How Does Export Diversification Impact Economic Growth?

By

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The author uses a mixed method approach to conduct a literature review of existing econometric studies to determine the key drivers of export diversification and economic growth, and to examine whether export diversification propels or hinders economic growth. The paper differs fundamentally from previous studies, as it focuses on identifying the key variables used, the frequency with which they are used and their degree of significance based on econometric studies that focused on measuring export diversification, economic growth and the linkage between diversification and growth in developed and developing countries, while highlighting a key gap in this literature, namely a lack of empirical studies focused on small island states.

The author finds that eight variables were used across all studies at a frequency of 10% or greater—namely: real GDP per capita, education, population, domestic investment, market distance, openness to trade, export concentration and rule of law. Based on the literature review, the key factors which support export diversification are human capital accumulation inclusive of higher education, domestic investment, population, quality of institutions, quality of infrastructure and market access. Conversely, the factors that retard export diversification or increase export concentration are: economic distance (remoteness from major markets), openness to trade and declining terms of trade, foreign direct investment, exchange rate volatility and exchange rate overvaluation.

Similarly, with regards to economic growth, the literature review suggests that the key factors which promote economic growth are: rule of law, investment ratio, favorable movements in the terms of trade, technology, higher education and increased international openness; while the factors that inhibit economic growth are fertility rate, the ratio of government consumption to GDP, and the inflation rate. In terms of the key variables used to link export diversification to economic growth, based on the literature, the six main categories of trade integration variables include: export composition, trade orientation, export structure, geographic structure and trade strategy. After having reviewed the extant literature on export diversification and its relationship to economic growth, one of the overlooked areas of research is a lack of studies examining export diversification in small island developing states, and how export diversification may or may not contribute to economic growth in those particular contexts.

> According to the research literature what are the key drivers of export diversification and economic growth and does export diversification propel or hinder economic growth?

Keywords: Export Diversification, Economic Growth, Developing Countries, Developed Countries, Small Island Developing States.

Introduction

Export diversification is widely recognized as a key vehicle for developing countries to grow and transform their economies to advanced or developed status. According to the literature, the process of economic development is typically a process of structural transformation where countries move from producing "poor-country goods" to "rich-country goods" and export diversification plays an important role in this process (Hesse, 2008). Further, economists have found export diversification to be an important factor in explaining the differences in growth performance of East Asian versus Latin American and Caribbean countries (Radelet, Sachs & Lee, 2001; Agosin, 2009). Thus, this literature review focuses on identifying the key determinants of export diversification and economic growth, and the link between export diversification and economic growth as countries move along the development continuum from developing to developed status.

Definition and measurement of export diversification

According to the literature, there is no common definition of, or metrics to measure, export diversification (United Nations' Framework Convention on Climate Change, 2016; henceforth, UN FCCC, 2016). Diversification is defined in a variety of ways according to the field of application (Hvidt, 2013).

> The success of the high-performing East Asian economies...is creating a consensus in the literature that export development and diversification is the new engine of growth

Within the context of political economy, which is the conceptual framework for this literature review, export diversification refers to policies designed to reduce the dependence on a limited number of export commodities that may be subject to price and volume fluctuations or secular declines (Hvidt, 2013). Consistent with this definition, if a country wishes to improve its export diversification, considered a reliable proxy for economic diversification, it would change the composition of the country's existing export product mix or export destinations, or spread its production over many sectors (Samen, 2010).

There is a consensus that a country's degree of export diversification depends upon the number of commodities within its export mix, as well as on the distribution of their individual shares across sectors (Mejia, 2011; UN, 2016). Various measures have been developed to calculate an economy's export diversification. As shown in Table 1, concentration indices serve as a measure in more than 80% of the econometric studies considered in this review. The primary concentration indices considered in the studies include the Herfindahl index (HI), Herfindahl-Hirchmann index (HHI), Gini index and Theil index (Hawaii, 2011; UN, 2016). Other less frequently used measures include variables based on export structure (i.e., horizontal and vertical diversification) and geographical markets (i.e., diversity of export markets).

Evolution of the main driver of economic growth

Economic growth in developing countries has received notable attention in the development economics literature over the past 60 years. Prior to the Second World War, the prevailing development strategy in many developing countries and particularly in Latin America, Africa and South Asia was free trade, premised on Adam Smith and David Ricardo's classical trade theories of comparative advantage, specialization, and international labor division (Samen, 2010). Following the Second World War and heavily influenced by the 1950 Prebisch-Singer hypothesis, the development strategy shifted in favor of import substitution coupled with extensive use of restrictive trade policies to drive development (Samen, 2010).

However, by the mid-1980s, in light of the dismal economic performance of many developing countries that implemented import substitution and restrictive trade policies in the 1960s and 1970s, in contrast to the success story of high-performing East Asian economies that adopted export-led growth policies--the primary development paradigm again undertook a major shift from import substitution-led growth to that of export-led growth and openness to international markets (Taylor, 2003; Samen, 2010). The success of the high-performing East Asian economies that experienced substantial increases in exports of manufactured goods, and high growth rates of their GDP over many decades, is creating a consensus in the literature that export development and diversification is the new engine of growth (Samen, 2010).

The author uses a mixed method approach to review 48 econometric studies to determine the key drivers of export diversification and economic growth and to examine whether export diversification propels or hinders economic growth. This paper differs fundamentally from previous studies, as it focuses on identifying the frequency with which the key variables are used in econometric studies that focus on measuring export diversification, economic growth and the linkage between diversification and growth in developed and developing countries.

For the purposes of this paper, the 48 econometric studies are reviewed based on three groupings where

18 studies focus on the key determinants of export diversification, 16 studies focus on the key determinants of economic growth, and the remaining 14 studies focus on the links between export diversification and economic growth. Further, the explanatory variables are grouped into three broad categories, namely structural factors, policy variables and political institutions.

The paper is structured as follows. The literature summary begins section 2 which provides a summary of the empirical evidence on export diversification. Section 3 provides the methodology for the literature review. Section 4 investigates the measures and key drivers of export diversification in developing and developed countries. Section 5 extends the analysis investigating the measures and key drivers of economic growth in developing and developed countries. Section 6 bridges Sections 4 and 5 by focusing on the drivers that link export diversification and economic growth in the developing and developed country contexts. Finally, Section 7 concludes the research and identifies gaps in the literature that emerge from the study.

