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Country Influence and Impact of Import Diversification on Economic Growth

Arati Bista
arati.bista@gmail.com

Country Influence and Impact of Import Diversification on Economic Growth

by

Arati Bista

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Committee Members:
Nimantha Manamperi, Chairperson
Artatrana Ratha
Gareth John

Abstract

This study uses panel data analysis across large cross-sections to identify the effects of covariates of economic growth by introducing import diversification into the growth model. It further analyzes the growth effects of diversification of import portfolio based on the country of origin using trade openness and institutional quality as some of the control variables. This is obtained by performing dynamic panel data estimation using the Generalized Methods of Moment (GMM) from which the basic specification of our model is decided. I further compare the diversification across two slices: developed countries and developing countries. I also run OLS and Fixed Effects estimates and see how the variables perform in these three different models. Overall, a statistically significant effect of import diversification is seen on growth. However, the magnitude of growth effects of import diversification is higher for developing countries than the developed countries. The effect of import diversification for developing countries is more than twice the effect of developed countries.

Acknowledgments

I would like to extend my deepest gratitude to my committee for their precious support, guidance, and the requisite knowledge without which a feat of this magnitude would not have been possible. Dr. Manamperi, Dr, Ratha, and Dr. John have helped me overcome the challenges throughout this project and pointed me towards the right direction.

My sincere thanks to the St. Cloud State library for providing me with the necessary tools to work on my project. The vast array of resources that St. Cloud State library offers is extremely useful especially ‘ask the librarian’ and St. Cloud State repository.

Special shout out to Statistical Consulting and Research Centre whose invaluable assistance and plethora of resources helped me explore new boundaries of statistical analysis.

I would like to thank my family who have been the silent supporters and lifted my spirit. Special thanks to my sister Puja and her husband Dinusha whose love and support helped me through the brutal Minnesota winters and made my stay here smoother than it would have been. My mom and dad whose blessings always work wonders.

Frequently, I harken back to the day I read my first article on economics, and even though I might not be able to recall the author or the publisher I am forever grateful to that source for sparking my interest in economics and changing the course of my life.

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Chapter I: Introduction

Why do some countries have a rich economy whereas others are poor? What are the factors responsible for such disparities? One might say the answer lies in the economic theories laid out by our ancestors in the field of economics, and these theories in themselves provide a good deal of answers to a certain extent. However, the basic foundations of economic growth theories concentrate on physical and human capital accumulation, and the endogenous growth variant, technological change. These happen to be the proximate causes of economic growth. In this paper, I investigate and capture the underlying factors of the economy other than the traditional growth variables that might influence a country's economic performance.

Hypothesis of the Study

Several studies have been conducted so far to help us understand such a gruelling question at a deeper level. Keeping in view the findings of such impactful research, I attempt to find the relation between economic performance of a country and variables other than labor, capital, and technological change. My research focuses on exploring the roles of other similar variables by bringing trade, institutions, and diversification into the picture. This research particularly focuses on how diversification of a country's import portfolio, based on the country of origin, may impact overall economic performance. I expect to find that a more diversified portfolio would lead to a better economic performance. In other words, a highly diversified import portfolio (based on country of origin) would have a positive impact on the economic growth of a country. This is my hypothesis for this study. This study aims to find out how much a country would be better off given a more highly diversified portfolio.

Several prominent researches point out that institutions are one of the most important variables that help us better understand the workings of an economy. The strength of a country's rule of law and the role of property rights also determine the well-being of a society and therefore, reflect upon the economic well-being of the country. So, I decided to include institutions in my model in the form of proxy variables suggested in the literature. Similarly, another significant variable that I want to explore is the openness of trade. The focus of this thesis is to try and understand the impact of the degree of diversification of trade on economic growth. I will be concentrating on import diversification based on the country of origin and exploring the role openness and institutional quality.

Researchers in the past have had polar views on instrumenting variables for institutional quality, panel data estimation works in my advantage to negate the endogenous effect of those variables. With panel data estimation I can use internal instruments for regressors such as openness and institutional quality that cause endogeneity in the model. The internal instruments are the lagged values of the endogenous regressors. The system- Generalized Method of Moments (GMM), along with panel data model, provides methodological advancement to deal with the endogeneity problem by using internal instruments efficiently. This study uses panel data analysis across large cross-section to identify the effects of covariates of economic growth by introducing import diversification into the model. It further analyzed the growth effects of diversification of import portfolio based on the country of origin. This is obtained by performing dynamic panel data estimation using the Generalized Methods of Moment (GMM) from which I decided the basic specification of my model. I further compare the diversification across two slices: developed countries and developing countries. I also run OLS and Fixed effects estimates

and see how my variables perform in these three different models. Working with panel data helps us capture the growth effect both over time and across countries. Panel data model overcomes the effect of unobservable variables that maybe country-specific and thereby reduce biases of estimated coefficients.

This study is divided into five chapters. The first chapter provides a brief introduction on the topic and hypothesis. Here, I discuss economic theories and how I would go about using them in my model. The second chapter is a literature review. The third and fourth chapters cover data, methodology and the empirical results from my study, in which I expand on Dynamic Panel data estimation used with internal instruments for regressors that helps us deal with the endogeneity in my model caused by reverse causality. The internal instruments are the lagged values of the endogenous regressors. The system generalized method of moments (GMM) along with dynamic panel data model, provides methodological advancement to deal with the endogeneity problem by using internal instruments efficiently. I also compare the OLS and Fixed Effects on panel data analysis. However, since these methods aren't dynamic, they do not allow us to use observable information from the previous periods in my model. Finally, the fifth section includes the conclusion, where I discuss what would be the implications of my study.

Chapter II: Literature Review

Various studies (Ades & Glaeser, 1999; Alesina, Spolaore, & Wacziarg, 2000; Dollar, 1992; Frankel & Romer, 1999; Sachs & Warner, 1995) have explored the causal influence of foreign trade on economic growth, suggesting that trade has a causal effect on long-run economic growth. Similarly, other research (Acemoglu & Johnson, 2005; Acemoglu, Johnson, & Robinson, 2002; Hall & Jones, 1999) have explored the causal role of institutional quality on economic growth. These scholars have reached a wide consensus that institutions have a significant role on economic growth. However, little evidence is found on the simultaneous partial effects of trade openness and institutions on economic growth. Rodriguez and Rodrik (2001) argued that when an empirical analysis is conducted controlling for variables such as institutions and geography, openness has no distinct effect on economic growth. This argument ensued a myriad of research projects conducted by prominent scholars (Dollar & Kraay, 2003; Irwin & Tervio, 2002; Rodriguez & Rodrik, 2001) that explore the relationship of institutions, geography and openness. However, these studies do not provide a concrete inclination towards the findings of Rodriguez and Rodrik (2001).

