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The Effect of COVID-19 on Global Value Chains – A Prediction Based on Previous Crises

Abstract

This thesis sets out to make a prediction on the effect of COVID-19 on Global Value Chains (GVCs). Since GVCs are influenced by offshoring and reshoring decision making, this study used literature on the drivers of offshoring and reshoring to understand the reasoning behind GVC decision making. To see what the effect of the pandemic will be on GVCs, this study used data from comparable crises for quantitative analyses. The data used belong to the SARS and MERS epidemics and the 2008 financial crisis, which have similar characteristics to the COVID-19 crisis. For the effect of the epidemics, a difference-in-difference analysis was performed and for the financial crisis, the panel data methods Fixed Effects & Random Effects were used. The results of the quantitative analyses were not in line with the propositions made. While this study expected the crises to have a negative effect on GVCs, the epidemics were found to have no significant effect and the 2008 financial crisis was found to have a significant positive effect on GVCs. Based on the findings, this study predicts that the COVID-19 pandemic will have a small significant positive effect on GVCs.

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List of Abbreviations

COVID-19	Coronavirus Disease 2019
DVA	Domestic Value Added
DVX	Indirect Value Added
FE	Fixed Effects model
FDI	Foreign Direct Investment
FVA	Foreign Value Added
GDP	Gross Domestic Product
GNI	Gross National Income
GVCs	Global Value Chains
IV	Instrumental Variable
MERS	Middle East Respiratory Syndrome
MNE	Multinational Enterprise
OECD	Organization for Economic Co-operation and Development
OLI	Ownership (O), Location (L) and Internalization (I)
RE	Random Effects model
SARS	Severe Acute Respiratory Syndrome
SME	Small and Medium-Sized Enterprise
VA	Value Added

Introduction

The year 2020 will be remembered as the year most of the world got hit by the pandemic caused by COVID-19. Worldwide measures had to be taken, lockdowns were set, and borders were closed to contain the spread of the virus. In a globalized world, COVID-19 limited both national and international flows of people and goods, and worldwide trade and investments got disrupted by its implications. (Chief Economist Team, 2020) Among those disruptions belong the stagnation of economic activities and lockdowns which caused demand shocks. Additionally, disruptions in supply networks, either temporary or permanent, caused supply shocks. (Shingal & Agarwal, 2020) Furthermore, it has already been recognized that operations and supply chains will experience a significant effect caused by the pandemic on their management, organization, and structure. (Barbieri et al., 2020) Hence, not only had the pandemic a great impact on people's health, but also a lot of uncertainty on economic aspects came forth from the disruptions caused by the implications of the pandemic.

Such implications caused by the pandemic are of even greater impact as the globalization process has been evolving over time. The evolvement within the globalized world came forth from the reduction in trade barriers and the lowered costs of transportation and communication. (World Bank & World Trade Organization, 2019) Whereas first the production process of products would take place in a single country, this has grown in a more complex structure. Now, before the final product gets sold it might have crossed one or even multiple borders during the production process. (World Bank & World Trade Organization, 2019) Moreover, the production process of goods and services got relocated overseas, also referred to as offshoring, and involves international fragmentation. (Strange & Magnani, 2018) This process of value adding is called Global Value Chains (GVCs) and has shaped the world economy over the past 30 years. (Barbieri et al., 2020) The rise of GVCs made economies become more interconnected and instead of specializing on final good production, economies specialized in specific parts of the production process. Economies turned towards specializing specific activities and parts of the value chains rather than the whole production process. Consequently, as part of the rise of GVCs the flows of intermediate goods and services have increased extensively. (OECD, 2013) Moreover, by means of GVCs companies were able to create new jobs internationally and more economic growth got established. (World Bank & World Trade Organization, 2019) Hence, Global Value Chains are one of the most evident trademarks of globalization. (Barbieri et al., 2020) However, all the developments regarding GVCs have also shown to have a downside effect during the pandemic caused by COVID-19.

Due to the global spread of the COVID-19 virus, locations worldwide got simultaneously affected by the contagion in the GVCs. The impact of the contagion was even higher as the economies are so highly interconnected through global trade and GVCs, in particular global hubs had to endure this burden. (Shingal & Agarwal, 2020)

Moreover, in response to the impact of the pandemic on the national and international trade and investments, businesses are seeking ways to maintain their operations. As stated, lockdowns were introduced across countries during the pandemic which exposed businesses with offshore production processes to great disruptions within their supply chains. This shock encourages managers to rethink their implemented policies. Whereas before, managers nourished the idea of prioritizing efficiency and growth, this pandemic contributes to the awareness of practices containing risks. Thus, decision makers will be more aware of the associated risks when making decisions on offshoring in the future. This might contribute to the consideration of reshoring businesses, bringing production processes closer to home. (Barbieri et al., 2020)

What's more, the outbreak of COVID-19 made countries even more aware of their dependence on other countries which may contribute to reconsiderations about GVCs. As a result of the outbreak the interdependence got emphasized, especially dependence on China, to produce products like masks and supplies for healthcare that are essential during the pandemic for the population to outlast. (Barbieri et al., 2020) This over-reliance on China might contribute to reconsiderations on global value chains. (Shingal & Agarwal, 2020) At the same time, countries became aware of the great impact that the discontinuation of the essential parts of the supply chains, that were offshored to other countries, has on their GDP. Therefore, countries became aware of the fact that they lack self-sufficiency, and the pandemic awoke the demand for self-reliance. This might cause governments to consider measures that would contribute to reshoring production processes. (Barbieri et al., 2020) Moreover, whereas before the pandemic, the international production system already faced challenges arising from technology/the New Industrial Revolution (NIR), the growth of economic nationalism and the imperative of sustainability. (Zhan et al., 2020) Zhan et al. (2020) show that the shocks caused by the pandemic strengthens this trend of reforming GVCs.

Previous literature on COVID-19 mainly focused on policy recommendations for governments to overcome this global crisis in the best possible way. (i.e., Baldwin, 2020; Danielsson et al., 2020) Moreover, the focus of most of previous literature has been on the economic and non-economic outcomes of the effects of health crises and natural disasters, but only limited studies have been done on the effect on global value chains. (Shingal & Agarwal,

2020) Nonetheless, Simola (2021) did research on the impact of COVID-19 on GVCs and stated that available data showed that the long-term effect of the pandemic is limited. Because GVCs have become well founded it is unlikely that the pandemic will result in major restructuring of GVCs on the aggregate level. Though, the design of future GVCs might get affected. Other trends that will shape the future GVCs can be amplified by the crisis. These trends might include environmental issues, protectionism, technological development and trends in emerging markets. Furthermore, incentives for further automation might increase as a result of the pandemic and digitalization and teleworking possibilities have become more efficient. (Simola, 2021) In addition, Shingal and Agarwal (2020) did research on the effect of two health epidemics on GVCs. They concluded that the supply chains were somewhat resilient during the previous health crises. (Shingal & Agarwal, 2020) Yet, this study will examine if the current pandemic may have a more permanent effect on GVCs.

Understanding the effect of the pandemic on GVCs in the long run is of great importance. This is especially true when considering the context of the globalized world, where a lot of international trade takes place in complex structures and production processes crossing multiple borders. Looking at the pandemic, the pandemic does seem to affect Global Value Chains during this time of crisis, but it is not clear how this will affect the future of GVCs as the COVID-19 virus is such a self-contained new phenomenon. Therefore, the main aim of this study is to examine the effect of COVID-19 on Global Value Chains. Hence, this study will give answer to the following research question: *What will be the effect of COVID-19 on Global Value Chains?*

To answer this research question, this study examines the drivers for offshoring and reshoring decisions as they have a direct influence on GVCs. In times of crisis some drivers might change as the factors change. As production processes get exposed to risks in times of crisis, it would be plausible to assume that such exposure could affect the importance of certain factors within the decision making regarding the production processes. Therefore, the conceptual framework will be based on literature that comprises such decision making on offshoring and reshoring. In other words, the conceptual framework will be used to examine if exposure to crises could affect the decision making on offshoring and reshoring and thus on the amount and length of GVCs. To make a prediction on the effect of COVID-19 on GVCs, this research will be based on data from previous crises to see what the effect of crises with similar properties on GVCs has been. Therefore, this study will use the epidemics SARS and MERS as they have had similar properties in nature compared to COVID-19, and the financial crisis of 2008 as it had a similar comprehensive effect compared to the pandemic. Based on its

comprehensiveness and the fact that this study focuses on GVCs, which is an economic matter, the comparison with the financial crisis is considered the most valid. Through quantitative research, a difference-in-difference analysis will be done to estimate if the epidemics with common properties in nature have had a significant effect on the GVCs, either on the amount or length of the GVCs. In other words, comparing the difference in the differences in observed outcomes between the affected and non-affected countries, across periods before and after the crises. Furthermore, a panel data analysis will be used to estimate the effect of the financial crisis that had a similar comprehensive effect compared to the pandemic. Therefore, both the Fixed Effects model (FE) and the Random Effects model (RE) will be used to test for the effect of the previous crises on the importance and length of GVCs. The Hausman test will then be used to test whether the results of either the FE model or the RE model should be used for the analyses. Finally, the results of those analyses will be used for the assessment on the effect of COVID-19 on GVCs.

The findings on the statistical analyses show that the epidemics had no significant effect on GVCs. Therefore, when assuming that COVID-19 will have the same effect as the epidemics, the findings are contradicting with the propositions made. The findings on the effect of the financial crisis do show a significant effect. However, the financial crisis appears to have a significant positive effect, which is also not in line with the propositions. Based on the findings, this study predicts that the COVID-19 pandemic will have a small significant positive effect on GVCs.

The remainder of this study has the following structure. The next section, Chapter I, presents a literature review of previous literature on relevant topics such as the role of GVCs. Then, Chapter II, discusses the theoretical framework and develops the propositions used. Thereafter, Chapter III sets out the data and methods used, and the empirical results are discussed in Chapter IV. Finally, Chapter V contains an assessment on what the effect of COVID-19 will be on Global Value Chains, limitations of this study are discussed and recommendations for further research are given.

I. An Overview of Global Value Chains

1.1 Globalization and Global Value Chains

Globalization has had an increasing impact on the world economy over the past decades. It has a great influence on the wealth distribution and international economic integration. To begin with, it is important to introduce both the meanings of Globalization and Global Value Chains. Starting with globalization, OECD (2013) gives the following clear definition: “The term globalization is generally used to describe an increasing internationalization of markets for goods and services, the means of production, financial systems, competition, corporations, technology and industries. Amongst other things this gives rise to increased mobility of capital, faster propagation of technological innovations and an increasing interdependency and uniformity of national markets.”

Moreover, as a result of lowering in transportation costs, advancements in information and communication technologies and the lowering of investments and trade barriers it was in the late 1980s that the provision of production and service globalized. (Castañeda-Navarette et al., 2020) Additionally, globalization has radically changed in its nature and impact in the period 1985-1995. According to Baldwin and Lopez-Gonzalez (2013), a driving force behind the change in globalization has been North-South production sharing. The international production required international movement of knowledge and expertise on managerial, marketing and technical aspects. Therefore, comparative advantages were denationalized, and as they joined the supply chains of advanced nations, emerging markets were able to industrialize at a fairly rapid pace. Hence, the global outline of income, manufacturing and trade became revolutionized. (Baldwin & Lopez-Gonzalez, 2013)

What’s more, the globalized world has evolved over time and the organization of trade and production has increasingly become around Global Value Chains over the last two decades. (World Bank & World Trade Organization, 2019; OECD, 2021) In the modern world economy, GVCs have had an increased impact on the formalization of international investment, production and trade and therefore also on globalization. (OECD, 2021) In other words, GVCs are one of the most evident trademarks of globalization and changed the nature of trade. (Barbieri et al., 2020; Raei et al., 2019)

The global economy has become highly interconnected, reflected at the aggregate level in FDI and the world trade, which is 60 percent intermediate goods and services. (Strange, 2020) Within the GVCs, value gets added during different phases of the production process, crossing one or even multiple borders. (World Bank & World Trade Organization, 2019;

OECD, 2021) Moreover, the production process of goods and services got relocated overseas, also referred to as offshoring, and involves international fragmentation. (Strange & Magnani, 2018) Economies turned towards specializing specific activities and parts of the value chains rather than the whole production process. Consequently, as part of the rise of GVCs the flows of intermediate goods and services have increased extensively. (OECD, 2013) Additionally, by means of GVCs companies were able to create new jobs internationally and more economic growth got established. (World Bank & World Trade Organization, 2019)

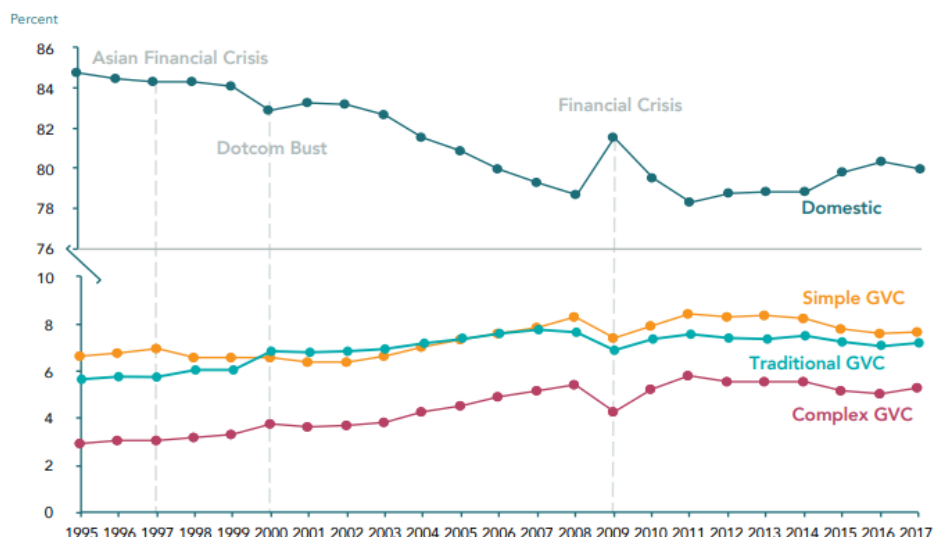
This was a result of developments around information and transportation technologies. Trade barriers got reduced and costs of transportation and communication got lowered which enabled companies to decompose their production processes. Hence, companies could take advantage of different factor costs, as parts of their production processes would take place at different locations. This way value got added during the production process under such GVCs. (Feenstra & Hanson, 1997; Grossman & Rossi-Hansberg, 2008; World Bank & World Trade Organization, 2019) In addition, GVCs can be characterized in different ways. While some GVCs may contain several small companies, each having their own specific tasks coordinated through transactions made on arm's length. Others may contain MNEs who have internalized their production activities. (Strange, 2020)

To assess the importance of GVCs, it is necessary to identify and measure GVC activities and make a distinction between production activities. Therefore, depending on whether the production process takes place in multiple countries, production activities are divided into four production types. First, the domestic production type, for this type both the production and the consumption of the product takes place domestically and involves no international trade. Then, the second production type is traditional trade which refers to a production process that takes place purely domestically, but the final product will cross a border only once for consumption purpose. The third type of production activity is called a simple GVC, which entails crossing one border during the production process. The last type of production activity is called complex GVC as it crosses at least two borders during the production process. By making this distinction between production activities it is possible to measure a country-sector's participation intensity within cross-country production sharing. (World Bank & World Trade Organization, 2019)

Turning to some data, Figure 1 (below) gives an illustration of the developments of domestic production and the different types of GVCs as a share of global GDP from 1995 to 2017. Here it is shown that the overall trend for domestic production activities as a share of the global GDP has decreased over time while the GVC activities have increased. What stands out

is the great impact the global financial crisis had on the production activities as a share of the global GDP. From 2011 to 2016, the domestic production activities rose as a share of the global GDP and therefore, the share of GVC activities fell in the same period. Within 2017, a slow recovery can be seen for the GVC activities as for this year their trend showed an upward trend for the first time since 2011. (World Bank & World Trade Organization, 2019)

Figure 1. Trends in Production Activities as a Share of Global GDP, 1995-2017

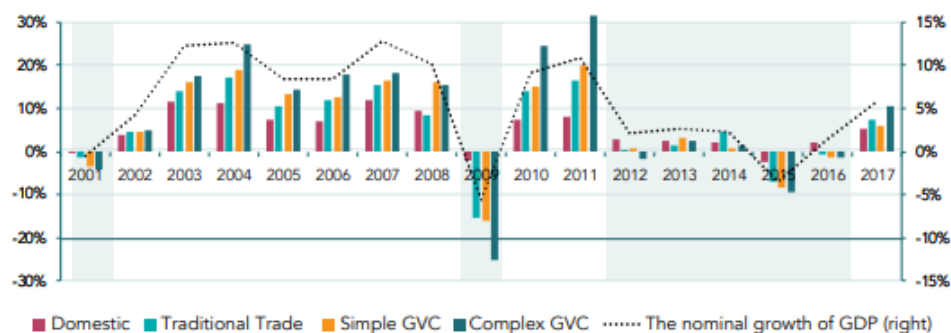


Source: World Bank & World Trade Organization, 2019, p.12, Figure 1.2.