Methodology

The general databases searched included Google, Google Scholar, ABI/INFORM Global – ProQuest, EBSCOhost and Web of Science. Based on these searches, approximately 200 articles, dissertations and books were obtained and screened for relevance to the research question. The researcher conducted a review of the references from the selected articles to expand the pool of articles to be analyzed. Further, the articles were reviewed to determine the journals where the articles were published to specifically review those journals to further identify relevant articles. Additionally, searches were also performed to review other articles written by researchers who featured prominently among the articles previously identified. The number of articles was further streamlined by focusing on articles that employed econometric modeling to study drivers of export diversification and economic growth.

Based on the foregoing, the final number of studies selected for inclusion in the literature review was streamlined to 48 articles that met the criteria for inclusion in the study. The researcher performed a detailed analysis of the drivers of export diversification and economic growth used in the econometric models across the articles. The relevant data from the research analysis was tabulated to attain consensus and develop summary findings.

Literature Summary

Rationale for pursuing an export diversification growth strategy

Based on Ansoff's four basic growth strategies defined at the firm level (Ansoff, 1957), diversification within the political economy context has been used as a development (or growth) strategy to transform an economy from using a single source to multiple sources of income spread over primary, secondary and tertiary sectors, involving large sections of the population (see Exhibit 1) (UN, 2016). It is well known that dependence on primary-product exports is one of the main characteristics of developing nations (Mejia, 2011), unlike the developed economies that tend to be involved in primary, secondary, and tertiary activities (Mejia, 2011; Zhang, 2003). (By way of explanation, primary product exports are those products, frequently commodities, produced by the primary sector (agriculture). In contrast, secondary product exports are those products produced by the secondary sector (manufacturing sector); and tertiary product exports are produced by the tertiary sector (service sector). The key differentiating factor between primary on one hand, and secondary and tertiary product exports is the knowledge content embedded in the products.)

Based on the literature, the rationale for promoting economic diversification centers around five key considerations, namely the need to (1) improve terms of trade, (2) mitigate price instability in primary commodity markets, (3) counter the depletion of natural resources, (4) enhance economies of scale and external economies especially associated with manufacturing and (5) reduce portfolio risk (Samen, 2010). Consequently, while diversification is primarily promoted as a development strategy to achieve the twin goals of stability and sustained economic growth, various economists argue that developing countries may engage a diversification strategy to attain multipronged objectives that include (1) meeting the challenges of unemployment and lower growth which feature prominently in some developing countries (Samen, 2010), (2) stabilizing export earnings through diversity of export product mix and destination markets (Sannassee et al., 2014; Hvidt, 2013; Hawaii, 2011; Mejia, 2011), (3) expanding revenue streams (Samen 2010; Hvidt, 2013), (4) retaining and increasing value-added (Hausmann, Hwang, & Rodrik 2007; Hvidt, 2013) and (5) achieving sustainable growth (Hvidt, 2013; Mejia, 2011; UN, 2016).

Dimensions of export diversification

According to the trade literature, export diversification can occur by means of related or unrelated diversification (see Exhibit 2). Within the context of related diversification, export diversification can

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take place through horizontal, vertical or cross-sectoral (diagonal) diversification although horizontal and vertical diversification are the two more well-known forms of export diversification (Agosin, 2009; Samen, 2010; Mejia, 2011; Hvidt, 2013; UN FCCC, 2016). Horizontal diversification takes place within the same sector (primary, secondary or tertiary) and entails diversifying into goods within the same broad category of goods (Samen, 2010; Mejia, 2011), while vertical diversification entails adding more stages of processing of domestic or imported inputs by means of increased value-added activities such as processing, marketing or other services (Hvidt, 2013; Samen, 2010). Furthermore, vertical diversification entails a shift from one sector or industry to another, and generally from the primary to the secondary and tertiary sectors (Hvidt, 2013). Thus, vertical diversification encourages forward and backward linkages in the economy, as the output of one activity becomes the input of another, thereby upgrading the value-added produced locally (Hvidt, 2013).

Risk & diversification

It is well established in the literature that reliance on a narrow economic base could have serious economic and political risks for a country and its people in terms of loss of wealth, income, employment and standard of living. Thus, export diversification can be considered a hedging strategy against adverse trends in commodity prices and volumes, or other exogenous economic or political shocks. Hence, risk mitigation is a key objective of export diversification. In this regard, it is widely accepted that a diversified economy is less sensitive to the ups and downs associated with a particular industry because risk is spread across multiple industries whereby losses in declining industries are offset by opportunities in other stronger industries (Hawaii, 2011). Thus, in the event of an economic shock or natural disaster in the world economy or in a region, export diversification plays a central role in mitigating the associated economic and political risks that may accrue in the short and long run (Hvidt, 2013).

Link between export diversification and economic growth

Since a number of empirical studies have examined the relationship between diversification and growth with the earlier studies predicting a monotonic relationship, more recent studies beginning with Imbs and Wacziarg (2003), found new and robust evidence that economies grow through two stages of diversification as they move along the development continuum (Imbs & Wacziarg, 2003; Aditya & Acharyya, 2013). Essentially, the seminal paper by Imbs & Wacziarg (2003) revealed the presence of a non-linear (i.e., u-shaped) pattern between production and employment diversification and growth whereby the production and employment base of poor countries initially tends to be highly concentrated. However, as the per capita income level of the country grows, poor countries tend to diversify, and it is not until they have grown to relatively high levels of per capita income that incentives to specialize take over as the dominant economic force such that the sectoral distribution of economic activity starts concentrating again. According to Hesse (2008), the turning point for countries that switch from domestic diversification to specialization occurred around US $9,000 of per capita income (based on the Imbs & Wacziarg, 2003 study), which means that most developing countries are actually in the diversifying stage over the course of their development paths.

Following upon the work of Imbs & Wacziarg (2003), several economists examined the relationship between export diversification and economic growth. In this regard, Hesse (2008) reported similar findings in that the effect of export concentration is potentially nonlinear with poorer countries benefiting from diversifying their exports in contrast to richer countries that perform better with export specialization. Likewise, Klinger and Lederman (2004, 2005) and Cadot, Carrere, and Strauss-Kahn (2011a) found a similar nonlinear relationship between export diversification and economic growth. However, Van Zandt, Dutt, and Mihov (2011) poignantly note that these papers simply present a pattern between development and diversification, while leaving aside questions of causality.