Rodriguez and Rodrik (2001) and Irwin and Tervio (2002) followed a cross sectional approach to their study. They purported that trade, institutions, and growth when used together give rise to the endogeneity problem; hence, an instrumental variable must be introduced to avoid reverse causality of growth towards openness and institutions. Acemoglu and Johnson (2005) used European settler mortality rate whereas Alcala and Ciccone (2004) used percentage speaking in major European languages to instrument the institutional quality. Frankel and Romer (1999) used predicted trade share by geography as an exogenous instrument for trade openness.

Albouy (2008) contradicted that European settler mortality rate has serious measurement error in the constructions. Furthermore, the empirical findings based on the data provided by Acemoglu et al. (2002) suggested that the variable used to instrument the institutional quality for property rights institutions is disingenuous. Moreover, settler mortality has been used as a combination of labor mortality rate, bishop mortality rate, and soldier mortality rate which further questions the validity of instrument for property rights institutions. Dollar and Kraay (2003) also support this school of thought, stating that use of historical and geographical factors as instruments would help us little; to detect the separate partial effects of openness and institutions. Similarly, common historical and geographical factors could be useful to determine the institutional quality and openness in the past but wouldn't help us capture the general partial effect of openness and institutions.

Rodrik, Subramanian, & Trebbi (2004) further highlighted the importance of trade integration in determining the cross-country income levels and suggested once institutions are controlled for, the trade has an indirect effect on income. There have been literatures that highlight the importance of diversification on composition of good in exports or imports. However, there haven't been a lot of studies to support the diversification of imports/exports based on the country of origin. Hentschel (1992) does not specifically demonstrate the relationship between imports and economic growth but provides pointers on how import and growth can be measured to avoid measurement errors and bias. It highlighted how bias is possible by double counting capital goods hence encouraging us to disaggregate imports into "Real Imports of Intermediate Goods" and "Capital Goods Imported" to get accurate estimations. Wall (1968) questions the UNCTAD assumption that a simple relation exists between import

capacity and growth. It demonstrates that less developed countries have a similar development pattern as described by the MOSAK model. It emphasizes that policies that worked for developing countries will not have the same effect for the less developed countries. To add on, the rate of growth will be the rate of growth of foreign exchange inflows that is required to finance imports. The share of these increased inflows is a harbinger of non-productive imports. All in all, it suggests for less developed countries import doesn't affect economic growth.

As I discussed earlier, not much work could be found on studies using "Import Diversification Based on Country of Origin" to measure economic growth. Whereas a lot of scholarly journals that talk about growth and import composition can be found. Panchamukhi (1969) largely discusses the importance of import composition and efficiency. The paper studies three slices of manufacturing industry: Paper and paper products sector, nonferrous metals and alloys and machinery and manufacture sector. The findings suggested that the impact of import content on profitability index is not significant and allocating import licensing skill does not seem to be based on efficiency principle. Also, efficiency is inversely proportional to import content. In contrast to the anticipated result, the study found that larger import content has less efficiency. However, the author warns us that there might be possibilities in other sectors that import might have a positive impact on growth. Similarly, Acemoglu and Yared (2010) found that countries experiencing greater militarization than their neighbours have seen a relatively smaller increase in trade over past 20 years. Nevertheless, the findings in this study is still in the infancy stage and much evidence must be accumulated towards the empirical patterns between trade and militarization being a result of causality instead of correlation.

Furthermore, I try to gain more insights on diversification by turning my attention to export diversity. Keun and Ramanayake (2015) explored the relation between economic growth rate and four trade integration variables and test for their interchangeability. Keun and Ramanayake (2015) warn against the traditional emphasis on simple trade openness and FDI as policy prescriptions for developing countries. This implies that inclusion of international integration into a host country will not result in guaranteed sustained economic growth. However, if international integration leads to export growth, then one can see a stronger sustenance of economic growth.

Since I am dealing with diversity, I try to find the best indicators to represent my variables. The robustness of diversity seems to vary across different studies. However, I will include import diversification in my model as an explanatory variable. Esteban (2012) measures the effect of change in import diversification against disposable income, whereas I will be measuring against economic growth. Out of the two tools to measure diversification Hirschman Herfindahl Index (HHI) and Gini Coefficient recommended by Esteban (2012) I will opt for the Herfindahl Index to measure import diversification. Keun and Ramanayake (2015) include import growth and openness to the model. In my case I will be including openness and import growth and a set of control variables used in the same study.

Considering the controversial literatures that have polar views on instrumenting variables for institutional quality, panel data estimation works in my advantage to negate the effects of the variables suggested in the literature. With panel data estimation I can use internal instruments for regressors such as openness and institutional quality that cause endogeneity in the model. The internal instruments are the lagged values of the endogenous regressors. The system generalized

method of moments (GMM) along with panel data model provides methodological advancement to deal with endogeneity problem by using internal instruments efficiently.

Trade theory treats the relationship between openness and economic growth as an intricate and complex matter. Heckscer-Ohlin-Samuelson theorem argues that in the absence of comparative advantage an efficiency gains trade openness does not contribute to economic growth. Nevertheless, Presbisch-Singer hypothesis argues that in the long run, openness may cause losses to the less developed countries due to declining terms of trade; mainly because developing countries export primary products that are income inelastic; however, empirical studies suggest otherwise. Empirical studies (Frankel & Romer, 1999; Dollar & Kraay, 2003; Sachs & Warner, 1995) have found an optimistic trade-growth relationship. Similarly, Melitz (2003), Amiti and Konings (2007), Melitz and Ottaviano (2008), and Topalova and Khandelwal (2011) have found that under an open economy trade has a positive impact on productivity and wage; when changes are made in resource allocation towards the higher return sectors.