Additionally, Figure 2 (below) shows the nominal growth of the four different value-added creation activities and the nominal growth of GDP from 2000 to 2017. Looking at these growth rates it can be noticed that for 2009, which was the time the financial crisis hit, all creation activities fell sharply. This happened again for the period 2012 to 2016, and in both periods the nominal growth rates fell more for GVC activities that took place across multiple countries. Therefore, the contribution of international trade to the slow recovery of global GDP from 2012 to 2016 was very little and most of the recovery was based on the growth of domestic production. After this period, it was in 2017 when global trade had a growth rate that exceeded the growth rate of global GDP. It was the complex GVC activities that led the increase in the global trades' growth rate. Figure 2 also shows a positive relation between the growth rate of complex GVCs, and the growth rate of world trade compared to world GDP. Whenever global real GDP growth got exceeded by the real growth rate of global trade, the growth rate of complex GVC was the highest of all production activities and the other way around in terms of higher real-world GDP growth. (World Bank & World Trade Organization, 2019) This can be

explained by the fact that complex GVC is the only production activity of the four for which at least two borders are crossed during the production process. Therefore, complex GVC have a great impact on global trade growth. (Baldwin & Lopez-Gonzalez, 2013; Raei et al., 2019; World Bank & World Trade Organization, 2019)

Figure 2. Nominal Growth Rates of Production Activities and GDP on a Global Level, 2000-2017



Source: World Bank & World Trade Organization, 2019, p.12, Figure 1.3.

1.2 COVID-19 and GVCs

COVID-19 has controlled the world since 2020, what started in China in 2019 was soon to be found in almost every country. As most countries around the world got affected by the virus, COVID-19 differentiates itself from other recent virus outbreaks. Previous recent virus outbreaks were called epidemics as they appeared more limited and local such as SARS from 2002 to 2004, MERS from 2013 to 2017 and Ebola from 2014 to 2016. Because of its global spread, COVID-19 is found to be a pandemic. (Strange, 2020)

Another way in which the COVID-19 virus distinguishes itself is that it has multi-dimensional effects on both health and economics in most countries. As said before, worldwide measures had to be taken to contain the spread of the virus which had an impact on worldwide trade and investments. What's more, policy responses designed to constrain the spread of the virus exacerbate the negative impact on the economy, and vice versa. (Chief Economist Team, 2020; Strange, 2020) Among the disruptions caused by the pandemic belong the stagnation of economic activities and lockdowns which caused demand shocks. (Shingal & Agarwal, 2020) Additionally, disruptions in supply networks, either temporary or permanent, caused supply shocks. (Shingal & Agarwal, 2020) Furthermore, it has already been recognized that operations and supply chains might experience a significant effect caused by the pandemic on their management, organization, and structure. (Barbieri et al., 2020)

Moreover, because of the highly interrelatedness across countries in terms of globalization, referring to GVCs and the international movements of people, capital, goods and services, the pandemic is not only contagious in the sense of public health but also in economic terms. (Shingal & Agarwal, 2020; Strange, 2020) This can be explained by looking at the way international trade is shaped. Strange (2020) found that for international trade, 60 percent consists of intermediate goods and services. In addition, within total world trade, 80 percent is connected to MNEs in which the MNE is either the importer, exporter or the leading company in the GVC. For roughly 40 percent of the total world trade, MNEs are simultaneously exporter and importer. (Casella et al., 2019; Strange, 2020) Consequently, this stimulates the interrelatedness across countries world wide and in terms of the pandemic it increases the effects of the virus on both public health and economic terms for countries that are involved. The only way a country would not have been affected, both health and economically, would be if it was totally isolated. (Strange, 2020)

II. The Drivers of Global Value Chains

This chapter presents the theoretical framework and the propositions for this study which will serve as the foundation for the empirical analysis conducted later in this study. This theoretical framework will elaborate on the motives behind offshoring and reshoring decisions as those decisions have a direct effect on GVCs. Those motives are explained in advantages and disadvantages, also referred to as drivers of offshoring and reshoring. They will be examined under normal circumstances on a country level, without any crisis having an impact on GVCs. In times of crisis some drivers will change as the factors change. Since production processes are exposed to risks in times of crisis, it is plausible to assume that this exposure may influence the importance of certain factors in decision making. Later in this study, the conceptual framework will be used to examine if exposure to risk could affect the decision making on offshoring and reshoring and thus on GVCs. Therefore, the conceptual framework will be based on literature that comprises such decision making on offshoring and reshoring and the patterns of GVCs.

2.1 Offshoring & Reshoring

Global Value Chains are affected by decisions on offshoring and reshoring. Therefore, it is necessary to understand the meaning of those terms and motives behind them. To understand the meaning of the term offshoring, the next definition can be given: “a business’s (or a government’s) decision to replace domestically supplied service functions with imported services produced offshore”. (OECD, Offshoring, 2013) Then, when an organization decides to offshore its production it has different modalities through which it can operate. Hence, offshoring can take place through either outsourcing or Foreign Direct Investment (FDI). (Juma’h & Campus, 2007) That is to say, offshoring refers to a decision of a company to acquire “services from an outside (unaffiliated) company or an offshore supplier”, which is a form of outsourcing, or the company can invest in a foreign affiliate to offshore its services through Foreign Direct Investment (FDI), which is called ‘offshore in-house sourcing’. (OECD, Offshoring, 2013) Moreover, when referring to offshoring, this study refers to all intermediary productions taking place in foreign countries, either through outsourcing or FDI. In addition, reshoring can be referred to as bringing back previously offshored production activities to a domestic location. In other words, reshoring is the reversal of offshoring decisions. (Benstead et al., 2017) As mentioned, these decisions on offshoring and reshoring have a direct effect on global trade and thus on GVCs. Therefore, when analyzing GVCs it is complementary to

analyzing international production decisions on outsourcing and FDI, in other words analyzing the drivers of offshoring and reshoring. (Casella et al., 2019; Benstead et al., 2017)

To understand a company's choice for offshoring and reshoring, John Dunning developed a theoretical framework which is known as the eclectic or OLI paradigm. This paradigm states that the considerations for offshoring/reshoring and modality choice depend on company's advantages in ownership (O), location (L) and internalization (I). First, an ownership specific advantage refers to a company's competitive advantage, or market power, gained by its products or even its production processes. Hence, for a company to be able to operate successfully it is necessary to have an ownership advantage, especially when the company is planning on operating in foreign countries because of liability of foreignness. Moreover, the ownership advantage can be subdivided in asset advantages (Oa) and institutional advantages (Oi). Whereas the asset advantages (Oa) refer to the resource structure of the company, the institutional advantages (Oi) refer to the institutions, both formal and informal, governing the value-added processes within the company, and between the company and its stakeholders. Thereafter, location specific advantages (L) determine if it is useful for a company to produce offshore or domestically. The location advantage depends on country specific properties and can be assigned to either the domestic or foreign country. Thereby, the L-advantage influences a company's decision on offshoring and reshoring. More specifically, a company would consider offshoring when location specific advantages can be found in a foreign country. In case a company has offshored activities, but its domestic country shows to have L-advantages, it is not necessarily useful for the company to have offshored activities and the company might consider reshoring its activities. Lastly, when a company decides to offshore/reshore, the internalization advantages (I) can influence a company's modality choice. In other words, internalization advantages determine the way in which offshoring/reshoring will take place, either through outsourcing or FDI. The internalization advantage refers to ownership and control, and rests on the transaction cost theory. When internalizing, a company owns and controls the whole production process which leads to efficient governance of the business and therefore lowers the transaction costs. For example, when a company decides to offshore its production, because of the ownership and the foreign location advantages, and it also has an internalization advantage, then it could be beneficial for a company to make use of fully owned subsidiaries (FDI) and thereby internalizing its foreign activities, instead of using arm's-length agreements (outsourcing). (Benstead et al., 2017; Dunning & Lundan, 2008; Navaretti & Venables, 2004) That is to say, according to the OLI paradigm, offshoring will take place when a company is in possession of an ownership advantage, and a foreign country is in possession

of a location advantage of which the company can profit. Whether there is an internalization advantage will determine through which modality the company will offshore. When there is an I-advantage, the company would use FDI otherwise the company would make use of arm's-length agreements. (Navaretti & Venables, 2004)

Moreover, to comprehend a company's choice to offshore and reshoring it is important to understand the drivers behind them. As mentioned, it is necessary for a company to have an ownership advantage to be able to operate successfully. In addition, the L-advantage gives the usefulness of offshoring/reshoring and the I-advantage determines if a company will make use of either outsourcing or FDI. Therefore, a company's decision on offshoring/reshoring depends on having an O-advantage and the comparison between advantages and disadvantages coming from offshore production compared to domestic production relating to Dunning's L- and I-advantages. (Dunning & Lundan, 2008; Navaretti & Venables, 2004) When companies reverse their offshored activities, and thus turn towards reshoring, it could be a result of changes within the company, e.g., losing O-advantages, or outside the company, e.g., losing L- or I-advantage. For example, the exposure to risks in foreign countries through changes in external factors, factors at which the company itself does not have any influence, could be a reason for a company to reshore its activities. (Benstead et al., 2017) Benstead et al. (2017) came up with a framework that captures both the reason behind reshoring and how this can be operationalized. Since reshoring is the reversal of offshoring decisions, the drivers of offshoring and reshoring are interchangeable. Therefore, this study will take Benstead et al. (2017) as the basis supplemented with findings from other literature to explain the drivers of offshoring and reshoring. The first part of the framework, which is based on prior literature, contains the next three main elements: the drivers of offshoring/reshoring; considerations of implementing offshoring/reshoring; and the factors of contingency, which is also represented by Figure 3 below.

First, the following categories are given as drivers for offshoring and reshoring. Foremost, offshoring and reshoring could take place for the ease of doing business. For offshoring this means the possibility to expand the productive capacity to desired quantity. Moreover, the access to regional and secondary markets and the increase in the talent pool are strong drivers for offshoring. (Gurtu et al., 2019) Besides, GVCs diversify and therefore unsystematic risk gets reduced by offshoring. As well, companies become more resilient to supply chain disruptions as a result of the diversified sourcing. Furthermore, GVCs give access to a greater number of possibilities in final goods, they give companies the possibility to satisfy consumer need more with offshored production than with domestic production. (Strange, 2020)

For reshoring the ease of doing business means running operations more efficient domestically, or to avoid risks and uncertainty that come with offshoring. By reshoring, companies decrease the distance within their production process, literally and figuratively. (Benstead et al., 2017) Connecting this to the OLI paradigm, the considerations of this driver can be seen as L- and I-advantages of either the foreign or domestic country. (Dunning & Lundan, 2008; Navaretti & Venables, 2004) Another driver for offshoring and reshoring could be to reduce certain costs. Usually, the production of intermediate goods and services in a foreign country can take place at a lower price, which is a locational advantage and might drive companies to offshore. (Strange, 2020; Gurtu et al., 2019) The foreign input being cheaper could be explained by lower labor costs in these countries. The savings through the lower labor costs were mostly used to cover for the logistic expenses of offshoring. However, labor costs in outsourced locations and the transportation costs might increase, which in turn increases the total cost of offshore production. Whenever this happens, a locational advantage gets turned into a disadvantage. Additionally, offshoring might lead to higher additional transaction costs, e.g., higher logistic expenses, but also communication and other administrative costs increase. When the total costs of offshore production are higher than domestic production, companies might consider to reshore their production. Hence, cost saving is for both offshoring and reshoring a strong driver. (Dunning & Lundan, 2008; Gurtu et al., 2019; Wu & Zhang, 2011) Also, infrastructure could be a driving force for reshoring when domestic infrastructure has better access. The last driver could be a company's competitive priorities, this refers also to the operational strategy. (Benstead et al., 2017) Again, these drivers can be linked to Dunning's OLI paradigm. (Dunning & Lundan, 2008; Navaretti & Venables, 2004)

