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THE GREAT TRADE COLLAPSE: AN ANALYSIS OF THE UNDERLYING DETERMINANTS.

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Preface

As this thesis would not have been possible without the help of several people, I would like to start this paper by thanking them.

First and foremost I would like to thank my supervisor, Prof. Selien De Schryder, for always being ready to answer my questions and for the extensive feedback during this writing process. This thesis would not be what it is today without your help.

I am also grateful for the eternal support and encouragement from my family throughout my 5 years of studying and when writing this thesis. My parents made me believe I could attain everything I want through hard work and I will be forever grateful for this. Furthermore, I am extremely grateful that my mother took time off from her busy schedule to proofread this thesis.

And last but not least I would like to thank my friends for making these past five years at the university unforgettable and for always supporting and motivating me. We definitely made memories together I will cherish forever.

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List of abbreviations

AD: Anti-Dumping

AR: Accounts Receivable

AP: Account Payable

BEA: Bureau of Economic Analysis

IMF: International Monetary Fund

COGS: Costs Of Goods Sold

GDP: Gross Domestic Product

GTC: Great Trade Collapse

HTS: Harmonized Tariff Schedule

NAICS: North American Industry Classification System

OECD: Organisation for Economic Co-operation and Development

OTRI: Overall Trade Restrictiveness Index

USITC: United States International Trade Commission

VIF: Variance Inflation Factor

WTO: World Trade Organisation

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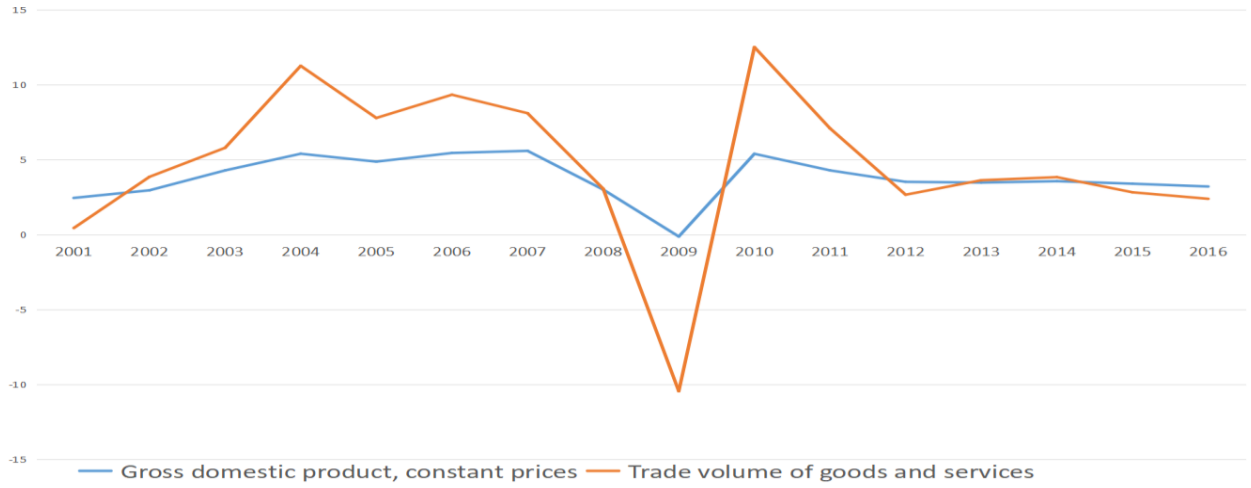
1. Introduction

From the first quarter of 2008 to the first quarter of 2009, world trade fell by around 15%, which was roughly 4 times more than the drop in the real world GDP[1] (Bems, Johnson & Yi, 2012), as depicted by Figure 1. The same is true if we look at data from individual countries. In the US, for example, output fell by almost 5 percent from the first quarter of 2009 to the second quarter of 2009, while exports and imports fell respectively 19 and 22 percent (Alessandria, Kaboski & Midrigan, 2010). This phenomenon is known as the Great Trade Collapse. The decline in exports was especially severe for small open economies, as some of these exports dropped by up to 30 percent (Chor & Manova, 2011). International trade began to recover by the last two quarters of 2009, which was faster than the recovery of the domestic economic activity.

This paper will start by providing a detailed overview of the Great Trade Collapse in chapter 2. Next to focusing on world data, we will take a more detailed look at the country level and investigate US and Belgian data. We firstly selected the US, because worldwide this is one of the economic giants, hence there are a lot of data available for this nation. Moreover, the empirical part of this paper is also focused on US data. We selected Belgium since Belgian data paint a picture of what happened in the home country. Next to that, both countries are situated on other continents, so a comparison of data of these two nations can give an overview of how similar the impact of the Great Trade Collapse was across the world.

The third chapter gives an analysis of the determinants that may have caused the trade collapse according to the existing literature. This chapter focusses both on the demand-side and the supply-side effects. In chapter 4 I empirically examine some conclusions of the literature. This econometric study is based on the existing model of Lewis, Levchenko and Tesar (2010) and investigates the impact of credit constraints, vertical linkages and protectionism on U.S trade. Research on this topic is important, since the gained insights can help us to understand the recovery process of international trade as well as the optimal policy and monetary approaches to favour recovery of the domestic economies during possible new downfalls.

[1] Real world GDP is the total of the gross domestic products worldwide, which on its term is the sum of all the added values produced within a nation.



Data obtained from the IMF World Economic Outlook Database.
Figure 1: GDP, constant prices and trade volume of goods and services for 'World'

2. Detailed Overview

The GTC was especially concentrated in Q4 of 2008 and Q1 of 2009, when all major developed and emerging markets where hit simultaneously. This was one of the only recessions where trade across countries declined in a remarkably synchronized manner. The exports and imports[2] for the 7 major advanced countries of the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom and the United Stated) for example all started to decline, in comparison to trade in the previous quarter, in Q2 of 2008. The imports for these nations all hit their hardest downfall in Q4 of 2008, with a maximum decline of 29% experienced in Germany and all other nations hitting a decline of over 20%. At the same time, G7 exports experienced their worst declines in Q4 of 2008 and Q1 of 2009, with Canada again hitting the steepest downfall of 24% and all other nations experiencing declines of over 19%. Figures 2 and 3 graphically show these findings. The same observation can be established when looking at the data for the 104 countries on which the WTO reports. These nations' imports and exports both declined severely between Q3 of 2008 and Q2 of 2009.

Levchenko, Lewis & Tesar (2010), however, have shown that although the trade collapse was synchronized over the different countries, different mechanisms were at play in each of these countries to cause this collapse in trade. Because even though all countries experienced a decline in trade, in some countries the decline in demand for imports was larger than what would be expected from the movements in domestic

[2] The data are obtained from the IMF world economic outlook database.

prices and domestic demand. For some countries this difference even amounted to 60% (Japan). For others, the decline in demand for imports was almost completely predicted by movements in prices and aggregate demand. The reason as to why this differs so much between countries remains unclear.

Figure 2: Percentage change of volume of exports of goods and services for G7.
Data obtained from the IMF World Economic Outlook Database.

Figure 3: Percentage change of volume of imports of goods and services for G7.
Data obtained from the IMF World Economic Outlook Database.

Since WWII, world trade has declined for at least three consecutive quarters. But this recent trade collapse stands out from the three previous worldwide recessions due to its magnitude and abruptness. The inflation crises of 1982-83 and the Dotcom crash of 2001-02 reached at most a decline in world trade of -5% from the previous year and the oil shock recession of 1974-75 hit a decline in world trade of -11% at its worst, whereas during this collapse world trade fell by -15% in comparison to its levels in the previous year (Baldwin, 2009). Moreover, even though the decline in trade of 2008-09 was not as large as it was during the Great Depression, the recent trade collapse was much sharper than that of the Great Depression. The level of decline of world trade that was observed after 24 months, was already reached after 9 months during the recent trade collapse. (Baldwin, 2009).

Both these observations of magnitude and sharpness of the Great Trade Collapse can also be noticed when looking at the change in total US imports and exports, with the level of trade compared to its previous quarter, displayed in table 1[3]. We can clearly mark that trade suddenly declined in Q4 of 2008 with a substantial 14.89% and 16.67% drop for exports and imports respectively. US imports experienced an even steeper decline the next quarter. However, by Q2 of 2009 a first sign of recovery can already be seen and by Q3 of 2009 US trade seemed to be completely restored. Levchenko et al. (2010) also observed that when looking at how much import demand in this recent economic crisis deviates from normal and historical levels[4], the 2008 trade collapse was indeed exceptional. The drop in import demand form the normal level (from 1984 onwards) amounted to -40%, resulting in a wedge as extensive as 6 standard deviations away from the mean. The only time a wedge close to this size has ever occurred was during the 2001-2002 recession and it then resulted in a decline in import demand of "only" -20%.

	Q1 2008	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009
Total Exports	5,31%	6,00%	1,40%	**-14,89%**	**-13,75%**	-0,25%	6,83%	7,66%
Total Imports	4,29%	4,43%	0,53%	**-16,67%**	**-19,60%**	3,14%	9,26%	8,98%

Table 1: Total US imports and exports. Data obtained from the US Census Bureau.

[3] Data obtained from the US Census Bureau.

[4] They used an import demand equation and called the deviation from the normal level of import demand a 'trade wedge'. In the equation they tried to link this deviation with the level of aggregated consumption and investments, the difference between domestic and import prices and the elasticity of substitution between import and domestic products.

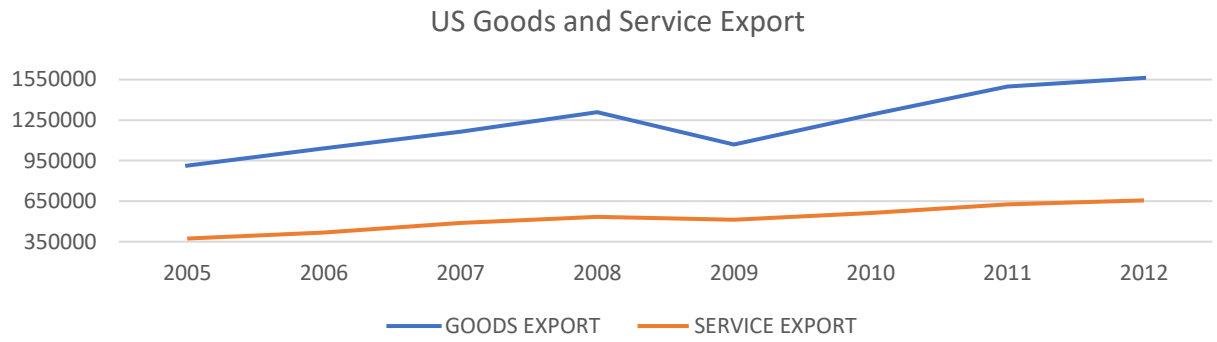


Figure 4: US exports of goods and services. Data obtained from the OECD.

