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Firms and the global crisis: French exports in the turmoil☆

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ABSTRACT

Global trade contracted quickly and severely during the global crisis. This paper uses a unique dataset of French firms to match export data to firm-level credit constraints and shows that most of the 2008–2009 trade collapse was due to the unprecedented demand shock and to product characteristics. While all firms have been affected by the crisis, the effect on large firms has been mainly at the intensive margin and has resulted in a smaller portfolio of products being offered to export destinations. The effect on smaller exporters has been to reduce the range of destinations served or to stop exporting altogether. Credit constraints have been an added aggravation for firms active in high financial dependence sectors. However, the share of credit constrained firms is small and their number has not increased hugely during the crisis, with the result that the overall impact of credit constraints on trade has been limited.

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1. Introduction

In the last quarter of 2008 and the first quarter of 2009 trade contracted in an exceptionally sudden, severe and globally synchronized fashion. This collapse was unparalleled in its suddenness: the decline in world trade reached 30% in just four months, from September 2008 to January 2009. It also seemingly was out of line with the decline in world GDP, which contracted by less than 3% over the same period.

Beyond the fall in demand and the limited resurgence of protectionism (Baldwin and Evenett, 2009), this sharp and disproportionate with GDP fall in trade has been attributed to two effects: first, a composition effect; second, financing difficulties and a shortage of liquidity linked to the intensification of the financial crisis.

In terms of the first effect, merchandize trade tends to be hit the hardest by demand shocks because it concerns mainly durable goods and other postponable production (Eaton et al., 2009; Bénassy-Quéré et al., 2009; Levchenko et al., 2009). Exports are two to three times more volatile than GDP because a large fraction of trade is in durable goods (Engel and Wang, 2008). In addition, in sectors that are highly dependent on global supply chains, goods are traded several times before reaching the consumer (Tanaka, 2009; Yi, 2009). Therefore, the large drop in demand for internationally fragmented sectors explains some of the unusually high discrepancy between the drop in overall activity and the contraction in trade.[1] Bems et al. (2010) apply a Leontief framework to a global bilateral input–output table, suggesting that demand can account for 70% of the trade collapse if composition effects and fragmentation are taken into account. The rapid communication among firms may explain the suddenness of inventory adjustments (Alessandria et al., 2010) and why the downsizing of trade was so synchronized and homogeneous worldwide (Baldwin, 2009). In addition, recent fiscal stimulus packages have been oriented mostly toward non-tradeables such as construction and infrastructure.[2]

Given the financial origin of the crisis, financial constraints and liquidity shortages have also been suggested to be determinants. Even in normal times, finance is particularly important for trade for at least three reasons. First, exporting entails important fixed costs such as the costs of learning about export market profitability, foreign distribution networks, regulatory compliance, etc. Second, exporting is a more risky activity than domestic transactions only. Third, exporting involves

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[1] O'Rourke (2009) has posited a convincing numerical example.
[2] An exception is the fiscal incentives in several countries for domestic purchases of new cars.

longer lags between production and delivery, with median shipment times of 2–3 months. Hence, exporters often need well functioning credit lines to maintain healthy cash flows. The introduction of financial frictions in standard models of firm heterogeneity à la (Melitz, 2003) implies that entry costs, marginal costs and cut-off conditions become more restrictive. Churn and the associated reallocation of market shares from the least productive (and hence smaller) firms to the most productive exporters are higher in the presence of credit constraints (Manova, 2008). Additional financial constraints during episodes of crisis, might leave negative legacies for export performance (Auboin, 2009). Using cross-country, cross-industry import data for the US, Chor and Manova (2010) show that the deterioration of money market rates played a role in the recent trade collapse. According to Amiti and Weinstein (2009), the decrease in financing explains one-third of the 1993 Japanese export collapse following the banking crisis. More generally, cross-country evidence from 23 past banking crises suggests that export growth is particularly slow in sectors reliant on external finance (Iacovone and Zavacka, 2009). This view that trade finance played a role in the recent trade crisis is challenged, however, in the case of US imports and exports (Levchenko et al., 2009) and also by the findings from IMF/BAFT surveys. According to the latter, the availability of trade finance was generally maintained over the course of the crisis, although the cost of trade credit increased and there was a — potentially — long lasting shift toward structured trade finance (G20, 2010).