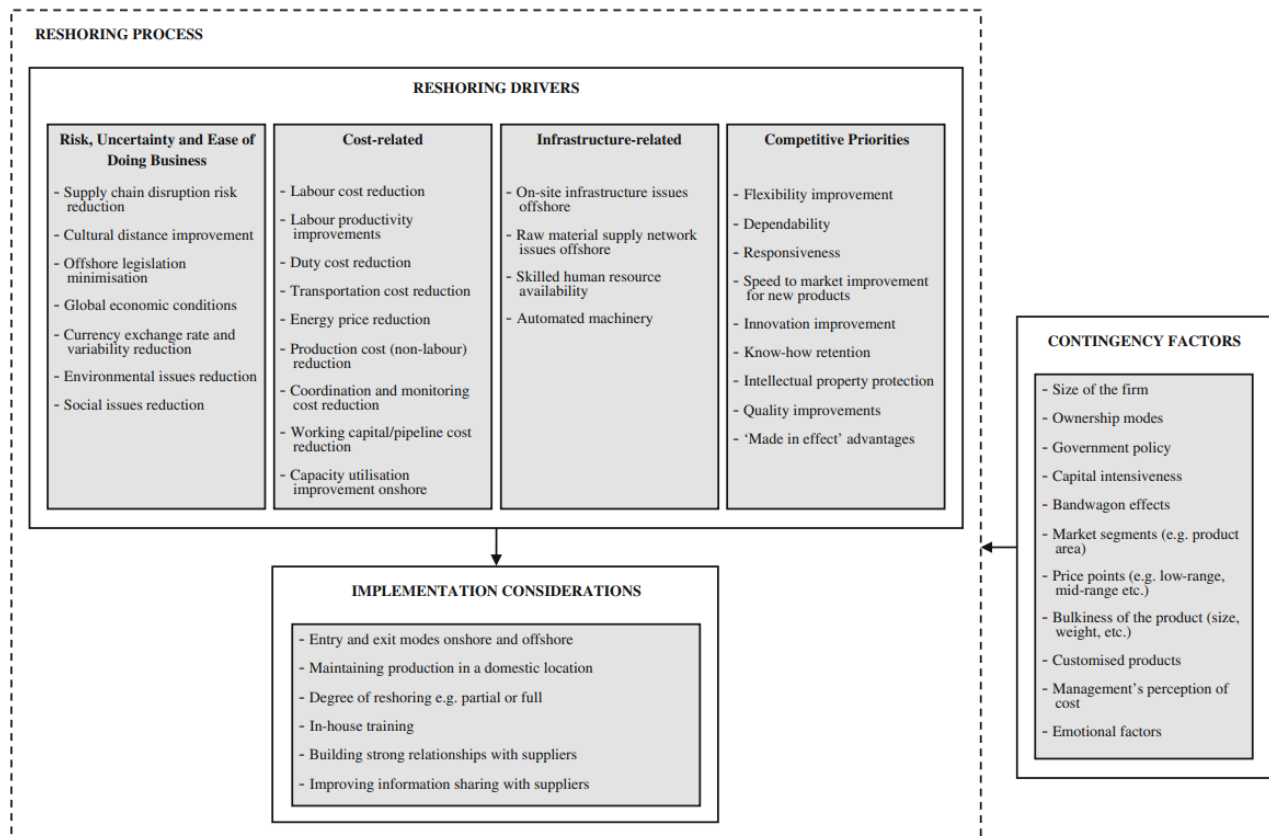
Then, for the implementation considerations on reshoring it is meaningful to consider a firm's entry mode in a country. (Benstead et al., 2017) The entry mode of a firm in a country is one of the most important determinants when a company must decide to (partly) reshore its offshored activities. (Benstead et al., 2017; Moriconi et al., 2019) It has been recognized that the entry mode in a foreign location can influence a company's exit strategy. For example, when a company offshored to a foreign country but did not own a factory – making use of arm's-length agreements (outsourcing) instead of fully owned subsidiaries (FDI) – it is easier for the company to withdraw from the offshore activities and reshore its production process to its domestic country. (Benstead et al., 2017; Dunning & Lundan, 2008; Navaretti & Venables, 2004) As well, it is essential for the company to consider the domestic entry mode when going back to the home location. Thereby, as mentioned before, the OLI specifications are defining for both offshoring and reshoring. For example, when a company decides to reshore an

offshored production process it might consider a change in its modality choice going from outsourcing to insourcing, in other words the company decides to internalize its activities (I). (Benstead et al., 2017; Dunning & Lundan, 2008) Hence, the way of ownership might change when the location changes and vice versa. Besides, it is acknowledged that reshoring does not have to contain a company's whole offshored production process, reshoring can also take place partially, leaving a part of the offshored production offshore. (Benstead et al., 2017) When a company does consider (partial) reshoring it should take into account the possible barriers of gaining access to finance and labor in its domestic country. These barriers could be a result of the previously made choice to offshore production. The domestic country could have adapted to the situation of offshored production or was never even in possession of the necessary finance/labor. Possible ways to overcome these barriers are in-house training, and strong relationships and information sharing with suppliers. (Benstead et al., 2017)

In addition, whether drivers lead a company to offshore/reshore and the way of implementing the offshore/reshore decision is affected by contingency factors, as can be seen in Figure 3. In other words, contingency factors explain indirect influences within the process of offshoring/reshoring. (Benstead et al., 2017) In addition, these contingency factors can be linked to one of the specifications of Dunning's OLI paradigm (2008). Benstead et al. (2017) have acknowledged the following eleven contingency factors. First, the size of the organization could have an influence on the decision making on reshoring. Large organizations are found to be more active in reshoring, which is explained by the fact that in the first place large organizations are more active in offshoring. What's more is that when SMEs do reshore, they do it earlier than large organizations because of unwillingness or inability to face difficulties that come with offshoring. (Benstead et al., 2017; Wu & Zhang, 2011) Then, the decision making on internalizing or outsourcing, Dunning's I, is the second contingency factor. This factor could influence reshoring drivers in terms of their weight, and the time and way reshoring should take place. Following, reshoring drivers can also be influenced by government policy as governments can use their policies to make reshoring more attractive and feasible for companies. (Benstead et al., 2017) Yet, this can similarly be applied on offshoring as foreign governments can also use their policies to attract companies. In addition, when a company considers offshoring or reshoring its production, the cost of entry is also of great influence as this is the fixed cost of the production activities. A country's cost of entry gets affected by its legislation, policies, and regulations. While for a company to offshore its production, low cost of entry in the foreign country would be desirable, for reshoring it would be desirable for the domestic country to have low entry cost. (Moriconi et al., 2019) Moriconi et al. (2019) studied

the effect of institutional fixed costs and immigration networks on offshoring, as these are part of the entry costs. They found that offshoring is negatively affected by institutional fixed costs as they are positively related to the entry costs of a country. On the contrary, immigrant networks are positive related to offshoring. The idea behind this is that a company may draw on the connections and knowledge of its foreign workers which will reduce the cost of entry of the country of origin of the workers. (Moriconi et al., 2019) Connecting the attractiveness and entry cost of a country to the OLI paradigm, it is to say that it can be seen as L-specifications. (Dunning & Lundan, 2008) Then, the fourth contingency factor mentioned is capital intensiveness. Low capital intensive productions are seen to be more often offshored than high capital intensive productions. This is explained by the reasoning of low capital intensive productions being involved with high labor content, which is more likely to take place offshore, in lower wage countries. (Benstead et al., 2017; Wu & Zhang, 2011) In addition to the in-house decision making of companies, actions of competitors may also influence the decision making of an organization. Therefore, bandwagon effects (competitive pressure) are also seen as a contingency factor. Thereafter, the following contingency factors are based on properties of the produced good: market segment, price point, bulkiness of the product and customised products. Another factor could be the management's perception of cost, which refers to misjudgements in the offshoring decision making process which might lead to a company to decide on reshoring. Lastly, emotional factors might have an effect on the influence of drivers on the decision to offshore/reshore. For example, fear of risks (risk aversion) might increase the influence the weight on reshoring drivers. (Benstead et al., 2017)

Figure 3. Reshoring (Offshoring Reversed)



Source: Benstead et al., 2017, p. 91, Figure 2.

2.2 Propositions

Before, companies would offshore their productions based on location advantages (L) and drivers such as cost saving through lower labor costs in foreign country; expanding capacities; access to markets and talent pool; reducing unsystematic risk by GVCs; etc. Companies were also familiar with the disadvantages of offshoring, such as higher transaction costs. (Strange, 2020; Gurtu et al., 2019) However, time has changed and based on the information provided in previous sections, the pandemic is a new phenomenon, affecting the whole world. Therefore, it comes with a lot of uncertainty and enlarges the risks of international trade and GVCs. Moreover, borders have been closed, and companies were put to a stop as a measure against the spread of the pandemic. This resulted in shocks in the supply and demand chains which directly affects GVCs. (Barbieri et al., 2020; Shingal & Agarwal, 2020) Furthermore, these shocks in supply chains have pointed out the need for economic self-sufficiency among many economies. But also the need for better strategies to cope with global risks that come with, or are enlarged by, such crises. One of the reactions of countries has been the establishment of more trade

policy interventions, which goes at the cost of international trade and affects GVCs. (Seric et al., 2021)

Reflecting this on the drivers for offshoring and reshoring, the pandemic might cause some changes among companies' earlier decisions on their production process. The increase in uncertainty and risks, and the measures taken as a result of the pandemic could be a reason for companies to (partly) reshore their operations. Based on the drivers of reshoring, reshoring would give companies more certainty and lowers the risks. In addition, transactions costs of offshoring, e.g., transportation costs, have been enlarged as a result of the measures taken against the spread of the virus. Therefore, through (partly) reshoring operations, a company can also save costs as a result of lower transportation costs. (Benstead et al., 2017) Hence, when production processes are fully reshored it will decrease the amount of GVCs and when partly reshored, it will decrease the length of GVCs.

Furthermore, within this study it has become clear that understanding the effect of the pandemic on GVCs in the long run is of great importance. Therefore, the main aim of this study is to examine the effect of COVID-19 on Global Value Chains (GVCs). Hence, this study will give answer to the following research question: *What will be the effect of COVID-19 on Global Value Chains?* From the previous sections, it can be summarized that it is important to understand a company's motives for offshoring and reshoring as those have a direct effect on GVCs. Therefore, this study is going to examine the effect of similar crises like the pandemic on the amount and length of GVCs. Based on the literature, it would be plausible to think that companies would (partly) reshore their production activities as a reaction on crises such as the pandemic which would affect the amount and length of GVCs. For example, the costs of doing business on an international level might increase as a result of the pandemic, which would give companies a reason to partly or wholly reshore their operations. This would shorten or decrease the amount of GVCs. It is for that reason, that the propositions of this study relate to the decision making on reshoring offshored productions. The first proposition therefore relates to the amount of GVCs. The second proposition relates to the length of GVCs, to see if the length of GVCs is affected by the crisis. Hence, the following propositions are suggested:

Proposition 1: COVID-19 is expected to have a negative effect on the importance of GVCs in the world.

Proposition 2: COVID-19 is expected to have a negative effect on the length of GVCs.

III. Data and Method

This chapter sets out the collection of data and the empirical strategy for this study. This empirical strategy is built upon the key elements of the theoretical framework set out in the previous chapter. Furthermore, it elaborates on the methods used within the quantitative research to examine the propositions made in chapter II.

COVID-19 seems to influence Global Value Chains. However, because the pandemic is such a new phenomenon it is uncertain what the long-term effect of the pandemic will be on GVCs. The recency of the pandemic ensures that the propositions made in Section 2.2 cannot be examined directly. Therefore, looking back at recently happened disasters with similar properties as the current pandemic that affected GVCs, might help predicting the effect of COVID-19 on the importance of GVCs and the length of GVCs.

First, COVID-19 is compared to two epidemics, named SARS and MERS, which happened over the last two decades and are most representative of the pandemic. The epidemics and the pandemic share similarities in nature, in other words they form a similar type of disaster. All three the disasters – SARS, MERS and COVID-19 – carry the same properties as containing symptoms like the flu, and their quick spread originated from an epicenter. (Shingal & Agarwal, 2020) As for MERS the contagion is in the first place from dromedary camels to human and does not as much occur from human to human like SARS, it is the spread of SARS that is most comparable to the spread of COVID-19. (Pietrasik, 2021; Frost, 2021) In addition, the disruption of value chains has been similar for the previous epidemics and the current pandemic. On the other hand, the main difference between COVID-19 and previous epidemics lays in the fact that for the latter two ‘only’ a few countries were hit by the epidemics while COVID-19 is a pandemic and therefore affects the whole world. Hence, the epidemics are not fully representative for the pandemic as they fall short in their comprehensive effect. (Shingal & Agarwal, 2020) Nonetheless, this study tests for the effect of the epidemics on the importance of GVCs and the length of GVCs.

Thereafter, a comparison is made between the pandemic and the 2008 financial crisis based on their comprehensive effects. Both crises managed to hit economies worldwide. (Danielsson et al., 2020) Yet the difference between the financial implications that came with the pandemic and the financial crisis of 2008 is the time in which it caused a globally felt effect. Whereas ‘normal’ financial crises like the crisis of 2008 will spread to other countries in a certain amount of time after it started in one or two countries, the COVID-19 crisis spread fast, all advanced economies were hit at the same time by the underlying shock. (Baldwin, 2020) In

addition, these two crises also differ because of their remedies. As mentioned, the pandemic caused both a health and an economic crisis. Policy responses designed to constrain the spread of the virus exacerbate the negative impact on the economy, and vice versa. Therefore, the potential remedy for the pandemic is much more difficult to conceive and harder to match the underlying problem than for the financial crisis of 2008. (Strange, 2020) Nonetheless, because of the similarities in comprehensiveness and because this study is considering the effect of a crisis on GVCs, which is a more economic effect, the comparison made with the financial crisis is considered more valid than the epidemics.

3.1 Data

As the pandemic is recent, it is not possible to get long-term data on the effect of COVID-19 on GVCs. Hence, this study uses historical data on previous disasters in order to do the quantitative research and to examine the propositions made on the effect of the pandemic on GVCs to determine the long-run effects. To test for the importance of GVCs, this study determines if previously happened disasters have had a significant effect on the total value of GVCs. In addition, to test for the effect of previous crises on the length of GVCs, this study examines the effect of the crises on the key GVC indicators. The key GVC indicators include Domestic Value Added, Foreign Value Added and Indirect Value Added. A more comprehensive explanation on the indicators is given below. To measure the effect of the pandemic on the length of GVCs, this study will examine if the previous crises have had a significant effect on the Foreign Value Added. As a robustness check, this study looks at the effect of the crises on the other two indicators to see if this is in line with the results of the study done on Foreign Value Added. The GVC indicators are not a perfect measure of the length of GVCs, as they indicate the value of the indicator, which gives an indication of the length of GVCs, but not the exact number of border crossings during a production process. For example, when the value of an indicator increases, it means that the importance of the indicator has increased relatively, which is expected to influence the length of GVCs.

The data on GVCs and the key indicators are on country level and collected from the UNCTAD-Eora Global Value Chain Database. This database covers 189 countries, and the remaining countries are included within a region called ‘the rest of the world’. The database covers a data-frame from 1990 to 2018, of which the timeframe from 1999 to 2018 is used for this study as it is related to the crises studied. Moreover, the database includes GVC indicators based on value added (VA). (UNCTAD-Eora Global Value Chain Database, 2019; Casella et al., 2019) When referring to value added (VA) the following definition is used: “Value-added

trade is the value generated by one country but absorbed by another country, while the domestic content of exports depends only on where value is produced, not where and how that value is used.” (Koopman et al., 2010)

This study makes use of the following key GVC indicators:

- *Domestic Value Added (DVA)*, which refers to the value added by domestic industries/companies within a country’s exports. In other words, the inter-sector flows are domestic. For example, Figure 4 shows country A has an exports’ value of 170, from which 45 is added by country A, the domestic country. Therefore, the Domestic Value Added (DVA) of country A is 45.

When the total value of a GVC stays constant, a change in the share of DVA is assumed to be negatively related to the length of the GVC. In other words, an increase in the share of DVA leads to a decrease in the share of foreign VA. Moreover, when the share of foreign VA decreases it means that either the VA in a foreign country has decreased or the number of foreign countries involved in the GVC has decreased. Therefore, this study assumes that when the share of DVA increases, it will decrease the length of the GVC.

- *Foreign Value Added (FVA)*, which refers to the value added by foreign industries/companies within a country’s exports. In other words, country A requires inputs from other countries to produce its output. A part of this output generated by country A will be exported. Therefore, through their inputs, other countries also add value to the output of country A. For example, in Figure 4, country A has an export value of 170 of which 125 was imported from foreign countries, which is seen as the Foreign Value Added.

