Global value chains and the resilience of trade: firm-level evidence from the Netherlands

INCOMPLETE DRAFT - PLEASE DO NOT CITE

Marcel van den Berg *

October 18, 2015

Abstract

Employing firm-level data from the Netherlands, we show that firm characteristics such as size, productivity, economic activity, the traded product portfolio, the focus of trade involvement and the geographic pattern of trade are important determinants of recovery following the trade collapse of 2008-2009, both in terms of speed and depth. Our findings suggest that recovery is quicker for trade in goods further downstream of the value chain and thus closer to the final consumer.

Keywords trade, recovery, firm heterogeneity, global value chains
JEL-classification D22, F14, F23

*Statistics Netherlands, Heerlen, the Netherlands, e-mail: m.r.vandenberg@cbs.nl. The content of this publication does not reflect the official opinion of Statistics Netherlands. Responsibility for the information and views expressed in the paper lies entirely with the author.

1 Introduction

This paper is work in progress and as such an incomplete draft. We are currently working on additional data collection and further development of the empirical analyses.

In a small and open economy like the Netherlands international trade is a key driver of economic growth. This is illustrated by Lemmers (2013) who show that the share of value added due to exports in total Dutch value added was 38 percent in 2011. This is comparable to Belgium (38 percent), but considerably higher than e.g. Denmark (31 percent), Germany (31 percent) and the UK (22.8 percent). This shows that the Netherlands depends heavily on developments on foreign markets.

The collapse of global trade in 2009, its causes and its consequences have been well-documented by now (see Bems, Johnson, and Yi (2012) for a review). However, much less work has been done to identify the drivers of trade recovery in 2010. This paper aims to fill that gap. We investigate the resilience of trade at the firm-level, particularly focusing on the role of global value chains in the process of recovery. In this paper we aim to investigate this issue by answering the following research question: *what drives heterogeneity in the resilience of trade at the firm-level, particularly with respect to the position of the firm in the global value chain, which determinants of trade recovery can be identified?*

We proceed as follows. Section 2 provides a brief discussion of the literature on the recovery and the preceding collapse of world trade. We continue with a discussion of our data and methodology adopted in section 3. The empirical results are presented in section 4. Section 5 concludes.

2 Literature

Existing literature on the general determinants of trade recovery is quite scarce, but the determinants of the trade collapse are well-documented. In a review of the literature on the causes of the trade collapse Bems, Johnson, and Yi (2012) identify the collapse in aggregate expenditure, particularly in trade-intensive durable goods, to be the key driver of the trade collapse. This effect was further propelled by contraction of credit supply and inventory adjustments. In addition, Bems, Johnson, and Yi (2012) note that the trade collapse occurred asymmetrically across sectors. The role played by global value chains and ongoing international fragmentation of production in the world trade collapse of 2009 is also frequently debated in this respect (Baldwin and Evenett, 2009; Cheung and Guichard, 2009; Bems, Johnson,

and Yi, 2011). However, no consensus has been reached on this issue so far. The *mainstream narrative*, as van Bergeijk (2013) puts it, links the depth of the collapse and the speed of recovery to the ongoing trend of international fragmentation of production. Case in point is an empirical analysis of Altomonte, Di Mauro, Ottaviano, Rungi, and Vicard (2011) of transaction level data of French firms who show that intra-firm trade in intermediates showed a more dramatic collapse followed by faster recovery than arm's length trade. This phenomenon is known as the bullwhip effect and implies that both decline and recovery is steeper and quicker when moving away from the final consumer. This is mainly attributed to the increasing importance of value chains in international trade. On the contrary, van Bergeijk (2013) shows in a cross-country empirical analysis of data on 42 countries that integration in international value chains has had a dampening effect on the amplitude of the collapse of trade. Two measures of international fragmentation of production, the share of trade in manufactures and a measure of vertical specialization, are associated with a smaller reduction of trade. *To be elaborated on.*

To be included: discussion of the literature on measures of distance to the final consumer

Since the mid-1990s a stream of papers has stressed the different nature of firms that are competing internationally compared to firms that solely serve domestic markets. Research on this topic was sparked by the seminal work of Bernard, Jensen, and Lawrence (1995), Roberts and Tybout (1997) and Melitz (2003). In the years following, compelling evidence has shown that firms engaging in international trade are in general 'better' than firms that focus primarily on domestic markets. This holds for various dimensions; trading firms are for example larger, more productive, more capital intensive, pay higher wages, invest more in R&D and have a higher probability of survival (see Greenaway and Kneller (2007), Wagner (2007) and Wagner (2012) for surveys of the empirical evidence). Resilience could pose another dimension at which firm heterogeneity is observable, especially since international trade was particularly hard hit during the global recession and recovered equally quickly from 2010 onwards. Bricongne, Fontagné, Gaulier, Taglioni, and Vicard (2012) show in an empirical analysis of French firms which determinants of the trade collapse can be identified at the micro-level. They show that a host of factors affect firm-level export decline, ranging from the size of the firm, the sector in which it is operating to the destination country of exports.