Moreover, the trade collapse was asymmetric across different sectors, as not all sectors were hit to the same extent. According to Borchert and Mattoo (2009) the drop in the trade of services only amounted to a quarter of the drop in the trade of goods. Figure 4 gives an overview of US export of services and goods for the period between 2005 and 2012, obtained from the OECD. It is clear that the drop in export of goods (-18% in 2009, compared to the previous year) is far more severe than the drop in export of services (-4% in 2009, compared to the previous year). If we only look at the trade of goods on the other hand, we also find differences across sectors. The decline in nondurable (consumer) goods was notably less steep than the decline in durable goods. U.S. exports, for example, experienced the steepest decline in the automotive and durable industrial supplies sectors (with drops of respectively 47% and 34%), while the exports of consumer goods only fell by 12% (Bems et al., 2012). As a comparison, the total decline in exports for that country amounted to 26%. So while the automotive and industrial supplies sectors make up for almost 40% of exports in the U.S., they are responsible for more than half of the drop in exports in the country (Levchenko et al., 2010). The same is true for the U.S. imports, where the automotive and industrial supplies sectors decreased by 49% and 47% respectively, while the consumer goods only dropped by 15% (Levchenko et al., 2010).

In tables 7 and 8 in the appendix, the quarterly changes in US exports and imports from Q1 2008 until Q4 of 2009, calculated based on data obtained from the US Census Bureau, are recorded. It is indeed quite clear that the decline in imports as well as in exports is especially situated in the industrial supplies sector (with declines of 32.17% at its maximum downfall for imports in Q1 of 2009 and 23,85% for exports in Q4 of 2008) and the automotive sector (with declines of 32.94% and 36.15% at its worst in Q1 of 2009 for imports and exports respectively), while there is almost no decline in consumer goods (with declines of 8.02% and 7.58% for imports and exports respectively at their lowest levels in Q4 of 2008). It can again be

observed that the largest declines occurred between Q4 of 2008 and Q1 of 2009. This observation of asymmetry across sectors is corroborated by Behrens, Corcos and Mion (2010), who found that the Belgian export and import of nondurable consumer goods declined by only 8.48% and 4.95% respectively, while those of durables fell by a significant 38.03% and 39.17%.

Another aspect of the trade collapse is that it mainly took place on the intensive trade margin, both on sector and firm levels (Bems et al., 2012). An increase or decrease in trade can be the result of changes through two different mechanisms, namely the intensive or extensive trade margins. The intensive trade margin indicates the changes in trade through changes in intensity of sales of an already existing trade relationship. That is, as trade becomes less costly, firms will start to trade more sizeable quantities. The extensive margin on the other hand refers to the changes in trade as a result of a newly established trade relationships, or in other words, as trade becomes less costly more firms will start to trade and more products will be traded. As the trade collapse especially took place on the intensive margin of export (Behrens et al., 2010), a decrease of intensity of trade between parties took place and not a decrease in the number of trade relationships that were being established. It can be deduced from this observation that as soon as the economic environment returns to 'normal', international trade should relaunch. Haddad, Harrison and Hausman (2010) find indeed that when observing trade data for the U.S., EU, Brazil and Indonesia, 70-95% of the decline in imports took place on the intensive margin of trade. Moreover, Behrens et al. (2010) found that almost 100% of the decline of Belgian imports and exports was situated on the intensive trade margin.

Manova (2012), however, reports that the credit constraint had an effect on financing both the intensive and the extensive margins of export. The credit constraint is one of the consequences of the financial crisis and indicates that because banks started having a problem to finance their own assets, it became more challenging for them to give out loans to enterprises. The enterprises in turn had a problem to obtain credit (even from other companies, because all companies felt the effect of the falling banks) and so some had a hard time financing their operations. As the credit constraint took place on both margins, it means that companies had a problem to finance their fixed as well as their variable costs. In other words, both servicing new markets (extensive trade margin) and maintaining the trading volumes of their foreign shipments (intensive trade margin) were problematic.

An additional attribute of this Great Trade Collapse is that price changes did not play an important role in the collapse of trade, since the collapse was to a great extent caused by a drop in trading volumes. Gopinath, Itskhoki and Neiman (2012) found that the import prices of differentiated goods in the US only declined by 1% and prices of exports by 0.5%, while their trade volume declined by 30%. The sectors that did endure a large drop in prices, such as non-differentiated goods, non-manufacturers and non-durable consumer goods, were sectors where trade did not fall as much. Levchenko et al. (2010) corroborate these findings, as they indicate that the import and export prices for the US also remain relatively stable for all sectors except for commodities (namely petroleum), but the decline in commodities is only accountable for a small part of the collapse of world trade. For the automotive, capital goods and consumer goods sectors - sectors where the most significant trade collapse was observed - they even found that prices almost did not move at all. They found that the nominal fall in U.S. exports from its peak value amounts to 26%, of which 19% can be attributed to a fall in real exports. In other words, they found that most part of the drop in exports can be explained by a drop in quantity and not in price. As another example, the fall in export on the Belgian intensive margin was mainly the consequence of a sharp drop in export quantities and only to a minor extent of price cuts. The intensive margin decreased by 20% in trade quantities and by a mere 7.04% in trade prices. The same conclusion can be drawn for the Belgian import (Behrens et al., 2010).

A final observation of this GTC was made by Levchenko et al. (2010). The authors found that the US foreign trade to their most prominent trading partners declined significantly more than trade to their minor trading partners. They report that U.S. exports to all their major trading partners dropped by more than 20% while for U.S. imports from major trading partners the decline even amounted to 30% (only import trade from China and India experienced smaller declines of 15% and 13% respectively).

3. Underlying Determinants of the Trade Collapse

The different causes as to why trade collapsed so much more than the GDP can be classified into two overall domains, namely the supply side effects and the demand side effects. The former indicates that trade declined because consumer demand for goods and services declined, the latter expresses that trade decreased because suppliers were not able to produce or export as much as needed by demand. If there was only an impact of the demand side effects on international trade, the initial economic shock would have just caused a drop in final aggregate demand. If the supply side effect on the other hand also played a part, the outcome of the initial demand shock would be worsened by credit constraints, protectionism, etc. There is still an ongoing discussion in the literature on whether the demand or the supply side effects were the main driver of the collapse, which is an important aspect in better understanding the trade collapse and in being able to prevent it from happening again in the future. In what follows, we will start by examining the demand side effects and then continue with the supply side effects.

3.1 Demand side

When first focussing on the demand side, two possible explanations for the severe collapse of international trade could be detected. First, this trade collapse could have been caused by a collapse of total expenditures. As consumers, companies or governments simply spent less money, this could have resulted in a decline of international trade. A second explanation is that as firms first go through their existing inventory when experiencing a decline in demand, they would import less and this would directly lead to a decline in trade. This may at first sight seem a supply side variable, but the adjustment of inventories by the firms is directly caused by a decline in demand and not by changes in the supply process of the producers.

3.1.1 Collapse in aggregated expenditures

Bussière et al. (2013) and Bems, Johnson and Yi (2011) estimate that 65-80 percent of the drop in trade was due to a decline in aggregate expenditures[5]. According to Eaton et al. (2010) the decline in demand for manufacturing goods was responsible for more than 80 percent of the drop in trade in GDP over the period of 2008 and 2009. Moreover, 65 percent of the decline in trade was caused by a drop in demand for durable (manufacturing) goods. This observation is actually quite easy to understand: people will easily

[5] The term “aggregate expenditures” refers to the sum of the expenditures by households, the investments by companies, the government expenditures and the differences between imports and exports.

postpone the purchase of durable goods, as for instance cars or laptops, in an economic downfall, since they are not as urgent as fast trading consumer goods, like food, personal hygiene products, etc. These observations reveal that the durable manufacturing goods were the main driver of the drop in aggregate demand. Bems et al. (2010) further suggest that, during the period of late 2008 and early 2009, the unpredictable path of the crisis created much uncertainty across producers and consumers, thus creating a decline in aggregated demand.

It must be noted that the structure of GDP plays an important role here. As Bems et al. (2010) mention, trade focuses especially on industrial output while GDP is composed of both industry and services. Since, as Baldwin (2009) indicates, the decline in demand was especially centred around fast-moving durable goods and not so much around services, the composition effect could explain why trade declined proportionally more than GDP. The percentage of the trade collapse that could be accredited to this compositional effect all depends on the elasticity of world GDP to world trade. If a sector with large import shares (e.g. the steel industry) experiences a large decline in aggregate expenditures, the elasticity of imports over aggregated expenditures will be higher than one and trade will be hit more than domestic demand (Bems et al., 2012). On the other hand, if the shares of trade and output for each sector are exactly alike in terms of volatility, the compositional effect cannot explain even 1% of the collapse in world trade. (Bems et al., 2012).

Levchenko et al. (2010) indeed found through their research that trade especially took place in sectors which experienced the largest declines in industrial production, causing these sectors to experience larger declines in imports and exports than others. In other words, they found evidence that sectors with large import or export shares experienced a bigger decline in trade, causing the elasticity to be bigger than one. According to their research, the compositional effect could explain about half of the collapse in world trade. However, they cannot explain why this phenomenon is occurring.

In addition, Levchenko et al. (2010) suggest that the trade of investment goods and durable goods, the sectors that were hit the hardest in the recent crisis, is more volatile than GDP, as consumption in these sectors is more volatile than total consumption. This volatility could again be explained by the fact that people will easily defer their purchases of durable and investment goods when money problems arise.

However, Eaton et al. (2010) indicate that the decline in trade in some countries was substantially higher than expected on the basis of demand patters, so there must be other factors at play. Econometric models

could indeed only predict about 70 to 80 percent of the observed decline in world trade based on this demand shock (Ahn, Amiti & Weinstein, 2011).

3.1.2 Inventory adjustments

A second possible explanation for the substantial collapse of world trade can be found in inventory adjustments. The fluctuations in production will be much more volatile than those in sales, since inventory also has to be taken into account (Alessandria, Kaboski & Midrigan, 2010). If sales decline, import and production will be hampered as the existing inventory will be sold first to adjust its level to the lowered level of sales. This effect will be even more amplified if the inventory adjustments are procyclical. Next to that, taking into account that labour costs and the costs of borrowing increase during recessions, retailers will postpone new orders until these costs decrease and will first go through their entire stock. (Alessandria et al., 2010). On top of that, import and export in an open economy can be even more volatile than production when, in that country, inventories are rather important for trade. Importers face more uncertainties and a longer time lag between order and delivery than domestic traders and consequently have to keep a larger stock (Alessandria et al., 2010). A mismatch in inventories, e.g. a rise of the inventory-to-sales ratio caused by a certain (economic) shock, could thus cause a subsequent drop in international trade. As the stocks for imports and exports are larger than the stocks for domestic trade, the trade in the former will decrease more (Alessandria et al., 2010). Considering that trade recovers once the inventories are adjusted and retailers will begin to import again, the downfall this shock causes will be sharp but brief (Alessandria et al., 2010). This corresponds to what is being observed as world trade began to recover by mid to late 2009.