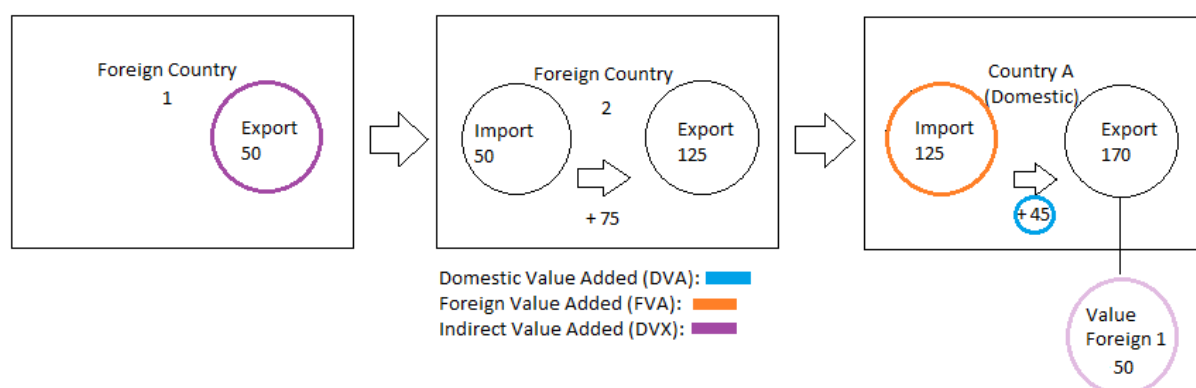
When the total value of a GVC stays constant, a change in the share of FVA is assumed to be positively related to the length of the GVC. In other words, an increase in the share of FVA leads to an increase in the share of foreign VA. Moreover, when the share of foreign VA increases it means that either the VA in a foreign country or the number of foreign countries involved in the GVC has increased. Therefore, this study assumes that when the share of FVA increases, it will increase the length of the GVC.

- *Indirect Value Added (DVX)*, which refers to the value added by domestic industries/companies within exports of other countries. In other words, looking at Figure 4, DVX gives the share of the domestic value added produced by foreign country 1 that turns into an intermediate input in the value added of exports produced by the other countries.

When the total value of a GVC stays constant, a change in the share of DVX is negatively related to the length of the GVC. In other words, an increase in the share of DVX leads to a decrease in the share of foreign VA.

(UNCTAD-Eora Global Value Chain Database, 2019; Casella et al., 2019)

Figure 4. Example Domestic Value Added (DVA), Foreign Value Added (FVA) and Indirect Value Added (DVX)



Looking at the figure above, it is possible that the export of country A gets imported again by foreign country 1. In other words, the final product is “re-imported” by the originating country, which is known as the re-imported DVA. Previous studies have shown that while some countries/industries might experience re-imported DVA more than others, it is a relatively small percentage on global trade. More specifically, “the OECD/WTO initiative estimates that the re-imported DVA equals to just 0.6 per cent of world gross exports in 2009”. Another study concluded that only 2-6 per cent gets re-imported for most countries/industries. (Casella et al., 2019) Since re-imported DVA makes only a small contribution to global trade and because Casella et al. (2019) have not included this indicator in their database, this study will not use it as an indicator. Hence, when the final product of country A gets imported by foreign country 1 (originating country), the re-imported value added will be included in the FVA for foreign country 1.

Additionally, this study makes use of control variables which are related to the theory discussed in the previous chapter. The control variables used will be comprehensively discussed below. Moreover, these control variables are collected from the World Development Indicators (WDI) which is part of the DataBank of The World Bank. The WDI comprises global development data collected from official international sources and covers most accurate and current data available. (The World Bank Group, 2021) The chosen control variables are checked and selected based on correlation, based on the criteria that correlation is low and does not exceed an amount of 3.0. (Hill et al., 2008) As the data on GVCs and the key GVC indicators

serve as the dependent variables, the collection of the data on the control variable has the same properties. The collected data is also on country level and covers the same countries and the timeframe used is from 1999 to 2018.

This study makes use of the following control variables:

- *GDP per Capita* (current US\$) (GDP): refers to the value added that is created within an economy (country) in current US dollars. Since it is per capita it means that the GDP has been divided by midyear population and thus it gives a good perspective when comparing to other economies. This variable has been chosen as it gives a good impression on the wealth within an economy. (The World Bank Group, 2021)
- *Compulsory Education*, duration (years) (CE): refers to the legally obliged number of years a child must attend school within a country. Compulsory education gives an impression on a country's believe in the development of children, but it also gives an impression on child labor. (The World Bank Group, 2021) When compulsory education is low, it can be assumed that children must work from an early age, leading to lower wages and higher labor content. This relates to the contingency factor capital attractiveness, discussed in Section 2.1. As mentioned above, it is common for low capital-intensive productions to involve high labor content, which is attractive for offshoring. (Benstead et al., 2017; Wu & Zhang, 2011) Therefore, compulsory education is expected to have a positive relationship with GVCs. Furthermore, it is also related to the contingency factor government policy since the government has a direct influence on the amount of compulsory education. Hence, this indicator has been chosen as a control variable as it is related to the literature and it is expected to influence GVCs and its key indicators.
- *School Enrollment Secondary Grade* (SESG): refers to the gross enrollment ratio, it gives the percentage of how many people have been enrolled to secondary education. The aim of secondary education is to lay foundations for human development and lifelong learning, and it is more subject- or skill-oriented than the primary education. Hence, it gives an impression on the level of the subject- or skill-orientation of a country's population. (The World Bank Group, 2021) This indicator is also related to the contingency factor capital attractiveness and besides it influences the driver competitive priorities. When the gross enrollment ratio on secondary education increases it could be assumed that it will result in higher capital-intensive work. Thereby, it will also stimulate innovation as people become more skilled and educated

which increases competitive priorities. Again, this influences GVCs and its key indicators which is the reason why this indicator is part of the control variables within this study.

- *Cost of Business Start-up (CBSU)*: refers to the cost of registering a business as a percentage of the gross national income (GNI) per capita. (The World Bank Group, 2021) This indicator is also expected to have a negative relationship with the attractiveness of a country to start a business. As this influence's offshoring/reshoring decision making and therefore on GVCs, this indicator is used as a control variable.
- *Taxes on International Trade (TIT)*: refers to all taxes on international trade as a percentage of the government's revenue. Included are export duties, import duties, profits of export/import monopolies, exchange profits, and exchange taxes. (The World Bank Group, 2021) When taxes on international trade are a high percentage of a government's revenue, the country would be unattractive for international trade for both domestic companies doing business with foreign countries and foreign companies doing business in the concerning country. Therefore, it is expected to have a negative relationship with GVCs. Because of its expected influence on GVCs, this study has taken this indicator as a control variable.

To provide an overview of all variables used and the corresponding data, the descriptive statistics are discussed in the tables below. As previously mentioned, this study uses data from the SARS and MERS epidemics, and the 2008 financial crisis to see what effect crises with similar characteristics to the pandemic have had on GVCs, to make a prediction about the effect of COVID-19 on GVCs. Since the variables GVC, DVA, FVA, DVX, GDP per Capita, School Enrollment Secondary Grade, Cost of Business Start-up and Taxes on International Trade were found to have a skewed right distribution, and thus are not normally distributed, a lognormal distribution was used. Thereby, the discrepancies in observations for the variables Cost of Business Start-up and Taxes on International Trade can be explained by the fact that some countries had a value of zero for the variable and these are not included by Stata. Given that the crises were each studied separately, the descriptive statistics presented below summarize the data analyzed separately for each crisis.

Table 1. Descriptive Statistics SARS

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	474	2002.5	2.632734	1999	2006
<i>GVC</i>	474	15.17933	2.464146	9.980449	20.63771
<i>DVA</i>	474	15.53864	2.251738	10.16969	20.66881
<i>FVA</i>	474	14.37295	2.594149	9.296518	20.06162
<i>DVX</i>	474	14.47773	2.402788	9.126959	19.81196
<i>GDP per Capita (GDP)</i>	474	13.10301	2.53668	6.915227	16.11692
<i>Compulsory Education (CE)</i>	474	9.161181	2.005197	4	16
<i>School Enrolment Secondary Grade (SESG)</i>	474	15.02621	1.266016	4.608465	16.11759
<i>Cost of Business Start-up (CBSU)</i>	468	2.771762	1.535837	-1.609438	6.813445
<i>Taxes on International Trade (TIT)</i>	399	12.15235	6.272018	-9.579956	16.11437

Table 2. Descriptive Statistics MERS

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	416	2012.75	3.116223	2010	2018
<i>GVC</i>	416	16.14753	2.56074	11.35744	21.08094
<i>DVA</i>	416	16.44622	2.414625	10.99541	21.35454
<i>FVA</i>	416	15.28749	2.689471	8.707813	20.51624
<i>DVX</i>	416	15.44475	2.568164	9.903487	20.342
<i>GDP per Capita (GDP)</i>	416	12.49091	2.664015	7.153904	16.11576
<i>Compulsory Education (CE)</i>	416	9.978365	2.169229	5	16
<i>School Enrolment Secondary Grade (SESG)</i>	416	14.99483	1.083711	11.4073	16.11767
<i>Cost of Business Start-up (CBSU)</i>	409	1.979726	1.555744	-2.302585	5.423186
<i>Taxes on International Trade (TIT)</i>	335	11.82843	6.636211	-9.91556	16.03496

Table 3. Descriptive Statistics Financial Crisis

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	2,286	2008.5	5.189263	2000	2017
<i>GVC</i>	2,286	15.30802	2.636014	9.568015	21.10853
<i>DVA</i>	2,286	15.696	2.480614	10.03889	21.32758
<i>FVA</i>	2,286	14.41279	2.750941	8.074026	20.58974
<i>DVX</i>	2,286	14.64279	2.617018	8.941153	20.31078
<i>GDP per Capita (GDP)</i>	2,286	13.01069	2.635608	5.503297	16.11692
<i>Cost of Business Start-up (CBSU)</i>	2,267	2.419016	1.611883	-2.525729	7.182656
<i>Taxes on International Trade (TIT)</i>	1,962	12.42743	6.023964	-11.19084	16.11437

3.2 Methodology

3.2.1 Method Epidemics SARS and MERS

To test for the effect of the SARS and MERS epidemics on GVCs, this study will examine the difference between what happened with the GVC indicators during the crises and what would have happened had the crises not happened. Therefore, this study contains a difference-in-difference analysis for the quantitative research on the epidemics SARS and MERS. For this difference-in-difference analysis, the epidemics SARS and MERS are used as treatments. Thus, when speaking about a treatment, this study refers to the epidemics studied. Consequently, the difference in differences in observed outcomes between the affected (treated) and non-affected (non-treated) countries will be compared across periods before and after the epidemics. Besides, this difference-in-difference analysis, the regression will control for the fact that an observation of the GVC indicators is from the crises period and whether it belongs to the group of affected countries. (Abadie, 2005; Bertrand et al., 2004)

The basic specification of the difference-in-difference model is as follows:

$$\delta_{it} = \alpha_1 + \alpha_2 D_T + \alpha_3 D^Y + \alpha_4 D_T^Y + \alpha_5 GDP + \alpha_6 CE + \alpha_7 SESG + \alpha_8 CBSU + \alpha_9 TIT + \varepsilon_{it}$$

Where δ_{it} is the dependent variable, so either GVC or one of the key indicators of GVCs, depending on the proposition examined. Moreover, the parameter i represents the group of countries studied and t represents the time period of the study. The residual is given by ε_{it} . Within this model the variable D_T represents a dummy variable of the treatment period, for which the dummy variable has a value of zero for the period before the treatment (epidemic) and a value of one for the period after the treatment. This study has taken one to three years for the periods before and after the treatment, depending on the availability of data. For the study on SARS, D_T equals zero for the period 1999-2001 (before), and one for the period 2004-2006 (after). For the study on MERS, D_T equals zero for the period 2010-2012, the period before the treatment, and one for 2018, the period after the treatment. The period after the treatment for MERS is only one year because there is no more recent data available on GVCs and the key indicators. The variable D^Y represents a dummy variable including the treatment group and the control group. In other words, D^Y has a value of zero for the non-affected countries (control group) and a value of one for the affected (treatment group) countries. For SARS, the treatment group consists of China, Canada, Singapore and Vietnam as those countries were affected by the epidemic. The control group encompasses 75 countries, which can be explained by the

number of countries included in the UNCTAD-Eora Global Value Chain Database that had a value above zero for minus missing data among the control variables. A more detailed explanation on how this study has handled with missing data will be provided below. For MERS, the treatment group consists of Saudi Arabia, United Arab Emirates, and the Republic of Korea. Hence, the control group encompasses 101 countries, which again can be explained by the number of countries included in the UNCTAD-Eora Global Value Chain Database that had a value above zero for minus missing data among the control variables. Then, variable D_T^Y is a dummy variable controlling for the fact that an observation belongs to the group of treated and whether it is from the treatment period. Therefore, variable D_T^Y is also called the interaction term and captures the difference in differences. For the study on SARS this means that the interaction term can only have a value of one if the results are from the period 2004-2006 and the country was affected by the epidemic. For the study on MERS this means that the interaction term can only have a value of one if the results are from 2018 and the country was affected by the epidemic. (University of Copenhagen;, 2019) The control variables for this analysis are GDP per capita (GDP), compulsory education duration (CE), School enrollment secondary grade (SESG), Cost of business start-up procedures (CBSU), and Taxes on international trade (TIT). To correct for missing data among the control variables, this study used a dummy variable adjustment, replacing the missing data with the average value of the variable in question for the country in question when possible to avoid too much data loss. If it was not possible to subtract the average value of a variable for a specific country, the country was not included in the analysis. (Hill et al., 2008)

Moreover, the assumptions of the difference-in-difference equal the assumptions of the OLS model. An important assumption is that data is normally distributed. However, as mentioned before, the majority of the variables happened to have a “skewed right” distribution which means that they have long right tail. Therefore, a lognormal distribution is used for the variables GVC, DVA, FVA, DVX, GDP per Capita, School Enrollment Secondary Grade, Cost of Business Start-up and Taxes on International Trade. In addition, there is, among other things, the assumption that there is no correlation between the explanatory variable, the epidemic (treatment), and the residual. A general issue is that obtaining the treatment and the outcome variable are in reality often related. Moreover, the explanatory variable and the residual would then be correlated and there would be nonrandomness which leads to a biased estimation. This would normally result in using an Instrumental Variable. (Hill et al., 2008) However, for this study the assumption on having no correlation between the explanatory variable and the residual can be maintained. Since epidemics are a result of infectious diseases it is important to

understand the occurrence and spread of such infectious diseases as this will show that there is no correlation between the explanatory variable and the residual. According to a report on epidemics and infectious diseases, the occurrence of infectious diseases is a 'blind' process which results from constant accidental changes in genetics of germs, bacteria and viruses. Therefore, it can be stated that the outbreak of an infectious disease, and thus an epidemic, is at random. In addition, the transmission of infectious diseases differs per disease. (Vandenbroucke-Grauls et al., 2021) For SARS the transmission was mainly from human to human and for MERS it was mainly from dromedary camels to human and another human could then be indirectly infected. However, there is no clear reason why some countries suffered from an epidemic caused by the virus and others with similar characteristics did not or less. (Pietrasik, 2021; Frost, 2021) Therefore, it also applies to the spread of the epidemic that it happened at random. Hence, there is no correlation between the acquisition of the treatment (epidemic) and the outcome variable and thus difference-in-difference analysis is sufficient. (Hill et al., 2008)

To conclude, to measure the effect of the epidemics on the importance and length of the GVCs, a difference-in-difference analysis is performed in this study. Having China in the treatment group for the SARS epidemic could give a biased effect, since China is a very large country relative to the other affected countries and it was also economically emerging at the time. In order to verify whether the presence of China in the treatment group had an effect on the results, the analysis was conducted again with China excluded from the treatment group. In addition, for the MERS epidemic, China was not included in the treatment group. In order to determine whether the absence of China in the treatment group influenced the results, the analysis was conducted again with China in the treatment group. In addition, the countries included in the treatment group for the main analysis of the impact of the MERS epidemic were those that were hardest hit. However, the spread of the virus has also reached many other countries, including some Western countries in the E.U. and the U.S. (Middle East Respiratory Syndrome (MERS), 2019) Therefore, another robustness check was conducted to measure whether the results differ when all affected countries are included in the treatment group, compared to the first choice of treatment group. This study also examined whether the impact of the MERS epidemic would have been different if only the affected Western countries were included in the treatment group compared to the first choice of treatment group.