The importance of geography as a defining dimension of global trade patterns is well established and generally investigated in the setting of the widely used gravity framework, for which a theoretical foundation was developed by Anderson (1979). Dimensions such as distance to and size of foreign markets, a shared border, language or cultural values are, among many others,

shown to explain trade patterns. However, these dimensions are to a large extent time-invariant and in that sense unlikely to explain heterogeneity in the recovery of trade at the firm-level. Indeed, in our analysis we focus on the intensive margin of trade rather than on the extensive margin where time-invariant gravity-like factors mainly shape trade patterns. Nonetheless, in line with Bricongne, Fontagné, Gaulier, Taglioni, and Vicard (2012) it seems straightforward that the recovery of trade at the firm-level hinges on the economic performance of the country the firm exports to, so investigating the geographic dimension of trade is worthwhile.

3 Data and methodology

We combine data sets from several sources within Statistics Netherlands to investigate the resilience of trade at the firm-level. Our starting point is the General Business Register (GBR). This is an, in principle, exhaustive register in the sense that it contains information about every firm in the Netherlands including a set of basic firm characteristics, such as firm size and the sector in which the firm is active. We match data from the international trade in goods statistics for the years 2008-2010 to the General Business Register.[1]

With respect to the international trade flows generated the firm we include imports and exports (including re-exports) in nominal euros.[2] These trade flows serve as the input for the calculation of the dependent variables in our analyses, which will be further detailed below.

To be included: introduction of data regarding productivity and measure of distance to final consumer

We now turn to an outline of the set of explanatory variables that is considered in the empirical analyses. First of all, we include a dummy variable indicating if the firm simultaneously imports and exports (twt_i). These firms are coined two-way traders. These firms are the generally the larger traders, and as such we expect them to have fared better during the crisis as Smit and Jaarsma (2013) have illustrated earlier. We also include the share of re-exports in total exports of each firm ($rexs_i$). The underlying hypothesis being that firms that mainly re-export differ fundamentally from firms that mainly trade (or manufacture) Dutch manufactured products. For

[1] Firm-level data regarding trade in services are at this point not sufficiently available for analytical purposes. Our analysis thus focuses exclusively on goods trade and on firms in manufacturing sectors and wholesale & retail trading.

[2] Unfortunately, price indices are not available at a sufficiently disaggregated sector, product, and/or destination market level. However, because of the relatively short time horizon of our analysis working with nominal trade values seems a proper alternative.

example, re-exporters have benefitted more from the pick-up of world trade in 2010, while Dutch manufacturers kept struggling. The exports of Dutch manufactured products took a full year longer to reach pre-crisis levels than re-exports, as Figure 1 shows.

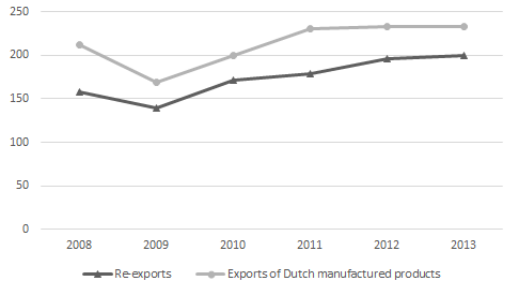
For both imports and exports we include information on the country of origin of imports or destination of exports and the type of product traded in our analysis.[3] We aggregate the countries of origin and destination of trade into 11 geographically clustered regions; northern EU-15 & non-EU north-western Europe, southern EU-15, rest of EU, rest of Europe, Latin America & the Caribbean, Anglo-Saxon countries outside Europe, advanced Asia, developing Asia, sub-Sahara Africa, Middle East & North Africa (see Table A1 in the appendix for details). We separate the EU-15 into a northern and a southern section because the southern economies have performed considerable poorer than the northern EU-members, which is likely to affect our findings.

Products are categorized following the SITC-coding system. The products traded by firms are aggregated to the 1-digit level of the SITC-classification: (0) food and live animals, (1) beverages and tobacco, (2) crude materials, (3) mineral fuels, (4) animal and vegetable oils, fats and waxes, (5) chemicals and related products, (6) manufactured goods, (7) machinery and transport equipment, (8) miscellaneous manufactured articles, (9) commodities not classified elsewhere.

