Is GVC participation the silver bullet? Does it bring economic growth and on what conditions?

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Date: 20/10/2015

1. Introduction

Trade has grown exponentially in the last decades, from 296 billion dollars' worth of trade in 1950 to 20 trillion dollars in 2010. It is estimated that those 20 trillion dollars of world trade, nearly 60 percent consists of trade in intermediate goods and services (UNCTAD, 2013). Dedrick, Kreamer & Linden (2009) proved just how fragmented production is when they looked into the construction of an iPod; the product contains hundreds of parts sourced from over all over the globe. Due to the high amounts of intermediate trade, goods cross multiple borders before reaching their final destination. Consequently, the high amount of intermediate goods trade leads to discrepancies when it comes to trade accounting. It is estimated that 28 percent, or 5 of the 20 trillion, of the world trade is "double counted", which means that the intermediate products are counted multiple times in the exports of different countries, therefore creating a higher value of exports for the countries involved than merely their value-added in capital and labour (UNCTAD, 2013). Luckily, scholars have been working hard and have created new databases where trade is no longer measured in gross trade values, but in value-added, looking only at the value which one country adds to a product (Timmer et al, 2014a).

With new data comes the opportunity to research new questions. One of the key topics since the start of the fragmentation of trade is global value chains (GVCs). Global value chains encompass all the activities needed to bring a product to the market. These GVCs, which are centred around trans national companies (TNCs), take account for 80 percent of global trade, either through intercompany trade or though trading with their affiliates and partners or arm's length suppliers (UNCTAD, 2012). The main reason that the GVC has received so much attention is because it has offered developing countries an easy way to participate in international trade. Where before the ICT revolution in the 1980's, it was imperative for a country to create its own supply chain it is now possible to join one. What this entails is that a country no longer has to be able to produce a whole product, it can also specialize in one single "task" in the value chain, such as assembly. It is true that developing countries have become more active in international trade. They have increased their proportion of

world trade; when measured in value-added they increased their share of world trade from 22 percent in 1990 to 42 percent in 2010. Nevertheless, the main question, if GVC participation has truly an effect on economic growth, has remained unanswered. This paper tackles this question and takes it one step further; we wonder if simply participating in GVCs is enough, or should a country strive for upgrading in GVCs, through increasing its export quality or its export diversification.

In a multiple regression analysis for 40 countries, using time spans of five years, we find that GVC income growth does have an effect on GDP per capita growth. However, this finding is not conditional on export quality or diversification growth. We dive deeper into the data and find that when we split the sample into developing and developed countries, GVC income growth is no longer a significant indicator for long-term economic growth for the developing countries, though it remains positive and significant for developed countries. This is surprising as participation in GVCs has been promoted as a one of the key facilitators of economic convergence (Baldwin, 2011, UNCTAD, 2013), though this could be caused by the limited sample size.
In section 2 of this paper, we delve into the extensive existing literature on trade, with section 2.1 looking into the history of trade, 2.2 contains the stylized facts on value-added trade, and section 2.3 dives deeper into the global value chain. Chapter 3 explains the propositions we want to examine in this paper. Chapter 4 explains which data and estimation models were used. Chapter 5 shows the empirical results. And chapter 6 concludes the paper and gives suggestions for future research.

2. Literature Review

In order to understand the newest trends in trade it is essential to understand the development of trade in the last century. Since the Second World War, trade has increased significantly. However, it has also changed in its composition. At first, trade in final products was the main priority, though since the 1980's intermediate good trade has gained more ground. The history of trade can be divided into two different

rounds of globalisation (Baldwin 2011, 2012). In each round a different connective technology has taken down constraint and driven globalisation to a new height.

First and Second Unbundling: Until the invention of the steam engine, goods could only be profitably traded when they had a very high value-to-weight ratio. This caused people to consume products that were locally produced. The invention of steam engines, steamboats and railroads[1] drastically lowered transportation costs, which led to the geographical separation of consumption and production. This is referred to as the first unbundling.

There are five stylized facts about the first unbundling. First, the North industrialized, while the South de-industrialized. Second, economic growth as we know it now took off. Due to economies of scale, costs decreased, freeing capital for innovation, which in turn led to a self-sustaining cycle of production, which raised income gains and led to further innovation. Third, a large income divergence between North and South took place. The industrialized North had innovation, scale and specialization on their side, which created an important cost-advantage over the South. In addition, because of local clustering of manufacturing due to complexity and communication costs, there was no incentive to invest and move manufacturing to the South. Fourth, international labour and trade migration boomed. And finally fifth, we saw that production was clustered locally, while it dispersed on an international scale. In other words, trade did not make the world flat. This is known as the paradox of the first unbundling. Improved technology favoured economies of scale that typically involved manufacturing processes that were complex. This complexity caused the local clustering of factories. Extreme proximity lowers the costs of coordination when it comes to this complexity; that is why production was placed close together.

In conclusion Baldwin states:

- Low transportation costs favour production in large scale
- Production involves complex activities;

[1] Invention (commercial) steam engine 1712 (although it was not common until improvements were made in 1781), steamboat 1807, railroad 1804

- Extreme proximity between production plants reduces the coordination costs of these complex activities.

The first unbundling removed transportation costs, however, it did not make the world flat as it was expected to do. This brought attention to the second constraint in trade; coordination costs.

Therefore, it is no surprise that the second unbundling started simultaneously with the revolution in the Information and Communications Technology (ICT) sector, which occurred around the mid 1980's. The invention of the mobile telephone, the personal computer (PC) and the Internet and more importantly the widespread usage of these inventions made it possible to transfer knowledge. This in turn made it possible to coordinate complex activities at a distance. At this point, the large differences between the wages in the developed North and the developing South became an interesting opportunity for companies to lower their costs. Production started to disperse on a global scale; local clustering was no longer necessary.

The second round of globalization had very different consequences than the previous one. First, the big income divergence - which had previously taken place - reversed; there was now a convergence. Due to rapid industrialization of emerging markets, economic growth accelerated at a high pace in these markets. It must be noted that economic growth only accelerated in those countries that fostered economic reforms that encouraged industrialization. Second, the South now industrialized and the North started to de-industrialize, with more and more firms outsourcing to the South. Third, trade became increasingly complex; complex two-way flows that previously only took place within factories were now based internationally. Fourth, development policies changed; instead of trying to build their own industrial supply chains, developing countries are now joining them, specializing in a certain part of this value chain. Fifth, the governmental attitude towards tariffs changed. Before, tariffs were reduced on an "I'll open mine, if you open yours" multilateral ideology. After the second unbundling, tariff reduction policies became increasingly unilateral. The idea was "I'll

open my borders because I am pro industrialization and want to attract investment and jobs".

Modern day research is slowly shifting to the second unbundling: When we distinguish these two different rounds of trade, we also have a better understanding of previous trade literature. Economics is a discipline trying to predict the future with knowledge of the past. Since it focuses on the past it is not surprising that research and literature is lagging. Until recently trade research was typically focused on the consequences of the first unbundling. This is not due to disinterest of economists, the first papers on the growing importance of vertical specialization appeared in the 1980's (Dixit & Grossman, 1982; Bhagwati, 1984), at the time when the second unbundling started. Though empirical research only started from the 2000's (Hummels, Ishii & Yi, 2001; Gereffi et al, 2001). This was due to the lack of data. Gross trade data no longer gave an objective view of international trade flows or competitiveness and it was necessary to create new indicators of country competitiveness. It was clear that trade should be measured in value-added. However, it is not easy to create a value-added trade database that captures trade of the whole world. Value-added trade databases were created after 2008 and the empirical literature emerged since then.

2.1.2 Definitions and accounting for Global Value Chains and Value-Added Trade

Before we continue to investigate the current state of trade and its transformation over time, it is imperative that some terms are defined.

Global value chains (GVC's): Are defined as

> *"[..] the full range of activities that firms engage in to bring a product to the market, from conception to final use. Such activities range from design, production, marketing, logistics and distribution to support to the final customer. They may be performed by the same firm or shared among several firms."*
>
> *- OECD Synthesis report 2013*

Within these Global Value Chains trade can be categorized into three trade concepts:

- Importing to produce
- Importing to export
- Value-added trade

Importing to produce (I2P): covers all imported intermediate inputs such as raw materials and services. Imported capital should also be included in I2P since it contains foreign factors and technology used for the production of domestic goods.

Importing to export (I2E): this trade concept comes closer to the concept of global value chains. In this case, the importing nation can be thought of as a part of a more extensive, complex, international production network. The key point of this concept is that the imported intermediates are used to produce goods and services that are then exported. This trade concept can therefore also concern "re-importing" and "re-exporting" which cause "*double counting*", which we will explain further on the next page.

Value-added trade: also known as factor-content trade, is a trade concept that does not have the recursion limitations I2E has: it does not suffer from double counting. To understand value-added trade, it is important to understand the following accounting identities: the sale value of a good must equal both:

- The cost of the intermediate inputs and the 'direct' domestic value-added
- The sum of all value-added domestically and abroad in all the sectors that have added to the production of the good.

