
Chile	Kazakhstan	Sweden
China	Lebanon	Switzerland
Colombia	Lithuania	Thailand
Costa Rica	Malaysia	Tunisia
Croatia	Mexico	Turkey
Czech Republic	Morocco	USA
Denmark	Netherlands	Ukraine
Ecuador	New Zealand	United Arab Emirates
Egypt	Norway	United Kingdom
Estonia	Peru	Viet Nam

4 Results

As our main estimation exercise, we present the two-step GMM system estimations for the Herfindal-Hirshman index of imports diversification. We were aware that the accuracy and reliability of our estimations after applying the system GMM estimator depended on the instrumentation procedure. According to the literature already mentioned, we treated as endogenous variables the labor productivity, TFP, real exchange rate, GDP, high-technology exports, terms of trade and openness, since all of these variables are directly related to our imports diversification measure and may be affected by imports. We consider as strictly exogenous variables the human capital index, household consumption, domestic investment, government size and the enrollment rate in primary school. The estimations were carried out adjusting the robust

standards errors and applying the Windmeijer small-sample variance and co-variance matrix correction. The Arellano-Bond test for Autoregressive Residuals order (2) is did not reject the null hypothesis of not serial correlation on the residuals. The Hansen Test confirmed that the used instruments are exogenous and valid. However, the same test is weak because of too many instruments.

Table 4 presents the estimation results. Most of the explanatory variables are significant and show the expected signs. A positive sign of the estimated coefficient shows a positive effect for import concentration –negatively affecting imports diversification–, while a negative sign represents a negative effect for import concentration—in other words, a larger imports diversification–. We included time dummies in all our estimations, as a tool that allows to control for probable shared tendencies or effects associated with economic cycles, which may have an impact on the import diversification process.

We find evidence to suggest that the total factor productivity has a substantial and significant impact on import diversification. This means that economies with higher total factor productivity levels tend to have a balanced basket of imports. As the literature has suggested, a wider range of imported goods (import diversification) will increase the overall productivity. The latter throughout the competition, access to inputs, and technology transfers channels, this result is similar to those found by Ardelean and Lugovskyy (2010), for the import variety price index. This result confirms what theoretical models have argued, namely, a dynamic relationship between total factor productivity and imports, as a source of technology transfer and quality upgrading.

Concerning factor endowments we find that countries with higher capital stock and higher labor productivity tend to diversify their imports, as suggested by the Heckscher-Ohlin traditional trade models. Here, it should be highlighted that Dornbusch et al. (1980) –adding a continuum of goods in the Heckscher-Ohlin model framework[3]– argues that an increase in the real wage will rise the demand for foreign-produced goods, allowing higher imports diversification. Moreover, a capital-rich country which experiences further growth in its capital-labor ratio, induces more capital-using techniques, and therefore, will produce more capital goods, lowering the relative

[3]One important difference in a model of continuum of goods is the fact that complete specialization is never achieved. In one single good model, the relation between relative factor prices and endowments are different from the comparative static results of the continuum case.