For each firm we individually determine if there is a dominant region of origin or destination of trade ($spGEO_i$) or trade specialization ($spSITC_i$) in a specific product group in 2010, i.e. whether the majority of trade takes place with a specific region or within a specific product category. We expect trade specialization in particular regions to have an impact on the resilience of trade, since different regions have been faring differently during the trade collapse and subsequent recovery. For instance, the EU has been recovering considerably slower than e.g. the US or China (see Figure 2). We would export firms that specialize in trade with partner countries that have been struggling to get out of recession to experience slower recovery than firms that trade mainly with countries that were relatively unaffected by the global recession.

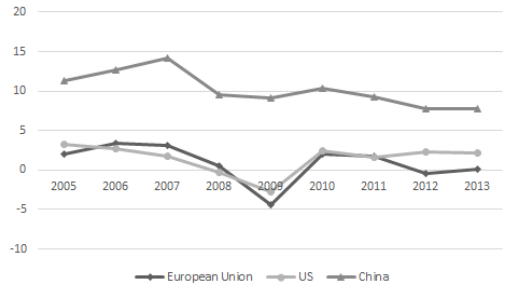
[3]Note that we do not have the cross-dimension of origin/destination and product type. We have information on the origin/destination of trade and on the products traded, but not on the products traded by destination/origin.

Figure 1: Development of re-exports and Dutch manufactured products (billion euro, 2008-2013)



Source: Statistics Netherlands

Figure 2: Annual percentage GDP growth in constant local currency (2005-2013)



Source: Worldbank

As one of the proxies for value chain involvement, we recode the products traded by a firm into *Broad Economic Categories* (BEC-classification, proposed by the United Nations), distinguishing between intermediate goods, capital goods and consumption goods.[4] We consider this dimension since we expect from the findings of e.g. Altomonte, Di Mauro, Ottaviano, Rungi, and Vicard (2011), that trade by firms specializing in intermediate goods (which are more likely to be highly integrated into a supply chain) responds differently to the collapse and subsequent recovery than firms without a specific specialization. In addition, firms specializing in consumption goods are supposedly operating downstream of the value chain and are thus expected to fare differently from firms operating further upstream. Here we also determine dominant products in the trade portfolio of firms, when the majority of trade consists of a particular BEC-product group ($spBEC_i$).

We also include a dummy variable indicating whether the firm is under foreign control as a control variable (fc_i). Firms under foreign control are likely to show different trading patterns than firms under domestic control as Jaarsma and Lemmens-Dirix (2010) show for the Netherlands. From Altomonte, Di Mauro, Ottaviano, Rungi, and Vicard (2011) we derive the hypothesis that the recovery of trade is positively affected by the fraction of trade generated by foreign controlled firms, thereby assuming that foreign controlled firms show relatively large intra-firm trade figures.

Firm size in terms of employment is also included as a control variable ($size_i$), since we expect larger firms to be able to diversify their activities, to cushion the hit more easily and to cope with adverse market conditions longer

[4]Note that the BEC-classification is already an aggregation of 3-digit SITC-classified products into homogeneous groups.

than smaller firms. We aggregate the size of the firm in three size categories, namely small (1-49 FTE's), medium-sized (50-249 FTE's) and large firms (more than 250 FTE's). We control for sector-fixed effects by including a set of dummy variables aggregated into four sectors based on their NACE Rev. 2 activity classification ($sector_i$).[5] We distinguish between agriculture & mining (NACE 01-09), industry (NACE 10-33), energy & construction (NACE 35-43) and wholesale & retail trade (NACE 45-47).

We also include a variable that indicates if the firm specializes in exporting goods from a specific SITC-product group in which the Netherlands has a revealed comparative advantage compared to the rest of the EU-15 using the well-known Balassa-index ($spRCA_{i,nl}$). To determine whether, the Netherlands has a revealed comparative advantage in the export of food we divide the share of food exports in total exports of the Netherlands by the share of food exports in total exports of the EU-15 (excluding the Netherlands).

Firms without trade and firms of which the annual trade value is below the threshold value (which only report total trade and are exempted from providing a detailed report of their trade in terms of trading partner and products), are excluded from the analyses.