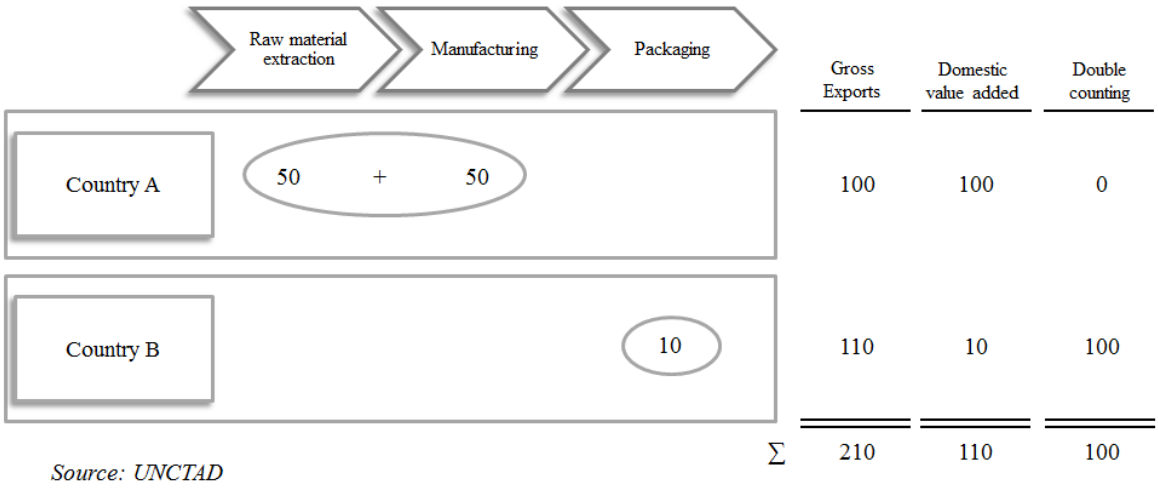
In this paper we will focus on GVC's with are active in value-added trade.

Double Counting: Within a global value chain, each link, or producer purchases input and adds value. The value-added is included in the price when the next link purchases the intermediate good. At each link the value-added equals the amounts paid to the factors of production: labour and capital. When trade is measured in gross terms, which includes both intermediate goods and final products, the value of the

intermediate good is “double counted” when it crosses an international border more than once.

Let us clarify this phenomenon with an example (see Figure 1). Country A exports 100 US dollars’ worth of intermediate goods to country B. In country B local production adds an additional 10 US dollars’ worth of value-added, before it exports the goods to country C, where the goods are sold for 110 US dollars. When we measure these transactions via gross trade measures, 210 US dollars’ worth of trade would be measured, even though only 110 US dollars of value-added has been created. This gives a clear example of the problem of estimating trade in gross measures; they overstate the value of trade and are therefore less reliable to estimate the value-added and competitiveness of individual countries.

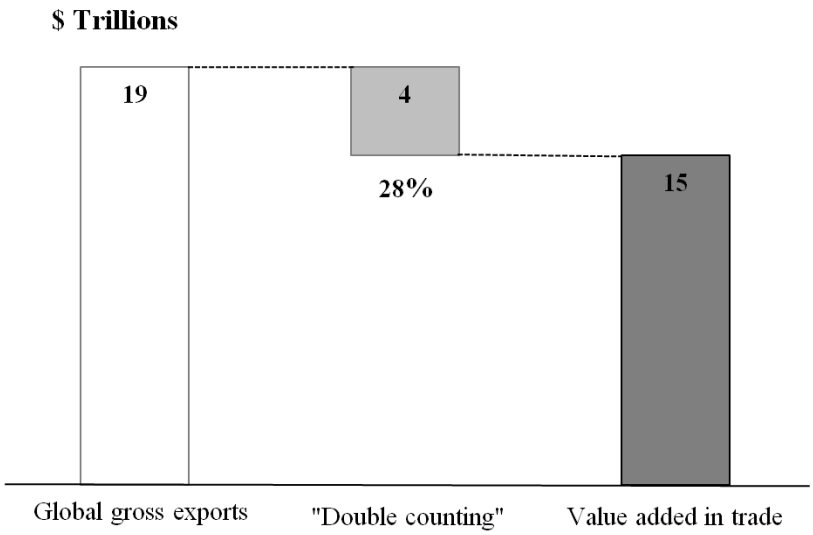
Figure 1. Example of double counting in gross trade



Source: UNCTAD

Why has this problem never been addressed in the past? As mentioned before, production has not always been as globalized as it is now. The second unbundling caused production chains to disperse globally; which meant that more intermediate goods were exported, which enhanced the problem of double counting. UNCTAD estimates that in 2010 28 percent of gross trade is double counted, accounting for 5 trillion US dollars of the approximately 19 trillion traded in that year, displaying the severity of double counting.

Figure 2. Double counting in trade (2010)



Source: UNCTAD-Eora GVC Database, UNCTAD estimates

Advantage of value-added trade: There are different advantages for using value-added measures of trade instead of gross measures. These advantages differ per level:

- Value-added in exports at the country level measures the level of which countries which are positioned further upstream in the value chain absorb the GDP contribution of trade. In addition, it measures to which extent a country is dependent on imports for its exports. Moreover, it measures the level of vertical specialisation in a country: whether a country focuses on one task or activity in a value chain or is capable of pursuing multiple tasks.
- At the industry level, value-added can indicate how segmented value chains are. This is important for policy makers to estimate the double counting occurring in the country and adjusting their policies to it.

Tabel 1. Value-added databases

Name of Dataset	Key Features	Selected research using this data
Global Trade Analysis Project Database	I-O tabled for over 100 countries for benchmark years	Trefler & Zhu (2010), Daudin, Rifflard & Schweisguth (2012a), Koopman, Wang & Wei (2014)
World Input-Output Database	Covers OECD countries and major emerging economies, 1995-2011	Baldwin & Lopez-Gonzales (2013). Costinot & Rodriguez-Clare (2013), Timmer, Los, Stehrer & de Vries (2013)
IDE-JETRO Asian Input-Output Database	Covers 8 East Asian countries at five year intervals, 1985-2000	Multiple chapters in Hiratsuka & Uchida (2010), IDE-JETRO & WTO (2011), Puzzello (2012)
WTO-OECD TiVa Database (Trade in Value-Added)	Value-added exports and other measures of GVCs for 57 countries, 1995, 2000, 2005, 2008, 2009	de Backer & Miroudot (2013)
OECD Input-Output Tables	I-O tables for OECD countries and major emerging economies, available for various years from 1970-2005	Hummels, Ishii & Yi (2001), Johnson & Noguera (2012b, 2014)
UNCTAD Eora GVC Database	Covers 187 countries for the time period 1990-2010	UNCTAD World Investment Report 2013, OECD (2015)

2.1.3 Previous empirical research

Since the 2000's there has been a sudden surge of new research on global value chains, vertical specialisation and value-added trade. This new stream of research started after the paper of Hummels, Ishii and Yi (2001), who investigated vertical specialisation, where separate countries specialize on a certain stage in the production chain. They found that vertical specialisation accounted for 21 percent of export of the countries they investigated[2] and grew nearly 30 percent between 1970 and 1990. Hummels et al (2001) lay the foundation for further research on how to measure vertical specialisation and more importantly develop input and output tables. This model has been used and extended by several researchers leading to multiple databases (table 1).

In this section we shall state the stylized facts found in recent value-added trade literature.

[2] Australia, Canada, Mexico, Denmark, France, Germany, Netherlands, UK, Ireland, Korea and Taiwan

Trend 1: International production fragmentation is expanding

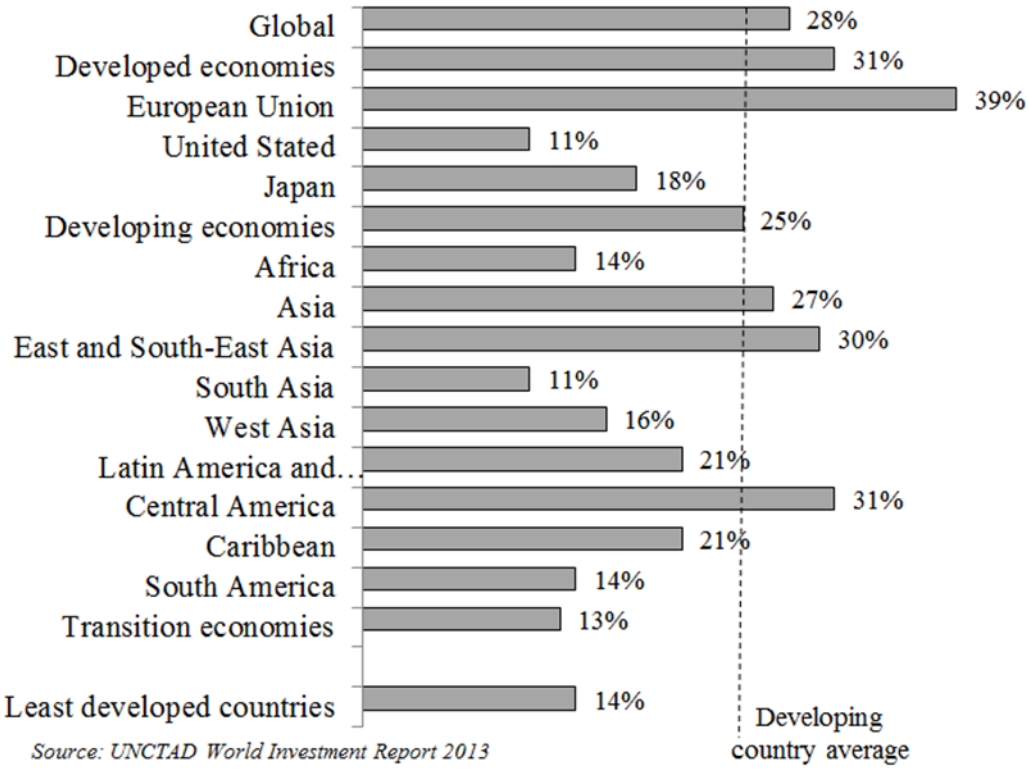
Even before input-output databases were available Hummels, Ishii and Yi (2001) found increasing vertical specialization in trade among multiple countries. Johnson (2014) reports that the share of value-added exports equals around 70 to 75 percent of worldwide gross exports today. The number is decreasing in time, coming down from 85 percent in the 1970's and 1980's, indicating more double counting which is caused by an increase in trade in intermediate products. Baldwin and Lopez-Gonzales (2014) found that in 2009 only 34 percent of all trade were final goods, indicating that 66 percent were intermediate goods. This decline occurred almost exclusively after 1990. In addition, Timmer et al (2014a), investigated this figure on an industry level and found that for 85 percent of the 560 production chains listed in the WIOD database the foreign value-added share increased, demonstrating the extensiveness of international fragmentation. Timmer et al (2014a) gives a clear example of the German car industry, where domestic value-added decreased from 79 percent in 1995 to 66 percent in 2008. The findings mentioned above do not come as a complete surprise; they illustrate the rapid changes that were happening in the world economy; the information technology revolution, the implementation of regional trade agreements, trade liberalisations in emerging economies, the expansion of the European Union.