3.2.2 Method Global Financial Crisis

For the global financial crisis this study will make use of Panel Data Analysis to study the effect of the financial crisis on GVCs. As the financial crisis hit most of the world panel data is preferred over the difference-in-difference analysis. With the use of panel data, it is possible to examine data from different countries across time, it provides a better indication of a causal relationship. For panel data, the following formula is used:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + u_{it} + a_i + \mu_t + GDP + CBSU + TIT$$

Where, Y is the dependent variable, so either GVC or one of the key indicators of GVCs, depending on the proposition examined. The explanatory variable, the financial crisis, is given by X . Moreover, the parameter i stands for the economic entity, the countries in this study, and t stands for the time scale. (Hill et al., 2008) The dataset used for this analysis covers 127 countries, which again can be explained by the number of countries included in the UNCTAD-Eora Global Value Chain Database that had a value above zero for minus missing data among the control variables. For this study the time frame contains the years 2000 to 2017, based on the literature of World Bank & World Trade Organization (2019), discussed in chapter I. Officially the financial crisis took place in 2008 and 2009, which is used in this study. For the period after the crisis, this study took 2010 to 2017 as the financial crisis has had a significant aftermath in the post-crisis years. (World Bank & World Trade Organization, 2019) Moreover, u_{it} is the error term and a_i encompasses the economic entity specific variation which is a variation that does not change over time. Additionally, μ_t is the time variation, it gives the variation for all economic entities between years, and these are simultaneously affected. In other words, a_i encompasses the country fixed effects and μ_t the time fixed effects. (Hill et al., 2008) The control variables for this analysis that are used are GDP per Capita (GDP), Cost of Business Start-up (CBSU), and Taxes on International Trade (TIT). Once more, to correct for missing data among the control variables, this study used a dummy variable adjustment, replacing the missing data with the average value of the variable in question for the country in question when possible. In case this was not possible, the related data was not included in the analysis.

Additionally, for panel data a common method is to use pooled regression. For this regression, some strong assumptions are made such as the assumption that the behavior of entities is similar through the years. These strong assumptions are for most studies somewhat unrealistic and one could question if the pooled regression is the right way to analyze the panel data. To test for the necessity to use another method than the pooled regression a Chow Test

could be performed to test for differences between economic entities. As it already can be concluded that the economic entities (the countries) in this study differ from one another, it is not necessary to perform the Chow Test. Furthermore, these differences between countries might cause the countries to have different intercepts and coefficients. To solve for the different intercepts, one could use the Fixed Effects (FE) model. By removing a_i , FE removes the economic entity specific variation. Then, by adding dummies FE corrects for the time invariant effects. Moreover, unique individual characteristics of entities are captured over time. Moreover, the FE model is seen as a very strong model, however, it also has some restrictions to it. It is not possible to measure variables which do not change over time. Additionally, the dummies used in a regression capture all characteristics that are stable. Hence, when using the FE model, it is not possible to use variation for estimating effects of variables that vary between economic entities. Concluding, the FE model only measures variables that change over time. (Hill et al., 2008)

To overcome the restrictions of the FE model, the Random Effects (RE) could be used for panel data. The RE model adds a random part which allows the model to include variables that are constant over time. However, a disadvantage of the RE model would be that correlation between the explanatory variable and the error term could lead to an overestimation of the coefficients. Therefore, correlation between the explanatory variable and the error term would lead to biased results. To test for the reliance of the RE model, and thus for correlation between the explanatory variables and the error term, one could use the Hausman Test. If the test determines that there is no correlation, one could use the RE model. Otherwise, in case of correlation, and thus the Hausman test p-value is below 0.05, one should use the FE model. (Hill et al., 2008)

What's more, to measure the effect of the financial crisis on the importance and length of the GVCs, a FE and RE analyses is performed in this study. As the financial crisis has had a significant aftermath in the post-crisis years, this study has done robustness checks to see if the aftermath might have had an effect on the results of the analyses done. Therefore, the analyses was conducted again with a change in crisis period. First, the original crisis period was extended to include the aftermath period 2012-2016 to see if this would give another result than the original analysis. Thereafter, another analysis was conducted in which the crisis period included only the aftermath period 2012-2016 to see what the effect of the aftermath has been on the importance and length of GVCs.

IV. Empirical Results

This chapter sets out the empirical results of this study. Primarily, by means of the difference-in-difference method, this study has estimated the effect of the epidemic caused by epidemics SARS and MERS on the importance of GVCs in the world and on the length of GVCs. The results of these difference-in-difference analyses are shown and discussed in Sections 4.1 and 4.2. Thereafter, by means of the FE model, this study has estimated the effects caused by the financial crisis of which the results are shown and discussed in Section 4.3.

4.1 Results SARS

This section will discuss the results of the difference-in-difference analyses done on the effect of SARS, shown in Table 4 (below). According to this statistical analysis done on the effect of SARS on GVCs, it can be concluded that the sample period does have a significant positive effect. This means that the total value of GVCs is higher for the years 2004 to 2006, the period after the SARS epidemic. In other words, it means that the total value of GVCs has increased over time, but it does not look at the difference between affected and non-affected countries. Nonetheless, the variable Affected Countries, so whether a country was affected by the epidemic in the years 2002 and 2003, appears to have no significant effect. In addition, when looking at the interaction term (years&affected) it also shows there is no significant effect. This means that the data on GVCs for Affected Countries in the years 2004 to 2006 (after the epidemic) does not significantly differ compared to the period before the epidemic or compared to the countries that were not affected by the epidemic. It is interesting to see that the interaction term shows no significant effect as this is in line with the expectations based on previous research done by Simola (2021) and Shingal and Argarwal (2020), that the epidemic had no significant long-term effect on the total value of GVCs. When looking at the control variables, it appears that the GDP per capita has a significant negative effect on GVCs. In addition, the control variable compulsory education produces a significant positive result, which is not in line with the expectations expressed in the data description section. Nonetheless, the significant negative results on the control variables cost of business and taxes on international trade are in line with the expectations.

Furthermore, to measure the effect of the epidemic on the length of GVCs this study has done the difference-in-difference analysis on FVA, and in addition the effect on DVA and DVX as a robustness check. The results of the analysis done on FVA show similar outcomes as the analysis done on GVC. First, the sample period does have a significant positive effect. Here,

however, the variable Affected Countries appears to have a significant positive effect. Therefore, the countries affected by the SARS epidemic have experienced an increase in the FVA and thus on the length of GVCs. However, to see if the epidemic had a significant effect on the total amount of GVCs it is important to look at the interaction term. Moreover, the interaction term (years&affected), again, does not give a significant effect. Once more, it is interesting to see that these results show no significant effect, which means that the SARS epidemic had no significant long-term effect on the length of GVCs. Furthermore, the results of the control variables are in line with the analysis done above. The control variable compulsory education has a significant positive effect on FVA, while the control variables GDP per capita, cost of business and taxes on international trade have a significant negative effect. The analyses done on DVA and DVX as robustness checks have confirmed the discussed results from the analysis done on FVA. According to the results of the analyses on the key GVC indicators the length of GVCs has increased over time but there was no significant long-term effect of the SARS epidemic.

Moreover, among the affected countries is China, which is very large relative to the other affected countries and was also emerging economically at the time. To see if having China in the treatment group has influenced the results the analysis has been performed again with China left out of the treatment group. However, removing China from the treatment group had no effect at all on the analysis, so no effect on Table 4 below. So contrary to expectations, the fact that China is part of the treatment group did not give biased results.

In conclusion, based on the difference-in-difference analysis done to measure the effect of the SARS epidemic on the importance of GVCs and the length of GVCs, this study found that there was no significant long-term effect of SARS on the importance or the length of GVCs. Therefore, these findings contradict the propositions made, as the crisis was expected to have a negative impact on the importance and length of GVCs. Nonetheless, these findings are consistent with the expectation of Simola (2021) and, Shingal and Argarwal (2020), that GVCs are well founded and unlikely to change as a result of a crisis.

Table 4. Difference-in-Difference Analysis SARS

	SARS	GVC	FVA	DVA	DVX
Sample Period (D_T)	.4383266* (2.43)	.4154697* (2.30)	0.3730464* (2.16)	.4629809* (2.52)	
Affected Countries (D^Y)	1.982275 (1.85)	2.386822* (2.22)	2.069536* (2.02)	1.356769 (1.24)	
GDP per Capita (GDP)	-.0945532* (-2.20)	-.1115188** (-2.58)	-.1012343* (-2.45)	-.0830833 (-1.89)	
Compulsory Education (CE)	.1639038*** (3.58)	.1930259*** (4.20)	.1403963*** (3.20)	.1432206** (3.07)	
School Enrolment Secondary Grade (SESG)	-.0484267 (-0.57)	-.0040978 (-0.05)	-.0784382 (-0.97)	-.0752609 (-0.87)	
Cost of Business Start-up (CBSU)	-.5675088*** (-8.34)	-.6047902*** (-8.85)	-.5184504*** (-7.95)	-.5575142*** (-8.04)	
Taxes on International Trade (TIT)	-.073533*** (-4.25)	-.084785*** (-4.88)	-.0429703** (-2.59)	-.0643229*** (-3.65)	
Interaction term (Year&Affected)(D_T^Y)	0.0302599 (0.02)	-.0039433 (-0.00)	.1590922 (0.11)	.1745931 (0.12)	
Constant	17.55403*** (12.31)	16.24989*** (11.35)	18.27219*** (13.37)	17.18373*** (11.82)	
Observations	399	399	399	399	
Adjusted R-squared	0.3838	0.4301	0.3403	0.3408	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

4.2 Results MERS

This section will discuss the results of the difference-in-difference analyses done on the effect of MERS, shown in Table 5 (below). According to this statistical analysis done on the effect of SARS on GVCs, it can be concluded that the sample period does have a significant negative effect. This means that the total value of GVCs was lower for 2018, the years after the MERS epidemic. In other words, it means that the total value of GVCs has decreased over time, but it does not look at the difference between affected and non-affected countries. In addition, the variable Affected Countries, so whether a country was affected by the MERS epidemic, appears to have a significant positive effect. Nonetheless, when looking at the interaction term (years&affected) it also shows there is no significant effect. This means that the data on GVCs for Affected Countries in the year 2018 (after the epidemic) does not significantly differ compared to the period before the MERS epidemic or compared to the countries that were not affected by the epidemic. It is interesting to see that the interaction term shows no significant effect as this is, again, in line with the expectations based on previous research done by Simola (2021) and Shingal and Argarwal (2020), that the epidemic had no significant long-term effect on the total value of GVCs. When looking at the control variables, it appears that the GDP per capita and cost of business have a significant negative effect on GVCs. However, the remaining control variables do not have a significant effect on the importance of GVCs.

Furthermore, to measure the effect of the MERS epidemic on the length of GVCs this study has, again, done the difference-in-difference analysis on FVA, and in addition the effect on DVA and DVX as a robustness check. The results of the analysis done on FVA show rather similar outcomes as the analysis done on GVC, as can be seen in Table 5 below. First, the sample period does have a significant negative effect. In addition, the variable Affected Countries appears to have a significant positive effect. Therefore, the countries affected by the MERS epidemic have experienced an increase in the FVA and thus in the length of GVCs. However, to see if the epidemic had a significant effect on the total amount of GVCs it is important to look at the interaction term. Moreover, the interaction term (years&affected), again, does not give a significant effect. Once more, it is interesting to see that the interaction term shows no significant effect, which means that the MERS epidemic had no significant long-term effect on the length of GVCs. Additionally, the results of the control variables are not entirely in line with the analysis done above. The control variables GDP per capita and cost of business again have a significant negative effect on the length of GVCs, and the effect of school enrollment secondary grade is still not significant. However, whereas for GVCs the control variables compulsory education and taxes on international trade had no significant result, now

the first one shows a significant positive effect and the later a significant negative effect. Furthermore, the analyses done on DVA and DVX as robustness checks have slightly different results. Whereas the sample period had a significant negative result on FVA, it does not have a significant effect on either DVA or DVX. The results of the variable Affected Countries appear to have a significant positive effect for both DVA and DVX, which is in line with the results on FVA. Therefore, the countries affected by the MERS epidemic have experienced an increase in the length of GVCs. However, to see if the epidemic had a significant effect on the total amount of GVCs it is important to look at the interaction term. Moreover, the interaction term (years&affected), again, does not give a significant effect. According to the results of the analyses on the key GVC indicators the length of GVCs has increased for affected countries but there was no significant long-term effect of the MERS epidemic.

Table 5. Difference-in-Difference Analysis MERS

	SARS	GVC	FVA	DVA	DVX
<i>Sample Period (D_T)</i>		-.523999* (-2.02)	-.6069523* (-2.37)	-.3880063 (-1.47)	-.4996418 (-1.82)
<i>Affected Countries (D^Y)</i>		3.096879*** (3.69)	3.220773*** (3.90)	2.89406*** (3.40)	3.093275*** (3.48)
<i>GDP per Capita (GDP)</i>		-.0875878* (-1.98)	-.0982552* (-2.25)	-.0692105 (-1.54)	-.0615863 (-1.32)
<i>Compulsory Education (CE)</i>		.0753166 (1.52)	.1561793*** (3.20)	.09102 (1.81)	.0509096 (0.97)
<i>School Enrolment Secondary Grade (SESG)</i>		-.129365 (-1.19)	-.130701 (-1.22)	-.170056 (-1.54)	-.1462457 (-1.27)
<i>Cost of Business Start-up (CBSU)</i>		-.7261709*** (-9.29)	-.7563397*** (-9.83)	-.6770568*** (-8.53)	-.7433468*** (-8.99)
<i>Taxes on International Trade (TIT)</i>		-.0326932 (-1.82)	-.0457193** (-2.58)	-.0014702 (-0.08)	-.0227227 (-1.19)
<i>Interaction term (Year&Affected)(D_T^Y)</i>		.5168455 (0.31)	.5227938 (0.32)	.482613 (0.29)	.5359523 (0.31)
<i>Constant</i>		19.97569*** (11.44)	18.63364*** (10.84)	20.1233*** (11.35)	19.40669*** (10.51)
<i>Observations</i>		335	335	335	335
<i>Adjusted R-squared</i>		0.3282	0.3855	0.2708	0.2883

Notes: The results are standardized beta coefficients, within the brackets is give the t-value. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Moreover, as discussed in Section 3.2.1, China was added to the treatment group as a robustness check to see if the results discussed above were affected. In order to determine if the presence of China in the treatment group has influenced the results, the analysis has been

performed again and the results are shown in Table 6 below. It can be concluded from the results that the values of the variables are slightly different and that the control variables have slightly different significance than in the first analysis of the MERS epidemic. Nevertheless, the variable sampling period still has a significant negative effect on the GVC and the FVA and the treatment group still appears to have a significant positive effect on the GVC and the key indicators. In addition, the interaction term still has no significant effect. Thus, adding China to the treatment group did not change the effect of the MERS epidemic on the importance and duration of GVCs.