Alessandria et al. (2010) find that by merely observing the aggregate data for US trade[6], inventory adjustments seem to have indeed influenced the foreign trade decline in US trade. While the average of the yearly total US imports and exports from the period of August 2008 to August 2009 fell respectively with 238 billion dollars and 202 billion dollars relative to the average import and export level of June-July-August 2008, the US stock decreased approximately with 102 billion dollars in that same period. However these observations are not very different of those of the past seven recessions. The log change of the inventory-to-sales ratio relative to industrial production is for the most recent recession -0.49, while the median of the past 7 recessions is -0.56 (Alessandria et al., 2010). Moreover, the observation that in the

[6] As it is not possible to find data about inventories on a worldwide level, they investigated the imports and exports of the US.

recession of 2008 the inventory-to-sales ratio peaked prior to the tumble of the imports or exports is also a recurring pattern over the past 7 recessions (Alessandria et al., 2010). These considerations led to the conclusion that inventory adjustments did not play any different role in this recession compared to the other recessions.

Moreover, Alessandria et al. (2010) were able to establish a link between changes in sales, inventories and trade by taking a closer look at the automotive industry[7]. The import of cars had fallen considerably more than their sales in the period of February to August 2009 compared to their level in Q2 of 2008, with at its lowest level a drop in imports which was 2.5 times worse than the drop in sales. This can be explained by the observation that starting from Q2 of 2008 sales fell with approximately 33%, causing inventories to decline with about 12%, leading to an increase of the sales-to-inventory ratio of 45% at its worst level. Due to this increase, importers had to extensively decline their car import to get their level of inventories at the same declined level of sales. This marked the starting point of the impressive decline of US automotive imports. Hence, a decline in sales caused a much larger decline in imports through inventory adjustments. This observation can be generalised for all US trade. Alessandria et al. (2010) found that US imports indeed decreased more than US final expenditures, with a 29% and a 13% import drop for capital goods and consumer goods respectively in April 2009, compared to an 18% and a 5% drop for final expenditures. For both these categories an increase of sales-to-inventory could be observed with a maximal increase of 19% and 6% for capital and consumer goods respectively at its highest level.

So although the inventory adjustments of these crises are not unusual, they still have contributed to the collapse of the international trade. However, the generalization of US trade to world trade is questionable, as there is no direct evidence of a link. Consequently, the precise extent to which inventories contributed to the collapse of world trade remains unclear.

[7] Alessandria et al. (2010) selected this industry because of the fact that it was the sector with the most significant decline in trade during the recent recession, as its US imports and exports had decreased twice as much as total imports and exports in December 2008 compared to August 2008. Moreover, substantial amounts of data are available for this industry.

3.2 Supply side

When turning to other possible explanations, we have to focus on the supply side effects. A first possible explanation is that it would be possible that as firms experienced some constraints on obtaining credit from banks or trading partners, firms could experience difficulties in producing or transporting their goods or services. As a consequence, this would hinder international trade. Further, linkages in the international production process could have been broken, leading to difficulties in producing certain goods or services. A last possible explanation is that governments could have turned to installing protectionist measures in their countries, which could also obstruct international trade as importing and exporting would become more expensive or at times impossible.

3.2.1 Credit constraints

Access to financial support stimulates trade openness (Dong Hyeon, Shu-chin and Yu-Bo, 2011). In normal times, countries with higher rates of private credit[8] and financially stronger countries have higher average export rates. If the sectors are split up per country, financially advanced countries export more in almost every sector and this effect is more visible in financially vulnerable sectors[9] (Manova, 2012). Moreover, in countries where financial institutions are weak, growth and economic activity are hampered (Manova, 2012). This implies that the economic crisis of 2008 would have hindered international trade, but there is still doubt about the channels through which this happened. Of course the effect of the credit crunch, i.e. the phenomenon that there is suddenly hardly any to no credit available independent of the changes in interest rates, differs across countries and sectors, because some are more prone to financial frictions than others. Chor and Manova (2011) estimate that in the second half of 2008 the worldwide trade finance shortage amounted to between 25 billion and 500 billion USD.[10]

It is first of all very important to highlight the fact that international producers are more in need of external financing than domestic producers. External financing is needed when the cashflows of the company do not cover their capital expenditures. Exporters have to incur extra costs, such as import taxes, shipping costs, freight insurance or a larger working capital, as shipping and delivery takes much longer than domestic trade and is much more risky. Often a new international distribution network has to be set up and maintained, which also brings along extra costs, and additional sunk cost have to be made for the

[8] Private credit is defined as credit granted by banks or other financial institutions to the private sector.
[9] Financially vulnerable sectors are defined as the sectors that depend the most on external financing.
[10] It is quite hard to obtain numbers on this, hence the large range.

upfront market research of the international markets that could be targeted (Manova, 2012). Manova (2012) indeed finds that credit restrictions hamper international trade disproportionally more than domestic trade. Research has estimated that up to 90% of world trade is somehow financed with external capital (Auboin, 2009).

There are two general channels through which credit constraints can impact international trade, with the first channel being trade credit or buyer-supplier credit and the second bank loans. Suppliers often extend trade credit to their buyers, which actually often comes down to extending a delay of payment. At the same time, suppliers also often make use of prepayments from their buyers to finance foreign shipments. Bems et al. (2012) point out that when companies no longer have access to financing, they are forced to produce less and they have less stock for exporting, which impedes exports and thus world trade. On top of that prices of production can increase, as it becomes harder to produce, which further obstructs imports and slows down international trade.

The second channel consists of bank loans. When banks have shortages or surpluses of their assets or liabilities at the end of a business day, they can lend or borrow this money on the interbank market, a market that is solely accessible by banks. Before the financial crisis outburst, this market was a very popular form of short term financing amongst a lot of banks worldwide. In Belgium, for instance, the bank Fortis needs to refinance 50 billion euros every day through this market. During the financial crisis, however, many of the banks started to experience problems to finance their assets through their liabilities, so they had no credit left to lend on the interbank market. On top of that, banks were worried about their own and others' exposure to the subprime crisis, as they were uncertain about the nature and the risk of the investment vehicles in everyone's portfolio. This also led banks to withdraw from the interbank market. As a consequence this market dried up and the interbank market rate increased sharply, thus banks charged the higher cost of borrowing directly to trade finance contracts, since the rates at which people could borrow were mostly based on the interbank rates (Ahn et al, 2011).

This is exactly what Chor and Manova (2011) observed. Countries where banks had less credit available on the interbank market, in other words where the market rates were higher, exported less to the US in comparison to countries where this was not the case. Especially those sectors that are financially vulnerable are very sensitive to credit constraints and higher costs of borrowing. Chor and Manova (2012) even found that if credit conditions remained as tight as they were in September 2008, which would lead

to very high interbank rates, the imports of the US sector most dependent on external finance would have declined 13.4% more than the imports of the US sector least dependent on external finance.

Amiti and Weinstein (2009) also present a survey by the International Monetary Fund Banker's Association for Trade and Finance that discovered that on average the spread on trade lending increased by 70 basis points during the crisis. A 2009 World Bank's survey of 425 firms and 78 banks in 14 developing countries also shows that the recent recession caused a fall in pre-payments on exports, the preferred method of payment of two-thirds of the interviewed exporters and importers. As the exports were no longer paid up front, firms had to deal with larger working capitals, making them even more reliable on their own cashflows. These observations show that in general the cost of borrowing rose at the beginning of the crisis. It wasn't until countries started to take extreme monetary measures that the rates began to lower. Chor and Manova (2011) indicate that the extreme monetary measures some countries took, helped to relax the cost of borrowing and thus stimulated international trade again. The authors indicate that if the interest rates had remained at their highest level of September 08, which would have happened if the US government did not intervene, the imports of the US would have declined with an extra 2.5 percent. Levchenko et al. (2010) indicate that the credit constraints on bank loans also had an effect on trade credit as companies were no longer able to grant trade credit to their foreign trading partners.

Further research findings by Chor and Manova (2011) also rule in favour of a rather substantial impact of credit constraints on the GTC. Their results indicate that countries which experienced higher interbank rates exported more in sectors that have access to trade credit. Although they point out that this effect could probably be diminished during the crisis because trade partners are likely to be less willing to extend trade credit as they experience the credit crunch themselves. Lastly they found that sectors that possessed more assets to pledge as collateral exported more than other sectors, this again in countries which experienced higher interbank rates. All of these effects were dramatically increased during the crisis. Levchenko et al. (2010), however, do not completely agree with Chor & Manova (2011). They found that although Chor & Manova (2011) demonstrate that sectors that are more exposed to external finance traded less, this result cannot be generalized for the US as a country, since the average effect of a credit crunch on all sectors in the country was almost zero.

Manova (2012) also found that credit constraints had a significant impact on bilateral exports, since weak financial institutions induce smaller trade volumes, less product variety in the export products and a

smaller range of export markets. These effects are even more significant in financially vulnerable industries. Her research also finds that the credit constraints affect both the financing of the fixed and of the variable costs of the exporting companies.

Moreover, Ahn et al. (2011) observed two new phenomena which also rule in favour of credit constraints as a cause of the GTC. First, they found that exporters like Japan, the European Union and the United States, which were responsible for 51 percent of the exports in 2009, raised their export prices relative to their domestic manufacturing prices. This could indicate that export was affected more by the financial shocks than domestic trade. This conclusion follows from the fact that for example the automotive imports (which is a durable good, so this sector was affected more substantially) saw their import price increase during the crisis. If this sector had been hit by a demand shock, prices would have decreased, so clearly a supply shock, not a demand shock, lay at the basis of the price increase. Secondly they observed that prices of products imported and exported over sea increased more than those of products shipped through air or land. This again could indicate that financial shocks can be held accountable for the decline in international trade during the crisis, as shipping over sea requires more short term financing and has a greater risk of default payment, which makes it more dependent on trade financing. However, this study is completely in contradiction with the research by Gopinath et al. (2012), Levchenko et al. (2010) and Behrens et al. (2010) who all indicated that the prices for US and Belgian imports and exports hardly changed during the GTC. It is therefore unsure to what extend the results of this research paper contribute to explaining the GTC.