UNCTAD (2013) also investigated which countries show the highest level of fragmentation. They found that developed countries do have a higher share of foreign value-added in their exports, 31 percent of their gross exports is foreign value-added in 2010, see figure 3. The authors add that this number is highly distorted by the European Union countries which have the highest foreign value-added of all developed factory blocks, with 39 percent foreign value-added in exports compared to the US with 11 percent and Japan with 18 percent. The high percentage of the EU countries can be explained by their high integration as a union, nearly 70 percent of EU trade is between EU countries. In addition, UNCTAD looked into the share of foreign value-added for developing countries, which was 25 percent in 2010. Although this is lower than the world average of 28 percent, it is significantly higher

than that of the US and Japan. Moreover, it is higher than that of the European Union when only external trade is counted.

In addition, UNCTAD also measures GVC participation rates, which they define as: “The share of a country’s exports that is part of a multi-stage process. This is the foreign value-added used in a country’s exports (upstream perspective) plus the value-added supplied to other countries’ exports (downstream perspective) divided by total exports”. Moreover, they measure the growth of the GVC participation rates used a compound average growth (CAGR) method. They found that the global average of GVC participation was 57 percent, with the average for developed countries at 59 percent and developing countries at 52 percent. UNCTAD also found that between 2005 and 2010 all regions saw a growth in the GVC participation rate. These growth rates differ significantly between countries; developed countries saw a lower growth rate than developing countries, with 3.7 percent and 6.1 percent respectively. The lowest growth in GVC participation is found in Japan; 1.9 percent The highest growth rates were found in South Asia with 9.5 percent, though it must be noted that this growth is from a low base of GVC participation; 37 percent.

Figure 3. Foreign Value-Added in Exports 2010



Trend 2: The geographical separation of production chains is changing over time

Where during the first unbundling production was clustered due to the complexity of activities and the relatively high communication costs (Baldwin, 2011 & 2012), production became regional during the second unbundling. Production started to move over borders due to the technological revolution in the communication sector. UNCTAD (2013) stated in their World Investment Report that developing countries are gaining share of world exports, both in gross terms as in terms of value-added. Developing countries' share of global value-added trade increased from 22 percent in 1990 to 42 percent in 2010. Moreover, their value-added share of trade also increased disproportionally to the share of gross trade; it increased more. This highlights the industrialisation of the South. As global trade increases, developed countries seem to rely increasingly on imported content for their exports, which in turn allows developing countries to add more value to their exports.

Trend 3: There is no agreement whether trade is becoming global of remains regional

Throughout the 1980's and 1990's trade was still very much regional, operating within the three factory blocks: the EU, NAFTA and East Asia. Since the 2000's Timmer et al (2014a) finds a slow but clear shift towards more global production chains. This is mainly due to the fact that Asia is supplying more and more of Europe's and America's intermediate goods. Timmer warns this is not a guarantee of a shift towards global fragmentation of production chains. He states that this will depend on a variety of different determinants: "including developments in wages and productivity, cost of transportation and trading, coordination costs, risk considerations, and the strength between linkages between various activities." This latter doubt on globalisation corresponds with Baldwin and Venables' (2013) view that certain high value-added tasks may always remain clustered in space due to complementarities which are strongly localized. In addition, the low skilled activities, which are currently outsourced, might be re-shored in the future if technological progress allows mechanized production to be cheaper in countries which have a capital abundance.

Johnson (2014) finds that the ratio between value-added and gross trade tends to be lower within regional trade than on an international scale, once again indicating GVCs are regional, not international. UNCTAD (2013) finds complementary results; when investigating GVC participation mentioned trend 1, they saw that certain regions had high intra-regional trade in 2010. Numbers vary between regions, the share of intra-regional GVC flows in total GVC participation was 61 percent North and Central America, 57 percent in the European Union, 42 percent in East and South-East Asia, showing high integration of the three factory blocks[3]. Other countries and regions showed less integration; on average in transition economies 22 percent of GVC participation accrued from intra-regional GVC trade, in Latin America and the Caribbean this was 11 percent, and in Africa it was the lowest at 6 percent.

[3] Factory America, Factory Europe & Factory Asia

Trend 4: Manufacturing trade has less importance in value-added trade, while service trade is relatively more important

According to Baldwin and Lopez-Gonzales (2014) manufacturing accounts for 70 percent of gross exports and services for 20 percent. When these sectors are measured in value-added trade both account for about 40 percent according to Johnson (2014). What this essentially means is that the value-added to gross exports ratio is much lower in manufacturing than in services. Manufacturing can be performed at arm's length without too much need for extensive communication between the sites. This ease of dispersion over time caused an even further "fine-slicing" of the value chain, which entails that relatively "small" tasks can be performed in a lot of different countries, lowering the domestic value-added and increasing the double counting within this sector. Due to the high level of imported intermediates in manufacturing, this sector faces a lot of double counting in trade, which leads to a high discrepancy between the value-added and gross exports share of trade. Services on the other hand have high value-added content, although this does not explain why this industry has a higher share in value-added trade than in gross trade. The reason for this is that industries buy services as inputs. In gross trade these services are then included in manufacturing's trade, while in value-added trade it is counted as services.

Trend 5: Domestic value-added in exports range between 60 to 90 percent, differing between countries.

According to the UNCTAD World Investment Report 2013 there are three factors that can influence the share of domestic value-added in trade. First, the size of the economy: large economies tend to rely less on foreign inputs because they possess significant internal value chains. Second, the composition of exports and the position in the GVC: exports at the beginning of the GVC require less foreign inputs and therefore countries that are positioned at this point often have higher shares of domestic value-added in exports. In addition, countries that have relatively higher service exports also have higher share of domestic value-added. Moreover, UNCTAD found that the ratio of value-added to gross trade is strongly negatively correlated with the share of manufacturing products in the export total. On the other hand, when

a country has a high amount of trade in natural resources, they have a high share of value-added in exports, such as countries as Russia and Saudi Arabia. Third and lastly, the economic structure and the export model are important. Some countries that have a significant share of entrepôt trade, such as the Netherlands, will have a higher share of foreign value-added. The same can be said for countries with important trade processing sectors.

Trend 6: High-skilled labour and capital value-added shares in output are increasing

Timmer et al (2014a) found that in 64 percent of the 560 production chains investigated in the WIOD the share of value-added of capital increased over the time period 1995-2008. The average increase was 1 percentage point, though the sample had large variance; some chains experienced an increase in capital share of 20 percentage points. The share of high-skilled labour increased in 92 percent of the production chains. The unweighted average change was 4 percent, with a lower variance than capital. In addition, Timmer et al found that the value-added shares of medium- and low-skilled labour decreased. The first decreased in 56 percent of the 560 production chains, the latter decreased in 91 percent of the chains. However, the findings stated above are not weighted for the size of the different production chains. Some chains such as manufacturing have larger output than other chains. Timmer et al also investigated the weighted change in value-added of the different production factors. Once again he found that capital and high-skilled labour increase their value-added share, although this time capital's increase is significantly higher than that of high-skilled labour; 6.5 percent against 1.5 percent. Moreover, medium- and low-skilled labour decreased once more, proving that the findings are not caused by developments in small production chains. It is also important to note the importance of the different factors, which can be seen in table 2. In 1995 the order of importance of value-added per factor was capital, medium-skilled labour, low-skilled labour and lastly high-skilled labour. In 2008, the capital and medium-skilled remain the top two contributors to value-added, though now high skilled has taken over from low-skilled labour as the third largest contributor in value-added.

Tabel 2. Weighted factor shares in Global Value Chains of all manufactures

Value-Added	1995	2008	2008 minus 1995
Total (Billion US$)	$6,586	$8,684	$2,098
By:			
Capital (%)	40.9%	47.4%	6.5%
High-skilled labour (%)	13.8%	15.4%	1.5%
Medium-skilled labour (%)	28.7%	24.4%	-4.2%
Low-skilled labour (%)	16.6%	12.8%	-3.8%

Source: Timmer et al (2014) calculations of WIOD

Timmer et al (2014a) dove deeper into the data, dividing the dataset into high-income countries[4] and all other countries that play an active role in international trade. In Table 3 we can see the relative importance of the different production factors. In high-income countries there is an enhanced specialization towards high-skilled labour, increasing its share in value-added by 5 percent. Capital also increased by 3 percent and remains the most important production factor. Medium- and low-skilled labour are the losers in high-skilled countries, losing 3 and nearly 5 percent value-added share respectively. These changes are in line with the Hecksher-Ohlin intuition; with the rise of labour abundant countries as China, high-skilled countries will lose their comparative advantage in low-skilled labour products and therefore specialize in products and activities that require more high-skilled labour and capital.