In addition, there is tremendous tension in the literature regarding the factors that drive economic growth. There is some consensus in the growth literature that trade and economic factors, inclusive of export diversification, are associated with faster growth and that the relationship between export diversification and growth is economically large (Al-Marhubi, 2000; Hesse, 2007 & 2008; Cadot, Carrere, & Strauss-Kahn, 2011a; Agosin et al., 2012; Mejia, 2011; Dutt et al., 2011). However, there are three other perspectives that also hold prominence in the literature and deserve mention. A second perspective is that location and climate have large ef-

> Reliance on a narrow economic base could have serious economic and political risks for a country and its people in terms of loss of wealth, income, employment and standard of living.

fects on income levels and income growth through their effects on transportation costs, disease burden, and agricultural productivity among other channels (Gallup, Sachs, & Mellinger, 1999; Radelet, Sachs, & Lee, 2001). A third perspective is that the quality of institutions in a country (inclusive of government consumption, rule of law and bureaucratic corruption) are also important determinants of growth which matter more than both the trade and economic factors and the geographic factors (Rodrik, Subramanian, & Trebbi, 2004; Dutt et al., 2011). Finally, there are other economists who take a more moderate approach in arguing that differing factors matter depending upon a country's level of income or development (Lee & Kim, 2009; Barro, 1996; Barro, 2003).

Findings

The determinants of export diversification

Less than 20% (36) of the 193 economies in the world today are considered developed or advanced. Sixteen (16) of the 36 developed economies successfully transitioned within the last 60-years (1961 to present). Thus, the transition period for a country to attain "developed" status can be protracted; as a re-

sult, an overwhelming number of countries remain stuck in transition. Accordingly, the importance of export development and diversification as the new engine of growth (Samen, 2010) for developing countries cannot be overemphasized. However, identifying the true determinants of export diversification is difficult as there exists no comprehensive theoretical or empirical framework to capture all potential factors in their entirety (Jetter & Hassan, 2013). Consequently, the literature review identifies the range of factors used, the frequency with which they are used and their degree of significance in supporting or inhibiting export diversification.

Table 1 depicts the various operationalizations of the dependent variables of interest in our literature review--export diversification and economic growth.

We reviewed eighteen (18) empirical studies that focused their research on identifying the key determinants of export diversification. The determinants or drivers of export diversification are grouped into three broad categories, namely structural factors, policy variables and political institutions. The operationalizations of the explanatory variables as grouped in the categories listed in Table 1 are depicted in Table 2 which discusses each group of explanatory variables.

Table 1: Summary of Dependent Variables

Variable	Indicator	Economic Growth Articles	Export Diversification Articles	Export Diversification & Economic Growth Articles	Total	%
Total number of articles examined		16	18	14	48	
Dependent Variables for export diversification:						
Export concentration	**Concentration Indices**					
	Herfindahl Index (HI)	-	4	-	4	
	Herfindahl-Hirshmann Index (HHI)	-	7	-	7	
	Gini Index	-	3	-	3	
	Theil Index	-	5	-	5	
	Other	-	2	-	2	
		-	21	-	21	81%
Export structure	Horizontal Diversification	-	2	-	2	
	Vertical Diversification	-	1	-	1	
		-	3	-	3	11%
diversification	Diversity of export markets	-	2	-	2	8%
	Total	-	26	-	26	100%
Dependent Variables for economic growth:						
GDP growth rate	Real GDP per capita growth rate	13	-	10	23	77%
GDP per capita	GDP per capita	2	-	3	5	17%
GDP	GDP	1	-	1	2	6%
	Total	16	-	14	30	100%

Table 2: Summary of explanatory variables

Category	Variable	Economic Growth Articles	Export Diversification Articles	Export Diversification & Economic Growth Articles	Total	%	%	%	%	Direction of impact: Positive (+) Negative (-) Both (+/-)
Total number of articles examined		**16**	**18**	**14**	**48**					
Explanatory Variables:										
Structural factors	**Resources (Capital accumulation)**									
	Initial level of development - per person	14	13	11	38	88%	72%	79%	79%	-
	Initial level of development - country	0	5	0	5	0%	28%	0%	10%	-
		14	18	11	43					
	Resources (Human capital)									
	Education	11	7	10	28	69%	39%	71%	58%	+
	Life expectancy	5	2	1	8	31%	11%	7%	17%	+ / -
	Population	13	10	8	31	81%	56%	57%	65%	- / +
		29	19	19	67					
	Resources (Physical capital)									
	Domestic Investment	8	6	11	25	50%	33%	79%	52%	+
	FDI	0	9	5	14	0%	50%	36%	29%	+
		8	15	16	39					
	Resources (Natural resources & industry intensity)									
	Natural resource intensity	3	1	0	4	19%	6%	0%	8%	?
	Agriculture intensity	0	0	1	1	0%	0%	7%	2%	+
	Manufacturing intensity	1	0	1	2	6%	0%	7%	4%	+
	Services intensity	1	0	1	2	6%	0%	7%	4%	+
	Technology intensity	2	0	0	2	13%	0%	0%	4%	+
	Other	1	1	0	2	6%	6%	0%	4%	
		8	2	3	13					
	Geography									
	Market distance	3	11	3	17	19%	61%	21%	35%	-
	Export destinations	4	0	0	4	25%	0%	0%	8%	+
	Environmental vulnerability	1	0	0	1	6%	0%	0%	2%	-
		8	11	3	22					
Policy variables	**Macroeconomic**									
	Inflation	5	2	1	8	31%	11%	7%	17%	-
	Financial Development	1	3	1	5	6%	17%	7%	10%	+
	Exchange rate	1	8	1	10	6%	44%	7%	21%	-
	Other macroeconomic factors	3	0	0	3	19%	0%	0%	6%	
		10	13	3	26					
	Trade integration									
	Openess to trade	13	13	11	37	81%	72%	79%	77%	-
	Export Concentration	2	3	9	14	13%	17%	64%	29%	-
	Terms of trade	3	2	1	6	19%	11%	7%	13%	?
	Vertical Diversification	0	2	2	4	0%	11%	14%	8%	+
	Horizontal Diversification	0	0	2	2	0%	0%	14%	4%	+
	Other trade variables	3	6	3	12	19%	33%	21%	25%	
		21	26	28	75					
	Market access									
	Preferential market access	1	4	0	5	6%	22%	0%	10%	+
	Tariffs & barriers	1	4	1	6	6%	22%	7%	13%	-
		2	8	1	11					
Political institutions	**Fiscal**									
	Savings	**2**	**0**	**0**	2	13%	0%	0%	4%	+
	Government spending	6	1	1	8	38%	6%	7%	17%	-
	National (public) debt	2	0	0	2	13%	0%	0%	4%	-
		10	1	1	12					
	Governance measures									
	Democracy index	3	1	0	4	19%	6%	0%	8%	+ / -
	Rule of law / Quality of Institutions	8	10	4	22	50%	56%	29%	46%	+
	Quality of Infrastructure	0	4	1	5	0%	22%	7%	10%	+
	Other governance variables	2	0	0	2	13%	0%	0%	4%	
		13	15	5	33					