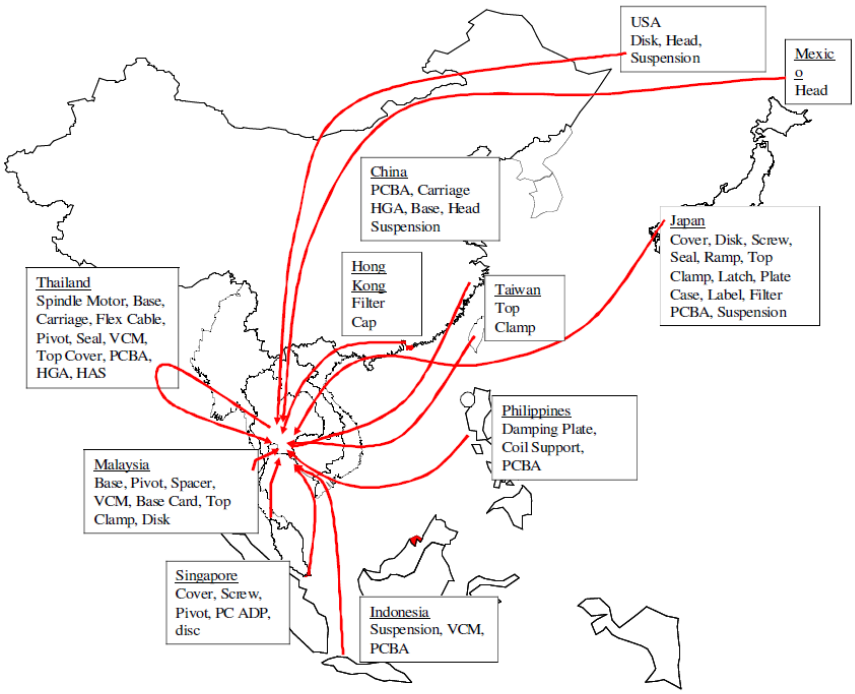
However, it is still quite clear from the literature that credit constraints, and as a consequence the increased cost of borrowing, had a substantial effect on the collapse of trade during the most recent financial crisis. Because exporters and importers are more dependent on external finance than domestic producers, this parameter also indicates why world trade declined so much more than world GDP. Based on research by Amiti and Weinstein (2011) and Paravisini et al. (2012), Bems et al. (2012) estimate that credit constraints account for about 15-20 percent of the decline in world trade.

3.2.2 Disruption of global value chain

The next possible supply-side explanation is the disruption of the global value chain. A country will have an advantage at producing certain types of products, while it will experience a disadvantage in producing other types. The former category will be domestically produced and exported, while the latter will have to be imported. France for example has an advantage in producing wines due to its climate, while that

same climate makes it difficult for France to culture tropical fruits. Wine is therefore an important export product, while tropical fruits will have to be imported. This is the traditional bilateral trade channel through which countries worldwide are linked. Final products are mainly traded through this channel (Bems et al., 2010).

Another manner in which countries are connected is through the global value chain, alternatively referred to as vertical linkages or vertical integration, referring to cross-border trade in intermediate products. Examples of vertical linkages are offshoring or outsourcing, i.e. moving (parts of) the production process to outside companies. An important subsection of vertical linkages is vertical specialization, which is the embodying of certain goods into exported products (Bems et al., 2010). A company in China for example will produce the chips for a computer, which will be exported to a firm in India. There these chips will be installed in the motherboard and the semi-finished product will again be exported to another country for further assembling, and so on. Figure 5 gives a graphical example, indicating the 10 countries a hard disk has to pass through in order to reach its final stage of production, obtained from Baldwin (2008). So countries are not only



Source: Baldwin (2008) based on data adapted from Hiratsuka (2005).

Figure 5: Overview of the 10 different countries a hard disk has to pass through to reach its final stage of production

directly linked with their trading partner through bilateral exports for final goods and services, but they are also indirectly linked when for example their products are first further assembled in a third country before being used as a final product in the country of the trading partner.

These vertical linkages will amplify the effect of a negative shock, since not only the traditional direct trade channel will be hit, but there will also occur an obstruction of these intermediate linkages. When for example demand for certain products declines in the country of the trading partner, the direct exports of those final goods to this trading partner will decline as well. But on top of that, the exporting country will experience a second downfall as exports of intermediates to produce these final products will also decline (Bems et al., 2010). The response will be more amplified, if industries with a greater share of vertical linkages than others, e.g. the automotive industry, are hit (Bems et al., 2010). The effect will even be worsened when a country that produces a link in the global value chain (e.g. the computer chips in the previous example) is not able to do this anymore due to a severe negative shock. This will consequently lead to a disruption of these value chains and will have serious consequences for all countries involved in the production chain (Bems et al., 2010).

According to Di Giovanni & Levchenko (2010) countries between which there exist an intermediate products trade relationship show a more synchronized business cycle on the sectoral as well as on the aggregate demand level. This can also be easily understood intuitively: exports of country A are not only absorbed in country B, but can also be adapted in country B and then imported back into country A. This could explain the synchronization of the decline in trade between countries that is observed during this recent trade collapse, as is described in the detailed overview.

Bems et al. (2011) found that trade in final goods in the period between the first quarter of 2008 and 2009 fell by roughly 16.9 percent, which is almost twice as large as the decrease in trade in intermediates (7.6 percent). However, since intermediates make up for 63.5% of the total trade, they are still responsible for 43.9% of the decline in total trade. In their previous work, Bems et al. (2010) suggested that, according to their framework, almost three-fifths of the decline in global trade can be allocated to the disruption of value chains. Consequently, the international transmission mechanism can have a large effect when shocks (especially in the tradable sector) appear. Furthermore the authors discovered that the effect differs across sectors, since some, like nondurable goods, are more vertically integrated than others. This could possibly explain the observed asymmetric impact of the trade collapse across sectors. Moreover,

Bems et al. (2011) investigated the share of vertical specialization in the collapse of international trade. Their research estimates that vertical specialization overall contributed 31.6 percent of the drop in total trade, which is quite substantial.

It is important to note that Bems et al. (2011) did not take the withdrawal of foreign production to the home country into account. This means that in their model global value chains could not break. Its occurrence and the extent to which it occurred would have had a great effect on the impact of the global value chain on the collapse of trade.

Levchenko et al. (2010) confirm the results of Bems et al. (2011), as they showed that the collapse of trade especially took place in intermediate goods and not in final goods. They indeed found that the wedge between the benchmark value for the trade flows and the value during the crisis was the most significant for intermediate goods and not significant for final goods. Moreover, their research indicates that vertical linkages indeed had a significant impact on the decline of US trade in the period from Q2 2008 to Q2 2009.

However, there is also research, like Behrens, Corcos and Mion (2010), that suggests that the trade in intermediate goods did not contribute to the out-of-proportion collapse of trade. They argue that trade and output move approximately proportionally, with or without trade in intermediate products, meaning that intermediates could never explain the collapse in trade. Bems et al. (2010) point out that both these views are not necessarily contradictory. They contend that the proportionality between trade and output only holds if the decline in demand is exactly the same in all countries and sectors. Their framework indicates that if demand changes are proportional to trade in all countries, output changes also need to be proportional as they are the weighted average of demand changes, with weights summing up to 1. So when, as was observed in the recent crisis, the changes in demand are not symmetric across countries, the trade elasticity deviates from 1. The effect of this deviation then depends on the economic composition[11] of the country and on how the demand changes will interact with this composition.

So even though Bems et al. (2010; 2011) did not take all the possible disruptions of vertical linkages into account, they still proved that the disruption of the global value chain could account for about 43.9 percent to 60 percent of the collapse of world trade and could explain why the decline of trade was so

[11] The economic composition of a country depends on the levels of production, the intensity of the use of intermediates, how demand is allocated, etc.

synchronized across countries. In other words, vertical linkages could be an important determinant as to why world trade collapsed so much more than world GDP.

3.2.3 Protectionism

Most people believe that as a response to the recession, countries would install protectionist policies to protect their own economy. But according to the World Trade Organisation, new protectionist measures have only accounted for 1% of the decline in world trade since the recession started. These new protectionist measures are fairly mild and are constructed in sectors that have been protected for a long time, such as steel and agriculture (Erixon & Sally, 2010).

Kee, Neagu and Nicita (2013) further stated that there is little evidence that nations worldwide have increased their tariffs on imports as in 125 of the 134 countries they investigated, the tariffs remained unchanged or even decreased. So this measure of traditional protectionism was not heavily used during the crisis. This could also be attributed to the fact that members of the WTO are tied to certain trade tariffs, so they cannot easily change them. This is especially true for the high-income OECD members, who have pledged not to raise their tariffs above a very strict, and on average low, rate. Developing countries on the other hand do not have very strict tariff limits, so that they could still increase their tariffs without breaching these limits (Evenett, 2009). It also must be noted that Boffa & Ollareaga (2012) found that countries did not install retaliation protectionism against trading partners, as severely happened in the crisis in 1930.

Global Trade Alert[12] (GTA) on the other hand enumerated at least 297 new protectionism instruments since November 2008. It must be noted that 40 of the already implemented instruments were color-coded green, meaning they were not discriminatory against foreign trading partners or they improved the transparency of the domestic trading regime (Evenett, 2009). GTA mainly noticed that traditional protectionism, such as border barriers, has been taken over by non-traditional more subtle protectionism, e.g. subsidies that could subvert trade and government bailouts to the financial sector. The latter was not taken into account by the WTO, because of its unclear impact on international trade. (Erixon and Sally, 2010).GTA estimates that these bailouts are accountable for about one third of the new protectionist

[12] An organisation founded after the economic crisis started, which provides information about worldwide state interventions that are likely to affect foreign commerce.

measures. Trade remedies[13] and import tariffs in turn respectively make up for 20 and 14 per cent of the newly installed measures (Erixon and Sally, 2010).

Erixon and Sally (2010) indeed found that, since the economic crisis outburst, governments have mainly made use of domestic economic policy as opposed to trade policy, thus in a non-traditional protectionist way. They found evidence of two main types of domestic government interactions: government bailouts and subsidies, which mainly took place in the financial sector (e.g. bailing out banks), and fiscal stimulating policies, often in combination with 'creative' monetary policies. These policies were installed to encourage expenditures in aggregate demand and to ensure liquidity in the markets.

Other non-traditional measures are industrial subsidies, buy-national restrictions, restrictions to only invest nationally and standards protectionism. The latter refers to restrictions of a technical or food-safety nature on import products. Governments also often strongly advise, directly or indirectly, (bailed-out) banks to lend locally. These actions of course obstruct international financing of trading activities. On top of that, WTO has hardly any to zero restrictions for this kind of non-traditional policy. Yet global markets have spontaneously installed restrictions on traditional protectionism, since they understood that this was very limiting and costly for international trade (Erixon & Sally, 2010).

Nevertheless, Erixon & Sally (2010) argue that the short term government interactions will eventually lead to more protectionist consequences, but this will take place on the medium term. As it takes time for these interventions to have an impact on prices, to raise costs and to eventually make economies more rigid and stifle competition, the resistance of economic actors to trade internationally will occur in the medium term. In other words, these measures will not have had an effect on the great trade collapse. Kee et al. (2010; 2013) proved this statement in their statistical study. They found that as the world trade declined by 24% in 2009, only 2% of this collapse could be attributed to newly installed protectionist measures. Although their research only took tariff increases on imports and antidumping duties into account, it is fair to say that the major part of the collapse in world trade cannot be explained by worldwide protectionism.