Within the same Heckscher-Ohlin predictions, we would expect to see a specialisation towards low-skilled intensive goods in the "*other countries"* region. Though when Timmer et al (2014a) investigates the data, they find no such trend. Low-skilled labour loses more than 6 percent share in value-added contribution in manufactured between 1995 and 2008. Medium- and high-skilled labour increase slightly over the period. What these relative shares of value-added tell us is, even though, on a whole, labour is losing value-added shares to capital in these other countries. However, it does not mean that the absolute number of workers has decreased. Quite the opposite: in China 42 million jobs were added, in India 20 million, in Brazil 6 million and 2

[4] Australia, Canada, Japan, South Korea, Taiwan, the United States, and the 15 pre-2004 members of the European Union

million in Mexico. However, because most of these countries are labour abundant, wages remained relatively low, lower than their marginal productivity. In comparison, rental wages will seem high and therefore capital will claim the lion's share of value-added (as we can see this already occurred in 1995).

Tabel 3. Factor shares in GVCs of manufactures, by region

Value-Added	1995	2008	2008 minus 1995
In high-income countries			
(Billion US$)	$4,863	$4,864	$1
By:			
Capital (%)	35.9%	38.7%	2.9%
High-skilled labour (%)	16.8%	21.8%	5.0%
Medium-skilled labour (%)	33.3%	30.3%	-3.0%
Low-skilled labour (%)	14.0%	9.1%	-4.9%
In other countries			
(Billion US$)	$1,723	$3,820	$2,097
By:			
Capital (%)	55.2%	58.4%	3.2%
High-skilled labour (%)	5.4%	7.1%	1.7%
Medium-skilled labour (%)	15.6%	17.0%	1.4%
Low-skilled labour (%)	23.8%	17.5%	-6.3%
Worldwide			
(Billion US$)	$6,586	$8,684	$2,098

Source: Timmer et al (2014) calculations of WIOD

2.2. Global Value Chains

Within the value-added trade literature, global value chains have received a lot of attention in the last decade. This relatively new way of organising production was previously known to happen within Multinational Enterprises (MNE's), though now it also happens between firms that do not share ownership or control. Many policymakers ponder on the question if promoting GVC participation is the same as promoting open markets for trade and whether it could be the magic bullet for income convergence for developing countries. Surprisingly, the empirical research on these questions has been lacking. Until this year, it was unclear why GVCs move to certain

countries. Kowalski et al investigated exactly this topic in their 2015 OECD paper. With the help of the OECD-WTO TiVa and UNCTAD Eora database they distinguished multiple factors, which are key to attracting GVC's. They divided them into two categories: structural characteristics of countries and trade & other policies.

Structural characteristics of countries:

- ***Market size:*** market size has always been a strong determinant for trade; larger markets attract more trade and the same line of thought can be extended to GVCs. However, when within GVC participation a distinction is made between forward linkages and backward linkages, the OECD (2015) found that large markets tend to have less backward linkages, sourcing the intermediate inputs from domestic companies instead. This is not surprising as these countries have a larger pool of domestic inputs to choose from than smaller countries. Though these countries do have, on average, more forward linkages, and provide more domestic inputs for other countries' exports.
- ***Level of development:*** in the past it has been documented (Lopez-Gonzalez, 2012; OECD, 2013) that the structure of the economy often changes along the development path and these changes will affect the GVC participation rate. In the early stages of development, countries tend to specialise in primary goods (e.g. natural resource extraction of agriculture), which will serve as inputs in the production process. This implies a higher level of forward linkages than backward linkages. The backward linkages develop with the early stages of industrialisation, when the economy partakes in factory-type activities (e.g. assembly). In the later stages of industrialisation international development will take place and result in the emergence of an internationally competitive service sector, which, in turn, will strengthen forward linkages.
- ***Industrial structure:*** the level of industrialisation in a nation[5] is positively correlated with backward integration and negatively with forward integration, which follows the path of industrialisation mentioned in the previous point.

[5] Measured as the percentage of value-added of manufacturing in GDP

- ***Location:*** as mentioned in chapter 1 global value chain activity is still largely clustered around three manufacturing hubs: the United States, Germany and China. The OECD finds that there is a negative relationship between backward integration and the distance to the closest headquarter economy. Moreover, they find that this negative relationship is much stronger than that between backward integration and the distance to final demand.

Trade and other policies:

- ***Regional trading agreements (RTAs) and tariffs:*** tariffs are obvious barriers for GVCs, who transport goods across multiple international borders, sometimes crossing the same border multiple times. It is therefore not surprising that backward integration has a negative relationship with tariffs levied by the home country as it raises the costs of intermediate inputs. On the other hand, forward integration is hindered by tariffs levied by the country of destination of the goods. So too, did the OECD test the relationship between RTAs and GVC participation. They found that both a higher share of exports and imports covered by RTAs have a positive correlation with higher backward integration and lower forward integration.
- ***FDI openness:*** the GVC revolution has been driven largely by MNEs through FDI (OECD, 2013) and therefore it is to be expected that FDI openness would have a positive relationship with GVC participation. Within their data the OECD found that FDI openness does have a positive relationship with backward integration, however not with forward integration. They reason that inward FDI is often associated with setting up a foreign affiliate that imports foreign intermediate goods and processes them for exports rather than sourcing local value-added.
- ***Logistics performance***, including trade facilitation, ***intellectual property protection***, the ***quality of infrastructure*** and the ***quality of institutions***.

The paper finds that the structural variables such as size, degree of industrialization and distance to manufacturing hubs are stronger determinants of GVC participation

which entails that the variation in GVC participation at least in the short to medium term are not directly affected by policy. Though, when the paper uses the auxiliary Eora database to assess these determinants between different income groups, they find that the above mentioned structural determinants explain a large proportion of variation in GVC participation in high-income countries (80 percent), though the percentage is significantly lower for middle- and low-income countries (37 and 34 percent, respectively). Kowalski et al therefore run an additional regression using supplementary policy variables[6] in order to distinguish the determinants of GVC participation for developed and developing countries. They find that for developing countries, logistics, the quality of infrastructure, intellectual property protection and the quality of institutions are estimated to have the largest positive effect on backward GVC integration. For developed countries, the quality of electricity supply and the quality of infrastructure are the two policy measures with the highest estimated impact.

Kowalski et al (2015) go even further and looked into GVC performance and ways of upgrading through investigating three measures:

- Domestic value-added in per capita exports
- Sophistication of the export bundle
- Diversification of exports

By investigating the determinants of the per capita value-added of exports Kowalksi et al (2015) determined how well a GVC performed, since this is the part of the value-added which accrue to domestic capital and labour. They find that there is a positive relationship between foreign sourcing and domestic per capita value-added in exports, indicating that a greater use of foreign inputs increases domestic per capita value-added in exports. Moreover, the sophistication of imported non-primary sector inputs has a positive relationship with domestic value-added in exports, though it declines at

[6] Logistics performance index, intellectual property protection index, infrastructure availability and quality, broadband subscription, tax rate, quality of electricity supply, FDI restrictiveness index, R&D expenditure, institutional quality, tertiary graduates, access to loans, technical occupations, product market regulation, services trade restrictiveness index

higher levels of sophistication. Kowalski et al (2015) also split their sample[7] into three income groups (high-, middle- and low-income countries) and found that high-income countries gain the most from the use of more sophisticated primary and non-primary inputs. On the other hand, in middle-income countries domestic per capita value-added has a positive relationship with growing inward flows of FDI, while in low-income countries the sophistication of non-primary inputs matter the most.

The measure of sophistication follows the theory of Hausmann et al (2007) and is used as a proxy for product upgrading. Kowalski finds that growing backward integration has a positive relationship with the production of more sophisticated export products. In addition, the import of more sophisticated products and a higher GDP per capita are also associated with the production of more sophisticated export products, though inward FDI flows are not. When Kowalski split the sample into income groups, it becomes clear that product upgrading for high and middle income countries lies in the growth in backwards integration, though this is not the case for the low income countries.

Kowalski et al use the diversification of exports as a proxy for functional upgrading and they find evidence that both the use of more sophisticated non-primary intermediate imports and positive changes in backward integration are associated with the diversification of exports. Moreover, a growing distance from an economic pole of activity has a positive relation with export diversification. In high income countries, the use of more sophisticated intermediate imports leads to more export diversification, while for medium and low income countries it is the level of backward integration that has more effect.

3. Theoretical Framework

Now that it is clear how to attract GVC, whether changing short-term policies or trying to change long-term structural variables as explained in the previous chapter,

[7] 152 countries over 15 years

we should further look into whether attracting GVCs is really the magic bullet in the search for income convergence between developing and developed countries. Why have scholars and policy makers alike shown such interest in Global Value Chains? In the literature several hypotheses are proposed to why GVC participation should lead to growth. We have divided them into two main channels:

- The possibility to capture value-added by the exporting country
- Technology dissemination and skill building through interaction due to GVCs interaction with local firms leading to GVC upgrading

In a simple model, Baldwin (2012) explains the benefits of joining value chain trade. He argues that developing countries gain from trade through a competitive effect. This competitive effect occurs due to the downstream effect of production. Developing countries can access cheaper more sophisticated (knowledge intensive) intermediate inputs and in addition can increase their production and exports of low sophisticated intermediate inputs. In the case of the latter, gains in production are attributable to scale economies and task specialization as predicted by comparative advantage, once scale limitations of the local market are lifted by access to the world market. In his partial equilibrium model, Baldwin (2012) states that less intermediate products are produced domestically, though through the increased demand from abroad due to new competitiveness of their (intermediate and final) goods, production increases. The increased demand leads to investment in skill development as more people are involved in the value chains jobs, which leads to a virtuous cycle of more competitive products, more demand, more production, more investment and therefore more growth for the developing country.