Table 4: Determinants of Import Diversification

	1.HHI	2.HHI	3.HHI	4.HHI
Lageed HHI	.1309835*	.1315643**	.1632355**	.1992977**
	(.0705158)	(.0583039)	(.0666716)	(.0792626)
tfp	-.0117202***	-.0080915***	-.0083952***	-.0100882***
	(.0039274)	(.0020321)	(.0016037)	(.0019523)
Lcapitalstock	-.002876**	-.002255**	-.0023108***	-.0023522***
	(.001169)	(.0008927)	(.0008752)	(.0005448)
HumanCapital	.0010742	.0018809*	.0017378*	.0013619*
	(.0009217)	(.0009612)	(.0009529)	(.0006943)
labproduc	-.0068203	-.0087641*	-.006582	-.0104303***
	(.0050173)	(.0051791)	(.0041601)	(.0027052)
Domestsave	.0026997*	.0023999*	.0019017	.0035218**
	(.001629)	(.0014188)	(.0015805)	(.0015807)
HousCons	.0080487**	.0072193**	.0057857**	.0060837**
	(.003407)	(.003112)	(.0025335)	(.0027943)
XR	-9.21e-07**	-6.32e-07*	-7.15e-07*	-6.55e-07*
	(3.91e-07)	(3.77e-07)	(3.86e-07)	(3.62e-07)
l.LGDP	-.0065678*	-.0071874**	-.0057603*	-.0062903*
	(.0034058)	(.0033967)	(.0031847)	(.0035916)
Openess	.0000336 **	.0000185	.0000189	.0000271**
	(.0000148)	(.0000152)	(.0000167)	(.0000117)
TermsTrade	-6.45e-17	-8.78e-17*	-8.72e-17*	-1.64e-16**
	(4.70e-17)	(4.76e-17)	(4.80e-17)	(7.71e-17)
ExpHigTech		.0006134	.0004785	4.01e-15
		(.0003932)	(.0003786)	(4.22e-15)
goverexp			-.0000509	-.0000177
			(.0000877)	(.0000778)
EnrollprimEdu				-.0000604
				(.0000395)
Arellano-Bond AR (1).	0.00	0.00	0.00	0.00
Arellano-Bond AR (2).	0.13	0.09	0.07	0.06
Hansen test.:	0.48	0.43	0.57	0.53

**Significance at 0.9; **Significance at 0.95; ***Significance at 0.99.*

price of relatively capital-intensive goods. This causes an increase in the demand for foreign labor-intensive goods and inputs, expanding its imports demand basket.

Concerning our macroeconomic variables, we find evidence that import diversification raises as the importing country income levels increases. This result goes in line with those found by Jaimovich (2012). It is important to say that higher income levels represent economies with more imports diversification, where the trade barriers and the non-homothetic preferences are key elements to explain this relationship. These results were also found in the study of export diversification by Parteka and Tamberi (2013), which found evidence suggesting that export diversification increases as the income of countries raises.

As the basic macroeconomic theory states and as expected, we find that an appreciated exchange rate promotes imports diversification, since foreign goods become cheaper at domestic markets. Naturally, cheaper imported goods allow demanding a wider range of foreign goods.

The relationship between consumption and trade direction is the core topic of the current theory trade literature. Recent approaches related to the *Love for Quality* models, as argued by (Jaimovich and Merella, 2012,0; Fieler, 2011; Khandelwal, 2010; Fajgelbaum et al., 2011; Hallak, 2006). The latter authors have brought new insights related to domestic consumption and trade, through the incorporation of non-homothetic preferences in a general-equilibrium trade models framework. This literature states that high-quality varieties attract upward consumer expenditure shares, meaning that in economies where consumers have higher incomes, the demand for high-quality goods is greater. From the imports view, this means that richer importers are likely to pay consistently more for goods that proceed from exporters which present a cost advantage in high-quality varieties. This theoretical approach supports the idea that higher private consumption shares tend to favor import concentration. In our estimations, domestic household consumption showed to be statistically significant for import concentration, suggesting that countries for which private consumption is higher tend to concentrate their imports. Specifically at the light of these models, imports concentration reflects a trend towards purchasing high-quality goods.

Domestic investment did not show to be statistically significant. Nevertheless, it always showed a positive sign, suggesting that higher domestic investment favors import concentration.

The high-technology export variable –which we introduced as a proxy for high-quality ex-

ports goods– was not significant although, as previously suggested, tended to have an import-concentrating effect. The non-significance of this variable may come from the fact that it may perform as a weak proxy to identify the high-quality goods. In the literature, Hallak (2006), previous studies have used a price index from export unit values as an accurate measure of quality. Since there is cross-country evidence of wide differences in export unit values, even between very disaggregated product categories, quality differentiation is considered the leading determinant of this variation. Thus, building price indices at the sectoral level from export unit values allows obtaining quality indices[4]. This is an area that we have identified for further research possibilities.