Structural factors

We examine several categories of structural variables that may represent barriers to export diversification. These include factor endowments (capital accumulation or level of development, human capital, physical capital, natural resources) and geographic variables.

Level of development

Real per capita income, a proxy for the level of development, is an explanatory variable in 72% of the diversification studies. The relationship between diversification and per capita income is non-linear wherein an increase in per capita income positively contributes to diversification up to a certain level of

income; thereafter, further increases have a negative effect on export diversification (Imbs & Wacziarg, 2003; Agosin et al., 2011).

Human capital & demographic changes

Human capital issues, measured in terms of education, life expectancy and population, are explanatory variables in 39%, 11% and 56% of the diversification studies, respectively.

Education – There is a positive relationship between education and export diversification. In particular, total net enrollment in primary education is one of the two most important predictors of export diversification (Jetter & Hassan, 2013). Further, the literature reveals that higher levels of education in the labor force allow countries to take advantage of the higher income stemming from positive terms of trade shocks to develop new export sectors (Agosin et al., 2012).

Population (growth & size) – Population, which serves as a proxy for the domestic market size, has a positive impact on export diversification in that larger countries tend to be more diversified due to larger internal markets and higher degree of product differentiation (Cadot et al., 2011b).

Physical capital

Traditional growth theory looks at capital accumulation, which consists of domestic-owned physical capital and foreign-owned physical capital, as the most important determinant of export diversification (Alemu, 2008). According to the literature, gross fixed capital formation as a share of GDP is used to capture the influence of the domestic investment while the ratio of foreign direct investment (FDI) to GDP is used to capture the effects of foreign-owned physical capital (Alemu, 2008).

Domestic investment – Found to be a positive driver of export diversification, domestic investment (public & private) is included as an explanatory variable in 33% of the diversification studies. According to the literature, unless a country commits a sufficient portion of its national income to building domestic capital stock, it is unlikely to be able to diversify (Alemu, 2008). Further, empirical evidence finds that a country which invests a bigger proportion of its output in capital formation is likely to accumulate the necessary infrastructure and equipment more rapidly to allow the country to diversify its production basis (Alemu, 2008).

Foreign direct investment – Measured either as the ratio of foreign direct investment (FDI) inflows to GDP or net FDI to GDP, FDI is included as an explanatory variable in 50% of the diversification stud-

ies. Across the literature, FDI is found to have a significant impact on export diversification, although the direction of impact is somewhat complex and unsettled. There is some consensus that FDI supports higher productivity and contributes to export diversification only when the host country has a minimum threshold stock of human capital to allow for sufficient absorptive capability of the advanced technologies within the host economy (Alemu, 2008).

Natural resource intensity

Natural endowment is an explanatory variable in fewer than 10% of the diversification studies. However, it is unclear whether abundant natural resources support or hinder diversification.

Geography

Market distance is an explanatory variable in 61% of the diversification studies. Based on the literature, there is a negative relationship between trade costs (distance) and export diversification whereby distance operates as a cost on trade, making goods with marginal comparative advantages less likely to be produced and exported (Agosin et al., 2012).

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Policy variables

Macroeconomic

Inflation – Though an explanatory variable in 11% of the diversification studies, the impact is mainly insignificant (Alemu, 2008; Jetter & Hassan, 2013).

Financial development – Financial development, an explanatory variable in 17% of the studies, has no significant effect on export diversification (Agosin et al., 2012).

Exchange rate – Exchange rate is an explanatory variable in 44% of the diversification studies. The literature suggests that an overvalued exchange rate may reduce export profitability directly while real exchange rate volatility may indirectly reduce export profitability through an increase in uncertainty (Agosin et al., 2012). Both variables have been found to have a negative effect on export diversification although researchers generally find the effect of these variables on export diversification to be insignificant. This does not suggest that exchange rates policies are not important for the development of the export sector, instead it suggests that other structural factors, such as human capital and remoteness, dominate over the potential negative consequences of exchange rate overvaluation and volatility (Agosin et al., 2011). In contrast, Abeysinghe and Yeok (1998) empirically investigate the impact of currency appreciation on exports in the case of Singapore and find that in the presence of high import content,

exports are not adversely affected by currency appreciation because the lower import prices (due to appreciation) reduce the cost of export production.

Trade integration

Trade openness – Trade openness, measured either by the ratio of the sum of exports and imports to GDP or exports to GDP, is an explanatory variable in 72% of the 18 diversification studies examined. There is growing consensus in the literature, based on robust empirical evidence across specifications and indicators, that trade openness induces higher specialization and not export diversification (Agosin et al., 2012; Bebczuk & Berrettoni, 2006).

Terms of trade – Terms of trade, typically defined as the ratio of an index of a country's export prices to an index of its import prices, is included as an explanatory variable in 11% of the diversification studies examined. Based on the literature, consistent with a Dutch disease effect, improvements in the terms of trade tend to concentrate exports in countries with low human capital; this effect is lower for those countries with higher levels of human capital (Agosin et al., 2013). Conversely, the literature suggests that improvements in terms of trade have a positive effect on export diversification for those countries with relatively high levels of skilled labor since skill-abundant countries tend to take advantage of the positive real-income effects of terms of trade improvements to further diversify their exports (Agosin et al., 2012).