The situation is less clear for developed countries. In general, there are two main results from fragmentation; it generates a cost saving strategy for firms through access to cheaper inputs from developing countries (Venables, 1999). In addition, it allows the relocation of resources from developed countries to developing countries (Baldwin, 2012). Balwin and Robert-Nicoud (2014) argue that these results lead to economic gains for both the developing as the developed countries involved in the GVC. They state that in a general equilibrium Walrasian setting, trade in intermediate

goods and services could be seen as “shadow migration” of resources between countries. Trade in tasks (off-shoring) leads to firm specific knowledge and technology being used across borders by firm affiliates and can therefore lead to similar predicted outcomes as that of the Heckser-Ohlin-Samuelson model. As a result, trade in tasks lead to positive net gains from trade for both countries involved. These net gains are both in terms of welfare and world production.

UNCTAD, who dedicated their 2013 World Investment Report to Global Value Chains, investigated this relationship between GVC participation and economic growth. They found, for the period 1990-2010, countries with the highest GVC participation growth[8] had a median GDP per capita growth of 3.3%, which was significantly higher than the 0.7% GDP per capita median growth rate for countries with little or no increase in their GVC participation. Moreover, countries that exhibited a high GVC participation growth had, on average, a GDP per capita growth of two percentages points higher than the average. Even though there was a very clear and significant correlation, no causal relationship could be found.

It is not surprising that UNCTAD has not found any causation between GVC participation and growth. GVC participation is an all-encompassing measurement, often measuring all intermediate trade. Global value chains come in all sorts and sizes. It is therefore critical that research dive deeper into what kind of GVCs can bring long-term growth.

Participation in GVCs provides opportunities for companies to upgrade within these value chains. Humphrey and Schmitz (2002) found there are four different types of upgrading:

- *Process upgrading*: transforming inputs into outputs more efficiently by reorganising the production system or introducing superior technology.
- *Product upgrading:* moving into more sophisticated product lines (which can be defined in terms of increased unit values).

[8] Stated as the first quartile of the distribution.

- *Functional upgrading:* acquiring new functions in the chain (or abandoning existing functions) to increase the overall skill content of activities.
- *Inter-sectoral upgrading:* using the knowledge acquired in particular chain functions to move into different sectors.

Hausmann et al (2007) found in his aptly titled paper "What you export matters" that the sophistication of export has a positive and significant relationship with GDP growth. They calculate the productivity of exports and call this EXPY, which can be seen as a measure of process upgrading. Then they run multiple regressions to test the effect of EXPY on economic growth for a sample of 80 countries over 9 years. Hausmann used different specifications to check the robustness of his estimation and found coefficients between 0.032 and 0.082. Taking the midpoint of this coefficient range would mean that a 10 percent increase in EXPY would increase GDP per capita growth by 0.5 percent.

Upgrading by increasing the quality of your products can boost a country's exports through the use of more human- and physical- capital intensive production. Moreover, it builds on a county's existing comparative advantage (IMF, 2014). The potential for quality upgrading, that is extending the length of the quality ladder of a product, is not possible for all goods. Natural resources for example, tend to have lower potential for upgrading than agricultural or manufacturing goods.

This paper continues on this train of thought, and we believe that the sophistication of export matters when upgrading in GVCs. We therefore use the same measures (stated in the previous chapter) as Kowalski et al (2015) to test if product or functional upgrading in GVCs leads to long-term economic growth.

Proposition 1: Participation in GVCs leads to long-term GDP per capita growth, conditional on export quality.

Although, improving export quality sounds like a sure way to upgrade, it is also possible to upgrade in exports by moving into different product chains, in other words

inter-sectoral upgrading. The IMF (2014) found that export diversification leads to economic growth for low-income countries. Increased export diversification is associated with lower output vitality, due to the fact that a country is not dependent on one sector for its exports. This in turn leads to greater macroeconomic stability. Therefore, we propose

Proposition 2: Participation in GVCs leads to long-term GDP per capita growth, conditional on export diversification.

Many scholars have argued in favour of upgrading to more "sophisticated" products to "move up in the value-chain". However, it can be argued that this focus is rather one-sided. The idea of "moving up in the value chain" likely stems from the "smiley curve" thesis (Low, 2013) who correctly puts forward that the domestic value-added in the product design and marketing stages may be higher than that of assembly or manufacturing stages. This finding has been interpreted to entail that it is favourable for a firm to move away from assembly and manufacturing stages of the value chain. However, this completely misses the point. For many, upgrading has become synonymous with capturing a higher share of domestic value-added, though this narrow view misses the point that volume matters just as much the share of domestic value-added in a product (OECD, 2015). For example, China has decreased its share of domestic value-added in electrical and optical equipment from 87 to 57 percent between 1995 and 2009[9], though their volume of domestic value-added increased more than tenfold. What is important is the comparative advantage; some countries could obtain higher levels of GVC participation if they specialize in less sophisticated products. Which products, industries or segments are profitable for a firm depend on the characteristics of the production process and the skills and relative resource endowments that firms (and countries) have. In other words, it is not a wrong strategy to specialize in one industry and produce "unsophisticated" products, as long as you can do this competitively. That is why we propose

[9] Kowalski et al (2015) calculation with OECD TiVa database

Proposition 3: Paticipation in GVCs leads to long-term GDP per capita, not conditional on export quality or diversification.

With all arguments mentioned above it does sound as if participation in GVCs is the magic bullet, however, one should be more careful as to assume this. The theories stated above have one crucial assumption: a host country of GVCs could theoretically benefit from "technology lending". Baldwin (2011) explains this as the application of firm specific knowledge of companies from developed countries in production facilities in developing countries. It is not always the case that companies upgrade within value chains. Trans National Corporations (TNCs) play a central role in the fragmentation of production and UNCTAD (2012) estimated that 80 percent of world trade takes place within these networks on a yearly basis. It is incorrect to assume that TNCs naturally share their company specific, technical knowledge with the local economy; they often keep the knowledge restricted to intra-company relations. Indeed, Schmitz (2004) states that there are multiple forms of relationships possible in GVC's:

- *Market based:* enterprises deal with each other in arm's length transactions.
- *Balanced network:* enterprises co-operate and have complementary competences but no control over each other.
- *Captive network:* the lead firm sets the parameters under which others in the chain operate; the relationship is quasi-hierarchical.
- *Hierarchy:* enterprises are vertically integrated; the parent company controls its subsidiaries.

It depends heavily on the sort of relationship between the TNC and the local company whether information is fully transmitted or not. Schmitz finds that " […] in most cases, developing country suppliers are in captive relationships with these buyers". In the case of a market-based, captive network and a hierarchical relationship, technology is likely not shared. Balanced networks are based on sharing competences and are more common in developed countries, as we know from the literature from innovation networks. Schmitz determines that a new form of balanced networks seem

to have emerged. These networks are based on rapid product delivery with tight product specifications and requiring only limited innovation from the side of the suppliers. This limits the sharing of technology and skill. When you dismiss the assumption of technology sharing in the above mentioned theories, they do not hold. Therefore, it is possible that

Proposition 4: Participation in GVCs does not lead to long-term GDP per capita growth.

4. Data and Methodology

In this section we shall explain which data we used to test the theoretical hypotheses mentioned in the previous section. In 4.1 we will explain out independent variable for GVC participation, which measure we used for this and how it is formed. In 4.2 we look into the other two independent variables export quality and export diversification. Lastly in section 4.3, we specify our model.

4.1 GVC participation measure

The data used for this paper is of the World Input-Output Database (WIOD). The WIOD contains a dataset of world input-output tables (WIOT's) of 35 industries[10] between 40 countries (table 6) and an aggregate for the rest of the world (Row) for the time period 1995 to 2011. The countries included in the WIOD project were chosen due to data availability and relevance; together these 40 countries cover more than 85% of world's GDP (Timmer et al, 2014b).

[10] See Annex A

Tabel 4. Countries included in the World Input-Ouput Database

European Union			**North America**	**Asia and Pacific**
Austria	Greece	Portugal	Canada	Australia
Belgium	Hungary	Romania	United States	China
Bulgaria	Ireland	Slovak Republic		India
Cyprus	Italy	Slovenia		Indonesia
Czech Republic	Latvia	Slovakia	**Latin America**	Japan
Denmark	Lithuania	Spain	Brazil	Korea
Estonia	Luxembourg	Sweden	Mexico	Russia
Finland	Malta	United Kingdom		Taiwan
France	The Netherlands			Turkey
Germany	Poland			

The WIOT dataset is constructed by benchmarking national supply and use tables (SUTs) to time-series data of final use industrial output from National Accounting System (NAS). Thereafter, these nationals SUTs were combined with information from international trade statistics in order to create international SUTs. At this time Timmer et al (2014b) split the products between those that were domestically produced and those that were imported. Subsequently, the international SUTs of all 40 countries and the "Rest of the World" were combined into a world input-output table.

To understand the dataset, we will continue with an explanation of the input-output table (IOT) step by step. In figure 4 a simplified version of the IOT shows the industry-by-industry type used for this paper. For ease of explanation we will continue with the assumption that each industry only produces one unique product. The columns in figure 4 give information about the use of the product for one single industry, dividing use between intermediate and final use. Intermediate use is referred to when the product is used in the production of another good. Final use is referred to when the product if consumed domestically (in either private or government consumption or for investment), or when it is exported. The final column shows the total amount produced of the product. The rows indicate where the product has originated, whether it was produced domestically or whether it was imported. The column totals the value of all labour and capital inputs used in the intermediate use, the sum of which is the value-added in an industry.