According to Dollar (1992), Asian developing economies see a higher economic growth for countries that are outward oriented than countries that are inward oriented. Both distortion and variability of the real exchange rates were combined to calculate the outward orientation index in this study. On the quest to find the effect of trade liberalization on economic growth Sachs and Warner (1995) performed an exercise that concluded open economies perform better than closed economies. The research conducted across 89 developing countries for the time period 1970-1989 explored the variables openness and growth and concluded that open economies experienced 4.49% per-capita income growth annually whereas closed economies experienced a 0.69% per-capita income growth. They even maintained that globally integrated

economies performed exceptionally well than closed economies in exception of extreme macroeconomic crisis and structural change. However, the statement that a country with higher GDP has higher tendency to trade is spurious since endogeneity between openness and growth might have serious influence on the growth effect of trade. The trade of a country is not determined exogenously; to some degree the trade of a country is determined by its overall economic policies which also have a direct role on economic growth. Resultantly, positive effect of trade on growth doesn't mean openness causes economic growth.

Frankel and Romer (1999) took a discrete approach to determine the growth effect of trade openness which included controlling endogeneity between openness and economic growth. This was accomplished by focusing on the geographic component of trade which is assumed to be unaffected by income and economic policies. Countries with higher proximity to the major markets, coastline have higher trade than countries with less proximity.

Gravity trade model suggests that geography of a country signifies a lot about its trade performance. The model uses geographic component of trade to instrument the growth effects of trade. Furthermore, it explains that this trade component is independent of country's income and economic policies. Frankel and Romer (1999) used the Gravity trade model to estimate the predicted trade share which was further examined to identify the impact of predicted trade share on economic growth. Based on the 1985 data, they concluded that a 1% increase in predicted trade-GDP ratio and a lift in income per person could raise the percent per-capita income by 0.5%. Following the research done by Hall and Jones (1999), Frankel and Romer (1999) attempted to investigate the conduit that connects trade and growth. They used the production technology where schooling years is used as a proxy for human capital.

Several literatures support that institutions plays a significant role in the long run economic growth. A firm's profit depends on costs, risks, barriers to entry, and competition. In this backdrop, costs do get affected by institutions such as protection of property rights. Institutions would have an indirect effect on cost through taxes, regulatory burden, corruption level, labor market regulation, infrastructure services, and finance. Moreover, risks get affected through property rights, policy predictability, and contract enforcement. These factors can affect barriers to competition through entry of finance and infrastructure markets.

Acemoglu et al. (2002) has played a significant role in determining the theoretical framework of institutions. The literature asserted that institutions affects long-run growth of economies. To add on, institutions plays a key role in economic development by influencing the incentives of the crucial component of the economy and makes a big impact on investments and product organization. In support of their theoretical framework, Acemoglu and Johnson (2005) conducted an empirical study to further examine the growth-institutions relationship using instrumental variable approach in order to support their theoretical framework. Whenever institutions are introduced to determine the income level of a country it creates endogeneity. In this study, the researchers investigated the colonial history to overcome the econometrics identification problem. As instruments for property rights institutions they used the variables, European settler mortality rate and population density before colonization. Their reasoning behind instrumenting settler mortality rate on property right institutions was that colonies with less health hazards were subject to make permanent settlements as a result of which they would establish good property institutions for themselves. Their research concluded a positive significant effect of property rights institutions on long-run growth. Moreover, they found out

income per-capita is higher for countries that have more protection against expropriation by powerful elites. According to Dowson (1998), institutions have a direct effect on total factor productivity and an indirect effect on investment. The study further states that countries that have better institutional setting have higher total factor productivity and investment. Hall and Jones (1999) saw disparities in institutions and government policies. Furthermore, as institutions cause large differences in human and physical capital, disparity in institutions and government policies causes large differences in income across countries. The study uses colonial origin of a country as instrumental variable where Hall and Jones (1999) argue that influence of Western Europe could be found on the institutions of the countries which had once been colonized.

The theoretical framework and empirical studies suggest that on an independent level trade and institutions have a positive effect on economic growth. However, Rodriguez and Rodrik (2001), and Rodrik et al. (2004) denied the independent growth effects of openness and supported that only institutions have an independent effect on growth. In contrast, Rodriguez and Rodrik (2001), Dollar and Kraay (2003) inspected the relationship between growth and institutions and maintained that it is trade, not institutions that has a direct effect on the long-run per-capita income growth. Research done by Dollar and Kraay (2003) in cross-section studies suggests that when trade and institutions is used together, it is difficult to detect the partial effects of trade and institutions on economic growth. However, the variable, institutions is here treated as an exogenous variable which contradicts the standard institutions-growth literature by Acemoglu and Johnson (2005) that explains institutions as being endogenous to growth. They later concluded that due to lack of proper instruments for trade and institutions, a definitive conclusion could not be achieved through simple cross-country linear instrumental variables

regressions. Alcala and Ciccone (2004) used real openness instead of current openness to identify partial effect of trade on productivity growth while controlling for institutional quality. They concluded that trade openness has significant and robust positive effect on productivity growth when real openness is used.

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Chapter III: Data and Methodology

Methods

This section covers the basic specification of the model that is to be estimated. I use dynamic panel data model to estimate the effect of import diversification on economic growth where import composition is based on the country of origin. The dynamic panel specification of growth equation is as follows:

$$\Delta y_{it} = \Theta + X_{it}\Upsilon + Z_{it}\beta + y_{i(t-1)}\lambda + \alpha_i + \varepsilon_{it} \ldots\ldots\ldots \text{Equation (1)}$$

For i= 1, N. and t=1…., T.

Where $\Delta y_{i,t}$ is the growth of per-capita real GDP of country i at time t and is measured as change of log of per-capita real GDP between end of the period and start of the period. X_{it} is a set of control variables that includes population growth rate, gross capital formation as a percent of GDP, and secondary enrolment rate as proxy measure of human capital. Hence, this is an extension of the augmented Solow model. Variable Z_{it} includes my variables of interest: import diversification, openness, and institutional quality. The disturbance term consists of two components; α_i is a time-invariant unobservable and ε_{it} is a time-varying unobservable. In cross section studies, Distance from the Equator and country size measured in terms of area were used as geographic control variables, so α_i will capture geographic heterogeneity in my specification.