[13] Trade remedies cover three measures a country can install when they believe there is an abuse of international trade regulation, namely: Anti-Dumping Duties (import tariffs installed on products which are sold at exceptionally low prices in the importing country), Countervailing duties (import tariffs installed on import products which are heavily subsidised by the home country which makes cheaper export possible) and Safeguards (temporarily restricting import in industries which suffer from sudden import peaks to protect them).

3.3 Conclusion

From this literature survey it appears that the collapse of aggregate demand was the main driver of the great trade collapse, as several research papers, e.g. Eaton, Kortum, Neiman and Romalis (2010), Bussière et al. (2013) and Bems, Johnson and Yi (2011), indicate that for 65-80% the collapse in world trade can be attributed to the decline in aggregate demand. However, this variable could not explain the total collapse of international trade, which implies that other variables must be looked at to explain the remaining collapse of trade. The adjustments of inventory did have an impact, but this impact was not different from its impact on the past recessions. This means that 20-35% of the collapse of trade needs to be explained by other, non-demand side, variables. When analysing the existing literature for the supply-side variables, it becomes clear that credit constraints indeed had an impact on the collapse. Research by Amiti and Weinstein (2011), Paravisini et al. (2012), and Bems et al. (2012) even estimates that the increase in credit constraints could account for 15-20 percent of the decline in world trade. However, there is also research by for instance Levchenko et al. (2010) that did not find a significant impact of credit constraints on the collapse of trade. Furthermore, this literature survey has also made clear that the existence and disruption of vertical linkages did play a role in the collapse of global trade. It can also explain why world trade collapsed in such a synchronized manner across countries. Although there are again some papers, as for instance Behrens, Corcos and Mion (2010), that suggest that the trade in intermediate goods did not contribute to the out-of-proportion collapse of trade. Finally, it seems that protectionism did not impact the collapse of international trade, as most countries did not install excessive protectionist measures to shield off their economies.

4. Empirical Research

From the literature survey it has become quite clear that 65-80% of the decline in world trade can be attributed to the decline in aggregate demand. Hence, in this empirical study I will focus on the 20-35% that can be attributed to supply-side shocks and where there is still an ongoing discussion whether or not these variables impacted the GTC, as explained above. Moreover, there is no model that incorporates all three possible supply-side explanations. As a consequence, this study focuses on the impact of the increase of credit constraints, the existence and potential disruption of vertical linkages and the increase of protectionism on the collapse of global trade in the 2008-2009 recession. Hence, the three research questions that will drive this study are the following:

1. Did the increase in credit constraints impact the collapse of international trade in the 2008-2009 recession?

2. Did the obstruction or disruption of vertical linkages impact the collapse of international trade in the 2008-2009 recession?

3. Did the increase in protectionism impact the collapse of international trade in the 2008-2009 recession?

I first have a look at the existing models concerning the three variables I investigate. This is followed by an elaboration on the implemented model and the used data in this research paper. To finish this study, I first I report on the results obtained from the analyses, followed by a discussion of these results.

4.1 Models

4.1.1 Credit Constraints

First I take a look at the existing models regarding the impact of credit constraints on the collapse of world trade. A first model was developed by Manova (2012) in which a heterogeneous-firm trade model is used where a company's need for external finance and its ability to pledge collateral are driven by the sector it is in, in which credit constraints are incorporated. Manova (2012) especially identifies the channels through which financial market imperfections have an effect on trade, taking into account the level of development of each country. Three possible channels are investigated: the selection of heterogeneous firms into domestic production, the selection of domestic manufacturers into exporting, and the level of firm exports (Manova, 2012, p. 712). The sample of the paper consists of 107 countries. The author finds

that weak financial institutions indeed cause exports to fewer countries, less variety in export products and lower trade volumes. These effects are even worsened in sectors that are more dependent on external capital and have less collateral to pledge.

Chor and Manova (2012) on the other hand examine the trade patterns of monthly US imports in the period of November 2006 to October 2009, and compare these trade patterns before and during the crisis. Credit conditions are defined as the variation in external capital costs in different countries over time as well as the variation in financial vulnerability over different sectors. The former is represented by the interbank lending rate of a country, while for the latter the authors used firms' dependence on external financing, firms' access to buyer-supplier credit and firms' asset tangibility as variables. They applied two different scenarios to the data: one where the interbank rates remained at their tightest level of September 2008 and one where the rates immediately went to their more relaxed level of September 2009. These two scenarios then give the 'upper' and 'lower' boundaries of the impact of the credit constraints on the trade flows. They found that exports fell more in sectors that are more dependent on external finance, that have low asset tangibility and that depend more on buyer-supplier credit. Lastly they found that countries whose interbank rates were higher, hence with tighter financial restrictions, exported less to the U.S.

A third model was developed by Eaton, Kortum, Neiman & Romalis (2010). They describe a multi-country quantitative general equilibrium model in which they introduce four types of shocks: demand shocks, trade frictions, deficits and productivity shocks. The trade frictions shock does not only comprise credit constraints, but also home-bias[14] or anything that has an influence on the absorption of imports. Their model is applied to data of 22 countries that together account for 75 percent of world manufacturing trade and world GDP and to data of the remaining countries indicated as 'rest of world'. They found that the drop in trade and GDP is nearly exclusively due to the demand shock, and in particular to a shock in the demand for durable manufacturing goods (e.g. cars). The three other types of shocks do not come close to explaining the observed drop in trade/GDP.

Finally, Levchenko, Lewis and Tesar (2010) found that there is a large gap between what the existing models (e.g. the CES aggregation of domestic and foreign goods based on the International Real Business Cycle model) predict would happen with real imports versus what is actually observable in the real data.

[14] These are regulations that rule in favour of the consumption of domestic products rather than imports.

The authors tried to uncover what could explain this divergence by looking at the impact of the decline in intermediate products and vertical linkages on real U.S. trade and the impact of increasing credit constraint for U.S. firms on U.S trade. On top of that they also investigated the impact of the compositional effect on U.S. trade. To study the impact of credit constraints on trade, they included the parameters accounts payable/cost of goods sold, to check for the amount of a company's purchases that are bought on trade credit, and accounts receivable/sales, to check how much trade credit a company offers to its buyers. Data for all these parameters was collected for the U.S.. They did not find an impact of credit constraints on U.S. trade. Moreover, their research indicates that there was only a small decline in trade credit during the most recent recession.

4.1.2 Vertical Linkages

With respect to the impact of vertical linkage on the collapse of world trade, two models can be discerned. The first one was developed by Levchenko, Lewis and Tesar (2010), who investigated the impact of vertical linkages on US imports/exports. They split up these linkages into two categories. On the one hand they define downstream linkages, indicating the use of an intermediate produced by a sector throughout different industries. On the other hand they distinguish upstream linkages, referring to the intensity with which the different industries make use of intermediate goods.

The three variables for the downstream linkages are the average use of intermediate *i* across all sectors in which it is used, the number of sectors that use *i* as an input and the Herfindahl index. The latter takes value 1 when only one sector uses the product as an intermediate product and takes the minimum value[15] when all sectors use it equally as an input. Their parameters of upstream intermediate linkages are the average use of intermediates by sector *j*, the total number of intermediates used by industry *j* and the Herfindahl index, which now takes the maximum value of 1 if the industry only uses 1 intermediate and takes the lowest value when a sectors uses all intermediates. Moreover, the authors also built two additional measures of product sharing. The first measure is defined as the share of imports from a foreign subsidiary by the U.S. parent company and imports from the foreign parent company to a U.S. subsidiary in total U.S. imports. The second one is the share of exports to a foreign subsidiary from the U.S. parent company and the exports from a foreign parent company to a U.S. subsidiary in total U.S. exports. All

[15] The minimum value is dependent on the number of sector and the amount of intermediate used per sector, meaning that it is not a uniform value for each time the Herfindahl index is calculated.

these variables are defined on sector level. Levchenko et al. (2010) did find a significant impact of vertical linkages on the collapse of U.S. trade.

A second model on vertical linkages was introduced by Bems, Johnson & Yi (2010). The authors used the global bilateral input-output framework developed by Johnson and Noguera (2011). Their framework differs from the normal input-output frameworks as the latter only include changes in demand, production and trade for one country towards its trading partners. The new framework on the other hand paints a global picture. Through this framework the authors want to investigate how exogeneous demand shocks work backwards through the framework in order to discover their effect on changes in trade and output. This framework also takes indirect linkages into account, next to the direct linkages between trading partners. The quantity of output from one sector in one country can be split up between the quantity of intermediates from that sector and country that have been used in another sector in another country and the quantity of final goods produced by that sector and country that have been consumed in another country. They then estimated demand changes for each country in the period of Q1 2008 to Q1 2009, introduced these into the framework and checked for the response of trade and output on these changes.

With this framework the authors try to estimate the elasticities of how output reacts to changes in demand in the different countries. The elasticities are measured as the output share from sector *s* in country *i* that have been used directly as final good or indirectly as intermediate good to produce final goods in sector *t* in country *j.* Through their framework they find an elasticity of world trade to GDP of 2.8 for the period from Q1 2008 to Q1 2009, with the actual observed elasticity being 4 for that period. Their framework is in other words able to 'explain' about 70% of the collapse of world trade.

4.1.3 Protectionism

Finally I take a look at the existing models integrating protectionism. However, most research on the increase of protectionism during the most recent economic crisis contains a rather extensive summing up of the facts or of the increased protectionist measures of different countries, rather than actual analytical research. Bown (2009) for example investigated the increase of protectionist policies of the G20 countries and WTO members in the first quarter of 2009. He found that the number of requests for import

restrictions, such as anti-dumping duties (AD), countervailing duties[16] and global safeguards[17] increased by 18.8% compared to the same period the year before. Moreover, the number of actually imposed import restrictions by the WTO members increased by 10.0% compared to Q1 2008. However, these restrictions are often the consequence of requests that had already been made in 2007.

There is nonetheless one research paper that developed a real statistical model, namely Kee, Neagu and Nicita (2009). They constructed an index, the Overall Trade Restrictiveness Index (OTRI), that measures the impact of a country's trade policies on the trade imports. The index is an answer to the following question: *"What is the uniform tariff that if imposed on home imports instead of the existing structure of protection would leave aggregate imports at their current level?"* (Kee et al., 2009, p. 5). In other words it calculates a weighted average import tariff of one country, with the weight being the product of the import demand elasticity and the share of the product in the total imports. They calculated this OTRI for 135 countries. Due to limitations in the data they only took changes in import tariffs and anti-dumping (AD) duties into account as protectionist measures. They found that most countries actually liberalized their trade tariffs and that the increase in tariffs and AD duties can maximally account for only 2% of the collapse of world trade.

[16] "Countervailing duties" are import taxes on goods which are subsidized in their home countries to neutralize this competitive advantage in comparison to domestic products.
[17] "Global safeguards" refer to restrictions on international trade to protect a domestic industry, such as a restriction on increasing imports that could damage domestic production.