With reference to the international trade factors, trade openness seems to have an import concentrating impact, although the significance of this variable showed to be mixed for different model specifications. This finding goes in line with the findings of Agosin et al. (2012), for the case of export diversification. Recent works of Mohler (2014), Mohler and Seitz (2012), as well as Ardelean and Lugovskyy (2010), have suggested that the elasticity of substitution between domestic and foreign goods is an important effect when assessing the import variety gains derived from trade liberalization. Specifically, it has been stated in the literature that a country with comparative advantage in a given industry is less dependent on foreign imported goods varieties and thus, losing some imported varieties is compensated by new domestic varieties, as it has the productive capacity to produce new varieties domestically. To identify the mechanisms through which higher trade openness could lead to import concentration –a decrease in import varieties- we would need an accurate tool that allows us to control for the elasticity of substitution between domestic and foreign goods, which may account for the heterogeneity between countries and sectors. This is something that we previously supposed to be non-observable –and that we had included in our non-observable heterogeneity-.

The variable terms of trade showed to be a significant a driver of import diversification, as terms of trade is one of the main factors to assess the performance and evolution of an open economy. Our results suggest that improvements in the terms of trade -which mean that a country finances without difficulty its import demand, due to the raise in its exports earnings-

[4]Specifically, Hallak (2006) constructed an export price index at the 3-digit level using a modified version of the Elteto Koves, and Szulc (EKS) multilateral price index, which are based on bilateral Fisher indices. Similar quality indices have been used by Hummels and Klenow (2005).

will allow economies to demand and pay for a wider variety of imported goods. This result is in line with the traditional postulates and relations between terms of trade and trade direction.

The political factors that we considered did not show to be significant. Contrary to what the literature on the determinants of export diversification has suggested as one of the main driving factors, the enrollment rate in primary education did not show to be significant for explaining the import diversification. Finally, the control variables were not significant, under any specification.

5 Robustness Checks

For the robustness check, we also applied the Arellano-Bond two step estimator for the dynamic panel data model in equation (3). Arellano and Bond (1991) argue that further instruments can be obtained using the orthogonally conditions among lagged values. They suggest performing the first-difference transformation of the dynamic panel data model, in order to eliminate the unobserved heterogeneity. Moreover, they recommend using as instruments for the difference form, all available lagged values for each explanatory variables that were considered as endogenous. In this regard, we considered as endogenous variables the same set of variables that we previously identified in the Blundell-Bond estimation - labor productivity, TFP, real exchange rate, GDP, high-technology exports, terms of trade and openness. As exogenous variables, we considered the human capital index, household consumption, domestic investment, government size, and enrollment rate in primary school. The estimations were carried using all the lagged values and with robust standards errors.

However, many economic relationships are dynamic by its own essence. The natural way to estimate our data, is using the static panel data model estimators. Supposing that our data can be modelled by the following specification, similar to equation (3):

$$ID_{it} = \alpha + F(GDPpc_{it}) + \sum_{k=1}^{K} \beta_k X_{k,it} + \sum_{l=1}^{L} \theta_l X_{li} + c_i + D_t + \varepsilon_{it} \tag{6}$$

Where our variables had the same interpretation as explained in section 3. The only difference is that here, we considered a static panel data model, where there is not a lagged independent variable. Recall that c_i is our unobserved heterogeneity, also known as the country-effect in

this case. In either case, the key issue about c_i is whether or not is correlated to our other explanatory variables $X_{it} = (GDPpc_{it}; X_{k,it}; X_{l,i})$, The most important assumption to use a static panel estimator, is that $E(\varepsilon_{it}|X_{it}; c_i) = 0$ leading to say that all our explanatory variables are strictly exogenous, conditionally on the unobserved effect c_i. Moreover we need to hold the serial uncorrelated assumption in sense of $E(\varepsilon_{it}\varepsilon_{is}) = 0$. For estimations purposes, we used the standard pooled OLS, Fixed Effects, First Difference and the Hausmann-Taylor estimator.