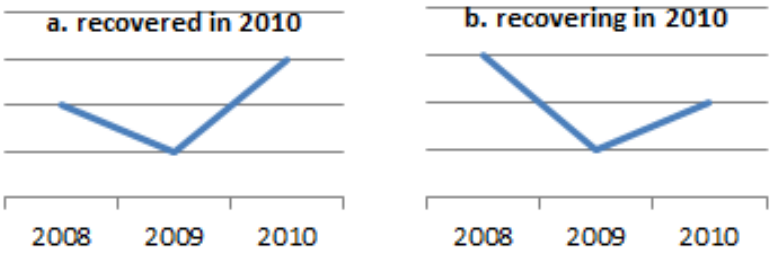
Focusing on the resilience of trade implies focusing on firms that actually experienced a decline in trade and subsequent recovery. In doing so, we discriminate between firms that are still in the process of recovery and firms that have recovered fully. We thus exclude firms with alternative growth paths from our analysis and focus on firms experiencing growth paths as depicted in Figure 3. In graphical terms, we consider the subset of firms that suffered from the 2008-2009 trade collapse, discriminating between firms that have been unable to attain their import (export) value of 2008 in 2010 (panel *b*) and firms that managed to recover in 2010 (panel *a*). The corresponding numbers of observations with each of the scenarios are presented in Table A2 in the appendix. In setting up the analysis this way we aim to identify specific determinants of the speed of recovery by discriminating between firms that are still on the rebound and firms that already attained their pre-crisis trade level in 2010.[6] By doing so we thus focus our analysis on the intensive

[5]Note that NACE-sectors and SITC-product categories are not linked; firms assigned to a particular sector can trade in any product from any given product group. Cross-tabulating both dimensions shows that no particular dedicated combinations of product specialisation and sector emerge, indicating that multicollinearity does not pose a threat when including both dimensions simultaneously.

[6]Over the past decades trade has been characterized by an increasing trade to value added ratio. This could provide an argument for including an average estimated increase of trade in the definitions of growth and recovery, in order to capture this trend. However, adding a firm-specific trend is not feasible, and imposing the same trend on every firm would make the procedure moot. We thus choose to refrain from imposing a trend to

margin of trade rather than the extensive margin.[7] The importance of the intensive margin of trade when investigating the determinants of the resilience of trade is illustrated by Bricongne, Fontagné, Gaulier, Taglioni, and Vicard (2012). They show that the collapse of exports by French firms was mainly on account of the intensive margin and less so due to firms exiting export markets altogether. The notion that trade growth mainly takes place along the intensive margin is corroborated by e.g. Buono, Fadinger, and Berger (2008); Schott (2009); Lejour (2013).

Figure 3: Development scenarios of trade values



We apply this empirical framework to both firm-level imports and exports. We perform each analysis both in the context of a Probit-model and of a basic ordinary least squares model (OLS). The dependent variable in the Probit-framework is a dummy variable ($recovered_{2010}$) indicating whether trade at the firm-level is still recovering (0) or fully recovered (1) in 2010. The Probit regression model is given in equation 1. In the OLS-models, given in equation 2, the growth of trade (imports or exports) between the trough (in 2009 by definition, see Figure 3) and 2010 serves as the dependent variable ($tradegrowth_{2009,2010}$).[8] This yields a continuous dependent variable, rather than a 0/1 indicator, which gauges the development of trade after the crisis years. In the Probit-model firms showing the same growth path of trade are lumped together, which renders us unable to account for differences in

account for this phenomenon. However, the notion of an increasing trade to value added ratio should be kept in mind when interpreting the results of our analysis.

[7]We only consider firms reporting trade values strictly larger than zero in the period 2008-2010.

[8]The top 5 percent of the observations of the growth rate of trade are excluded from the analysis, in order to eliminate implausible observations due to measurement error. Unfortunately, we are unable to further investigate these observations due to confidentiality constraints.

the depth of recovery. The OLS-regressions enable us to also consider the amplitude of recovery.

The set of explanatory variables we include in our baseline specifications are derived from the discussion above. The set of firm specific explanatory variables included is the sector of activity ($sector_i$), the size class of the firm ($size_i$), a dummy indicating whether the firm is foreign controlled (fc_i), a two-way trading dummy variable (twt_i) and the share of re-exports in total exports ($rexs_i$). Some descriptive statistics of the explanatory variables are presented in Table A2 in the appendix. The subscript i identifies the firm. The error term is denoted e_i. Note that the share of re-exports in total exports is only included in the regressions with exports serving as the dependent variable.