Figure 4. Example Simplified Input-Output Table

	Industry	Final Use		Total
Industry	Intermediate Use	Domestic Final Use	Exports	Total Output
	Imports			
	Value-Added			
	Total Output			

The WIOT are an extension of the IOT; in the WIOT the use of products is further broken down to their original country and industry. This representation is schematically shown in figure 5 in a simplified manner for two regions (A & B) and the rest of the world. In the WIOD database there are 40 countries, however the outline remains the same, except one can now sell the products in the domestic market to final consumers of other producers (as intermediate input) or sell it to another country, also either to their final consumers or other foreign producers.

Figure 5. Example Simplified World Input-Output Table

		Country A Intermediate Industry	Country B Intermediate Industry	Rest of World Intermediate Industry	Country A Final Domestic	Country B Final Domestic	Rest of World Final Domestic	Total
Country A	Industry	Intermediate use of domestic output	Intermediate use of B of exports of A	Intermediate use by RoW of exports from A	Final use of domestic output	Final use by B of exports from A	Final use by RoW of exports from A	Output in A
Country B	Industry	Intermediate use by A of exports from B	Intermediate use of domestic output	Intermediate use of RoW of exports from B	Final use by A of exports from B	Final use of domestic output	Final use by RoW of exports from B	Output in B
Rest of World (RoW)	Industry	Intermediate use by A of exports from RoW	Intermediate use by B of exports from RoW	Intermediate use of domestic output	Final use by A of exports from RoW	Final use by B of exports from RoW	Final use of domestic output	Output in RoW
		Value Added	Value Added	Value Added				
		Output in A	Output in B	Output in RoW				

For our research we use the WIOT we take the measure for GVC participation as Timmer et al (2013). We estimate GVC participation by measuring the country's intermediate exports, as it is certain that this trade is part of a global value chain.

According to Timmer et al (2013) services within this database are not contestable on an international scale, therefore we use the GVC income due to foreign demand from agriculture and manufacturing.[11]

4.2 Export quality & diversification measures

For the quality of exports and the diversification of exports, we use the IMF Export Diversification and Quality Database. The database covers 187 countries and provides information on export diversification and quality from 1962 to 2010. The measures are based on the UN-NBER dataset, which harmonizes the COMTRADE trade flow data. The database differs from previous studies[12] on export quality. In the past, scholars have taken unit values as a measure of quality comparison for exports, as these values were easy to come by. However, simply using unit values has some serious limitations. First, a good can differ across exporters but within a product category. When this occurs, unit values reflect differences in composition, instead of differences in quality. Second, unit values may reflect pricing strategies or production costs. Third, changes in unit values over time could reflect changes in quality-adjusted prices, which occur due to demand or supply shocks, instead of changes in quality. The IMF quality database tackles the last two limitations, however, it is unable to address the first shortcoming as data is lacking in this area and the comprehensiveness of the database would be lost. The database follows the methodology of Hallak (2006) and complements it to achieve a comprehensive database for as many countries as possible. According to the researchers (Henn et al, 2013) quality is determined by importers' taste for quality, unobservable quality, trade prices, the income per capita of the exporting country (as this captures cross country variations in production costs) and lastly, the distance between the exporter and importer.

Henn et al (2013) estimate export diversification by creating dummy variables for "traditional", "new" and "non-traded" goods in the UN-NBER dataset. They define the categories as follows:

- *Traditional:* good that is exported at the beginning of the period.

[11] Industries 1 through 18 in Annex A

[12] Khandewal, 2010; Feenstra & Romalis, 2012

- *New:* the good must have been "non-traded" in at least two previous years and then exported in two consecutive years.
- *Non-traded:* have not been exported throughout the entire period

The values for "traditional" and "non-traded" remain constant for the entire period, as one is the initial value and the other counts only the products which have the same status throughout the entire period. The value of dummy variable "new" changes over time. After which they create a Theil index for both the intensive and extensive margin:

$$T_{extensive} = \Sigma_k \left(\frac{N_k}{N}\right)\left(\frac{\mu_k}{\mu}\right)\ln(\frac{\mu_k}{\mu})$$

$$T_{intensive} = \Sigma_k \left(\frac{N_k}{N}\right)\left(\frac{\mu_k}{\mu}\right)\{\left(\frac{1}{N_k}\right)\Sigma_{i\in k}\left(\frac{X_i}{\mu_k}\right)\ln\left(\frac{X_i}{\mu_k}\right)\}$$

Where k is a subscript for the three groups: traditional, new and non-traded. N is the amount of products exported within each group. $\left(\frac{\mu_k}{\mu}\right)$ is the relative mean of exports for each group. Lastly X, represents the export value.

These two Theil indices are added together to measure the overall export diversification index.

4.3 Regression specification

To estimate our models, we specify the following regressions:

$$Proposition\ 1:$$

$$GDPpcGwt_{it} = \beta_0 + \beta_1 GVCGwt_{it} + \beta_2(GVCGwt_{it} * EXQGwt_{it}) + \beta_3 EXQGwt_{it} + \beta_4 InitialGDPpc_{it} + \beta_5 HC_{it} + \beta_6 AvgInvestRate_{it} + \beta_7 Openess_{it} + \beta_8 RuleLaw_{it} + \beta_9 PolStab_{it} + \varepsilon_{it}$$

$$Proposition\ 2:$$

$$GDPpcGwt_{it} = \beta_0 + \beta_1 GVCGwt_{it} + \beta_2(GVCGwt_{it} * EXDivGwt_{it}) + \beta_3 EXDivGwt_{it} + \beta_4 InitialGDPpc_{it} + \beta_5 HC_{it} + \beta_6 AvgInvestRate_{it} + \beta_7 Openess_{it} + \beta_8 RuleLaw_{it} + \beta_9 PolStab_{it} + \varepsilon_{it}$$

$$Proposition\ 3:$$

$$GDPpcGwt_{it} = \beta_0 + \beta_1 GVCGwt_{it} + \beta_2 InitialGDPpc_{it} + \beta_3 HC_{it} + \beta_4 AvgInvestRate_{it} + \beta_5 Openess_{it} + \beta_6 RuleLaw_{it} + \beta_7 PolStab_{it} + \varepsilon_{it}$$

We do not specify a model for proposition four, as it is the alternative hypothesis of proposition three, therefore it uses the same model.

$GDPpcGwt_{it}$is an average annual compound growth rate measured for three time spans of 5 years: 1995-2000, 2000-2005, 2005-2010. It is measured as the output-side real GDP per capita at chained PPPs in 2005 US millions and is taken from the Penn World Tables Version 8.1 (Feenstra, Inklaar & Timmer, 2015). The five-year compound averages follow the reasoning of Barro (1997). He argues that cross-country regressions relate to long-term economic growth. Durlauf et al (2005) states that yearly data can be subjected to short-run dynamics, creating a higher chance of measurement error bias.

$GVCGwt_{it}$, $EXQGwt_{it}$, $EXDivGwt_{it}$, $InitialGDPpc_{it}$, $InitialHC_{it}$ $AvgInvestRate_{it}$, $Openness_{it}$, $RuleLaw_{it}$, $PolStab_{it}$ are a set of control variables in these growth equations and ε is the idiosyncratic error term.

$GVCGwt_{it}$ is the natural logarithm of the compound average growth rate of the export of intermediate goods from the WIOD database. $EXQGwt_{it}$ is the compound average growth rate of the export quality. $EXDivGwt_{it}$ is the compound average growth rate of the export diversification. The source for both export quality as export diversification growth is the IMF quality and diversification database. $Initial\ GDP\ pc_{it}$ is the natural logarithm of the initial (t_0) outside-real GDP per capita measured in chained PPPs in 2005 millions of US dollars. This variable accounts for the convergence parameter in the growth theory as stated by Barro & Sala-i-Martin (2004). $InitialHC_{it}$ is the natural logarithm of the average years of

schooling measured for a population of 15 years and over at the beginning of each time period (Barro & Lee, 2013). $AvgInvestRate_{it}$ is the average investment rate over each time period. The source for initial GDP per capita and the average investment rate is the Penn World Tables 8.1. $Openness_{it}$ is a measure of openness to trade, measured by the Worldbank World Development Indicators (WDI) as imports plus exports divided by the total output of a country. This variable takes the initial value of each time period. $RuleLaw_{it}$and $PolStab_{it}$ are two indicators for institutional quality and are taken from the World Governance Indicators (WGI) of the Worldbank. The WGI consists of six political indicators which range between the value of -2.5 and 2.5 (Kaufmann et al, 2010). The values are highly correlated, as can be seen in Annex C. Therefore, in our models, we have chosen only to use the ones we believe are relative to this research topic: Rule of Law and Political Stability.

Tabel 5. Expected signs of the variables used

Variable	Expected sign
GVC income growth	+
Export quality	+
Export diversification	+
Initial GDP per capita	-/+
Initial years of schooling	+
Average investment rate	+
Openness to trade	+
Rule of Law	+
Political Stability	+

5. Results

We analysed the three[13] propositions through a pooled cross section OLS estimation, of which the results are stated in table 9. We see that the interaction effect of export quality growth and GVC income growth is positive and significant, indicating that export quality growth strengthens the GVC income growth effect on long-term

[13] also indirectly analysing proposition four, though the model of proposition three

economic growth and vice versa. Moreover, in the regression output for proposition two, we once again see that the interaction effect between export diversification growth and GVC income growth is positive and significant, once again indicating a positive relation between these two variables and long-term economic growth. When we look at the results for proposition three, we see that GVC income has a positive sign and is significant. What we can conclude from these results is that we cannot reject any of the propositions. Growth in GVC income has a positive effect on long-term GDP per capita growth. This effect is not conditional on export quality or diversification growth, though export quality growth and export diversification growth can have a positive effect on long-term GDP growth conditional to GVC income growth.