Table 6. Difference-in-Difference Analysis MERS (Robustness Check, China Added to Treatment Group)

	SARS	GVC	FVA	DVA	DVX
<i>Sample Period (D_T)</i>		-.512708* (-2.01)	-.5921976* (-2.36)	.3774594 (-1.46)	-.4899615 (-1.81)
<i>Affected Countries (D^Y)</i>		3.383626*** (5.03)	3.49023*** (5.28)	3.26376*** (4.78)	3.370213*** (4.73)
<i>GDP per Capita (GDP)</i>		-.1053694* (-2.48)	-.116968** (-2.80)	.0852055* (-1.97)	-.0794063 (-1.76)
<i>Compulsory Education (CE)</i>		.0858756 (1.77)	.1667443*** (3.50)	.1016787* (2.07)	.0614857 (1.20)
<i>School Enrolment Secondary Grade (SESG)</i>		-.0681452 (-0.64)	-.0679981 (-0.65)	.1108098 (-1.02)	-.0850463 (-0.75)
<i>Cost of Business Start-up (CBSU)</i>		-.6785351*** (-8.87)	-.7072417*** (-9.40)	.6314997 *** (-8.13)	-.6957537*** (-8.58)
<i>Taxes on International Trade (TIT)</i>		-.0382653* (-2.17)	-.0513483** (-2.96)	-.007057 (-0.39)	-.0282846 (-1.51)
<i>Interaction term (Year&Affected)(D_T^Y)</i>		.5834409 (0.44)	.5078537 (0.39)	.5610069 (0.42)	.6396013 (0.46)
<i>Constant</i>		19.08408*** (11.11)	17.72805*** (10.49)	19.24177 *** (11.03)	18.5161*** (10.16)
<i>Observations</i>		335	335	335	335
<i>Adjusted R-squared</i>		0.3599	0.4157	0.3043	0.3184

Notes: The results are standardized beta coefficients, within the brackets is give the t-value. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Additionally, as mentioned in Section 3.2.1, the treatment group of the first analysis done on the MERS epidemic includes the countries hardest hit by the MERS epidemic. However, more countries have had to deal with infections. In order to determine if the presence of these other countries in the treatment group has influenced the results, the analysis has been performed again and the results are shown in Table 7 below. It can be concluded from the results that the values of the variables are slightly different and that the control variables have slightly different significance than in the first analysis on the MERS epidemic. The variable sampling

period only has had a significant positive effect on the FVA, which differs from the findings in the first analysis. Nevertheless, the results of the variable affected countries and the interaction term are consistent with the findings in the first analysis, as the affected countries has a significant positive result for the GVC and its main indicators, and the interaction term again has no significant results. Thus, the MERS epidemic has still not had a significant long-term effect on the importance of GVCs or the length of GVCs.

What's more, part of the additional affected countries are European countries and the USA. In order to determine if the presence of only these Western countries in the treatment group has influenced the results, the analysis was performed again, and the results are also shown in Table 7 below. The most important findings are that the results of the variable sample period are not significant, which contradicts with the finding that the sample period has a significant positive effect for the analysis done including all affected countries (the first results in Table 7). Nonetheless, the affected countries once again have significant positive results for the GVC, and its key indicators and the interaction term still has no significant results. Hence, even in this situation, the MERS epidemic had no significant long-term effect on the importance of GVCs or the length of GVCs.

In conclusion, the analyses of the impact of the MERS epidemic found that both the importance of GVCs and the length of GVCs were not significantly affected by the epidemic. Therefore, these findings are similar to the results concerning the SARS epidemic. Consequently, these findings contradict the propositions made, as the crisis was expected to have a negative impact on the importance and length of GVCs. Nonetheless, these findings are, similar to the findings on the SARS epidemic, consistent with the expectation of Simola (2021) and, Shingal and Argarwal (2020), that GVCs are well founded and unlikely to change as a result of a crisis.

Table 7. Difference-in-Difference Analysis MERS (Robustness Check, All Affected Countries & Only Western Affected Countries)

<i>All Affected Countries</i>					
	SARS	GVC	FVA	DVA	DVX
<i>Sample Period (D_T)</i>		.4373072 (-1.83)	.5120459* (-2.23)	.3016688 (-1.21)	.4184607 (-1.63)
<i>Affected Countries (D^Y)</i>		3.147552*** (10.20)	3.29383*** (11.07)	2.950373*** (9.18)	3.130041*** (9.41)
<i>GDP per Capita (GDP)</i>		.0708963 (-1.87)	.0806839* (-2.21)	-.053658 (-1.36)	.0449882 (-1.10)
<i>Compulsory Education (CE)</i>		.0869354* (2.03)	.1684051*** (4.08)	.1018927* (2.29)	.0624337 (1.35)
<i>School Enrolment Secondary Grade (SESG)</i>		.1976656* (-2.10)	-.202111* (-2.23)	.2340357* (-2.39)	.2142218* (-2.11)
<i>Cost of Business Start-up (CBSU)</i>		-.692044*** (-10.24)	-.720737*** (-11.06)	.6451072*** (-9.17)	.7093175*** (-9.74)
<i>Taxes on International Trade (TIT)</i>		.0165452 (-1.06)	.0288186 (-1.92)	.0137061 (0.84)	.0066903 (-0.40)
<i>Interaction term (Year&Affected)(D_T^Y)</i>		.0273289 (0.04)	.0065624 (-0.01)	.0132454 (-0.02)	.069458 (0.10)
<i>Constant</i>		120.0063*** (13.29)	18.66242*** (12.87)	20.1521*** (12.86)	19.43869*** (11.99)
<i>Observations</i>		335	335	335	335
<i>Adjusted R-squared</i>		0.4969	0.5593	0.4260	0.4470
<i>Western Affected Countries</i>					
	SARS	GVC	FVA	DVA	DVX
<i>Sample Period (D_T)</i>		.3980953 (-1.53)	.4838372 (-1.88)	.2675174 (-1.02)	.3724355 (-1.36)
<i>Affected Countries (D^Y)</i>		2.976403*** (4.48)	2.830165*** (4.30)	2.949359*** (4.39)	3.073289*** (4.38)
<i>GDP per Capita (GDP)</i>		.1141826** (-2.63)	.1270417** (-2.96)	.0932459* (-2.13)	.0876846 (-1.92)
<i>Compulsory Education (CE)</i>		.0386956 (0.78)	.1200034* (2.45)	.0555758 (1.11)	.01356 (0.26)
<i>School Enrolment Secondary Grade (SESG)</i>		.1725792 (-1.59)	.1721919 (-1.60)	.2127702 (-1.93)	.1908601 (-1.66)
<i>Cost of Business Start-up (CBSU)</i>		.7098442*** (-9.10)	.7400457*** (-9.58)	.6611223*** (-8.38)	.7264991*** (-8.82)
<i>Taxes on International Trade (TIT)</i>		.0036496 (0.19)	.0106123 (-0.56)	.0342456 (1.78)	.014656 (0.73)
<i>Interaction term (Year&Affected)(D_T^Y)</i>		1.145484 (-0.73)	-1.20771 (-0.78)	-.973754 (-0.62)	-1.05255 (-0.64)
<i>Constant</i>		20.80841*** (12.00)	19.48876*** (11.35)	20.90818*** (11.92)	20.24334*** (11.06)
<i>Observations</i>		335	335	335	335
<i>Adjusted R-squared</i>		0.3315	0.3813	0.2793	0.2945

Notes: The results are standardized beta coefficients, within the brackets is give the t-value. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

4.3 Results Financial Crisis

This section will discuss the results of the panel regression analyses done on the effect of the financial crisis on the importance of GVCs, shown in Table 8, and on the length of GVCs, shown in Table 9 to 11. After discussing the results in Tables 8 to 11, the results of Table 12 to 15 will show the first robustness check for which the periods 2008-2009 and 2012-2016 are taken as the crisis period. Then, the results in Table 16 to 19 show the results on having only the period 2012-2016 as crisis period to see what the effect of the aftermath of the 2008 financial crisis has been. To be complete, this study will include the results of both FE and RE, and the Hausman test in the Appendix. As explained in chapter III, the results of the Hausman test determine whether FE or RE should be used. Therefore, this section will show the results of the test used, including the results of the Hausman test.

According to the results of the Hausman test in Table 8, it can be stated that the FE model should be used as the p-value of the Hausman test is below 0.05. The FE model shows that the financial crisis had a significantly positive effect on the amount of GVCs. The R-squared results are given for the three types of variation and according to those, the correlation is found to be not that strong. This could probably be because the model could be refined by adding variables. Moreover, the variation between (R-squared (between)) appears to show the most correlation, which means that across the countries there is an influence of the financial crisis on GVCs. In addition, according to Rho, the variation in GVCs can be mostly related to the differences between the countries. Furthermore, all three control variables appear to have had a significantly negative effect on the amount of GVCs, which is in line with the literature discussed in Chapter II. In other words, the results are in line with the theory behind drivers of offshoring and reshoring. In conclusion, the financial crisis appears to have had a significant positive effect on the importance of GVCs.

Table 8. Results of Panel Regression with Dependent Variable GVC

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.18816 *** (5.57)
<i>GDP per Capita (GDP)</i>	-.0252334*** (-4.63)
<i>Cost of Business Start-up (CBSU)</i>	-.4564177*** (-21.74)
<i>Taxes on International Trade (TIT)</i>	-.0331881*** (-9.02)
<i>Constant</i>	16.74161 *** (177.85)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.2770
<i>R-squared (between)</i>	0.3298
<i>R-squared (overall)</i>	0.2903
<i>F test</i>	176.14
<i>Prob>F</i>	0.0000
<i>Rho</i>	.95162103
<i>Hausman test</i>	10.46 (p-value = 0.0334)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Furthermore, the results in Table 9 show that the p-value of the Hausman test done for the effect on FVA is below 0.05, and therefore the FE should be used. The results on this analysis correspond to the results of the previously discussed analysis on the effect on GVCs. The financial crisis has had, again, a significantly positive effect on the FVA of a country. The correlation found is not that strong and the variation between shows the most correlation. In addition, the variation in GVCs can again be mostly related to the differences between the countries. Furthermore, the results on the control variables correspond with previously discussed results in Table 8 (above). In conclusion, the financial crisis appears to have had a significant positive effect on the length of GVCs. Hereafter, the effect of the financial crisis on the DVA and DVX will be analyzed to see their results are in line with this conclusion.

Table 9. Results of Panel Regression with Dependent Variable FVA

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.1728261*** (4.97)
<i>GDP per Capita (GDP)</i>	-.0227621*** (-4.05)
<i>Cost of Business Start-up (CBSU)</i>	-.4610717*** (-21.31)
<i>Taxes on International Trade (TIT)</i>	-.034333*** (-9.06)
<i>Constant</i>	15.78383*** (162.73)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.2673
<i>R-squared (between)</i>	0.3828
<i>R-squared (overall)</i>	0.3336
<i>F test</i>	167.69
<i>Prob>F</i>	0.0000
<i>Rho</i>	.95028085
<i>Hausman test</i>	20.87 (p-value = 0.0003)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Moreover, since the results in Table 10 (below) show that the p-value of the Hausman test done for the effect on DVA is above 0.05, it appears that the RE test should be used for this analysis. The RE test shows that the financial crisis has had a significant positive effect on a country's DVA. Again, the R-squared results are given for the three types of variation and according to those, the correlation is found to be not that strong. Moreover, the variation between (R-squared (within)) appears again to show the most correlation, which means that within the countries there is an influence of the financial crisis on DVA. In addition, as the RE model is used Rho shows that the variation could be almost entirely explained by the constant term. Furthermore, the results on the control variables correspond with the results in Table 9 (above). Again, all three control variables appear to have a significant negative effect on the dependent variable, in this case DVA. Hence, these findings confirm the previously discussed results of Table 9 (above) and the conclusion that the financial crisis has had a significant positive effect on the length of GVCs.

Table 10. Results of Panel Regression with Dependent Variable DVA

	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.145595*** (4.65)
<i>GDP per Capita (GDP)</i>	-.024193*** (-4.80)
<i>Cost of Business Start-up (CBSU)</i>	-.4545849*** (-23.63)
<i>Taxes on International Trade (TIT)</i>	-.0282004*** (-8.32)
<i>Constant</i>	17.20156*** (84.88)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.2872
<i>R-squared (between)</i>	0.2658
<i>R-squared (overall)</i>	0.2419
<i>Wald test</i>	777.10
<i>Prob>Chi2</i>	0.0000
<i>Rho</i>	.95612152
<i>Hausman test</i>	5.50 (p-value = 0.2393)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Finally, the results in Table 11 (below) show that the p-value of the Hausman test done for the effect on DVX is also above 0.05, and thus the RE test should be used. The results on this RE test are, again, in line with the previously discussed results of Table 10 (above). The financial crisis had a significant positive effect on the DVX of a country. The correlation found is not that strong and the variation within shows the most correlation. In addition, Rho shows here too that the variation could be almost entirely explained by the constant term. Thereby, the control variables turn out to have, once again, a significant negative effect on the relevant key indicator. These results lead to the conclusion that also this analysis supports the conclusion of Table 9, the financial crisis has had a significant positive effect on the length of global value chains.

Table 11. Results of Panel Regression with Dependent Variable DVX

	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.1997342*** (5.93)
<i>GDP per Capita (GDP)</i>	-.0265028*** (-4.88)
<i>Cost of Business Start-up (CBSU)</i>	-.4463552*** (-21.57)
<i>Taxes on International Trade (TIT)</i>	-.0312003*** (-8.56)
<i>Constant</i>	16.16293*** (76.52)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.2635
<i>R-squared (between)</i>	0.2883
<i>R-squared (overall)</i>	0.2577
<i>Wald test</i>	695.69
<i>Prob>Chi2</i>	0.0000
<i>Rho</i>	.95268818
<i>Hausman test</i>	7.48 (p-value = 0.1124)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

As mentioned, the panel regressions are done again having the periods 2008-2009 and 2012-2016 as the crisis period to see if including the aftermath of the 2008 crisis influences the analysis done. According to Table 12 (below), the Hausman test gives a p-value of 0.000 which is below 0.05 and thus FE should be used. The FE model shows, again, that the crisis had a significantly positive effect on the amount of GVCs. According to the R-squared results, the correlation is found to be not that strong. Moreover, the variation within (R-squared (within)) appears to show the most correlation, which means that within the countries there is an influence of the financial crisis on GVCs. In addition, according to Rho, the variation in GVCs can be mostly related to the differences between the countries. Furthermore, all three control variables appear to have had once more, a significantly negative effect on the amount of GVCs, which is in line with the literature discussed in Chapter II. In other words, the results are again in line with the theory behind drivers of offshoring and reshoring. This robustness check shows that adding the aftermath to the crisis period yields results similar to those discussed above. Therefore, one assumption is that the 2012-2016 period also had a significant positive effect on the importance of GVCs. This will have to be shown in the next robustness check, shown in Table 16.