To be included: additional explanatory variables in the regression models, productivity and distance measure(s)

$$Pr(recovered_{2010} = 1) = \alpha + \beta_1 sector_i + \beta_2 size_i + \beta_3 fc_i + \beta_4 twt_i + \beta_5 rexs_t + e_i \quad (1)$$

$$tradegrowth_{2009,2010} = \alpha + \beta_1 sector_i + \beta_2 size_i + \beta_3 fc_i + \beta_4 twt_i + \beta_5 rexs_t + e_i \quad (2)$$

In addition to our baseline specification presented above we estimate several extended models including sets of dummy variables indicating whether the firm specializes in trading with specific regions or in specific product groups. Following from the discussion above we add a dummy variable set indicating whether the firm specializes in trading goods...

- ...from specific 1-digit SITC-product groups ($spSITC_i$),[9]
- ...from specific 1-digit SITC-product groups in which the Netherlands has a revealed comparative advantage ($spRCA_{i,nl}$),
- ...from specific BEC-product groups ($spBEC_i$),
- ...with specific regions of origin and destination ($spGEO_i$).

As before, subscript i identifies the firm, subscript nl the Netherlands, for which the revealed comparative advantage is determined. Descriptive statistics of these four dimensions can be found in Table A3 in the appendix.

[9]Note that we exclude specializing in SITC-product group 9 (commodities not classified elsewhere) from the analysis. This product group is very small in size and contains a mishmash of rather atypical goods.

4 Empirical findings

Note: this section presents some very preliminary findings, only to give a rough impression of the direction and progress of our analyses. We are currently for example working on the preparation of a measure of the distance to the final consumer which we are aiming to incorporate in de complete version of this paper.

The baseline regression model introduced in equations 1 and 2 is run 4 times for each separate model specification. As detailed in section 3 we run each model for imports and exports separately, in a Probit setting with a binary measure of recovering versus recovered and with a continuous measure of trade growth in an OLS-setting. The results of the baseline regression model are presented in Table 1.

As for sectoral heterogeneity we see that particularly agriculture & mining and energy & construction have been bouncing back relatively well considering the higher trade growth and higher probability of being recovered. The picture emerging for wholesale & retail trade is mixed. Exports of wholesale & retail traders are characterized by faster growth relative to industrial sectors, but not by a higher probability of being back at 2008-levels. This could indicate that firm-level exports generally face the same curve in both sectors, but with a deeper trough and steeper recovery in wholesale & retail trade. Concerning imports we find a significant and positive coefficient relative to industrial sectors in the Probit-model, indicating that wholesale & retail traders have a higher probability of being fully recovered from the 2008-2009 trade collapse in terms of imports. However, the coefficient on the growth rate of imports is negative and significant. This suggests that the curve of imports of firms in this sector is most likely less pronounced altogether, both in times of decline and in times of recovery, explaining the relatively modest growth rates compared to industrial sectors in the aftermath of the crisis.

Concerning the relationship between firm size and resilience the results seem to suggest that in general larger firms show a flatter trade curve than small firms. This is reflected by the increasingly negative coefficients of trade growth with firm size. However, the probability of being recovered is largest for mid-sized firms, suggesting that this size group might be able to reconcile the best of both worlds; the agility of the smaller firm with the more solid foundation of the larger firm. These findings seem well reconcilable with the findings of Bricongne, Fontagné, Gaulier, Taglioni, and Vicard (2012) who show that smaller firms are affected by the trade collapse mostly along the extensive margin while larger firms responded to the trade shock particularly along the intensive margin.

Being controlled by a foreign parent shows to be negatively associated

with recovery in general. Particularly for exports we find a significantly lower probability of being recovered and significantly lower growth rates in the aftermath of the trade collapse. Regarding imports we also find a lower probability of being recovered, but higher growth, suggesting a relatively deep trough followed by steep recovery. This might relate to intra-firm trade being hit particularly hard by the crisis, as Altomonte, Di Mauro, Ottaviano, Rungi, and Vicard (2011) have shown. However, Altomonte, Di Mauro, Ottaviano, Rungi, and Vicard (2011) show that intra-firm trade also recovered more rapidly, a notion we thus only corroborate for imports, but not for exports.

Two-way trading does not seem to be tied to the resilience of exports at the firm-level. Regarding imports, the results suggest a flatter curve for two-way traders. As for the re-export share in exports the results are in line with the picture emerging from Figure 1. Re-exports have been showing much smaller contraction figures than exports of Dutch products. This implies that the probability of being recovered is most likely higher for firms with a relatively large share of re-exports, hence the positive and significant coefficient in the Probit-model. However, since the curve of re-exports is much flatter altogether, also in terms of recovery, a relatively large share of re-exports is bound to have a negative impact on the growth rate of total exports, since exports of Dutch products have returned much steeper growth rates after experiencing a deeper trough.