The equation above is based on the studies conducted by Dollar and Kraay (2003) and Rodrik et.al. (2004) where I extend the basic specification used in the cross-section studies to panel estimation and changed some control variables. Since, I have included institutions and openness in my model I may be capturing reverse causality while estimating economic growth.

For instance, countries with high economic standing may improve institutional quality for reasons other than institutions. Whereas, deterioration in economic environment may affect the quality of institutions development. Dollar and Kraay (2003), Rodrik et.al. (2004), and Alcala and Ciccone (2004) argue that institutions are endogenous with trade and growth; so simple ordinary least square (OLS) cannot estimate growth consistently when institutions, growth and trade are used together. The best way to get rid of possible problem of endogeneity caused by introducing openness and institutional development to growth model is by using instruments. Though Acemoglu and Johnson (2005) used European settler Mortality rate and population density to instrument institutional quality, proper instruments for both openness and institutional quality that vary both across countries and time is not prevalent in the literatures. I will be using the weak method of controlling endogeneity by introducing lag of explanatory variables as instruments. Hence, I will not be following the two-stage least squares (2SLS) approach since, according to Mileva (2007) this approach along with 2SLS would give me the same results as OLS, i.e., my estimates would be bias.

Arrelano and Bover (1995) and Blundell and Bond (1998) developed and improved the system GMM method to estimate dependent variable by instrumenting lag of explanatory variables to solve for endogeneity. I will be using this method to regress growth on import diversification, openness and institutional quality with other control variables. Over other estimation strategies, system GMM has additional benefits when estimating my model.
In the presence of heteroskedasticity in error variance, system GMM provides efficient estimates over least squares model. Baum, Mark, and Stillman (2003) asserted that system GMM is especially useful when the form of heteroskedasticity is unknown. When equation (1) was tested

for heteroskedasticity in OLS estimation, the Likelihood-ratio test confirmed the presence of heteroskedasticity in error variance. Baum et al. (2003) stressed that in the presence of heteroskedasticity 2SLS could not give consistent results. Due to these shortcomings, I will not be using 2SLS estimation for this study.

System GMM further helps us to solve endogeneity problem. Openness, institutional quality and per-capita real GDP are endogenous when they come together in a model. This means they may have association with the error component that varies across cross section and over time. This problem can be solved by using the lagged-values of the endogenous explanatory variables as instruments. Once the variables have been instrumented with the lagged values, it makes them exogenous. This way I can satisfy my moment conditions that error terms are uncorrelated with explanatory variables and control variables. The validity of the instruments can be checked with Hansen J test for over-identification.

According to Roodman (2006), when time dimension of panel data is short, system GMM gives consistent estimators than differenced-GMM estimators. The differenced-GMM estimators under this condition are weak and can lead to problematic statistical inference. Blundell and Bond (1998) asserted that bias can be eliminated, and precision can be obtained by using lagged differences of the explanatory variables along with the lagged levels of regressors in first differences.

Within GMM estimation, I need to decide if I am going to choose one-step system GMM or two step system GMM. Bond (2002) stated that more efficient estimators can be obtained through two-step system GMM. Moreover, according to Mileva (2007) two-step GMM

estimation gives robust Hansen J-test for overidentification in comparison to one-step system GMM. Thus, I decide to go with two step-system GMM.

In order to estimate my model, all the variables in my equation should have stationary mean. Substantial literature supports the stationarity assumption of per-capita real GDP growth and population growth.[1] However, I cannot expect a stationary mean for import diversification, openness, institutional quality, and secondary enrolment rate. According to Bond (2002) time dummies must be included with system GMM estimation for efficient estimation.

Data

The dataset that I have used for this study is a balanced panel for 161 countries over the period 2003-2017. The data originally obtained had some missing values, so multiple imputation was performed to get a balanced set. My data set includes 86 advanced countries and 75 developing countries. Country classification of high-income countries, upper income countries, lower middle-income countries, and low-income countries was obtained from World Development indicators 2017 of the world bank. The four groups were reduced to two groups: developed countries and developing countries due to small data set yields inefficient results in GMM estimation. The high income and upper middle-income countries were classified as advanced countries, and the low income and low middle income were classified as developing countries. My main variable of interest import diversification was calculated using Hirshcman Herfindahl Index (HHI). The bilateral trade data for this calculation was obtained from UN Comtrade. Hirschman Herfindahl Index measures the diversification of imports based on the country of origin. Therefore, it is a suitable proxy variable for import diversification. Value

[1] A unit root test for population growth, and the result suggested population growth is a stationary series.

range from 0 to 1(1 being the least diverse and < 1 suggesting more diversity. The proxy variable that I used to measure institutional quality is Polity2 Index which is the measure of the level of democracy or autocracy in the country. The minimum values it can take is negative 10 and maximum value is positive 10. In my data set I have values ranging from -10 to 10. The more positive the value gets it suggests the country is getting closer towards democracy. The data for polity2 index is obtained from polityIV dataset, which will be indicating the degree of democracy or autocracy of a country.

Other control variables include, Population Growth which is the annual population growth rate for year t, expressed as a percentage. Openness is a proxy for trade, which is the sum of exports and imports of goods and services measured as a share of gross domestic product measured in current US dollars. Gross capital formation as a percent of GDP is the net capital accumulation that consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Gross secondary enrolment, which is the proxy variable for human capital accumulation, Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the secondary level of education. All the control variables were extracted from the World Development indicators 2017 of the world bank. My dependent variable economic growth is the change of log of per-capita real GDP between end of the period and start of the period. The per capita real GDP was extracted from world bank data in constant 2010 US dollars and the growth rate was self-calculated.

The Summary statistics of the major variables used in my estimation is presented in Table A1 which can be found in the Appendix. According to the table, the average economic

growth based on per capita real GDP over a 15-year period is approximately 4%. The overall average of trade openness is 86% and the level of autocracy or democracy is 3.82. Similarly, the correlation Table A2 from the Appendix shows the possible relation between per-capita real GDP growth and its explanatory variables. My main variable of interest represented by HHI has a negative correlation with economic growth. This makes sense since, higher the HHI, lesser the diversification. Correlation between trade openness and import diversification, represented by HHI, is weak but negative. This could be because growth is expected to have a negative relationship with HHI, which is reflected on openness since, it captures the growth effect. I can see a positive relationship between per-capita real GDP growth and the three predictor variables, gross capital formation as a percent of GDP, trade openness, and level of autocracy and democracy whereas a negative relation is observed between economic growth and population growth rate.