Table 12. Results of Panel Regression with Dependent Variable GVC, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4614604*** (21.33)
<i>GDP per Capita (GDP)</i>	-.0212451*** (-4.32)
<i>Cost of Business Start-up (CBSU)</i>	-.4384211*** (-14.02)
<i>Taxes on International Trade (TIT)</i>	-.02671*** (-8.02)
<i>Constant</i>	16.00885*** (173.98)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.4106
<i>R-squared (between)</i>	0.3213
<i>R-squared (overall)</i>	0.2674
<i>F test</i>	320.32
<i>Prob>F</i>	0.0000
<i>Rho</i>	.9636409
<i>Hausman test</i>	34.28 (p-value = 0.0000)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Moreover, the results of the Hausman test in Table 13 show yet again that the FE should be used. The results on this analysis correspond to the results of the previously discussed analyses. The financial crisis has had, a significant positive effect on the FVA of a country. The correlation found is not that strong and the variation between shows the most correlation. In addition, the variation in GVCs can again be mostly related to the differences between the countries. Furthermore, the results on the control variables correspond with previously discussed results. In conclusion, adding the period 2012-2016 to the crisis period appears to have had a significant positive effect on the length of GVCs. Hereafter, the effect of the financial crisis on the DVA and DVX will indicate if this conclusion is correct.

Table 13. Results of Panel Regression with Dependent Variable FVA, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4672491*** (20.92)
<i>GDP per Capita (GDP)</i>	-.0187561*** (-3.69)
<i>Cost of Business Start-up (CBSU)</i>	-.2898293*** (-13.71)
<i>Taxes on International Trade (TIT)</i>	-.0276267*** (-8.03)
<i>Constant</i>	15.03958*** (158.28)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.4002
<i>R-squared (between)</i>	0.3727
<i>R-squared (overall)</i>	0.3035
<i>F test</i>	306.70
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96306669
<i>Hausman test</i>	51.96 (p-value = 0.0000)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Additionally, the results in Table 14 (below) show that the Hausman p-value is below 0.05, and therefore the FE test should be used for this analysis. The FE test shows that the financial crisis has had a significant positive effect on a country's DVA. The results on this analysis correspond to the results of the previously discussed analysis on FVA. All in all, the results confirm the conclusion above that adding the period 2012-2016 again shows a significant positive effect of the crisis on the length of GVCs.

Table 14. Results of Panel Regression with Dependent Variable DVA, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4078319*** (20.21)
<i>GDP per Capita (GDP)</i>	-.0204612*** (-4.46)
<i>Cost of Business Start-up (CBSU)</i>	-.2990572*** (-15.66)
<i>Taxes on International Trade (TIT)</i>	-.0220439*** (-7.09)
<i>Constant</i>	16.47502*** (191.93)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.4100
<i>R-squared (between)</i>	0.2612
<i>R-squared (overall)</i>	0.2291
<i>F test</i>	319.45
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96618877
<i>Hausman test</i>	15.23 (p-value = 0.0042)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

The results in Table 15 (below) show that the Hausman p-value is yet again below 0.05, and therefore the FE test should be used for this analysis. The FE test shows that also DVX has been significant positively affected by the financial crisis. The results on this analysis correspond to the results of the previously discussed analysis on FVA and DVA. These results also confirm the conclusion that adding the period 2012-2016 shows a significant positive effect of the crisis on the length of global value chains. Hereafter, the panel regression is done once more on GVCs and the key indicators FVA, DVA and DVX but with only the period 2012-2016 taken as the crisis period.

Table 15. Results of Panel Regression with Dependent Variable DVX, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4443725*** (20.41)
<i>GDP per Capita (GDP)</i>	-.0223728*** (-4.52)
<i>Cost of Business Start-up (CBSU)</i>	-.2747713*** (-13.34)
<i>Taxes on International Trade (TIT)</i>	-.0245904*** (-7.33)
<i>Constant</i>	15.34936*** (165.77)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.3880
<i>R-squared (between)</i>	0.2812
<i>R-squared (overall)</i>	0.2370
<i>F test</i>	291.52
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96453349
<i>Hausman test</i>	15.23 (p-value = 0.0042)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

To see if the period 2012-2016 has influenced the importance of GVCs, Table 16 (below) covers the results on the regression done for GVC. According to the Hausman p-value, which is 0.0000, the FE model should be used. The regression gives results in line with the previous regressions which means that also the period 2012-2016 has had a significant positive effect on the importance of the GVCs. In other words, both the 2008 financial crisis and the aftermath in 2012-2016 have brought about an increase in the total value of GVCs.

Table 16. Results of Panel Regression with Dependent Variable GVC, Robustness check period 2012-2016 as crisis period.

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4605601*** (18.53)
<i>GDP per Capita (GDP)</i>	-.0204089*** (-4.04)
<i>Cost of Business Start-up (CBSU)</i>	-.2770054*** (-12.82)
<i>Taxes on International Trade (TIT)</i>	-.0305508*** (-8.98)
<i>Constant</i>	16.07018*** (169.53)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.3805
<i>R-squared (between)</i>	0.3240
<i>R-squared (overall)</i>	0.2680
<i>F test</i>	282.37
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96173091
<i>Hausman test</i>	30.38 (p-value = 0.0000)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Furthermore, to see if the period 2012-2016 has had an effect on the length of GVCs, Table 17 (below) covers the results on the regression done for FVA. Once more, the Hausman p-value has a value of 0.0000. Therefore, the FE model should be used again. The regression gives results in line with the previous regressions which means that also the period 2012-2016 has had a significant positive effect on the length of the GVCs. Yet again, the same regression done on DVA and DVX will show whether this is correct.

Table 17. Results of Panel Regression with Dependent Variable FVA, Robustness check period 2012-2016 as crisis period.

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4775147*** (18.71)
<i>GDP per Capita (GDP)</i>	-.0178007*** (-3.43)
<i>Cost of Business Start-up (CBSU)</i>	-.275549*** (-12.42)
<i>Taxes on International Trade (TIT)</i>	-.0314138*** (-8.99)
<i>Constant</i>	15.08479*** (154.93)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.3762
<i>R-squared (between)</i>	0.3767
<i>R-squared (overall)</i>	0.3039
<i>F test</i>	277.21
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96158922
<i>Hausman test</i>	45.72 (p-value = 0.0000)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Additionally, the results in Table 18 (below) show that the Hausman p-value is below 0.05, and therefore the FE test should be used again. The FE test shows that the financial crisis has had a significant positive effect on a country's DVA. The results on this analysis correspond to the results of the previously discussed analysis on FVA. In other words, the results confirm the conclusion above that taking the period 2012-2016 as crisis period shows a significant positive effect of the crisis on the length of GVCs.

Table 18. Results of Panel Regression with Dependent Variable DVA, Robustness check period 2012-2016 as crisis period.

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4202328*** (18.27)
<i>GDP per Capita (GDP)</i>	-.0195939*** (-4.19)
<i>Cost of Business Start-up (CBSU)</i>	-.2852838*** (-14.27)
<i>Taxes on International Trade (TIT)</i>	-.025318*** (-8.04)
<i>Constant</i>	16.50928*** (188.21)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.3897
<i>R-squared (between)</i>	0.2607
<i>R-squared (overall)</i>	0.2269
<i>F test</i>	293.62
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96511792
<i>Hausman test</i>	15.24 (p-value = 0.0042)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Finally, the results in Table 19 (below) show that the Hausman p-value is yet again below 0.05. The results of the FE test show that also DVX has been significant positively affected by the period 2012-2016. The results on this analysis correspond to the results of the previously discussed analysis on FVA and DVA. More specifically, the analyses confirm that the period 2012-2016 has had a significant positive effect on the length of global value chains.

In conclusion, the analyses of the impact of the 2008 financial crisis found that both the importance of GVCs and the length of GVCs were significantly affected by the financial crisis and its aftermath. It is interesting to see that, when assuming that the pandemic will have a similar effect on GVCs as the financial crisis of 2008, these findings are inconsistent with the expectation of Simola (2021) and, Shingal and Argarwal (2020), that GVCs are well founded and unlikely to change as a result of a crisis. Moreover, these findings completely contradict the propositions made, as the crisis was expected to have a negative impact on the importance and length of GVCs.

Table 19. Results of Panel Regression with Dependent Variable DVX, Robustness check period 2012-2016 as crisis period.

	<i>Fixed Effects (FE)</i>
<i>Financial Crisis (X_{it})</i>	.4316201*** (17.22)
<i>GDP per Capita (GDP)</i>	-.0216832*** (-4.26)
<i>Cost of Business Start-up (CBSU)</i>	-.2697569*** (-12.38)
<i>Taxes on International Trade (TIT)</i>	-.0283974*** (-8.27)
<i>Constant</i>	15.42637*** (161.32)
<i>Observations</i>	1,962
<i>Groups</i>	119
<i>R-squared (within)</i>	0.3536
<i>R-squared (between)</i>	0.2825
<i>R-squared (overall)</i>	0.2379
<i>F test</i>	251.45
<i>Prob>F</i>	0.0000
<i>Rho</i>	.96244573
<i>Hausman test</i>	20.95 (p-value = 0.0003)

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

V. Conclusion: Assessment of the Effect of COVID-19 on GVCs

This study has been set out with the aim of making a prediction on the effect of COVID-19 on Global Value Chains. Based on analysis done with data of previously comparable crises, this chapter will give an assessment of the potential effect of COVID-19 on GVCs. In addition, this chapter will also discuss some limitations and, some opportunities for future research.

5.1 Assessment of the Effect of COVID-19 on GVCs

During this study it has become clear that understanding the effect of crises like the pandemic is important for international trade, specifically for the existence of GVCs. When COVID-19 became a pandemic, countries took destructive measures against the spread of the virus which affected GVCs as productions were put still and borders got closed. Hence, it is clear to say that COVID-19 did influence GVCs during the pandemic. At the time of writing, the pandemic has been going on for about a year and a half which means that the long-term effects are still unclear as these cannot be substantiated from available data. Nevertheless, this study made two propositions based on previous literature and with the help of data on previously comparable crises quantitative research has been conducted.

The propositions made within this study suggest a negative effect of COVID-19 on the importance and length of GVCs. Keeping these propositions in mind when looking at the results in Chapter IV, it is interesting to see that for the difference-in-difference analyses on SARS the results show no significant effects for the interaction term (years&affected). This suggests that the SARS epidemic had no significant effect on the importance and the length of GVCs for countries affected by the epidemic in the period after the crisis. Furthermore, robustness analyses showed that having China in the treatment group had no significant effect on the results. In other words, including a large country like China in the treatment group did not lead to biased results for the effect of the SARS epidemic on the importance and length of GVCs. Thus, if COVID-19 is expected to have the same effects on GVCs as SARS, this would be a refutation of both propositions made.

Additionally, when looking at the results of the MERS epidemic it appears that this epidemic did also have no significant effect on the importance and length of GVCs. Besides, as China was a factor for the robustness analysis done for the effect of the SARS epidemic, a similar robustness analysis was done for the MERS epidemic. More specifically, China was not part of the affected countries by the MERS epidemic and therefore, the difference-in-difference

analysis was done again including China to see if including such a large country would have had an effect on the results of the first analysis done on MERS. The results of this robustness analysis concluded that adding China to the treatment group did not change the effect of the MERS epidemic on the importance and duration of GVCs as found within the original analysis done. Furthermore, the treatment group of the original analysis done on the effect of MERS included only the included those countries that were hardest hit by the epidemic. However, the spread of the virus has also reached many other countries, including some Western countries in the E.U. and the U.S. (Middle East Respiratory Syndrome (MERS), 2019) Therefore, another robustness check was conducted to measure whether the results differ when all affected countries are included in the treatment group, compared to the first choice of treatment group. This robustness analysis has shown that despite expanding the treatment group, MERS still appears to have had no significant effect on the importance and length GVCs. Finally, the analysis was conducted again using only the affected Western countries, including some European countries and the U.S., to see if the impact of MERS would have been different if only those countries had been affected. Also, in this case, however, it appears that MERS would have had no significant long-term effect on the importance and length of GVCs. Thus, if COVID-19 is expected to have the same effects on GVCs as MERS, this would also be a refutation of both propositions made. Taking this into consideration and assuming that COVID-19 will have the same effect on GVCs as the epidemics, neither of these propositions would hold true. Thus, the pandemic is then expected to have no significant long-term effect on the importance and length of GVCs.

By contrast, considering the results on the effect of the financial crisis in 2008 and 2009 on GVCs it appears that there were significant effects. More specifically, according to the original regression analyses it appears that the period 2008 and 2009 has had a significant positive effect on the importance and the length of GVCs which is a refutation of both propositions as those suggested a negative effect. As the financial crisis has had a significant aftermath in the post-crisis years, this study has done robustness checks to see if the aftermath might have had an effect on the results of the analyses done. Therefore, a robustness analysis was conducted with a different crisis period, including both the official period of the financial crisis 2008-2009, and the aftermath period 2012-2016. This robustness analysis has shown similar results as the original analysis done on the effect of the financial crisis. Thus, including the aftermath period has also led to significant positive results. Thereafter, another analysis was conducted in which the crisis period included only the aftermath period 2012-2016 to see what the effect of the aftermath has been on the importance and length of GVCs. This later analysis

has also led to similar results. Hence, the aftermath has also had a significant positive effect on the importance and length of GVCs. Taking this into consideration and assuming that COVID-19 will have the same effect on GVCs as the financial crisis, neither of these propositions would hold true. The pandemic is then expected to have a significant positive long-term effect on the importance and length of GVCs.

Given these findings about the different crises and the resulting expectations, they are contradictory. Nonetheless, as mentioned these previous crises did have some similarities with the current pandemic but were not entirely the same. Whereas the pandemic shows to have similarities based on symptoms as the epidemics, the epidemics did not have the same comprehensive effects as they did not hit worldwide. On the other hand, the financial crisis might not have had the similar health effects, it did have a similar comprehensive effect. Since this study is considering the effect of the pandemic on GVCs, which is a more economic effect, the comparison made with the financial crisis is considered more valid also considering the comprehensive effects of both types of crises. That is not to say, however, that the results of the analyses on the epidemics are completely ignored. Therefore, based on the results of the quantitative study, COVID-19 is expected to have a similar effect on the importance and length of GVCs as the financial crisis, but to a lesser extent. In conclusion, this study expects COVID-19 to have a small positive significant effect on GVCs in the long term.

5.2 Limitations

It should be acknowledged that this study is not free of limitations. The main limitation to this research lies in the fact that there is no suitable data available because of the recency and uniqueness of COVID-19. The data used belong to crises that are similar but not identical. Consequently, it remains uncertain whether future data on COVID-19 will be comparable to those for the crises used. Therefore, this study remains "only" a prediction based on some similarities in characteristics between the epidemics/financial crisis and the pandemic.

What's more, as previously discussed in Section 3.1, the GVC indicators are not a perfect measure of the length of GVCs. The key indicators specify the value of the indicator, which gives an indication of the length of GVCs, but not the exact number of border crossings during a production process. Hence, the exact changes in length of GVCs cannot be measured with the data used, only an indication is made.

5.3 Further Research

This thesis has laid a foundation for future research on the effect of COVID-19 on GVCs. Within some time (months, years) more data on the effects of the pandemic will become available which can be used to examine the real effect of COVID-19 on GVCs. In other words, future research could be based on the limitations of this study, the suitability of data. As well, it would be interesting to see what the effect of the pandemic would be having a better measure of the length of GVCs. Additionally, future research could delve deeper into the impact of a crisis like COVID-19 on the drivers of offshoring/reshoring, something this study did not get to.