However, the pooled OLS model does not take into account the heterogeneity among the countries in the sample. Therefore, to tackle this problem we use a country fixed effects estimator. When we look at the estimation results of proposition one and two, we see that in both cases the interaction term is no longer significant. This indicates that we reject proposition one and two. Once again the GVC income growth variable is positive and significant in the estimates of all three regressions, indicating we cannot reject proposition three, though reject proposition four. What we can conclude from these tests is that for this sample, GVC income growth leads to long term economic growth, though it is not conditional on export quality or diversification growth.

The control variables do not always have the expected sign (initial trade openness and initial rule of law). When we check the variables that are significant[14] however, we see that they do have the expected sign.[15]

[14] Initial GDP per capita (OLS & FE), initial years of schooling (FE), average investment rate (OLS & FE), initial trade openness (FE), initial rule of law (OLS)
[15] For the complete regression results see annex F and G.

Tabel 6. Regression Results

	GDP per capita average annual compound growth rate 5 year spans (1995-2010)					
	OLS			Fixed Effects		
VARIABLES	Proposition 1	Proposition 2	Proposition 3	Proposition 1	Proposition 2	Proposition 3
GVC inc growth * Export quality growth	0.172**			0.0454		
	(0.0757)			(0.0631)		
Growth in export quality	-0.0951			0.0380		
	(0.133)			(0.0727)		
GVC inc growth * Export diversification growth		0.0307***			0.00259	
		(0.0107)			(0.00901)	
Growth in export diversification		-0.0411**			0.00286	
		(0.0189)			(0.0166)	
GVC income growth	0.108***	0.132***	0.0960**	0.0928***	0.102***	0.0894***
	(0.0359)	(0.0388)	(0.0432)	(0.0312)	(0.0304)	(0.0315)
Initial GDP per capita	-0.336***	-0.354***	-0.357***	-1.419***	-1.466***	-1.434***
	(0.0545)	(0.0619)	(0.0577)	(0.131)	(0.147)	(0.149)
Initial years of schooling	0.271	0.313	0.302	1.101**	1.216*	1.467**
	(0.174)	(0.195)	(0.183)	(0.544)	(0.616)	(0.631)
Average investment rate	0.588	0.941**	0.976**	3.731***	4.189***	4.165***
	(0.365)	(0.402)	(0.419)	(0.673)	(0.658)	(0.677)
Initial trade openess	-0.000126	0.000191	0.000235	0.00474**	0.00558**	0.00198
	(0.000566)	(0.000752)	(0.000565)	(0.00197)	(0.00226)	(0.00270)
Initial Rule of Law index	0.106**	0.136**	0.117**	-0.153	-0.131	-0.152
	(0.0509)	(0.0527)	(0.0540)	(0.209)	(0.225)	(0.235)
Initial Political Stability index	0.0563	0.00673	0.0268	0.0558	0.0231	0.0183
	(0.0706)	(0.0660)	(0.0642)	(0.0586)	(0.0639)	(0.0682)
Constant	2.584***	2.552***	2.635***	10.35***	10.37***	9.865***
	(0.537)	(0.546)	(0.551)	(1.343)	(1.130)	(1.226)
Observations	115	111	117	115	111	117
R-squared	0.436	0.417	0.347	0.640	0.630	0.596

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

For a robustness check we divided the countries into developing and developed countries[16] and ran the country fixed effect regressions again. In table 10 we see that proposition one holds for developed countries, though not for developing countries.

Proposition two, on the other hand, has very different outcomes for developing and developed countries. The interaction of export diversification growth and GVC income growth has a negative and signification effect on long-term economic growth, while the interaction has a positive effect for developed countries. The difference in two signs could be attributed to the level of development of the different industries.

[16] See Annex H

Developed countries, which are more industrialized, have had the time to become competitive in multiple industries, though developing countries which are relatively new to the world market have often only found a comparative advantage in one industry. When a country moves into a new industry (as for export diversification), there are initial entry costs to overcome (e.g. building a new plant) and it will not be competitive immediately, there will be the necessary learning by doing. It would be unjust to say that all the developing countries in this dataset are still in initial phases for other industries, though this trend could be what is driving the negative sign.

GVC income is once again positive in all regression results, though it is only significant for developed countries. This could be due to sample size restrictions as their sample for developing countries is limited to 13 countries for 3 time periods, while that of the developed countries are in between 24 and 26 countries, depending on the proposition tested.

Tabel 7. Regression results for developed and developing countries

	GDP per capita average annual compound growth rate 5 year spans (1995-2010)					
	Proposition 1		Proposition 2		Proposition 3	
VARIABLES	Developing	Developed	Developing	Developed	Developing	Developed
GVC inc growth * Export quality growth	-0.199	0.115**				
	(0.239)	(0.0493)				
Growth in export quality	0.287	-0.0659				
	(0.231)	(0.100)				
GVC inc growth * Export diversification growth			-0.103***	0.0121**		
			(0.0285)	(0.00498)		
Growth in export diversification			0.196**	-0.00763		
			(0.0649)	(0.00947)		
GVC income growth	0.135	0.0673**	0.0285	0.0693**	0.0961	0.0552*
	(0.104)	(0.0288)	(0.102)	(0.0260)	(0.0542)	(0.0297)
Initial GDP per capita	-0.982***	-1.535***	-1.286***	-1.571***	-1.052***	-1.552***
	(0.318)	(0.134)	(0.306)	(0.139)	(0.281)	(0.155)
Initial years of schooling	2.031*	0.265	2.723**	0.299	1.851	0.616
	(1.082)	(0.476)	(1.137)	(0.430)	(1.192)	(0.475)
Average investment rate	2.994	2.074**	3.178	2.354***	4.127**	2.238**
	(1.871)	(0.806)	(1.850)	(0.763)	(1.369)	(0.993)
Initial trade openess	-4.30e-05	0.00701***	-0.00433	0.00749***	0.000909	0.00231
	(0.00303)	(0.00187)	(0.00633)	(0.00202)	(0.00236)	(0.00329)
Initial Rule of Law index	-0.789***	0.309**	-1.158***	0.355**	-0.837***	0.334
	(0.241)	(0.146)	(0.286)	(0.152)	(0.215)	(0.205)
Initial Political Stability index	0.0646	0.00616	-0.189	-0.0139	0.0543	0.00536
	(0.175)	(0.0342)	(0.266)	(0.0401)	(0.164)	(0.0500)
Constant	4.158	13.52***	5.747	13.68***	4.884	13.26***
	(3.599)	(1.182)	(3.678)	(1.077)	(3.058)	(1.133)
Observations	39	76	39	72	39	78
R-squared	0.675	0.864	0.741	0.863	0.627	0.771

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6. Conclusion

For a long time, trade literature has focused on the first unbundling. However, new value-added trade databases give the opportunity to tackle new questions referring to the second unbundling. The second unbundling was characterized by production fragmentation on a global scale. This was facilitated by the ICT revolution, which lowered coordination costs for TNCs and therefore allowed these companies to benefit from the large wage gaps between North and South. Countries were no longer specializing in products or industries, they were specializing in “tasks”. In order to

partake in international trade, they no longer had to build the entire value-chain, they could simply join one.

The first unbundling caused an income divergence between North and South, though the second unbundling created an income convergence. Scholars have argued that GVC participation is one of the reasons for this income convergence. However, this has not been tested empirically.

With the help of the value-added trade database of the WIOD, we found that GVC participation does have a positive effect on long-term economic growth. Moreover, for our dataset, this effect is not conditional on either export quality or diversification growth. This indicates that it is not wrong to specialize in low-sophisticated products, if this is what the country is competitive in.

When the dataset was divided, the results did not prove to be robust. GVC income growth was still a significant determinant for long-term economic growth for developed countries. Moreover, economic growth due to export diversification was conditional on GVC income for developed countries. For developing countries GVC income growth had a negative effect on long-term economic growth, conditional on export diversification. This counter intuitive finding can be explained by the level of industrialisation. At the beginning of industrialisation, it is costlier to increase export diversification due to entry costs and undeveloped competitiveness.

Even though this paper has found some interesting findings on the effects of GVC participation on long term GDP per capita growth, many questions remain. One of the main questions the authors had after researching this topic is if the growth in GVC income has a different effect on long term economic growth than of total trade. As there is likely a high correlation between growth in GVC income and total exports, it would be interesting to see which of these variables has a stronger effect. This is an important question to ask, as determinants of trade differ for some part to those of

GVC participation. Therefore, before we give a clear-cut policy advice, it is imperative to know if there is a difference.

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ANNEX A

Industry Sectors Number Codes

1	Agriculture, Hunting, Forestry and Fishing
2	Mining and Quarrying
3	Food, Beverages and Tobacco
4	Textiles and Textile Products
5	Leather, Leather and Footwear
6	Wood and Products of Wood and Cork
7	Pulp, Paper, Paper, Printing and Publishing
8	Coke, Refined Petroleum and Nuclear Fuel
9	Chemicals and Chemical Products
10	Rubber and Plastics
11	Other Non-Metallic Mineral
12	Basic Metals and Fabricated Metal
13	Machinery, Nec
14	Electrical and Optical Equipment
15	Transport Equipment
16	Manufacturing, Nec; Recycling
17	Electricity, Gas and Water Supply
18	Construction
19	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
20	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles
21	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods
22	Hotels and Restaurants
23	Inland Transport
24	Water Transport
25	Air Transport
26	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
27	Post and Telecommunications
28	Financial Intermediation
29	Real Estate Activities
30	Renting of M&Eq and Other Business Activities
31	Public Admin and Defence; Compulsory Social Security
32	Education
33	Health and Social Work
34	Other Community, Social and Personal Services
35	Private Households with Employed Persons

ANNEX B

Variables used in regression, their sources and details.