Calculation of Hirschman Herfindahl Index

The sectoral Hirschman index measures the concentration of a region's exports or imports. It tells us the degree to which a country's exports or imports are dispersed across different sectors. In this study, I will be calculating Hirschman Index dispersed across different countries based on the origin of the imports. High concentration levels are an indication of vulnerability. Overtime decrease in the index may be used to indicate broadening of the import/export base. It can be defined as the square root of the sum of squared shares of imports or exports for the region under study. It takes a value between 0 and 1. Higher values indicate that the exports or imports are concentrated in fewer sectors.

According to the United Nations Commodity Trade database (COMTRADE), sectoral Hirschmann index is defined as the square root of the sum of the squared shares of exports or imports of each industry in total exports or imports for the region under study. Mathematically it can be calculated as follows:

$$\sqrt{\sum_{i=1}^{N}\left(\frac{M_j}{M}\right)^2} \quad \text{.....Equation (2)}$$

Where,

M = $\sum_{j=1}^{N} M_j$ which is the total imports of country *j*,

M_j = Import from country j,

According to UN Comtrade HHI can be calculated in several variants. It may be seen without the final square root operation or using percentages instead of fractions. I will be using the HHI in the percentage form.

Interpretation of Hirschman Herfindahl Index

The degree of import diversification across group of economies at some point of time can be calculated using the Hirschman index. Figure 1 represents the average Hirschman index for 15 years from year 2003 to 2017 for developed countries. Similarly, Figure 2 represents the average Hirschman index for 15 years from year 2003 to 2017. In this sample, developed countries such as United State, Switzerland and Japan are relatively diversified. By contrast, Afghanistan, Mali and Somalia are not. The smaller values indicate import base are spread out whereas higher values suggest import base are concentrated, which is an indication of vulnerability.

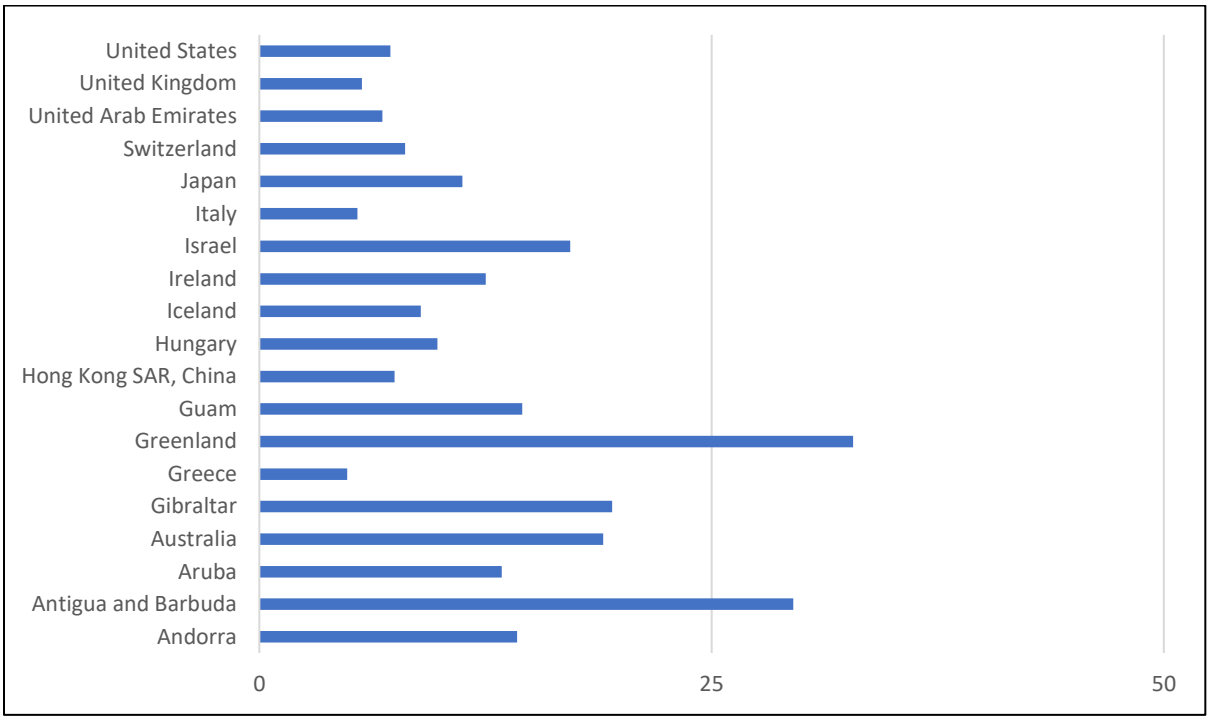

Figure 1: Average Hirschman Index for developed countries from 2003 to 2017.