> Artificial barriers such as tariffs, quotas and export costs vary across countries and have a negative effect on export diversification.

Market access

Preferential market access – Preferential market access is an explanatory variable in 22% of the diversification studies. Proxied by country membership in preferential trade agreements, some researchers found a robust positive relationship between preferential market access and export volumes as well as the initiation of export of new products (Van Zandt et al., 2009; Mihov, 2011; Cadot et al., 2011b).

Tariffs & barriers – Tariffs and barriers are an explanatory variable in 22% of the diversification studies. Based on the literature, artificial barriers such as tariffs, quotas and export costs vary across countries and have a negative effect on export diversification (Mihov, 2011). While some researchers find these variables to be robustly associated with geographical export diversification (Mihov, 2011: Van Zandt et al., 2009; Shepherd, 2010; Cadot et al., 2011b), others find them to be insignificant (Jetter & Hassan, 2013).

Political institutions

Governance factors – Measured in terms of rule of law (quality of institutions), governance is included in 56% of the diversification studies examined. Rule of law (quality of institutions) is positively correlated with diversification.

The Determinants of Economic Growth

Petrakos states, "Due to the lack of a unifying theory on economic growth, a substantial volume of empirical research has multi-theoretical bases. This means that studies draw on several theoretical frameworks and examine factors highlighted by many paradigms. As a result, findings are often contradictory and far from conclusive" (Petrakos, 2008). Accordingly, the literature review identifies the factors used, the frequency with which they are used and their degree of significance in supporting or inhibiting economic growth as countries move along the development continuum from developing to developed status.

In this section, we review eighteen (16) empirical studies that focused their research on identifying the key determinants of economic growth. For the purposes of the review, the determinants or drivers of economic growth are grouped into four broad categories, namely: structural factors, natural resources & capital accumulation, policy variables and political institutions.

Structural factors

We reviewed five categories of structural variables that may represent natural and situational barriers to economic growth. These consist of factor endowments (namely capital accumulation, human capital, physical capital, natural resources & industry intensity variables) and geographic variables.

Initial conditions (level of development)

GDP per capita serves as one of three indicators of the level of development that exists within a country at a given point in time. GDP per capita is an explanatory variable in 88% of the growth studies and 79% of the studies that link diversification and growth. Across the literature, the three indicators used to measure initial conditions or initial level of development include GDP per capita, level of human capital (educational attainment) and life expectancy. The evidence indicates that there exists a negative relationship between the starting level of GDP per capita and economic growth whereby countries with higher GDP per capita tend to grow at a slower rate than countries with a lower level of GDP per capita. Barro states, "In particular, if countries are similar with respect to structural parameters for preferences and technology, then poor countries tend to grow faster than rich countries. Thus, there is a force that promotes convergence in levels of per capita income

across countries" (Barro, 1991). "The convergence is conditional in that it predicts higher growth in response to lower starting GDP per person only if the other explanatory variables are held constant" (Barro, 2003). Without controlling for other variables, there is no simple relationship between income levels and growth rates (Barro, 1991).

Human capital & demographic changes

Human capital, which features prominently in the empirical growth literature, has been found to be an important driver of economic growth. Human capital, measured in terms of education, health (life expectancy) and population, is included as explanatory variables in 69%, 31% and 81% of the empirical growth studies, and 71%, 7% and 57% of the studies that link diversification and growth respectively.

Education - Many empirical studies use years of schooling at the secondary or tertiary level as the key indicator for growth, and generally find a significant positive relationship between education and growth. However, several studies find a weak direct link between education and growth and cited measurement problems as one possible explanation for the weak link. According to the literature, what is important for economic growth is not the number of years of schooling alone, but also the quality of education (that is, the quality of the labor force). However, quality measures such as internationally comparable test scores, which have much more explanatory power for growth and are arguably a better determinant of human capital accumulation, tend to be unavailable for many countries (Barro, 2003).

> Human capital, which features prominently in the empirical growth literature, has been found to be an important driver of economic growth.

Several studies disaggregate the education variable to consider different aspects of education. For example, Barro (1996 and 2003) disaggregates the education variable to separately examine years of schooling for males and females and finds a significantly positive effect for males aged 25 and over but finds that female education is not significantly related to growth. Similarly, Lee and Kim (2009) disaggregate the education variable for countries based on their income level and find that while the effect of secondary education on growth is significant for lower middle-income and low-income countries, more advanced factors like tertiary education and technological innovation are significant for high-income countries.

Population (growth & size) – Economists have generally given scant attention to the relationship between demographic change and economic growth. In the econometric analyses examined in this section, the population variables typically relate to population growth rates and size with the most commonly used variable being the growth rate of the total population, the working-age population, or to a lesser extent, the fertility rate. In terms of population size, the variables typically used include: (1) total population, (2) total working-age population (i.e.,15 to 65 years), (3) land area and (4) Gross Domestic Product (GDP).

Population (fertility) growth rates – The studies generally find that increases in population growth rates and fertility rates tend to be significantly negatively correlated with long-term economic growth. However, some studies disaggregate population growth and find that when growth of the working age population outpaces the growth of the overall population, growth of GDP per capita increases (Radelet, Sachs, & Lee, 2001).

Population (country) size – An expanded literature review finds that country size receives limited attention as a determinant of economic growth, likely because traditional measures of country size (i.e., population or land area), generally do not have much explanatory power (Alesina, Spolaore, & Wacziarg, 2005) or provide inconclusive results. For instance, Barro (2003) and Rose (2006) find no evidence that country size matters for growth, while Alouini and Hubert (2018) find a significant negative correlation between country size and growth. Similarly, Alesina, Spolaore and Wacziarg (2005) find that size matters for economic performance.

According to Alesina, Spolaore and Wacziarg (2005), a country can be small and prosperous or, at the very least, size alone does not guarantee economic success. They note that: (1) of the five largest countries in the world in terms of population, only the United States is rich, (2) among the richest countries in the world, most have populations well below the world median of about 6 million in 2000, (3) the richest country in the world in 2000, in terms of income per capita, was Luxembourg, with less than 500,000 inhabitants, and (4) between 1960 -1990, the fastest growing country in the world, in terms of income per capita, was Singapore, with a population of only 3 million inhabitants.