Table 2 includes, in addition to the baseline model, a set of three dummy variables indicating whether the firm specializes in importing or exporting goods in a specific product group according to the division in *Broad Economic Categories* developed by the United Nations. Employing the BEC-framework enables us to gain understanding of the relationship between trade in supply chains and the resilience of trade, since the ongoing fragmentation of production is most visible in the increased importance of trade in intermediate goods. A clear picture emerges. The results indicate that specialization in exporting and particularly importing intermediate goods seems to slow the speed of recovery of trade both in terms of post-crisis growth and the probability of being back at pre-crisis trade levels. Our findings at least partially corroborate with the findings of van Bergeijk (2013). Although he only considered the collapse of trade, not the recovery, he concluded that being integrated in global value chains has had a dampening effect on the collapse of trade characterized by a smaller amplitude and a slower adjustment. Our findings indeed suggest that being highly involved in international value chains has an adverse effect on recovery in terms of speed. Alternatively, specializing in importing consumption goods is associated with a flatter curve; a higher probability of recovery and lower growth rates. This is most likely tied

to the relatively flat curve of consumer demand during the crisis years in the Netherlands. Combing these results of intermediate goods and consumption goods is intuitively straightforward since they point at a mechanism where final demand needs to pick up first, before recovery moves further up the value chain and also demand for intermediate goods starts to recover. Finally, specializing in capital goods appears to hamper the post-crisis growth of exports in particular. This makes sense considering the fact that consumer spending showed a decline that was considerably less steep than investments and investments were characterized by subsequent slow recovery.

Table 1: Baseline regression results

	imports		exports	
	status	growth	status	growth
firm-level determinants				
agriculture & mining	0.144**	0.471***	0.155*	-0.050
	(2.79)	(5.04)	(2.50)	(-0.42)
industry	baseline	baseline	baseline	baseline
energy & construction	0.110**	0.644***	0.024	0.578***
	(2.80)	(8.81)	(0.41)	(4.38)
wholesale & retail trade	0.105***	-0.127***	-0.045	0.350***
	(4.56)	(-3.63)	(-1.53)	(5.52)
small firms (1-49 FTE)	baseline	baseline	baseline	baseline
mid-sized firms (50-249 FTE)	0.158***	-0.292***	0.178***	-0.401***
	(4.53)	(-6.21)	(4.10)	(-5.20)
large firms (>=250 FTE)	0.066	-0.531***	0.048	-0.643***
	(0.75)	(-6.01)	(0.48)	(-6.27)
foreign controlled	-0.077**	0.198***	-0.166***	-0.382***
	(-3.04)	(4.67)	(-5.13)	(-5.94)
two-way trader	0.140***	-0.189***	0.079	0.168
	(7.56)	(-6.65)	(1.94)	(1.88)
re-export share in exports			0.099**	-1.187***
			(2.92)	(-20.07)
No. of observations	23,524	22,057	12,890	11,773

Notes: t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Regression results - specialization in BEC-product categories

	imports		exports	
	status	growth	status	growth
specialization in BEC-product categories				
intermediate goods	-0.091***	-0.166***	-0.002	-0.845***
	(-3.54)	(-4.51)	(-0.06)	(-13.01)
consumption goods	0.258***	-0.337***	0.036	-0.837***
	(11.37)	(-10.40)	(0.91)	(-12.17)
capital goods	-0.014	-0.109	0.035	-0.734***
	(-0.29)	(-1.63)	(0.67)	(-7.74)
other firm-level determinants				
agriculture & mining	0.128*	0.467***	0.157*	-0.118
	(2.47)	(4.99)	(2.53)	(-0.97)
industry	baseline	baseline	baseline	baseline
energy & construction	0.102**	0.648***	0.029	0.436***
	(2.58)	(8.90)	(0.48)	(3.32)
wholesale & retail trade	0.037	-0.055	-0.046	0.271***
	(1.57)	(-1.53)	(-1.55)	(4.27)
small firms (1-49 FTE)	baseline	baseline	baseline	baseline
mid-sized firms (50-249 FTE)	0.180***	-0.251***	0.175***	-0.138
	(5.07)	(-5.18)	(3.93)	(-1.75)
large firms (>=250 FTE)	0.107	-0.482***	0.043	-0.337***
	(1.20)	(-5.38)	(0.43)	(-3.31)
foreign controlled	-0.069**	0.254***	-0.161***	-0.301***
	(-2.62)	(6.21)	(-4.84)	(-4.45)
two-way trader	0.103***	-0.097**	0.08	0.204*
	(5.23)	(-3.14)	(1.95)	(2.29)
re-export share in exports			0.078	-0.526***
			(1.82)	(-7.98)
No. of observations	23,524	22,057	12,890	11,773

Notes: t statistics in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5 Conclusion and discussion

We analyze to what extent the resilience of trade at the firm-level is shaped by global value chain involvement A motivation for taking up this question

is that the determinants of the trade collapse have been well-documented by now, but the determinants of the resilience of trade have been virtually uncharted territory thus far.