The pooled OLS estimator assumes that regressors are exogenous and puts c_i in the error term, this is $E(c_i|X_{it}) = E(c_i) = 0$ and assumes strict exogenity $E(\varepsilon_{it}|X_{it}; c_i) = 0$ Therefore, we can apply GLS methods assuming the usual rank condition for GLS. We can get consisting results under these assumptions, but inference needs to control for probable correlation between and within the error term over time, adjusting the variance and covariance matrix.

The fixed effect estimator consider that $E(c_i|X_{it}) = E(c_i) \neq 0$, implying that the regressors may be correlated to the unobserved effect. Under strict exogenity assumption, we made the transformation $\ddot{X}_i = X(it) - (\bar{X}_i)$, where $(\bar{X}_i)$ is the average of (X) over time, in order to eliminate the unobserved effect. However, the variance and covariance matrix must be adjusted, in order to get consistent results.

The first difference estimator, hold the strict exogenity assumption –also for first difference form-. The c_i term is eliminated throughout the model first difference transformation, then the first difference estimator is the pooled OLS estimator from that regression. Assuming that the first difference of our error term $(\Delta\varepsilon_{it})$ is serially uncorrelated and has constant variance, the latter implies that ε_{it} is a random walk. Under these assumptions, the first difference estimator is the most efficient estimator in the category of strict exogenity assumptions.

The above estimators of static panel data models in some way allow a limited endogenity form, since the fixed effect c_i might be correlated with one of the regressors and uncorrelated with the error term, –as in the case of first difference estimator-. Even so, you could obtain consistent estimations for the parameters of interest. Now suppose a more complex type of endogeneity, with X_{it} being correlated with ε_{it}. It is possible that some of our explanatory variables may be correlated with the error term, implying the existence of an endogenity bias in equation (6) –the variables that we considered as endogenous at section 3-.

To tackle this problem, we would need to find and prove the existence of instrumental

variables Z_{it}, correlated with X_{it} and uncorrelated with ε_{it}. The usual identification strategy is that an instrument must be a variable that does not appear directly as a regressor in the model, but is highly correlated with the endogenous variables. However, we consider that finding and using a good instrument for our endogenous variables is not the purpose of this work. Furthermore, in the related literature we did not identify the instruments set that perform well as instruments and covers all of our endogenous variables[5]. For that reason, we refrained from using the fixed effect, random effect and first difference instrumentals variable estimators.

However, we implemented the Hausman and Taylor (1981) instrumental variables estimator, who proposed an estimator for a static panel data model using instrumental variables, in order to estimate the time-invariant coefficient, and using instruments for the variables that are correlated with the unobserved effect. In cases where the model specification contains time-varying and time-invariant variables –and among them, the variables are subdivided in correlated and uncorrelated with the unobserved term–, under strict exogeneity conditional on c_i, the estimation can proceed by instrumenting the endogenous variables with its own fixed effect transformation –which is uncorrelated with the unobserved effect- and the time-invariant variable will be instrumented with the average of the other time-invariant that is not correlated with c_i. In our case, we considered as exogenous variables the capital stock and the government size, since government expenditure is determined by fiscal policy. The remaining variables were considered as endogenous, since they are correlated with unobservable countries' characteristics. The instrumental variables estimators are consistent, if it is proved that instruments are uncorrelated with the error term. Similarly, for the Hausman-Taylor estimator, instruments must be uncorrelated with the idiosyncratic errors.

Since we did not have time-invariant variables in our model equation, we included three variables that characterize the countries income level, using the World Bank income classification[6] that sorts countries under the low-middle income, upper-middle income and high income categories.