4.2 Data and Model

To investigate the impact of the supply side variables on the change in trade I closely follow the previously mentioned approach used by Levchenko et al. (2010), as they already incorporated two of the three possible explanations I would like to examine. This model also easily allows for the integration of new variables to check for the impact of protectionism. My research is also based solely on US data, given that there is a substantial amount of data available for this country. Moreover, this is one of the most prominent members of world trade and was hit quite hard during the most recent recession, making this a reasonably representative nation. Based on Levchenko et al. (2010), the following regression model is estimated in this empirical study:

$$Y_{i,k}^{trade} = \alpha + \beta \widehat{VAR}_{i,k} + \boldsymbol{\gamma} X_{i,k} + \epsilon_{i,k}$$

Here $Y_{i,k}^{trade}$ indicates the percentage growth in trade, with the index *i* indicating the sector observed and the index *k* indicating whether it concerns import or export trade. $\widehat{VAR_{i,k}}$ covers the logarithm of the variables concerning one of the three possible supply-side drivers I investigate and $X_{i,k}$ are the control variables. The goal of this empirical study is accordingly to check whether sectors that made more use of intermediates or trade credit before the crisis hit or that implemented protectionist measures during the crisis experienced a larger decline in trade during the crisis. I would therefore like to point out that data for the variables of vertical linkages and credit constraints necessarily need to be obtained for the period before the recent crisis. For the dependent variable $Y_{i,k}^{trade}$ of this regression I collected quarterly import and export data for the US versus all its trading partners on the 6-digit NAICS level from USITC, data that is available for 456 sectors. I then calculated the percentage drop of trade from Q2 of 2008 to Q2 of 2009. I selected this time period because the GTC was the most severe in Q4 of 2008 and Q1 of 2009 and trade started to recover by Q3 of 2009, hence not including this last quarter in the data.

The first explored supply-side explanation for the collapse of international trade is the increase of credit constraints. To examine its impact on the collapse of trade, I used two of the standard measures for the use of trade credit in the literature, namely the fractions of accounts payable to cost of goods sold (AP/COGS) and of accounts receivable to sales (AR/SALES), as Levchenko et al. (2010) also use in their model. The former indicates the share of purchases from a supplier on which the buyer obtained a delay of payment, or in other words the share of purchases which is obtained through trade credit. The accounts

receivable to sales ratio indicates the opposite, namely the share of a company's sales which are financed through trade credit. In order to find out whether the increase of credit constraints had an impact on the collapse of world trade, I wanted to check whether sectors that made use of trade credit more intensively before the crisis experienced larger declines in trade. This is examined for import as well as for export trade. I obtained quarterly data for 1500[18] companies for the period between 2000 and 2007[19] from the Thomson Reuters Eikon database. This period was based on Levchenko et al. (2010), as it is long enough to get an adequate view of the use of trade credit in the pre-crisis period, but not too long to give outdated information. However, unlike the authors I did not include the year 2008, as data of this period is already possibly distorted by the economic crisis. I calculated both variables (AP/COGS and AR/SALES) for each quarter and then took the median of all quarters for each company. Next I calculated the median of all companies per industry, to obtain a statistic for each sector. As Levchenko et al. (2010), I opted to work with the medians, to prevent outliers from having a substantial impact. However, a caveat of the data is that they are only available at the 3-digit level of the NAICS and not on the detailed 6-digit level. I collected data for 15 sectors on the 3-digit level of the NAICS, i.e. those sectors for which the necessary trade data were available.

The next possible supply-side cause of the collapse of trade I consider is the disruption of vertical linkages. Levchenko et al. (2010) bundle different views on the use of vertical linkages in their study and create eight[20] measures of vertical linkages. However, due to data limitations I only integrate six of them in this empirical study. The first three variables concern the use of downstream linkages, while the last three deal with the use of upstream linkages. All variables are built based on the methods adopted in Levchenko et al. (2010).

The downstream linkages indicate the use of an intermediate produced by a sector throughout different industries, so this gives a first overview of how interconnected industries are. The first variable I created

[18] To make sure that I had enough data for each industry, I sometimes had to incorporate data of companies that did not cover the total . However, I always made sure that the data included covered at least 5 year.
[19] Working with data covering the same time period as the dependent variable is not possible, as the crisis has possibly influenced the use of trade credit across sectors and will thus give a distorted picture of the intensity of the use of trade credit per industry, as previously mentioned.
[20] The measures used in the paper are the average use of intermediates by sectors, the number of sectors which make use of the intermediates, the Herfindahl index for downstream vertical linkages, the average number of sectors which make use of intermediate *i,* the number of intermediates that are used per sector, the Herfindahl index for upstream vertical linkages and two measures for product sharing for imports and exports respectively.

is the intensity with which a good is used as an intermediate by other sectors. I created this parameter, as well as all the other parameters, starting from the 2007 Direct Requirements Table obtained from the U.S. Bureau of Economic Analysis (BEA). The yearly input-output tables contain data on a limited amount of sectors, so I opted to work with the more elaborate benchmark versions. The benchmark version of table is only available for 2002, 2007 and 2012 data, so I worked with the most up to data before the crisis of 2008. This table contains data on the 6-digit level of the NAICS for 408 sectors. The numbers in row *i* and column *j* of this table indicate how much of intermediate *i* is needed to produce one dollar of output in industry *j*. To get an overview of the intensity with which each intermediate is used, I calculated the average use of each intermediate across all industries. This is done by looking at the row averages. In this way I obtained the average use of intermediate *i* to produce one dollar of output across all sectors. The second variable is the number of sectors that make use of intermediate *i* in the Direct Requirements Table. Finally, the last variable of downstream linkages is the Herfindahl index, which is another way of measuring the intensity with which intermediate *i* is used across all industries. This index will give the maximum value of one when intermediate *i* is only used by one sector and will reach its lowest value when it is used by all sectors equally. This variable is created by first dividing each cell by its total use across all industries (which is represented by its row total) and afterwards summing up the squared value of each cell in the entire row.

Thereafter Levchenko et al. (2010) integrate three variables of the upstream vertical linkages. As Bems et al. (2010) indicate, when sectors that make more use of intermediates than others are struck by a shock, this will amplify the effect of the shock. This indicates that I also have to take the industry viewpoint into account and document how intensively they make use of intermediates. That is exactly what the upstream vertical linkages illustrate. A first measure of the upstream linkages gives the intensity of the use of intermediates per sector to obtain one dollar worth of final output. This is simply calculated by taking the average of all the cells in each column, with each column indicating the use of each intermediate per sector to obtain one dollar worth of output. Similar to the downstream linkages, I also counted the number of intermediates that industry *j* uses and calculated the Herfindahl index for industries. That index now gives the maximum value of one when an industry uses only one intermediate and will reach its lowest value when an industry uses all intermediates equally. This is calculated in the same way as the downstream Herfindahl index, but then for each column.

The last possible explanation for the collapse of international trade on the supply side is the increase of protectionism. However, this explanation was not integrated in Levchenko et al. (2010). Initially I tried to integrate the OTRI index developed by Kee et al. (2010) in my model, but the data to calculate this index was not available on the sector level. Next, I checked whether trade collapsed more in sectors that increased tariffs or installed AD duties. However, after comparing the import tariffs, which I obtained for all import sectors on the 6-digit level of the NAICS from the USITC for 2007, 2008 and 2009, I noticed that in none of the import sectors the tariffs changed over this time period. As a consequence this variable was deleted form the model. I then collected data on the US AD duties form the Temporary Trade Barriers Database of The World Bank created by Chad P. Bown (2014). As there was no numerical data available on these AD duties, I built a dummy variable indicating whether AD duties were installed in a sector in the period between Q2 of 2008 and Q2 of 2009. I narrowed it down to this period as only duties installed in this period would be a reaction to the economic recession of 2008 and thus could have affected the collapse of trade. Older AD measure were already in place and hence could not have impacted the decline in trade. These data only concern US imports. As I only focus on US data, it would take me too far to collect data on the imports tariffs for all US trading partners to use in the export equations.

Lastly I also had to add control variables into the model as the explanation of the variation in changes in trade could possibly be affected by other variables as well. Levchenko et al. (2010) explain what should be controlled for. The first control variable included is the elasticity of substitution between goods within a sector. This data is obtained from Broda and Weinstein (2006) and covers the period of 1990-2001 as this is the most up to data period on which the data is available. It is, however, only available on the 10-digit level of the HTS classification system, so I had to convert the data to the 6-digit level of the NAICS with the aid of a HTS-NAICS conversion table obtained from USITC. The next control variables recorded in this model are used to check for movements in domestic demand and prices on sector level (Levchenko et al, 2010). This is done by introducing the sector size, which is calculated as the share of each export (import) sector in total exports (imports) for the period of 2000 to 2007, for which data is obtained from the USITC. In addition a measure of labour intensity is added, which is included as the total payroll for each sector. Lastly I also controlled for skill intensity, capital intensity and level of inventories per sector as robustness checks, based on the research of Levchenko et al (2010). Data for the last four variables is all collected from the NBER productivity database on the 6-digit NAICS level for the period between 2000 and 2007. This period is again long enough to obtain an adequate picture of these parameters in the pre-

crisis period, but not too long to get outdated information[21]. Unfortunately these data are only available for the manufacturing industries. However after comparing the number of sectors on which I obtained data from the USITC to the number of sectors in the Direct requirements table and on which I obtained data for the anti-dumping duties, I ended up with data on 132 remaining industries on which data for one of the variables is available. Those sectors are mostly manufacturing industries. Table 2 indicates the abbreviations with which the control variables are recorded in the regressions and their explanations.

Variable	Explanation
Sigma*_1990_2001 / *Elasticity	Elasticity of substitution between goods within a sector.
Labour	Labour intensity of a sector, calculated as the total payroll per sector.
Inventories	Level of inventory of a sector.
Sector size	Share of each sector in total imports or exports.
Skill_Intensity	Skill intensity of a sector.
Total_cap	Capital intensity of a sector.

Table 2: List of control variables

[21] Working with data for the same period as the dependent variable is again not possible, for the same reason as for the credit constraint variables.

4.3 Results

4.3.1 Benchmark Model

To start this empirical analysis, I regressed all variables together on changes in import and exports trade as the benchmark model of this empirical research. Moreover, in this way I also checked for reciprocal linkages between the variables. However, as the data for the credit constraints are only available at the 3-digit level, I had to aggregate all other variables to the 3-digit level. After aggregating all the data to the 3-digit level and due to missing values in the data, I ended up with too few observations to run either regression (that is imports or exports). Even when trying to run the regression for only the variables of upstream or downstream linkages in combination with the credit constraints and protectionism variables, there was no sufficient data available to carry out the regression.