Variable name	Years available	Countries available	Source	Comments
GDP per capita growth	1950-2011	167	Penn World Tables 8.1	Output-side real GDP at chained PPPs (in mil. 2005US$).
GVC income growth	1990-2011	40	WIOD	Measured by the authors as all exports which are incorporated in other countries production.
Export quality growth	1962-2010	187	IMF	Contains export quality measures across different aggregation levels of export products.
Export diversification growth	1962-2010	187	IMF	Measures the amount of products exported by countries.
Initial GDP per capita	1950-2011	167	Penn World Tables 8.1	Output-side real GDP at chained PPPs (in mil. 2005US$) at the beginning of each period.
Initial years of schooling	1950-2010	146	Barro-Lee	Educational attainment data by 5-year intervals.
Average investment rate	1950-2011	167	Penn World Tables 8.1	Share of gross capital formation at current PPPs.
Openness to trade			Worldbank – World Development Indicators	This variable is a composite of "import/GDP" plus "export/GDP", both sourced of the WDI.
Initial rule of Law index	1996-2014	215	Worldbank – World Governance Indicators	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Initial political stability	1996-2014	215	Worldbank – World Governance Indicators	Measures perceptions of the likelihood of political instability and/or politically motivated violence.

Note: Comments are taken from websites of the respective databases and their methodology descriptions.

ANNEX C

Correlation matrix of the World Governance Indicators

	Voice and accountability	Rule of law	Regulatory quality	Control of corruption	Government effectiveness	Political Stability and absence of violence
Voice and accountability	1					
Rule of law	0.8272	1				
Regulatory quality	0.7955	0.8893	1			
Control of corruption	0.7763	0.9332	0.8680	1		
Government effectiveness	0.7830	0.9291	0.9327	0.9325	1	
Political Stability and absence of violence	0.6913	0.7890	0.6475	0.7331	0.6911	1

ANNEX D

Summary Statistics

VARIABLES	N	mean	sd	min	max
GDP per capita growth	120	0.277	0.286	-0.644	1.008
GVC income growth	120	0.767	0.643	-1.090	2.739
Export quality growth	115	0.0541	0.453	-1.086	1.286
Export diversification growth	111	-0.414	2.266	-8.431	5.120
Initial GDP per capita	120	9.720	0.725	7.285	10.98
Initial years of schooling	120	2.231	0.236	1.335	2.558
Average investment rate	120	0.229	0.0507	0.0994	0.428
Openness to trade	117	85.17	49.37	16.03	286.2
Initial rule of law index	120	0.848	0.803	-1.126	1.954
Initial political stability index	120	0.556	0.787	-2.037	1.668

ANNEX E

Correlation matrix of variables used

	GDP per capita growth	GVC income growth	Export quality growth	Export diversification growth	Initial GDP per capita	Initial years of schooling	Average investment rate	Openness to trade	Initial rule of law index	Initial political stability index
GDP pc growth	1.0000									
GVC income growth	0.3778	1.0000								
Export quality growth	0.2772	0.2299	1.0000							
Export diversification growth	-0.0667	0.0141	0.3805	1.0000						
Initial GDP per capita	-0.4427	-0.3996	-0.2279	0.0003	1.0000					
Initial years of schooling	-0.1839	-0.0958	-0.1297	-0.1334	0.7003	1.0000				
Average investment rate	0.0892	-0.1261	0.1898	0.0759	0.1944	0.0497	1.0000			
Openness to trade	0.0073	0.0329	0.1134	0.0049	0.2731	0.3401	0.0790	1.0000		
Initial rule of law index	-0.2742	-0.4025	-0.1855	0.0216	0.8228	04633	0.2440	0.2382	1.0000	
Initial political stability index	-0.1892	-0.3078	-0.2419	-0.0561	0.7477	0.6000	0.2137	0.4048	0.8343	1.0000

ANNEX F – Regression results with export quality

	GDP per capita average annual compound growth rate 5 year spans (1995-2010)							
	OLS				Fixed Effects			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GVC inc growth * Export quality growth				0.172**				0.0454
				(0.0757)				(0.0631)
Growth in export quality			0.0791	-0.0951			0.0837**	0.0380
			(0.0757)	(0.133)			(0.0345)	(0.0727)
GVC income growth		0.0960**	0.120***	0.108***		0.0894***	0.0979***	0.0928***
		(0.0432)	(0.0351)	(0.0359)		(0.0315)	(0.0298)	(0.0312)
Initial GDP per capita	-0.404***	-0.357***	-0.355***	-0.336***	-1.461***	-1.434***	-1.444***	-1.419***
	(0.0645)	(0.0577)	(0.0560)	(0.0545)	(0.150)	(0.149)	(0.132)	(0.131)
Initial years of schooling	0.389**	0.302	0.327*	0.271	1.416**	1.467**	1.128**	1.101**
	(0.191)	(0.183)	(0.169)	(0.174)	(0.604)	(0.631)	(0.521)	(0.544)
Average investment rate	0.958**	0.976**	0.640	0.588	4.006***	4.165***	3.796***	3.731***
	(0.439)	(0.419)	(0.386)	(0.365)	(0.667)	(0.677)	(0.681)	(0.673)
Initial trade openness	0.000395	0.000235	-0.000362	-0.000126	0.00301	0.00198	0.00469**	0.00474**
	(0.000512)	(0.000565)	(0.000531)	(0.000566)	(0.00256)	(0.00270)	(0.00191)	(0.00197)
Initial Rule of Law index	0.114**	0.117**	0.110**	0.106**	-0.270	-0.152	-0.144	-0.153
	(0.0542)	(0.0540)	(0.0553)	(0.0509)	(0.241)	(0.235)	(0.208)	(0.209)
Initial Political Stability index	0.0177	0.0268	0.0524	0.0563	-0.00788	0.0183	0.0585	0.0558
	(0.0649)	(0.0642)	(0.0723)	(0.0706)	(0.0759)	(0.0682)	(0.0594)	(0.0586)
Constant	2.970***	2.635***	2.648***	2.584***	10.37***	9.865***	10.52***	10.35***
	(0.582)	(0.551)	(0.536)	(0.537)	(1.236)	(1.226)	(1.388)	(1.343)
Observations	117	117	115	115	117	117	115	115
R-squared	0.312	0.347	0.410	0.436	0.561	0.596	0.638	0.640

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ANNEX G – Regression results with export diversification

	GDP per capita average annual compound growth rate 5 year spans (1995-2010)							
	OLS				Fixed Effects			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GVC inc growth * Export diversification growth				0.0307***				0.00259
				(0.0107)				(0.00901)
Growth in export diversification			-0.00635	-0.0411**			0.00651	0.00286
			(0.0113)	(0.0189)			(0.00769)	(0.0166)
GVC income growth		0.0960**	0.127***	0.132***		0.0894***	0.101***	0.102***
		(0.0432)	(0.0398)	(0.0388)		(0.0315)	(0.0301)	(0.0304)
Initial GDP per capita	-0.404***	-0.357***	-0.357***	-0.354***	-1.461***	-1.434***	-1.475***	-1.466***
	(0.0645)	(0.0577)	(0.0623)	(0.0619)	(0.150)	(0.149)	(0.145)	(0.147)
Initial years of schooling	0.389**	0.302	0.321	0.313	1.416**	1.467**	1.210*	1.216*
	(0.191)	(0.183)	(0.198)	(0.195)	(0.604)	(0.631)	(0.617)	(0.616)
Average investment rate	0.958**	0.976**	0.875**	0.941**	4.006***	4.165***	4.235***	4.189***
	(0.439)	(0.419)	(0.408)	(0.402)	(0.667)	(0.677)	(0.625)	(0.658)
Initial trade openness	0.000395	0.000235	-4.63e-05	0.000191	0.00301	0.00198	0.00553**	0.00558**
	(0.000512)	(0.000565)	(0.000784)	(0.000752)	(0.00256)	(0.00270)	(0.00218)	(0.00226)
Initial Rule of Law index	0.114**	0.117**	0.125**	0.136**	-0.270	-0.152	-0.138	-0.131
	(0.0542)	(0.0540)	(0.0543)	(0.0527)	(0.241)	(0.235)	(0.219)	(0.225)
Initial Political Stability index	0.0177	0.0268	0.0227	0.00673	-0.00788	0.0183	0.0248	0.0231
	(0.0649)	(0.0642)	(0.0644)	(0.0660)	(0.0759)	(0.0682)	(0.0640)	(0.0639)
Constant	2.970***	2.635***	2.605***	2.552***	10.37***	9.865***	10.48***	10.37***
	(0.582)	(0.551)	(0.539)	(0.546)	(1.236)	(1.226)	(1.228)	(1.130)
Observations	117	117	111	111	117	117	111	111
R-squared	0.312	0.347	0.383	0.417	0.561	0.596	0.630	0.630

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

ANNEX H

List of countries included in the WIOD and their classification

Country	Developing Country	Country	Developing Country
Austria		Japan	
Australia		Korea	
Belgium		Latvia	X
Bulgaria	X	Lithuania	X
Brazil	X	Luxembourg	
Canada		Malta	
China	X	Mexico	X
Cyprus		Netherlands	
Czech Rep.		Poland	X
Denmark		Portugal	
Estonia		Romania	X
Finland		Russia	X
France		Slovakia	
Germany		Slovenia	
Greece		Spain	
Hungary		Sweden	
India	X	Taiwan	
Indonesia	X	Turkey	X
Ireland	X	UK	
Italy		USA	

Note: Countries considered developing economies using the IMF World Economic Outlook Classification.