Next to sector of economic activity, firm size and degree of involvement in trade activities, the dedicated trading in particular product groups or trade with particular partner regions turn out to be relevant determinants of trade recovery, both in terms of speed and depth, although we also document considerable heterogeneity within each of these dimensions as well. In addition, a third dimension shaping the resilience of trade emerges from our analysis. External demand shows to drive the speed and depth of the recovery of exports of Dutch firms specialising in exporting to regions that have been faring relatively well during the crisis years, although this relationship is far from monotonic.

Firms that mainly import consumption goods are associated with faster recovery of trade and a flatter trade curve in general. Focusing on trade in intermediate goods, which can be considered a proxy for integration in international value chains, is associated with slower recovery of trade and lower post-crisis growth rates. Regarding the role played by global value chains in the world trade collapse and subsequent recovery our findings do not necessarily confirm the existence of the bullwhip effect. This effect implies that both decline and recovery is steeper and quicker when moving upstream the supply chain and away from the final consumer, which is supposedly tied to inventory adjustments. However, our findings suggest that recovery is quicker for trade in goods further downstream in the value chain and thus closer to the final consumer. This does not seem improbable since that would suggest that final demand first needs to pick up, before orders start moving up through the supply chain. This would suggest a model where decline is steeper when moving up the supply chain while recovery arrives later. Put differently, the trough seems to be wider and most likely also deeper for firms trading goods further upstream the value chain. It could thus be that recovery in upstream stages of the value chain accelerates at a later stage and that the time horizon of our analysis is too short to capture this effect. The exact anatomy of the bullwhip effect is an issue that clearly needs more work.

To be included: policy implications and limitations of our work.

References

Altomonte, C., F. Di Mauro, G. I. Ottaviano, A. Rungi, and V. Vicard (2011): "Global value chains during the great trade collapse:

a bullwhip effect?," Working Paper 1412, European Central Bank.

Anderson, J. (1979): "A theoretical foundation for the gravity equation," *American Economic Review*, 69(1), 106–116.

Baldwin, R., and S. Evenett (eds.) (2009): *The collapse of global trade, murky protectionism and the crisis: Recommendations for the G20*. VoxEU, London.

Bems, R., R. Johnson, and K.-M. Yi (2011): "Vertical linkages and the collapse of global trade," *The American Economic Review*, 101(3), 308–312.

Bems, R., R. Johnson, and K.-M. Yi (2012): "The great trade collapse," NBER Working Paper Series No. 18632, National Bureau of Economic Research.

Bernard, A., J. Jensen, and R. Lawrence (1995): "Exporters, jobs, and wages in US manufacturing: 1976-1987," *Brookings Papers on Economic Activity. Microeconomics*, 1995, 67–119.

Bricongne, J.-C., L. Fontagné, G. Gaulier, D. Taglioni, and V. Vicard (2012): "Firms and the global crisis: French exports in the turmoil," *Journal of International Economics*, 87(1), 134–146.

Buono, I., H. Fadinger, and S. Berger (2008): "The micro dynamics of exporting: Evidence from French firms," MPRA Paper 12940, University Library of Munich.

Cheung, C., and S. Guichard (2009): "Understanding the world trade collapse," OECD Economics Department Working Papers 729, OECD Publishing.

Greenaway, D., and R. Kneller (2007): "Firm heterogeneity, exporting and foreign direct investment," *The Economic Journal*, 117(517), F134–F161.

Jaarsma, M., and C. Lemmens-Dirix (2010): *Internationalisation Monitor 2010*chap. B2, pp. 85–100. Statistics Netherlands.

Lejour, A. (2013): "The duration of Dutch export relations: decomposing firm, country and product characteristics," CPB Discussion Paper 258, CPB Netherlands Bureau for Economic Policy Analysis.

Lemmers, O. (2013): *Internationalisation Monitor 2013*chap. 2, pp. 49–65. Statistics Netherlands.

Melitz, M. (2003): "The impact of trade on intra-industry reallocations and aggregate industry productivity," *Econometrica*, 71(6), 1695–1725.