As a consequence I could only run a regression that tested for the impact of vertical linkages and protectionism on the decline of import trade as these variables are at the 6-digit level. Because the variable for import trade was only built for imports, we were not able to regress the benchmark model on the changes in export trade. When testing for multicollinearity, I observed that the variables for level of inventories, labour intensity and skill intensity experienced correlations of (-)0.65 or higher with multiple other variables. After running multiple regression analyses to test for the best fit of variables, I decided that these variables needed to be eliminated from the model to avoid multicollinearity. Moreover the Herfindahl down and number of sectors that make use of intermediate *i* variables showed a correlation of -0.8. After testing both variables in the regressions, it appeared that the number of sectors that make use of intermediate *i* variables performed worse in the model and was thus deleted. When calculation the VIF after these variables were deleted, I obtained values between 1 and 2.65 for all variables included, thus not indicating a multicollinearity problem. I eventually estimated the following regression:

$$\gamma_{i,k}^{trade} = \alpha + \beta_1 AD + \beta_2 \widehat{DOWN1}_i + \beta_3 \widehat{DOWN2}_i + \beta_4 \widehat{UP1}_\iota + \beta_5 \widehat{UP2}_i + \beta_6 \widehat{UP3}_i + \boldsymbol{\gamma}_1 \widehat{Elasticity}_i + \boldsymbol{\gamma}_2 \widehat{Sector\ Size}_{i,k} + \boldsymbol{\gamma}_3 \widehat{Capital\ Intensity}_\iota + \epsilon_{\iota,k}$$

Here *k* again indicates whether it concerns import or export data and *i* indicates the sector. AD covers the dummy variable that indicates whether or not Anti-Dumping duties were installed in a sector in the period between Q2 of 2008 and Q2 of 2009. DOWN 1 and 2 respectively denote the average use of intermediates by sectors and the Herfindahl index for downstream vertical linkages. Likewise, UP 1 and 2 denote the same variables for upstream vertical linkages and UP 3 denotes the number of intermediates per sector.

I executed the Breusch-Godfrey Serial Correlation LM Test to control for autocorrelation (for p = 1,2,3 and 4) and the Breusch-Pagan-Godfrey test and the White test to control for heteroscedasticity. The null hypothesis of no autocorrelation could not be rejected, but this model did experience heteroscedasticity for both import and export trade. So I implemented the Newey-West estimator to correct the standard errors of the model. The results of the regression can be found in table 3.

A first observation is that the variable for protectionism is not significant, not even on the 10% significance level. It can further be observed that the Herfindahl variable for downstream linkages is significant on the 10% significance level, but not anymore on the 5% significance level. However, none of the other variables of upstream or downstream vertical linkages are significant. So as this variable is significant on the weakest level of significance and as the other variable of downstream or upstream vertical linkages do not appear to be significant, it can be concluded that vertical linkages did not have a significant impact on import trade. Moreover, the adjusted-R^2 of the models is 18.7%, which is fairly low.

	IMPORTS
ANTI-DUMPING	-0.7836 (0.5879)
AVERAGE USE DOWN	-13.202 (42.731)
HERFINDAHL DOWN	0.3681* (0.1909)
AVERAGE USE UP	843.5331 (736.4369)
HERFINDAHL UP	0.3064 (0.2207)
NUMBER OF INTERMEDIATES UP	1.6086 (1.0823)
ELASTICITY	0.3141 (0.3411)
SECTOR SIZE	-0.3866* (0.2328)
CAPITAL INTENSITY	0.2254 (0.1939)

Table 3: Coefficients of the regression of the benchmark model.

*The regression contains 112 observations after adjustments. * indicates significance on 10% level, ** on the 5% level and *** on the 1% level. Adjusted R-squared is 0.1872. Standard errors are reported in parentheses. HAC standard errors & covariance.*

Due to the limitation of this benchmark model, i.e. no inclusion of the credit constraints and no regression on the changes in export trade, I now continue with regressing each variable separately on the decline in import or export trade to get a more complete picture.

4.3.2 Credit Constraints

I first start by elaborating on the regression of the AP/COGS and AR/SALES on the change in exports and export trade. As I experienced a problem of multicollinearity with some variables, I had to delete them from the model. Again, the level of inventories, labour intensity and skill intensity variables all showed correlations of more than (-)0.65 with multiple other variables. After deleting these variables, the Variance Inflation Factors of the different variables for the import and export regression were all situated between 1 and 3, thus not indicating a multicollinearity problem. I eventually ended up with the following estimation:

$$Y_{i,k}^{trade} = \alpha + \beta_1 \frac{\widehat{AP_\iota}}{COGS_\iota} + \beta_2 \frac{\widehat{AR_\iota}}{SALES_i} + \boldsymbol{\gamma}_1 \widehat{Elasticity_\iota} + \boldsymbol{\gamma}_2 \widehat{Sector\ Size_{i,k}} + \boldsymbol{\gamma}_3 \widehat{Capital\ Intensity_\iota} + \epsilon_{i,k}$$

I executed the Breusch-Godfrey Serial Correlation LM Test to control for autocorrelation (for p = 1,2,3 and 4) and the Breusch-Pagan-Godfrey test and the White test to control for heteroscedasticity, but both tests could not reject the null hypothesis of homoscedasticity and no autocorrelation. In other words, these issues were found absent in the data. The results of the OLS regression of the trade in exports and imports are reported in table 4. For the change in exports trade it is clear that the AP/COGS variable is not significant. The AR/SALES variable on the other hand is significant on the 10% significance level, but not anymore on the 5% significance level. This indicates that AP/COGS does not have a significant impact on the change of exports trade, but the AR/SALES does, although it is on the lowest level of significance. As I am working with a percentage change in trade and the logarithms of the independent variables, the β coefficients have to be interpreted as elasticities. This means that a 1% change in the AR/SALES ratio will cause a 38.3% change in the other direction. The adjusted-R^2 of the model amounts to 32%, meaning that this model is rather good in explaining the decline in export trade.

To continue with the change in import trade on the other hand, I found even more significant observations. Both variables are significant on 1% level of significance. A 1% change in the AR/SALES ratio leads to a 58.1% change of imports trade in the other direction. A 1% change in the AP/COGS ratio, on the

other hand, leads to a 54.9% change in trade in imports in the same direction. This model is certainly good at explaining the changes in import trade, as it has an Adjusted-R^2 of 83%.

	EXPORTS	*IMPORTS*
AP/COGS	0.2408 (0. 1135)	0.5815*** (0.0987)
AR/SALES	-0.3834* (0.1504)	-0.5489*** (0.1126)
ELASTICITY	-0.0677 (0. 0619)	-0.0975 (0.0557)
SECTOR SIZE	0.01963 (0.0316)	-0.004 (0.0193)
CAPITAL INTENSITY	0.0014 (0.0407)	-0.0488 (0.0317)

Table 4: Coefficients of the regression of credit constraints on import and export trade.

*Both regressions contain 10 observations after adjustments. * indicates significance on 10% level, ** on the 5% level and *** on the 1% level. Adjusted R-squared are 0.8324 and 0.3217 for exports and imports respectively. Standard errors are reported in parentheses.*

4.3.3 Vertical Linkages

To continue, I regressed the variables for vertical linkages on import and export trade. Here I also encountered problems with multicollinearity for some of the control variables. The labour intensity, skill intensity and level of inventories again showed correlations of more than (-)0.65 with multiple variables, so these were deleted from the model. Moreover, the variable that indicates the number of sectors which make use of intermediate *i* was also deleted from the model, for the same reason as described above. After deleting these variables, the VIF indicated values between 1 and 3 for all the variables of both equation, thus not indicating a multicollinearity problem. So I eventually estimated the following model:

$$\gamma_{i,k}^{trade} = \alpha + \beta_1 \widehat{DOWN1}_i + \beta_2 \widehat{DOWN2}_i + \beta_3 \widehat{UP1}_\iota + \beta_4 \widehat{UP2}_i + \beta_5 \widehat{UP3}_i + \boldsymbol{\gamma}_1 \widehat{Elasticity}_i + \boldsymbol{\gamma}_2 \widehat{Sector\ Size}_{i,k} + \boldsymbol{\gamma}_3 \widehat{Capital\ Intensity}_\iota + \epsilon_{\iota,k}$$

DOWN 1 and 2 and UP 1, 2 and 3 indicate the same variables as explained in the benchmark model. When estimating this regression, I experienced a problem of heteroscedasticity, so I applied the Newey-West estimator to correct the standard errors of the model. Issues of autocorrelation on the other hand were absent from the data. The OLS regression of vertical linkages on export and import trade are inserted in table 5. As can be observed from these table, none of the six variables are significant for import nor for

exports trade. Moreover, the Adjusted-R^2 only amount to 2.58% and 17% for exports and imports trade respectively, indicating that the models are not very capable of explaining the decline in trade from Q2 2008 to Q2 2009. When regressing the variables for upstream and downstream linkages separately on the decline in import or export trade, the variables become even more insignificant and the adjusted-R^2 becomes even lower. Consequently, the results from this individual regression are in accordance with the results from the benchmark model.

	EXPORTS	*IMPORTS*
AVERAGE USE DOWN	-0.1577 (0.2113)	-0.1219 (0.080)
HERFINDAHL DOWN	0.8679 (0.7088)	0.2411 (0.1573)
AVERAGE USE UP	-3531.77 (4088.52)	519.14 (634.46)
HERFINDAHL UP	0.0475 (0.9451)	0.3959 (0.2651)
NUMBER OF INTERMEDIATES UP	4.6643 (2.9871)	2.01 (1.3078)
ELASTICITY	0.1103 (0.7638)	0.2598 (0.3216)
SECTOR SIZE	-0.2323 (0.3721)	-0.2975 (0.1843)
CAPITAL INTENSITY	0.1561 (0.2526)	0.1168 (0.1262)

Table 5: Coefficients of the regression of vertical linkages on import and export trade.

*Both regressions contain 112 observations after adjustments. * indicates significance on 10% level, ** on the 5% level and *** on the 1% level. Adjusted R-squared are 0.0258 and 0.1697 for exports and imports respectively. Standard errors are reported in parentheses. HAC standard errors & covariance.*

4.3.4 Protectionism

The next regression I performed is that of protectionism on changes in import trade. After deleting the control variables which experienced a high correlation with other variables (higher than 0.65), which were again the labour intensity, skill intensity and level of inventories variables, the VIF amounted to values

between 1 and 1.55 for all variables. The data was thus absent of multicollinearity issues. I ended up with estimating the following model:

$$\gamma_{imports}^{trade} = \alpha + \beta_1 AD + \boldsymbol{\gamma}_1 \widehat{Elasticity} + \boldsymbol{\gamma}_2 \widehat{Sector\ Size}_{i,imports} + \boldsymbol{\gamma}_3 \widehat{Capital\ Intensity} + \epsilon_i$$

AD again indicates the dummy variable for anti-dumping duties. As I also detected a heteroskedasticity problem, I again applied the Newey-West estimator to correct the standard errors. The output of the regressions for imports is recorded in table 6. It can clearly be seen that the AD variable does not have a significant impact on import trade. Furthermore, the explanatory power of the model is very low, as the adjusted-R^2 amounts to only 6.19%. These results are again in agreement with the observations from the benchmark model.