Life expectancy – Used as an indicator of the overall health of the population, life expectancy has been found to be a significant positive driver of economic growth. However, the positive effect on growth diminishes as life expectancy increases, and once it passes a particular age level, further increases actually have a negative effect on growth (Radelet, Sachs, & Lee, 2001).

Physical capital

Domestic Investment – Found to be a positive driver of economic growth, domestic investment (public & private) is an explanatory variable in 50% of the growth studies and 79% of the diversification and growth studies examined in this section. Domestic investment is identified across the empirical growth literature as the most fundamental determinant of economic growth by both neoclassical and endogenous growth models (Petrakos & Arvanitidis, 2008). Many notable studies across the growth literature find a significant positive relationship between domestic investment and economic growth. However, others find the relationship to be positive but insignificant (Barro, 1991, 1996, & 2003).

Foreign direct investment – FDI is a variable in 36% of the studies that link export diversification and economic growth. Further, an expanded literature review finds that FDI not only directly promotes economic growth by itself, but also indirectly promotes economic growth via its interaction with human capital and technology (Tang et al., 2008; Li & Liu, 2005; Borensztein et al., 1998; Choe, 2003). For example, according to Li and Liu (2005), the interaction of FDI with human capital exerts a strong positive effect on economic growth in developing countries, while the interaction of FDI with the technology gap has a significant negative impact.

Based on the literature review, there is a debate as to the relative importance of FDI and domestic investment in supporting economic growth. While some notable studies such as Borensztein et al. (1998) find that FDI contributes more to economic growth than domestic investment when the host country has a minimum threshold of human capital, others such as Tang et al. (2008) find the opposite. Despite the debate, there is general consensus that instead of crowding out domestic investment, FDI is found to be complementary with domestic investment in supporting economic growth.

Natural resources & industry intensity

Natural resource intensity – Natural endowments, which may form the bedrock of a comparative competitive advantage, are included as an explanatory variable in 19% of the growth-only studies examined; however, this variable is not included in the studies that link diversification and growth. Researchers generally find a negative relationship between countries endowed with abundant natural resources and economic growth as these countries tend to place overreliance on the natural resources to the detriment of other sectors of the economy

(Radelet, Sachs, & Lee, 2001). Conversely, Bebczuk and Berrettoni (2006) and Lederman and Maloney (2003) compellingly contradict the general perspective which finds that natural resource abundance has a positive effect on growth.

Technology intensity – This variable is an explanatory variable in 13% of the growth studies, but it is not included as a variable in any of the studies that link diversification and growth. Technology intensity is measured using either (1) R&D to GDP or (2) number of patents per segment of the population. Technology intensity is found to have a significant positive effect on economic growth for upper middle- and high-income countries (Lee & Kim, 2009). According to Bassanini and Scarpetta (2001), there seems to be consensus that R&D may have a persistent effect on growth; that is, higher R&D expenditure would, other things equal, be associated with permanently higher growth rates.

Geography

Geography, measured in terms of market distance, geographic structure and environmental vulnerability are included in 19%, 25% and 6% respectively of the empirical growth articles examined. Market distance is found to have a negative effect on economic growth. The commonly used measures of market distance are distance from major markets (i.e., New York, Tokyo and London) and a country's distance from the equator. Geography is an exogenous determinant for which the main challenge is to identify the main channel(s) through which it influences economic performance (Rodrik et al., 2004). Based on the literature, geography may influence growth directly through the level of productivity and transport cost. However, location and climate have large effects on income levels and income growth, through their effects on transport costs, disease burdens, and agricultural productivity, among other channels (Gallup et al., 1999).

Policy variables

Macroeconomic

A central objective of macroeconomic policies is to provide a stable macroeconomic environment that fosters sustained economic growth while keeping inflation low (Chen & Feng, 2000; Gokal & Hanif, 2004; Bick, 2010). Growth studies have, however, considered three issues with respect to macroeconomic policy settings, namely (1) the benefits of establishing and maintaining low inflation, (2) the impact of government deficits on private investment, and (3) the possibility of negative impacts on growth

> There is a debate as to the relative importance of foreign direct investment and domestic investment in supporting economic growth.

stemming from too large a government sector (Bassanini & Scarpetta, 2001).

Inflation – Included as an explanatory variable in 31% of the growth-only studies and less than 10% of the studies that link diversification and growth, the empirical findings on the inflation and growth relationship have been mixed. There is some evidence that high and volatile inflation has a negative and statistically significant effect on growth. Further, some researchers find that statistically significant results emerge only when inflation is above 10% (Barro, 1996, 2003, & 2013; Bassanini & Scarpetta, 2001; Bick, 2010; Gokal & Hanif, 2004; Khan & Senhadji, 2001). Based on the literature, while contemporaneous inflation has substantial explanatory power, lagged inflation values do not (Barro 2003, 2013).

Financial development – Financial system is endogenous with respect to general economic development and is included as an explanatory variable in fewer than 10% of the growth, and diversification and growth studies examined. According to the literature, financial systems promote economic growth by providing funding for capital accumulation and by helping the diffusion of new technologies (Bassanini & Scarpetta, 2001). Based on the literature, the ratio of private financial system credit to GDP is the more frequently used measure of financial development. On the issue of causality, there appears to be contradiction in the literature as some analyses find that

> Some analyses find that growth may prompt the development of financial systems...while others find causality runs from financial development to economic growth

growth may prompt the development of financial systems, thus there may be an element of reverse causality (Bassanini & Scarpetta, 2001), while others find causality runs from financial development to economic growth, but not in the opposite direction (Caporale et al., 2009).

Exchange rate – For the basic same reasons as previously discussed, real exchange rate volatility and exchange rate overvaluation have both been found to have a similar negative impact on economic growth. Exchange rate is included as an explanatory variable in fewer than 10% of the growth, and diversification and growth studies examined.