Considering that in all models specifications and their respective estimators the errors can

[5]Mainly, because the empirical literature normally uses the Arellano-Bond and Blundell-Bond estimators.

[6]According to the World Bank, low-income economies are defined as those with a GNI per capita of \$1,045 or less in 2014; middle-income economies are those with a GNI per-capita of more than \$1,045 but less than \$12,736; lower-middle-income and upper-middle-income economies are separated at a GNI per capita of \$4,125. High-income economies are those with a GNI per capita of \$12,736 or more.

be potentially serially correlated and heteroskedastic, to get trustworthy statistical inference, controlling for both of these problems is required. Taking that into account, all the estimations were carried out with robust standards errors.

Table 5: Determinants of Import Diversification, Robustness Checks

	Arellano-Bond	**Pool OLS**	**FE**	**Hausm-Taylor**	**FD**
Lageed HHI	.110815***				
	(.0380463)				
tfp	-.0196871***	-.0136151***	-.0113967***	-.0098332***	-.0297592**
	(.0055185)	(.0042504)	(.0037888)	(.0034038)	(.0141667)
Lcapitalstock	-.0058137**	-.0047498***	.0046343	-.0003807	-.0195748
	(.0046598)	(.0016949)	(.0032741)	(.001412)	(.0161737)
HumanCapital	-.0113052	7.67e-06	-.0052241*	.0001389	-.0120127
	(.0056097)	(.0013162)	(.0026046)	(.0024425)	(.0246586)
labproduc	.0075189	-.0196166***	.0025494	.00286	-.0050031
	(.021417)	(.0060025)	(.0144389)	(.0081576)	(.028925)
DomestInvest	.0005696	.0010775	.0007371	.0007693	.0011262
	(.0007506)	(.0013681)	(.0011113)	(.0008259)	(.0008949)
HousCons	.0131425**	.0096542**	.0056971	.004668	.0191593**
	(.0057655)	(.0039241)	(.0048137)	(.0034439)	(.0086344)
XR	-.0000199***	-1.75e-06	-6.77e-06**	-6.10e-06**	-.0000126
	(3.97e-06)	(3.96e-06)	(2.56e-06)	(2.71e-06)	(9.26e-06)
l.LGDP	-.0011324*	-.0052263	-.0062398	-.0034871	-.0039729
	(.0057371)	(.0039421)	(.0043363)	(.0034171)	(.0098148)
ExpHigTech	4.21e-14	1.70e-14	1.48e-14**	1.31e-14	3.16e-14**
	(2.60e-14)	(1.27e-14)	(7.20e-15)	(9.50e-15)	(1.48e-14)
Openess	.0000293*	.000029	.0000497**	.0000606***	.0000208
	(.0000289)	(.0000188)	(.0000193)	(.0000196)	(.0000413)
TermsTrade	-3.90e-16***	-3.09e-16***	-4.80e-17	-4.37e-17	-3.25e-16**
	(9.84e-17)	(6.70e-17)	(5.12e-17)	(4.99e-17)	(1.62e-16)
goverexp	-.0004929**	-.0003324	-.0001737	-.0000793	-.0000425
	(.0001463)	(.0001362)	(.0001324)	(.0001451)	(.0002996)
EnrollprimEdu	-.0000208	.0000618	2.31e-06	.0000369	-.0000764
	(.0000796)	(.0000811)	(.0000418)	(.0000541)	(.0000916)
Lowmidincome				-.0002161	
				(.0087234)	
Uppmidincome				-.0025172	
				(.0084694)	
Highincome				-.0036721	
				(.008536)	

**Significance at 0.9; **Significance at 0.95; ***Significance at 0.99.*
For the Arellano-Bond estimator. The test for $AR(2) = 0.08$, *Hansen* $p - value = 0.59$
Standards errors in brackets

According with the estimations for Arellano-Bond estimators at table 5 the results for the dynamic panel data model exhibit similar results comparing with the Blundell-Bond estimators indicating the robustness of the data generating process, under different estimations methods. The Hansen test confirmed that the set of instruments was exogenous and that the AR(2) second order serial correlation did not reject the null hypothesis of no second order serial correlation. However, surprisingly the government expenditure appeared as a significant variable that favors import diversification. This goes in line with Corsetti et al. (2006), who suggests that an increasing and permanent government expenditure causes a terms of trade appreciation, which represents that the prices for domestic goods rise relative to imported goods, allowing for import diversification.