	IMPORTS
ANTI-DUMPING	-0.6432 (0.4525)
SECTOR SIZE IMPORTS	-0.2367 (0.1867)
CAPITAL INTENSITY	-0.1323 (0.2931)
ELASTICITY	0.4683 (0.3299)

Table 6: : Coefficients of the regression of protectionism on import trade

*The regression contains 125 observations after adjustments. * indicates significance on 10% level, ** on the 5% level and *** on the 1% level. Adjusted R-squared is 0.0619. Standard errors are reported in parentheses. HAC standard errors & covariance.*

5. Discussion

I will now critically interpret the results that were found through the analyses. To start, the benchmark model indicates that sectors which make more use of intermediate products, whose products are more used as intermediate or which experienced anti-dumping duties did not experience a significantly higher decline in import. However, as the benchmark model was not able to capture all the variables nor the impact on export trade, I am going to discuss each variable separately. Besides, the results of the individual regression analyses are in agreement with the results of the benchmark model.

When first looking at the findings for the impact of credit constraints on export trade, it can be observed that the AP/COGS is not significant, while the AR/Sales variable is significant on the 10% level and has a negative coefficient. This is exactly in line with expectations and related work, as this means that companies in sectors that extended more trade credit to their customers would see a bigger decline in their trade output. When looking at imports, it can be observed that both variable have a significant impact on the 1% significance level and both variables have opposing signs in their coefficients. While the AR/Sales ratio has again a negative coefficient, the AP/COGS variable moves in the same directions as trade, meaning that companies in industries that receive less trade credit from their suppliers experienced bigger declines in trade. This is not in line with expectations. Nevertheless the change in sign could be explained by the fact that one ratio covers the granting of trade credit, while the other ratio covers the obtaining of trade credit. The AR/SALES ratio might, however, be a better indicator, as this variable tells us to which extent companies in different sectors make use of financing their operations through trade credit. Overall, changes in import trade can be explained by changes in the access to trade credit. The changes in export trade can to a certain extent be explained by changes in being able to make use of trade credit extended by a company's supplier, although the results are one the weakest level of significance. However, taking into account the results of both regressions, it can be concluded that changes in trade can be explained by changes in the constraints on obtaining credit.

These results not in line with Levchenko et al. (2010), as they found that there was no significant impact of the variables of credit constraints on the change in trade. Moreover, the partial-R^2 of their models was close to 0. However, the findings in the current study are in accordance with Manova (2012) and Bems et al. (2010), who also report that credit constraints hinder international trade proportionally more than domestic trade, as firms are less able to produce and ship their products when they have less access to trade credit. The fact that my findings are in contradiction with those of Levchenko et al. (2010), although

I applied the same method, is probably due to the fact that I work with another, limited, dataset for credit constraints. A possible explanation of this difference in results is that, as I am almost solely working with data on the manufacturing industries, the observation of increasing credit constraints could be more outspoken in these industries. Levchenko et al. (2010), on the other hand, worked with more generalised data, for which this impact might overall be not significant. This is exactly what Levchenko et al. (2010) point out in their discussion as the authors state that: "it is perfectly plausible that while changing credit conditions affect sectors differentially, the average affect is nil" (p18). I can thus conclude from this empirical study that that increasing credit constraints did influence the decrease in import and export trade, especially for the manufacturing industries. I would still like to note that working with this limited dataset of 15 sectors on the 3-digit NAICS level causes me to be careful with the interpretation of my results. Although a significant impact of the credit constraint variables on the decline in trade can be observed and this is in agreement with the existing literature, I would recommend to execute this research with extensive data at the 6-digit NAICS level to get more robust results. This was unfortunately not possible for me, as I did not have access to data on that level. It also must be noted that the current study only highlights one aspect of credit constraints, namely that of trade credit. Whether the reduction in granting bank loans worsened the decline of international trade and to what extent this impacted trade, remains unclear from this study and is a topic for further research.

Continuing with the results for vertical linkages, I can conclude that sectors which make more use of intermediate products and sectors whose products are more used as intermediates did not experience a significantly higher change in trade than the other sectors. The findings are quite surprising, as they contradict those of Bems et al. (2010) and Bems et al. (2011). They are also in contrast with those of Levchenko et al. (2010), who found a significant impact for the downstream vertical linkages for both imports and exports. They found, in other words, that sectors whose products are more used as intermediates experienced larger changes in trade. However, they also found no significant impact for the upstream linkages and their partial-R^2 is also very low. The fact that I only obtained data on the manufacturing industries could have influenced my non-significant result, as the decline in sales of final products which contain intermediates by the retailing industry could also have influenced the decline in trade. My model was unfortunately not able to capture this impact as data was not available for these sectors.

Moreover, I also did not capture that total impact of vertical linkages on trade, as in my research model the value chains could not break. This means that I did not take into account the fact that some producers simply could not produce their products anymore. If this disruption of vertical linkages occurred, this could have had a great impact on the collapse of trade. It also needs to be noted that this model is a large simplicity from reality, as the production process of goods in these value chains often occur in multiple countries. I, however, only captured the linkages between the countries that the US imports from and the intermediate use within the US industries. This gives an idea of the intermediate use of products, but it does not give the complete picture.

Finally, I can conclude from the analysis that the change in protectionist measures did not have a significant impact on the change in US import trade. These results are in agreement with the existing literature covered by Kee et al. (2010), Erixon and Sally (2010) and Bown (2009), who also did not find any impact of increasing protectionism on the collapse of world trade. Nevertheless I do have to note that, in line with existing studies (Kee et al., 2010) I did not take into account all types of protectionist measures, as there is no data available for the other types of measures[22]. Nonetheless, taking into account that imports tariffs for the US between 2007 and 2009 did not increase nor decrease, it is fair to say that the increase in protectionism did not have a significant impact on the decline of import trade between Q2 of 2008 and Q2 of 2009. However, further research is needed to identify the impact of increasing protectionism in the countries of the US trading partners on the US exports. As this research would require collection of substantial amounts of import tariff data from all US trading partners, it is not included in this paper as it would take me too far.

To finish, I would like to point out that the explanatory power of the benchmark model is higher than that of the individual models. Moreover, one of the variables for downstream vertical linkages became significant, however only on the 10% significance level. Hence, the benchmark model seems better in explaining the decline of import trade in the period between Q2 2008 and Q2 2009. Therefore, it would be recommended to do further research of this benchmark model once all of the above described data limitations could be solved.

[22] Other types of measures are for example subsidies or bail-outs granted by the US government.

6. Conclusion

In this final chapter I will give a summary of the results found in this study. First of all, I can conclude that the collapse of aggregated expenditures was the main driver of the World Trade Collapse in 2008-2009. Even though I did not empirically test its impact, the evidence from my literature study indicates that it could be held accountable for about 65%-80% of the collapse of trade. This variable, however, could not explain the total collapse of trade, so there must be other factors at play. From my literature and empirical study I can conclude that the existence of credit constraints also had a significant impact on the collapse of trade. Although my empirical results are not as robust due to data limitations, I did find that US sectors which appealed for trade credit more, experienced larger declines in import and export trade, especially in the manufacturing industries. Moreover, the evidence in my literature study also rules in favour of credit constraints as an explanation as to why trade collapsed so much more than GDP. On the other hand, from my empirical study it cannot be concluded that US sectors which make more use of intermediates or whose products are more used as intermediates in other sectors experienced larger declines in trade, although I found evidence that supports this variable as an explanation for the Great Trade Collapse in my literature study. My model, however, did not capture the total impact of vertical linkages on the collapse of trade. Hence further research in this field is recommended to come to a legitimate conclusion regarding the impact of vertical linkages on the collapse of global trade. Furthermore I can conclude from my findings that increasing protectionism did not have a significant impact on the collapse of trade, as I found through my literature study that most nations did not install excessive protectionist measures as an answer to the economic recession of 2008. The US did not even increase their import tariffs at all in the period between 2007 and 2009, and installed antidumping measures in a very limited number of sectors between Q2 of 2008 and Q2 of 2009. Finally I can conclude from the literature study that inventory adjustments did have an impact on the collapse of trade, but this impact was not different from its impact on trade during the past recessions.

To sum up, it has become clear from this study that the Great Trade Collapse was mainly caused by a collapse of aggregated demand. The wedge between the decline in trade and in GDP was even further enlarged by the credit constraints that came into existence as a consequence of the economic recession and by adjustments in inventories due to declines in demand.

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8. Appendix

8.1 US imports from Q1 2008 to Q4 2009

IMPORTS	Q1 2008	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009
Total Imports	4,29%	4,43%	0,53%	-16,67%	-19,60%	3,14%	9,26%	8,98%
Foods, Feeds, Beverages	3,49%	3,94%	1,98%	-3,25%	-7,71%	1,09%	0,47%	2,02%
Industrial Supplies (2)	9,38%	9,45%	5,17%	**-28,26%**	**-32,17%**	3,68%	14,60%	12,33%
Capital Goods	2,22%	2,47%	-2,02%	-8,44%	-12,84%	5,62%	5,39%	8,07%
Automotive Vehicles, etc.	0,90%	-2,14%	-9,29%	**-15,74%**	**-32,94%**	0,43%	35,24%	16,62%
Consumer Goods	1,42%	1,79%	-0,24%	-8,02%	-6,77%	1,45%	1,44%	5,70%
Other Goods	-0,51%	5,27%	0,79%	-6,53%	-7,86%	5,34%	5,75%	-1,25%

Table 7: US imports from Q1 2008 to Q4 2009.

Calculated on the basis of data of the US Census Bureau

8.2 US exports from Q1 2008 to Q4 2009

EXPORTS	Q1 2008	Q2 2008	Q3 2008	Q4 2008	Q1 2009	Q2 2009	Q3 2009	Q4 2009
Total Exports	5,31%	6,00%	1,40%	-14,89%	-13,75%	-0,25%	6,83%	7,66%
Foods, Feeds, Beverages	11,57%	7,02%	-1,02%	-19,69%	-7,14%	11,09%	-2,20%	7,63%
Industrial Supplies (2)	12,08%	10,45%	2,82%	**-23,85%**	**-18,44%**	3,06%	13,36%	6,83%
Capital Goods	1,47%	3,63%	0,51%	-8,68%	-8,83%	-4,29%	1,68%	7,03%
Automotive Vehicles, etc.	-1,33%	3,44%	3,08%	**-17,97%**	**-36,12%**	-0,47%	29,96%	15,82%
Consumer Goods	4,68%	4,46%	1,88%	-7,58%	-6,33%	-0,55%	3,73%	5,68%
Other Goods	0,10%	2,79%	-2,24%	-2,40%	-13,11%	-5,07%	3,88%	9,61%

Table 8: US exports from Q1 2008 to Q4 2009.

Calculated on the basis of data of the US Census Bureau.