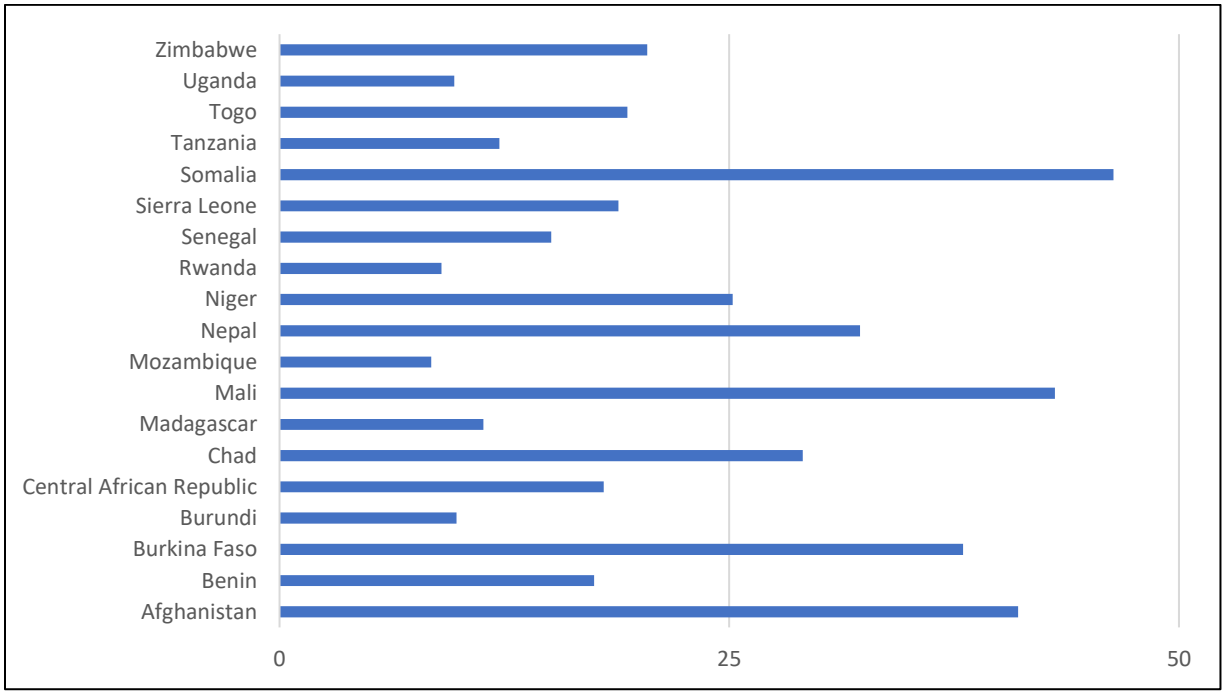

Figure 2: Average Hirschman Index for developing countries from 2003 to 2017.

Chapter IV: Empirical Results

The results of my interest are reported in Table1 computed by using the two-step system GMM. Out of the four columns, the first two specifications exclude secondary school enrolment and last two columns include it. The correlation between starting level per-capita real GDP and secondary enrolment is 0.8, so I try to study if there is a significant effect in my model with this variable included. At the bottom of the table are all the relevant diagnostics reported. For the instruments to be valid, I look at the second order auto correlation test (AR (2)) in disturbances and difference in Hansen's test of overidentification. For both the test I need to fail to reject null hypothesis. It is clear from Table 1 that the high p-values allow me to not reject the null hypothesis hence, supporting the validity of the instruments used in my model. Moreover, difference-in-Hansen tests suggest that my instruments are exogenous.

In two-step system GMM estimation, *Hansen* test for overidentifying restrictions outperforms *Sargan* test, so I report the former test. There were 94 instruments generated as I used two lag variables for institutional quality and openness, and three lags for the difference in the data. The p-values for *Hansen* test are quite high at 5% significance level thus I fail to reject null hypothesis that the overidentification restrictions are valid. These diagnostics support the reliability of the instruments and estimated coefficients reported in my model.

The second and fourth specification include instrument variable for import diversification; to check for any reverse causality if it exists between growth and import diversification. The model without import diversification as instrument does better with higher p-values for the *Hansen* test. Including the instrument did not make significant difference so the model without the instrument variable for import diversification is used to maintain parsimony in

the model. Thus, my focus is on the first specification. In all the four specifications, import diversification appeared with the correct sign. The four control variables those are, per capita GDP at the start of the period, population growth rate, gross capital formation (percent of GDP), and gross secondary enrolment rate appeared with correct signs as well. However, gross capital formation (percent GDP) and population growth appeared statistically insignificant in each specification. Exclusion of these variables weaken my *Hansen* test statistics which indicate the problem of over identification. Thus, I keep these variables in the model. According to Table A2 in the Appendix, secondary enrolment rate has high correlation with lag of per capita real GDP growth rate, population growth rate and polity score. The high correlation could be due to multicollinearity that makes us second guess my results for the specifications including the proxy for human capital i.e. secondary enrolment. If I look at Table A2 in the Appendix, I can see that the correlation between lag of per-capita real GDP is about 0.80 which means that the lagged per-capita real GDP captures the partial effect of secondary enrolment on growth. Thus, I keep aside other specifications and look at the very first specification that gives us the best results.

Table 1

Base Specifications

	1	2	3	4
Dep. Var.: Per-capita real GDP growth rate	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM
Per-capita real GDP growth rate at start of the period	-0.0623***	-0.0598**	-0.121***	-0.127***
	(-3.16)	(-2.39)	(-5.04)	(-5.72)
Gross Capital formation (% GDP)	0.074	0.0531	0.0451	0.035
	(1.35)	(0.97)	(0.97)	(0.83)
Population Growth Rate	-0.189	-0.121	-0.401	-0.305
	(-0.59)	(-0.41)	(-1.07)	(-0.88)
Secondary Enrollment Rate			0.140***	0.162***
			(3.12)	(3.30)
Log (Openness)	0.0832**	0.0699**	0.0516	0.0425
	(2.27)	(2.12)	(1.32)	(1.21)
Polity Score	0.0711***	0.0664**	0.0531***	0.0523***
	(4.81)		(4.44)	
Import Diversification	-0.0201**	-0.019***	-0.0203	-0.013**
	(4.28)	(4.06)	(4.10)	(2.48)
Constant	-0.189	-0.256	-0.0107	-0.0487
	(-1.12)	(-1.48)	(-0.05)	(-0.27)
Arellano-Bond test for AR (1) (p-value>Z)	0.119	0.116	0.005	0.004
Arellano-Bond test for AR (2) (p-value>Z)	0.2670	0.267	0.466	0.451
p-value for Hansen Test	0.55	0.23	0.38	0.23
p-value for Difference Hansen Test	0.839	0.924	0.371	0.331
Prob > F	0.000	0.000	0.000	0.000
Total number of observations	2415	2415	2415	2415
No. of Sample Countries	161	161	161	161

Notes: i) Robust standard errors were used obtain t statistics in parentheses.

ii) * denotes significance at 10% level, ** denotes 5% level significance; and *** presents 1% level significance.

iii) All estimations were performed with time dummies and coefficients are not reported.

iv) The highlighted columns represent results excluding instruments for import diversification