Roberts, M., and J. Tybout (1997): "The decision to export in Colombia: an empirical model of entry with sunk costs," *The American Economic Review*, 87(4), 545–564.

Schott, P. K. (2009): "US trade margins during the 2008 crisis," .

Smit, R., and M. Jaarsma (2013): *Internationalisation Monitor 2013*chap. 8, pp. 150–168. Statistics Netherlands.

van Bergeijk, P. A. (2013): "The world trade collapse and international value chains: A cross-country perspective," *International Economic Journal*, 27(1), 41–53.

Wagner, J. (2007): "Exports and productivity: A survey of the evidence from firm-level data," *World Economy*, 30(1), 60–82.

——— (2012): "International trade and firm performance: a survey of empirical studies since 2006," *Review of World Economics*, 148, 235–267.

Appendix A

Table A1: Regional aggregation of origin and destination countries

region	remarks
Northern EU-15	Germany, Belgium, Luxembourg, United Kingdom, Ireland, Denmark, Finland, Sweden and Austria
Southern EU-15	France, Greece, Italy, Portugal and Spain
rest of EU	EU-27 except EU-15
non-EU Northwestern Europe	Norway, Switzerland and Iceland
rest of Europe	includes Russia and non-EU Central & Eastern Europe
Anglo-Saxon countries outside Europe	United States, Canada, Australia, New Zealand
Latin America & the Caribbean	includes Brazil and Mexico
advanced Asia*	Japan, South Korea, Singapore, Hong Kong, Taiwan, Brunei Darussalam and Macao
developing Asia*	Asia and Pacific except advanced Asia
Middle East & North Africa	includes Turkey and Israel
sub-Sahara Africa	includes South Africa

*The advanced Asian countries are identified by GDP per capita levels of at least $ 25,000 (2008 PPP-values in constant 2005$).

Table A2: Descriptive statistics

no. of observations	exporters	importers	*no. of observations*	exporters	importers	
total	12,890	23,524		12,890	23,524	
by development of trade			*by province (NUTS2-region)*			
recovering in 2010	7,510	13,498	Groningen	281	563	
recovered in 2010	5,380	10,026	Friesland	315	677	
by firm size			Drenthe	295	585	
small (1-49 FTE)	11,645	21,731	Overijssel	979	1,832	
mid-sized (50-249 FTE)	1,071	1,576	Flevoland	283	497	
large (>=250 FTE)	174	217	Gelderland	1,603	2,898	
by sector			Noord-Holland	1,736	3,345	
agriculture & mining	515	720	Zuid-Holland	2,405	4,188	
industry	2,945	4,184	Utrecht	828	1,559	
energy & construction	555	1,436	Zeeland	378	718	
wholesale & retail trade	8,875	17,184	Noord-Brabant	2,678	4,606	
by foreign control status			Limburg	1,109	2,056	
yes	1,987	3,171				
no	10,903	20,353	*descriptive statistics*	mean	median	sd
by two-way trading status			$re-exportshareinexports_{2010}$	0.190	0.000	0.344
yes	11,756	15,776	$exportgrowth_{2009,2010}$	1.624	0.499	2.662
no	1,134	7,748	$importgrowth_{2009,2010}$	1.162	0.429	1.847

Table A3: Descriptive statistics (cont.)

no. of observations	exporters	exporters with regional RCA	importers	*no. of observations*	exporters	importers
total	12,890	12,890	23,524		12,890	23,524
by SITC-product group				*by region of origin/destination*		
no specialisation	7,748	10,043	13,714	no specialisation	8,470	14,078
food & live animals	516	348	1,168	northern EU-15	3,331	5,008
beverages & tobacco	50	16	73	southern EU-15	238	608
crude materials	349	215	331	rest of EU	85	96
mineral fuels	70	20	205	non-EU NW Europe	160	197
animal & vegetable oils	13	X	20	rest of Europe	127	40
chemicals & rel. prods.	543	121	750	Anglo-Saxon outside Europe	80	660
manufactured goods	673	308	1,505	Lat. America & the Carib.	145	93
machinery & transp. eq.	1,262	726	2,023	advanced Asia	57	421
misc. manuf. art.	1,648	1,081	3,713	developing Asia	54	2,046
comm. n.c.e.	18	X	22	Middle East & N. Africa	97	219
by BEC-product group				sub-Sahara Africa	46	58
no specialisation	7,835		13,338			
intermediate goods	2,205		4,144			
consumption goods	2,186		5,225			
capital goods	664		817			

Note: Due to confidentiality issues some values in the table have been suppressed. These cases are marked with an 'X', but have not been dropped from the analysis.