Trade integration

Trade openness – Trade openness is an explanatory variable in 81% of the growth studies and 79% of the studies that link diversification and growth. Trade openness is measured by the ratio of exports plus imports to GDP. The relationship of trade openness to growth makes for interesting and rich debate with numerous divergent perspectives posited by distinguished economists such as Barro (2003), Radelet et al. (2001), and Gallup, Sachs and Mellinger (1999)

who find a positive relationship while Lee and Kim (2009) and Rodrik et al. (2004) find that openness is not important for growth.

Terms of trade – Terms of trade, measured as the ratio of export prices to import prices, are included as an explanatory variable in 19% of the growth-only studies and less than 10% of the diversification and growth studies examined in this section. The literature finds that changes in the terms of trade have a positive and statistically significant effect on economic growth. Changes in the terms of trade, which depend primarily on world conditions, have often been stressed as an important negative influence on developing countries, which typically specialize their exports in a few primary products with relatively low export prices (Barro, 1996, 2003).

Political institutions

Fiscal policy – Fiscal policy, measured in terms of savings, government consumption and national debt, is an explanatory variable in 13%, 38% % and 13% of the empirical growth studies examined. Based on the literature, savings is positively associated with economic growth while government consumption and national debt are negatively associated with economic growth. The empirical results suggest evidence of an inverse, nonlinear relationship between debt and growth with higher levels of initial debt having a proportionately larger negative effect on subsequent growth (Checherita-Westphal & Rother, 2012; Kumar & Woo, 2010).

Governance measures – Governance, measured in terms of rule of law (quality of institutions) and democracy index are explanatory variables in 50% and 19% of the empirical growth studies examined. Rule of law (quality of institutions) is positively correlated with economic growth. However, as it relates to the democracy index, there is evidence of a nonlinear relationship whereby at low levels of political rights, an expansion of these rights stimulates economic growth. However, once a moderate amount of democracy has been attained, a further expansion reduces growth. Further, democracy does not emerge as a critical determinant of growth (Barro, 1991, 1996, & 2003).

Discussion

The link between export diversification and economic growth

Al-Marhubi states, "During the last two decades the role of international trade has received considerable attention in the literature on economic growth. Yet

there have been remarkably little systematic empirical investigations into the implied links between export diversification and long-term growth" (Al-Marhubi, 2000). Therefore, the implied links continue to be highly controversial.

The ex-ante theoretical predictions assume that two primary mechanisms explain the link between export diversification and economic growth. The first mechanism concerns the stabilization of export income, which is particularly important for developing and less developed countries whose primary export products (commodities) often suffer from price fluctuation in the international markets. These fluctuations in turn may elevate uncertainties in macroeconomic conditions which may be harmful to economic growth. In essence, a higher degree of export diversification has the ability to reduce the volatility of export prices of goods by creating greater stability in export income. More stable export income will increase purchasing power, boost investment and as a consequence result in higher economic growth (Ghosh & Ostry, 1999). Consistent with predictions by Prebish-Singer, Agosin (2007) further noted that low levels of export diversification will lead to high fluctuations in export income which in turn depresses economic growth.

Several studies analyzed in this paper sought to identify the specific channels through which export diversification is linked to economic growth. Agosin (2009) speculated that there are two channels through which diversified export growth stimulates output growth: (1) portfolio effect and (2) the dynamic benefits associated with successful efforts to diversify comparative advantages.

Despite the possible links identified above, Samen (2010) identifies studies which challenge the position that export diversification and economic growth are linked.

Moreover, the empirical results to date do not resolve the theoretical contradictions. On the one hand, the literature indicates that diversified exports have a positive effect on growth in general (Lederman & Maloney, 2003) and is robustly demonstrated to have a positive effect on the economic growth of developing countries (Hesse, 2008; Agosin, 2009). On the other hand, according to Al-Marhubi (2000), most existing empirical work has been confined largely to examining various aspects of trade, with particular emphasis on the importance of trade orientation, export expansion and export composition. To this end, the literature review reveals that researchers tend to study the following dimensions of the trade, export diversification and economic growth relationships:

> There is a stark absence of research examining the extent of export diversification in Small Island Developing States (SIDS).

1. **Export composition** – Export composition relates to industry composition (specifically primary, secondary & tertiary sectors) and product composition (i.e., rich country goods versus poor country goods). As summarized in Table 2, the natural resources and industry intensity variables are used, on average, by less than 5% of studies examined.
2. **Trade orientation** – Trade orientation relates to import substitution versus export-led growth. The primary indicator is trade openness and, as shown in Table 2, 77% of the studies use this indicator.
3. **Geographic structure** – Geographic structure relates to market distance, export destinations/trading partners, and environmental vulnerability. As shown in Table 2, market distance was used in 61% of the export diversification studies while export destination/trading partners, and environmental vulnerability were used in less than 10 % of all studies.
4. **Trade strategy** – Trade strategy relates to preferential market access and tariffs & barriers. As shown in Table 2, preferential market access and tariffs & barriers were used in 22% of the export diversification studies.

Conclusion

Gaps in the literature

After having reviewed the extant literature on export diversification and its relationship to economic growth, it is evident that there is a stark absence of research examining the extent of export diversification in Small Island Developing States (SIDS). More important, it is unclear if and how export diversification contributes to their economic growth. This is surprising since SIDS represent an aggregate (domestic) population of 67 million with a combined GDP of $605 billion and are often located in geographic areas that are particularly prone to weather or other natural events that may significantly impact their growth and long-term survival. Furthermore, some SIDS suffer significant brain drain to developed countries, depleting the best of their human capital, which not only further threatens the survival of these states, but also adds to the immigration concerns in developed nations.

The 2002 UN report highlights multiple factors which make export diversification particularly challenging for small island developing states (Binger et al., 2002). The challenges arise from an interplay of a number of special factors including smallness, re-

moteness, geographical dispersion, vulnerability to natural disasters, the fragility of their ecosystems, constraints on transport and communication, isolation from markets, lack of natural resources, limited fresh water supplies, heavy dependence on imports and limited commodities, depletion of non-renewable resources, migration (particularly of personnel with high-level skills) and their limited ability to reap the benefits of economies of scale. Yet, there are several small islands that have successfully evolved from developing to developed nation status, suggesting that there may be a path by which SIDS can become economically advanced. Thus, studying export diversification patterns in small island developing states and their link to economic growth is of crucial importance to inform economic policies in those countries. Accordingly, the proposed study is highly warranted.