In my preferred model, import diversification is significant at conventional 5% significance level. Effect of import diversification on economic growth is a negative 0.0201 that implies one percentage increase in HHI is associated with a 0.0201% decrease in economic growth, on average, ceteris paribus. One must recall the definition of HHI according to which higher values of HHI suggests less diversification. With this information I can rewrite the interpretation as- a one percent decrease in diversification causes 0.0201% decrease in economic growth. Hence, import diversification and per-capita real GDP exhibit an inelastic relationship. As for trade openness, I see that a percentage increase in trade openness could raise the per-capita real GDP growth by 0.083%. Institutional quality appears to enter the model with the correct sign and is highly significant. As a country moves from autocracy to democracy, i.e., a 1-point increase in autocracy level causes 0.07 percentage point increase in per-capita real GDP growth over 15-year period. My study varies from the literatures due to the presence of panel data estimates; also, not enough literature could be found on import diversification. According to Dollar and Kraay (2002), the researchers conducted dynamic regressions and found that openness had a significant impact on growth. Comparing my results to this research, I can see that, trade openness is insignificant when human capital is introduced in the model.

Using the base specification, I run estimates for the sample of developing country. The results can be seen in Table A3 in the Appendix. I can see that the diagnostics are very similar to the base specification that support the validity of the instruments in my model. For the instruments to be valid, I look at the second order auto correlation test (AR (2)) in disturbances and difference in Hansen's test of overidentification. For both the test I need to fail to reject null hypothesis. It is clear from Table 1 that the high p-values allow us to not reject the null

hypothesis hence, supporting the validity of the instruments used in my model. Moreover, difference-in-Hansen tests suggest that my instruments are exogenous.

This sample contains a total of 75 developing countries. The diagnostics are again very similar to the base specification that support the validity of the instruments in my model. For the instruments to be valid, I look at the second order auto correlation test (AR (2)) in disturbances and difference in Hansen's test of overidentification. For both the test I need to fail to reject null hypothesis. It is clear from Table 1 that the high p-values allow us to not reject the null hypothesis hence, supporting the validity of the instruments used in my model. Moreover, difference-in-Hansen tests suggest that my instruments are exogenous. Coefficient of import diversification for this sample doesn't vary much from my base model and all my estimates for developing countries are similar as well. When all the other variables are held constant, a 1-point increase in import diversification causes a 0.0203% increase in the per-capita real GDP of a developing country. I see a slight increase in the coefficient of openness, which implies that for a developing country, 1 percentage point increase in trade openness causes the economic growth to increase by 0.116 percentage points. Openness and import diversification enter the model significant at 5% level. Institutional quality is significant at 5% level as well.

However, I find significant changes in estimates for developed countries. I sampled 86 countries and ran estimates on the base specification. The diagnostics are similar and support the validity of my instruments. Table A4 in appendix reports the results for the sample of developed countries. Import diversification is significant at only 10% level. Moreover, I see a decrease in the effect of import diversification on growth. The effect of import diversification is less on economic growth for developed countries in comparison to less developed countries. A 1%

increase in HHI is associated with 0.006218% decrease in economic growth for developed countries, ceteris paribus.

The Ordinary Least Squares (OLS) and Fixed-Effect (FE) results are reported in Table A5. This analysis doesn't account for instruments so the estimates have endogeneity bias and cannot be trusted. However, I can see that the estimates for import diversification are significant at 5% level for fixed effect model and at 10% significance level for the OLS estimate. Similarly, gross capital formation is significant at conventional five prevent level for OLS, but the Fixed Effect coefficients are insignificant. The similar phenomenon is observed for trade openness as well. Institutions is highly significant at 1% significance level in both the cases.

Chapter V: Conclusion

Overall, I see a statistically significant effect of import diversification on growth. However, the magnitude of growth effects of import diversification is higher for developing countries than the developed countries. For developing countries, one percent increase in import diversification causes 0.0203% increase in per-capita real GDP growth ceteris paribus. As for developed countries, 1% increase in import diversification causes 0.00621% increase in economic growth. I see that the effect of import diversification is more than twice for developing countries. One of the reasons could be, that developed countries have already reached a stagnation in growth caused by physical capital and human capital accumulation. Hence the the growth effect is minuscule.

With this in the backdrop, I get a chance to contribute to the developing countries better. For developing countries, a diverse portfolio would contribute to a better economy. This result has been achieved through two-step GMM estimation across 75 developing countries over the period of 2003-2017. I performed a dynamic panel data estimation. I considered the endogeneity factor and treated it by using internal instrument variables. The recent methodological advancement in GMM estimation motivated us to work with instrument variables in this project.

As discussed earlier, system GMM helps us solve endogeneity problem. Openness, institutional quality and per-capita real GDP are endogenous when they come together in a model. They have association with the error component that varies across cross section and over time. This problem was solved by using the lagged-values of the endogenous explanatory variables as instruments. Those variables were instrumented with the lagged values, which them exogenous. This way I satisfied the moment conditions that error terms are uncorrelated with

explanatory variables and control variables. The validity of the instruments was checked with Hansen J test for over-identification.

Future Scope

The broad objective of this study was to examine the growth effects of import diversification based on the country of origins. With these results, I can work towards framing better trade policies for developing countries that diversifies the base import countries. This gives some new insights on how developing countries could be better off trading with different pool of countries than making imports from a few concentrated countries. This opens doors to exploring different aspects of import diversification based on country origin. I could look at other economic components such as international relations, the degree of dependency of a country on its neighbouring countries and how they could be influencing the diversification strategies of a country.