Besides, a suggestion for further research could be the effect of a crisis like the current pandemic on the social importance of GVCs for emerging economies. The impact of GVCs differs across developed and emerging economies. For developed economies, the participation in GVCs gives access to economies of scale, as a result of producing on a large scale the production costs will decrease. Thereby, inputs become more competitively priced and there is more variety among products. For emerging economies, the participation in GVCs means, as mentioned before, the ability to industrialize at a relatively fast rate. (Baldwin & Lopez-Gonzalez, 2013) These statements are supported by theoretical literature in which studies have shown that several channels can show productivity gains related to GVCs and offshoring. (Caliendo & Parro, 2015; Grossman & Rossi-Hansberg, 2008; Halpern et al., 2015; Raei et al., 2019) What's more, previous empirical research has shown the macroeconomic impact of GVCs on a country's income. Moreover, it was found that participation in GVCs is positively related to income per capita, productivity and investments. In addition, participation within GVCs is strongly determined by institutional features. Though, it should be noticed that participation in GVCs does not result in gains automatically. More specifically, heterogeneity has been found between countries with different income levels. It appears that upper-middle and high-income countries benefit more of GVC participation than lower-middle and low income countries. (Raei et al., 2019) Therefore, it could be interesting for future research to measure how much the progress of developing countries depends on the connections with other countries through GVCs. And, to measure the effect of a crisis like COVID-19 on the progress made by emerging economies as a result of involvement with GVCs.

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Appendix A – Descriptive Statistics

Table A1. Descriptive Statistics - Unchanged

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	5,510	2004	8.36736	1990	2018
<i>GVC</i>	5,510	3.41e+07	1.12e+08	0	1.47e+09
<i>DVA</i>	5,510	4.31e+07	1.47e+08	0	1.88e+09
<i>FVA</i>	5,510	1.71e+07	5.83e+07	0	8.75e+08
<i>DVX</i>	5,510	1.71e+07	5.84e+07	0	6.83e+08
<i>GDP per Capita (GDP)</i>	5,086	2674800	2821176	175.01	9988294
<i>Compulsory Education (CE)</i>	3,441	9.305434	2.184245	0	17
<i>School Enrollment Secondary Grade (SESG)</i>	3,624	5005342	3478972	14.17	9999272
<i>Cost of Business Start-up (CBSU)</i>	2,519	49.58742	112.6142	0	1540.2
<i>Taxes on International Trade (TIT)</i>	2,859	2360290	2464059	-	9962858
				158417	

Table A2. Descriptive Statistics - Lognormal

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	5,510	2004	8.36736	1990	2018
<i>GVC</i>	5,046	14.38704	2.73486	9.125872	21.10853
<i>DVA</i>	5,045	14.81998	2.713029	.6097656	21.35454
<i>FVA</i>	5,045	13.4497	2.814696	7.933797	20.58974
<i>DVX</i>	5,046	13.71213	2.817573	-	20.342
				.2744368	
<i>GDP per Capita (GDP)</i>	5,086	13.19492	2.578989	5.164843	16.11692
<i>Compulsory Education (CE)</i>	3,441	9.305434	2.184245	0	17
<i>School Enrollment Secondary Grade (SESG)</i>	3,624	14.9647	1.265593	2.651127	16.11802
<i>Cost of Business Start-up (CBSU)</i>	2,498	2.658226	1.716273	-	7.339667
				2.302585	
<i>Taxes on International Trade (TIT)</i>	2,434	12.19475	6.23065	-	16.11437
				11.19084	

Table A3. Descriptive Statistics – Lognormal, Dummy variable adjustment used to correct for missing data and still missing data dropped

<i>Variable</i>	<i>Obs</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>
<i>Sample Period</i>	3,451	2004	8.367813	1990	2018
<i>GVC</i>	3,451	15.08144	2.653356	9.686575	21.10853
<i>DVA</i>	3,450	15.50734	2.503146	9.830916	21.35454
<i>FVA</i>	3,451	14.18775	2.753215	8.321178	20.58974
<i>DVX</i>	3,451	14.40543	2.647849	8.523175	20.342
<i>GDP per Capita (GDP)</i>	3,451	13.03087	2.61884	5.503297	16.11692
<i>Compulsory Education (CE)</i>	3,451	9.408355	2.090931	4	16
<i>School Enrollment Secondary Grade (SESG)</i>	3,451	15.01927	1.175868	4.486837	16.11767
<i>Cost of Business Start-up (CBSU)</i>	3,430	2.327029	1.595675	- 2.436116	7.182656
<i>Taxes on International Trade (TIT)</i>	3,043	12.72586	5.6952	- 11.19084	16.11437

Appendix B –Regression Results on Panel Data

Table A4. Results of Panel Regression with Dependent Variable GVC

(Corresponds to Table 8)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.18816 *** (5.57)	.1877022*** (5.55)
<i>GDP per Capita (GDP)</i>	-.0252334*** (-4.63)	-.0256221*** (-4.70)
<i>Cost of Business Start-up (CBSU)</i>	-.4564177*** (-21.74)	-.4653999*** (-22.42)
<i>Taxes on International Trade (TIT)</i>	-.0331881*** (-9.02)	-.0339278*** (-9.27)
<i>Constant</i>	16.74161 *** (177.85)	16.8775*** (82.35)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.2770	0.2770
<i>R-squared (between)</i>	0.3298	0.3298
<i>R-squared (overall)</i>	0.2903	0.2903
<i>F test</i>	176.14	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		749.35
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.95162103	.94874159
<i>Hausman test</i>	10.46 (p-value = 0.0334)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A5. Results of Panel Regression with Dependent Variable FVA

(Corresponds to Table 9)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.1728261*** (4.97)	.1721136*** (4.93)
<i>GDP per Capita (GDP)</i>	-.0227621*** (-4.05)	-.0233764*** (-4.15)
<i>Cost of Business Start-up (CBSU)</i>	-.4610717*** (-21.31)	-.4730217*** (-22.10)
<i>Taxes on International Trade (TIT)</i>	-.034333*** (-9.06)	-.0354557*** (-9.39)
<i>Constant</i>	15.78383*** (162.73)	15.96486*** (78.20)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.2673	0.2673
<i>R-squared (between)</i>	0.3828	0.3829
<i>R-squared (overall)</i>	0.3336	0.3337
<i>F test</i>	167.69	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		722.70
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.95028085	.94422127
<i>Hausman test</i>	20.87 (p-value = 0.0003)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A6. Results of Panel Regression with Dependent Variable DVA

(Corresponds to Table 10)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.145687*** (4.66)	.145595*** (4.65)
<i>GDP per Capita (GDP)</i>	-.0239543*** (-4.75)	-.024193*** (-4.80)
<i>Cost of Business Start-up (CBSU)</i>	-.4485563*** (-23.07)	-.4545849*** (-23.63)
<i>Taxes on International Trade (TIT)</i>	-.0279382*** (-8.20)	-.0282004*** (-8.32)
<i>Constant</i>	17.1255*** (196.42)	17.20156*** (84.88)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.2872	0.2872
<i>R-squared (between)</i>	0.2658	0.2658
<i>R-squared (overall)</i>	0.2419	0.2419
<i>F test</i>	185.23	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		777.10
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.956791	.95612152
<i>Hausman test</i>	5.50 (p-value = 0.2393)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A7. Results of Panel Regression with Dependent Variable DVX

(Corresponds to Table 11)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.2000084*** (5.94)	.1997342*** (5.93)
<i>GDP per Capita (GDP)</i>	-.0262479*** (-4.83)	-.0265028*** (-4.88)
<i>Cost of Business Start-up (CBSU)</i>	-.4384211*** (-20.95)	-.4463552*** (-21.57)
<i>Taxes on International Trade (TIT)</i>	-.0306724*** (-8.37)	-.0312003*** (-8.56)
<i>Constant</i>	16.05254*** (171.10)	16.16293*** (76.52)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.2635	0.2635
<i>R-squared (between)</i>	0.2883	0.2883
<i>R-squared (overall)</i>	0.2577	0.2577
<i>F test</i>	164.48	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		695.69
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.95427342	.95268818
<i>Hausman test</i>	7.48 (p-value = 0.1124)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A8. Results of Panel Regression with Dependent Variable GVC, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

(Corresponds to Table 12)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4614604*** (21.33)	.4541187*** (20.95)
<i>GDP per Capita (GDP)</i>	-.0212451*** (-4.32)	-.0217109*** (-4.39)
<i>Cost of Business Start-up (CBSU)</i>	-.4384211*** (-14.02)	-.3008256*** (-14.82)
<i>Taxes on International Trade (TIT)</i>	-.02671*** (-8.02)	-.0276533*** (-8.31)
<i>Constant</i>	16.00885*** (173.98)	16.19577*** (79.21)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.4106	0.4105
<i>R-squared (between)</i>	0.3213	0.3220
<i>R-squared (overall)</i>	0.2674	0.2705
<i>F test</i>	320.32	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1304.24
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.9636409	.95777832
<i>Hausman test</i>	34.28 (p-value = 0.0000)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A9. Results of Panel Regression with Dependent Variable FVA, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

(Corresponds to Table 13)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4672491*** (20.92)	.4577587*** (20.40)
<i>GDP per Capita (GDP)</i>	-.0187561*** (-3.69)	-.0194365*** (-3.80)
<i>Cost of Business Start-up (CBSU)</i>	-.2898293*** (-13.71)	-.3074289*** (-14.64)
<i>Taxes on International Trade (TIT)</i>	-.0276267*** (-8.03)	-.0289497*** (-8.41)
<i>Constant</i>	15.03958*** (158.28)	15.27466*** (74.97)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.4002	0.3999
<i>R-squared (between)</i>	0.3727	0.3737
<i>R-squared (overall)</i>	0.3035	0.3081
<i>F test</i>	306.70	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1250.15
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96306669	.95376043
<i>Hausman test</i>	51.96 (p-value = 0.0000)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A10. Results of Panel Regression with Dependent Variable DVA, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

(Corresponds to Table 14)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4078319*** (20.21)	.4029825*** (19.97)
<i>GDP per Capita (GDP)</i>	-.0204612*** (-4.46)	-.0207656*** (-4.51)
<i>Cost of Business Start-up (CBSU)</i>	-.2990572*** (-15.66)	-.3087932*** (-16.31)
<i>Taxes on International Trade (TIT)</i>	-.0220439*** (-7.09)	-.0225098*** (-7.26)
<i>Constant</i>	16.47502*** (191.93)	16.59443*** (81.97)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.4100	0.4099
<i>R-squared (between)</i>	0.2612	0.2614
<i>R-squared (overall)</i>	0.2291	0.2305
<i>F test</i>	319.45	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1300.53
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96618877	.96345229
<i>Hausman test</i>	15.23 (p-value = 0.0042)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A11. Results of Panel Regression with Dependent Variable DVX, Robustness check periods 2008-2009 and 2012-2016 included as crisis period

(Corresponds to Table 15)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4443725*** (20.41)	.4379915*** (20.10)
<i>GDP per Capita (GDP)</i>	-.0223728*** (-4.52)	-.0227166*** (-4.57)
<i>Cost of Business Start-up (CBSU)</i>	-.2747713*** (-13.34)	-.2872289*** (-14.07)
<i>Taxes on International Trade (TIT)</i>	-.0245904*** (-7.33)	-.0253306*** (-7.57)
<i>Constant</i>	15.34936*** (165.77)	15.50822*** (73.48)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.3880	0.3879
<i>R-squared (between)</i>	0.2812	0.2817
<i>R-squared (overall)</i>	0.2370	0.2395
<i>F test</i>	291.52	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1187.08
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96453349	.96034466
<i>Hausman test</i>	15.23 (p-value = 0.0042)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A12. Results of Panel Regression with Dependent Variable GVC, Robustness check period 2012-2016 as crisis period.

(Corresponds to Table 16)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4605601*** (18.53)	.4512414*** (18.13)
<i>GDP per Capita (GDP)</i>	-.0204089*** (-4.04)	-.020923*** (-4.13)
<i>Cost of Business Start-up (CBSU)</i>	-.2770054*** (-12.82)	-.2924273*** (-13.67)
<i>Taxes on International Trade (TIT)</i>	-.0305508*** (-8.98)	-.0314397*** (-9.26)
<i>Constant</i>	16.07018*** (169.53)	16.25497*** (79.00)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.3805	0.3803
<i>R-squared (between)</i>	0.3240	0.3246
<i>R-squared (overall)</i>	0.2680	0.2712
<i>F test</i>	282.37	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1154.74
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96173091	.95579462
<i>Hausman test</i>	30.38 (p-value = 0.0000)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A13. Results of Panel Regression with Dependent Variable FVA, Robustness check period 2012-2016 as crisis period.

(Corresponds to Table 17)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4775147*** (18.71)	.4655829*** (18.17)
<i>GDP per Capita (GDP)</i>	-.0178007*** (-3.43)	-.0185419*** (-3.55)
<i>Cost of Business Start-up (CBSU)</i>	-.275549*** (-12.42)	-.2949534*** (-13.40)
<i>Taxes on International Trade (TIT)</i>	-.0314138*** (-8.99)	-.0326711*** (-9.34)
<i>Constant</i>	15.08479*** (154.93)	15.31907*** (74.73)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.3762	0.3759
<i>R-squared (between)</i>	0.3767	0.3776
<i>R-squared (overall)</i>	0.3039	0.3089
<i>F test</i>	277.21	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1134.54
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96158922	.95214866
<i>Hausman test</i>	45.72 (p-value = 0.0000)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A14. Results of Panel Regression with Dependent Variable DVA, Robustness check period 2012-2016 as crisis period.

(Corresponds to Table 18)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4202328*** (18.27)	.413987*** (18.01)
<i>GDP per Capita (GDP)</i>	-.0195939*** (-4.19)	-.0199288*** (-4.26)
<i>Cost of Business Start-up (CBSU)</i>	-.2852838*** (-14.27)	-.2960643*** (-14.96)
<i>Taxes on International Trade (TIT)</i>	-.025318*** (-8.04)	-.0257356*** (-8.20)
<i>Constant</i>	16.50928*** (188.21)	16.62686*** (81.81)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.3897	0.3897
<i>R-squared (between)</i>	0.2607	0.2611
<i>R-squared (overall)</i>	0.2269	0.2285
<i>F test</i>	293.62	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1197.47
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96511792	.96227152
<i>Hausman test</i>	15.24 (p-value = 0.0042)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001

Table A15. Results of Panel Regression with Dependent Variable DVX, Robustness check period 2012-2016 as crisis period.

(Corresponds to Table 19)

	<i>Fixed Effects (FE)</i>	<i>Random Effects (RE)</i>
<i>Financial Crisis (X_{it})</i>	.4316201*** (17.22)	.423483*** (16.89)
<i>GDP per Capita (GDP)</i>	-.0216832*** (-4.26)	-.0220659*** (-4.32)
<i>Cost of Business Start-up (CBSU)</i>	-.2697569*** (-12.38)	-.2835207*** (-13.14)
<i>Taxes on International Trade (TIT)</i>	-.0283974*** (-8.27)	-.029084*** (-8.50)
<i>Constant</i>	15.42637*** (161.32)	15.58199*** (73.39)
<i>Observations</i>	1,962	1,962
<i>Groups</i>	119	119
<i>R-squared (within)</i>	0.3536	0.3534
<i>R-squared (between)</i>	0.2825	0.2831
<i>R-squared (overall)</i>	0.2379	0.2404
<i>F test</i>	251.45	
<i>Prob>F</i>	0.0000	
<i>Wald test</i>		1028.90
<i>Prob>Chi2</i>		0.0000
<i>Rho</i>	.96244573	.95823012
<i>Hausman test</i>	20.95 (p-value = 0.0003)	

Notes: The results are standardized beta coefficients, within the brackets is give the t-value for FE and the z-value for RE. The t statistics in parentheses give significance as followed: * P < 0.05; ** P < 0.01; *** P < 0.001