References

Aditya, A., & Acharyya, R. (2013). Export diversification, composition, and economic growth: Evidence from cross-country analysis. *The Journal of International Trade & Economic Development, 22*(7), 959-992, doi: 10.1080/09638199.2011.619009

Agosin, M.R. (2007). Export diversification and growth in emerging economies. Working paper no. 233, *Department of Economics, University of Chile, Santiago, Chile*.

Agosin, M.R. (2009). Export diversification and growth in emerging economies. *Cepal Review, 97*.

Agosin, M.R., Alvarez, R., & Bravo-Ortega, C. (2012). Determinants of export diversification around the world: 1962-2000. *The World Economy 35*, 295-315.

Alemu, A.M. (2008). Determinants of vertical and horizontal export diversification: Evidences from Sub-Saharan Africa and East Asia. *Ethiopian Journal of Economics, 17*(2).

Alesina, A., Spolaore, E., & Wacziarg, R. (2005). Trade, growth and the size of countries. In *Handbook of economic growth* (Vol. 1, pp. 1499-1542). Elsevier. doi:10.1016/S1574-0684(05)01023-3

Al-Marhubi, F. (2000). Export diversification and growth: An empirical investigation. *Applied Economics Letters, 7*, 559-562.

Alouini, O. & Hubert, P. (2018). *Country size, economic performance and volatility.* Retrieved from http://hubertpaul.free.fr/Country_Size.pdf

Ansoff, H. I. (1957). Strategies for diversification. *Harvard Business Review*, *35*(5), 113-124.

Bassanini, A., & Scarpetta, S. (2002). The driving forces of economic growth. *OECD Economic studies*, *2001*(2), 9-56.

Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, *106*(2), 407-443.

Barro, R. J. (1996). *Determinants of economic growth: A cross-country empirical study* (No. w5698). National Bureau of Economic Research.

Barro, R. J. (2003). Determinants of economic growth in a panel of countries. *Annals of Economics and Finance*, *4*, 231-274.

Barro, R. J. (2013). Education and economic growth. *Annals of Economics and Finance*, *14*(2), 301-328.

Bebczuk, R. N., & Berrettoni, N.D. (2006). Explaining export diversification: An empirical analysis. *CAF Research Program on Development Issues.*

Bick, A. (2010). Threshold effects of inflation on economic growth in developing countries. *Economics Letters*, *108*(2), 126-129. doi:10.1016/j.econlet.2010.04.040

.Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011a). Export diversification: What's behind the hump? *Review of Economics and Statistics*, *93*(2), 590-605.

Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011b). *Trade diversification: Drivers and impacts.* Retrieved from https://pdfs.semanticscholar.org/8132/e45955582e2ec85987e982172fd2e2c-b11a5.pdf

Chen, B., & Feng, Y. (2000). Determinants of economic growth in China: Private enterprise, education, and openness. *China Economic Review*, *11*(1), 1-15.

Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. *European Economic Review*, *56*(7), 1392-1405.

Gallup, J. L., Sachs, J. D., & Mellinger, A. D. (1999). Geography and economic development. *International Regional Science Review*, *22*(2), 179-232.

Ghosh, A. R., & Ostry, J. D. (1994). Export instability and the external balance in developing countries. *Staff Papers*, *41*(2), 214-235.

Gokal, V., & Hanif, S. (2004). *Relationship between inflation and economic growth.* Economics Department, Reserve Bank of Fiji.

Hausmann, R., Hwang, J., & Rodrik, D. (2007). What you export matters. *Journal of Economic Growth 12,* 1-25. doi:10.1007/s10887-006-9009-4.

Hvidt, M. (2013). Economic diversification in GCC countries: Past record and future trends. Kuwait Program on Development, Governance and Globalization in Gulf States. London School of Economics and Political Science.

Imbs, J., & Wacziarg, R. (2003). Stages of diversification. *American Economic Review*, *93*(1), 63-86.

Jetter, M., & Hassan, A. R. (2013). *The roots of export diversification.* Department of Economics, School of Economics and Finance, Universidad EAFIT, Medellin, Columbia. Retrieved from https://repository.eafit.edu.co/bitstream/handle/10784/600/2013.

Kumar, M. S., & Woo, J. (2010). *Public debt and growth*. IMF Working Paper WP/10/174.

Lee, K., & Kim, B. Y. (2009). Both institutions and policies matter but differently for different income groups of countries: Determinants of long-run economic growth revisited. *World Development*, *37*(3), 533-549.

Lederman, D., & Maloney, W. (2003). Trade structure and growth. World Bank Policy Research Working Paper N 3025.

Mejía J.F. (2011) Export Diversification, International Trade, and Economic Growth: A Survey of the Literature. In: Export Diversification and Economic Growth. Contributions to Economics. Physica, Heidelberg. doi 10.1007/978-3-7908-2742-2_2

Mihov, I. (2011). On the links between trade diversification and economic development. *Macroeconomic Review*, Monetary Authority of Singapore Economic Policy Group.

Radelet, S., Sachs, J., & Lee, J. W. (2001). The determinants and prospects of economic growth in Asia. *International Economic Journal, 15*(3).

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, *9*, 131-165.

Samen, S. (2010). A primer on export diversification: Key concepts, theoretical underpinnings and empirical evidence. *Growth and Crisis Unit World Bank Institute*, 1-23.

Sannassee, R. V., Seetanah, B., & Lamport, M. J. (2014). *Export diversification and economic growth: The case of Mauritius.* WTO, Geneva, 11-23. Retrieved from http://www.wto.org/english/res_e/booksp_e/cmark_full_e.pdf.

Shepherd, B. (2010). Geographical diversification of developing country exports. *World Development, 38*(9), 1217-1228.

Taylor, T. G. (2003). Export diversification in Latin America and The Caribbean. *The International Trade Journal, 17*(2).

Van Zandt, T., Dutt, P., & Mihov, I. (2011). Export diversification and growth. *Journal of Public Economic Theory*. Submission Number: PED11-11-00032.

Zhang, L. (2003). *Economic diversification in the context of climate change.* UNFCCC Workshop on Economic Diversification. United Nations.

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