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Appendix

Table A1

Summary Statistics of Major Variables

Variables	Mean	Std. Dev.	Min	Max
Per-capita Real GDP Growth	0.04195	0.05804	-0.62075	1.2313
Population growth rate	1.55073	1.16178	-3.58951	16.33163
Gross Capital Formation (% GDP)	24.52788	8.12479	0	73.77735
Gross secondary Enroll Rate	76.53269	27.05249	5.96506	163.93053
Openness as trade ratio to GDP at current US dollars	86.05495	47.95975	1.16741	4441.60380
Level of Democracy and Autocracy	3.82484	1.121965	-10	10
HHI	16.93363	0.15100	23.21234	87.88612

Table A2

Simple Correlation among the Predictor Variables

	$\Delta y_{i,t}$	$y_{i,t-1}$	pop	p_c	h_c	open	polity	HHI
$\Delta y_{i,t}$	1							
$y_{i,t-1}$	-0.0029	1						
pop	-0.2013	-0.5023	1					
p_c	0.0687	0.1531	-0.0563	1				
h_c	0.1347	0.8071	-0.5123	0.2171	1			
open	0.1008	0.1593	-0.0641	0.2142	0.2206	1		
polity	0.1241	0.6256	-0.342	0.251	0.4811	0.0236	1	
HHI	-0.1573	-0.17082	0.3717	-0.0172	0.02016	-0.0256	0.5016	1

Note: •$\Delta y_{i,t}$: change in log of per-capita real GDP. • $y_{i,t-1}$: Per-capita real GDP growth at the start of the period. • pop: population Growth Rate. • p_c: Gross Capital Formation

• h_c: the log gross secondary enrollment rate. • open: openness measured as (Export+Import)/GDP in current prices.

• poliy: polity score for degree of autocracy and democracy. •HHI: Degree of diversification

Table A3

Estimated Results for the Sample of Developing Countries

1	2	3	4	5
Dep. Var.: Per-capita real GDP growth rate	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM
Per-capita real GDP growth at the start of the period	-0.068*	-0.0677**	-0.153*	-0.165**
	(-1.78)	(-1.20)	(-1.75)	(-2.52)
Gross Capital Formation (% GDP)	0.054	0.0421	0.080	0.0857
	(1.21)	(0.92)	(1.38)	(1.62)
Population Growth Rate	-0.0695	-0.0701	-0.258	-0.331
	(-0.30)	(-0.30)	(-0.75)	(-0.84)
Secondary Enrollment Rate			0.134*	0.163*
			(1.77)	(1.9)
Log (Openness)	0.116**	0.129***	0.0598	0.0699
	(2.15)	(2.78)	(1.32)	(1.32)
Polity Score	0.0610**	0.0596**	0.0296	0.0129
	(2.35)	(2.24)	(1.31)	(1.09)
Import Diversification	-0.0203**	-0.0205**	-0.0207	-0.00395
	(2.29)	(2.25)	(0.23)	(0.32)
Constant	-0.181	-0.313	0.205	0.188
	(-0.84)	(-1.47)	-0.49	-0.61
Arellano-Bond test for AR (1) (p-value>Z)	0.150	0.132	0.009	0.009
Arellano-Bond test for AR (2) (p-value>Z)	0.287	0.298	0.323	0.333
p-value of Hansen Test	0.523	0.263	0.4831	0.431
p-value for Difference Hansen Test	0.454	0.826	0.181	0.256
Prob > F	0.000	0.000	0.000	0.000
Total number of observations	1125	1125	1125	1125
No. of Sample Countries	75	75	75	75

Notes: i) Robust standard errors were used to obtain t statistics that are reported in parenthesis.

ii) * denotes significance at 10% level, ** denotes 5% level significance; and *** presents 1% level significance. iii) All estimations were performed with time dummies and coefficients are not reported. iv) Highlighted results exclude instruments for HHI

Table A4

Estimated Results for the Sample of Developed Countries

1	2	3	4	5
Per-capita real GDP growth rate	S-GMM	S-GMM	S-GMM	S-GMM
Per-capita real GDP growth at the start of the period	-0.0721*	-0.0753**	-0.1101	-0.0603
	(-1.94)	(-2.31)	(-1.42)	(-1.13)
Gross Capital Formation (% GDP)	0.0851	0.0831*	0.162**	0.126**
	(1.33)	(1.77)	(2.7)	(2.29)
Population Growth Rate	-0.241	-0.352	-0.145	-0.16
	(-1.13)	(-1.38)	(-0.56)	(-0.61)
Secondary Enrollment Rate			0.0926	0.0454
			(0.71)	(0.37)
Log (Openness)	0.0570	0.0482	0.0401	0.0434
	(1.27)	(1.5)	(0.89)	(1.36)
Polity Score	0.0236	0.0132	0.0303*	0.0317*
	(1.30)	(1.35)	(1.71)	(1.75)
Import Diversification	-0.006218*	-0.00767*	-0.00782*	-0.0075*
	(1.99)	(1.97)	(1.94)	(1.75)
Constant	0.09	0.15	-0.185	-0.354
	(-0.24)	(-0.43)	(-0.42)	(-1.00)
Arellano-Bond test for AR (1) (p-value>Z)	0.022	0.020	0.060	0.035
Arellano-Bond test for AR (2) (p-value>Z)	0.169	0.167	0.230	0.226
p-value of Hansen Test	0.99	0.99	0.99	0.99
p-value for Difference Hansen Test	0.99	0.99	0.99	0.99
Prob > F	0.000	0.000	0.000	0.000
Total number of observations	1290	1290	1290	1290
No. of Sample Countries	86	86	86	86

Notes: i) Robust standard errors were used to obtain t statistics that are reported in parenthesis.

ii) * denotes significance at 10% level, ** denotes 5% level significance; and *** presents 1% level significance. iii) All estimations were performed with time dummies and coefficients are not reported. iv) Highlighted results exclude instruments for HHI

Table A5

Results for Ordinary Least Squares (OLS) and Fixed-Effect (FE)

	1	2
Dep. Var.:Per-capita real GDP growth rate	OLS	FE
Per-capita real GDP growth at the start of the period	-0.016**	-0.335***
	(-2.05)	(-6.17)
Gross Capital Formation (% GDP)	0.0582**	0.0351
	(2.16)	(0.76)
Population Growth Rate	-0.081	0.312
	(-0.51)	(1.14)
Log (Openness)	0.0168*	0.0631
	(1.85)	(1.40)
Polity Score	0.0270***	0.0467***
	(4.2)	(3.32)
Import Diversification	-0.0078*	-0.023**
	(3.97)	(2.76)
Constant	-0.15	2.347***
	(-1.45)	(-5.53)
Total number of observations	2415	2415
No. of Sample Countries	161	161

Notes: i) Robust standard errors were used to obtain t statistics that are reported in parenthesis.

ii) * denotes significance at 10% level, ** denotes 5% level significance; and *** presents 1% level significance.

iii) All estimations were performed with time dummies and coefficients are not reported.