The others estimations at table 4 correspond to static panel data estimators. In the light of the strong assumptions explained above—strict exogeneity, non-serial correlation– the robustness checks results proved that our four main variables are significant under any estimator. The total factor productivity is a significant variable to explain the import diversification process, meaning that countries with higher TFP tend to diversify their imports. The real exchange rate kept its sign and is significant among estimators, confirming that an appreciated exchange rate promotes imports diversification, through its impact on local prices for foreign goods. The openness variable was significant across specifications, suggesting that higher openness levels tend to exert an import concentration impact, as suggested using the Blundell-Bond estimator. However, we may concluede that the estimations results derived from the static panel data estimators are not robust, which allows us to state the model specification as dynamic panel data model gather in a better way the import diversification process.

However, the strict exogenity class estimator fails to solve the inherent endogeneity of our variables, which –jointly with the strong assumptions– make these estimations inconsistent and less reliable. We consider that the methodological approach previously used, namely the system GMM or Blundell-Bond and the Arellano-Bond estimators, are the most accurate way to estimate our data. As stated in the literature, the import diversification process is governed by the dynamic interactions among variables that we considered in this work. These estimators present accurate tools to approach the endogeneity problem, in absence of goods and valid extern instruments.

6 Concluding Remarks

This papers seeks to provide a detail analysis on the import diversification in a aggregated perspective, this work represent a step towards advance in filling the gap and improve the understanding about import diversification, using a long panel of countries to shed light on what are the main factors driving the evolution and explaining the determinants of imports diversification. We may suggest that countries already have high import diversification independently from the income level, considering imports as domestic demand for foreign goods, we can interpreter this results as in line with the microeconomic theory, which argues that individual prefer balanced consumption baskets. The relationship between imports diversification and the stages of the development, measure by the income level, is showed and suggested by this work more stable than the relationship between exports diversification and country income levels.

Estimating a dynamic panel data model, where we used the two step system GMM estimator, the result are robust across specifications in suggesting that the total factor productivity has an important effect on the import diversification process. Since TFP improvements allows economies broaden its demand for foreign varieties, at the same time that more import varieties raises the overall economic productivity. The capital stock was found as a driver to favors import diversification, since capital-rich economies tend to produce more capital goods, expanding its demand for foreign inputs and labor-intensive goods. Although our estimations results regard de relationship between import diversification and countries income level, was not highly significant, we may suggest that economies at higher stages of development tend have a higher import diversification level, this result confirms the previous work of Jaimovich (2012).

Domestic household consumption, was found significant as an important determinant for import concentration, suggesting that economies with higher domestic consumption share tend to concentrate their imports. However, this result is explicit state by the new develop literature about non-homothetic preferences and high quality goods, which argued that economies with greater consumption share tends to bias its demand towards high quality goods, decreasing import diversification which mean increasing import concentration. Related to the international trade variables, we found that both terms of trade and an overvalued real exchange rate are significant and key variables to favor import diversification. Improvements in terms of trade, meaning

that the price of export are higher than the price of imported goods, will allows economies to expand its demand for a broaden varieties of imported goods. Naturally and overvalued exchange rate will favors import diversification, throughout the impact on domestic prices of imported goods.

This paper contributes to the understanding of the import diversification process and its long- run determinants, in the light of a solid theoretical framework, to claim the importance and benefits derived from import diversification. The factors identified in our work as the main drivers behind imports diversification may be useful to revise and improve trade policy with respect to imports.

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