Micro-economic adjustments to large and temporary shocks are not well understood. On the one hand, based on their size and/or lack of collateral and credit guarantees, smaller and less productive firms may be more affected by demand shocks and credit restrictions (Greenaway et al., 2007; Muuls, 2008), and firms operating in sectors exhibiting structurally higher financial dependence are likely also to be more sensitive to tighter credit conditions (Rajan and Zingales, 1998). The result may be adjustments at the extensive margin. On the other hand, there are sunk costs to firms' entering foreign markets or expanding their product ranges. Since for already active firms entering and exiting are more time consuming than changing the scale of operations, firms confronted by an exogenous shock of uncertain duration will likely prefer adjustments at the intensive margin to a reorganizing or downsizing in the scale of their operations (Melitz and Ottaviano, 2007). Given the dominance of large firms in trade, in the aggregate, firms should respond to a demand shock first at the intensive margin, then adjustments to the product, country and firm extensive margins. Empirical evidence on the 1997 Asian crisis supports the intuition that a large part of the adjustment is at the intensive margin. Bernard et al. (2009) investigate the impact of the Asian crisis on individual US exporters and find that most of the decline in US exports took place at the intensive margin.[3]

Our paper contributes to this debate by shedding light on the type of adjustments that took place during the 2008–2009 trade collapse — mostly at the intensive margin. It assesses the relative importance, at firm level, of the channels through which this trade collapse materialized. It quantifies the joint effects of demand, composition and financial constraints on the value of individual firms' exports, based on a unique database that combines firm trade data, broken down by product and destination, with direct information on firm-level credit constraints and balance sheet data. To the best of our knowledge, this is the first paper to address these issues using consistent and exhaustive information on individual firms' exports and financial constraints before and throughout a trade crisis. Another important contribution is that we have access to monthly data, which allow more precise assessment of the deployment of the trade crisis.

Our results are clear-cut. We do not observe a drastic reduction in the number of French exporters. Most of the downsizing activities took place at the intensive margin of the top 1% of exporters. Small exporters tended to make adjustments at the product or destination margins, or exited export entirely. When we control for demand at sector and destination levels, we find that large and small firms are evenly impacted. *Additional* financial constraints during the crisis exacerbated the difficulties for financially constrained firms, but this effect was quantitatively quite small in the aggregate since only a small number of firms were affected. As we do not rule out the possibility of an overestimation of the credit channel, this impact may be even smaller. These contrasting findings help to reconcile the opposing views in the literature regarding the respective roles of demand and financial constraints as determinants of the trade collapse.

The rest of the paper is organized as follows. Section 2 discusses the adjustment to the margins of trade in response to the shock, the sectoral, geographical, product and price dimensions of the trade collapse and the distribution of losses across firms. Section 3 provides a firm level econometric investigation of the relative importance of the different channels of the trade collapse. Section 4 concludes and highlights some implications of our results.

2. Crisis impact on individual firms — the facts

We exploit a dataset of individual exporters located in France.[4] France is similar to several other countries in terms of its exporting being limited mainly to a very select club of "champions", flanked by a large number of marginal competitors exporting on an irregular basis (Mayer and Ottaviano, 2007). Some 1,000 individual exporters account for two-thirds of the annual exports of France, the 5th largest world exporter.

Monthly exports by destination and product category, data provided by the French Customs, are observed for the period January 2000 to April 2009. Our unit of observation is the value exported each month by a French resident company, in each 8-digit Combined Nomenclature (CN-8 hereafter) sector to each export destination.[5] These data provide two main advantages. First, they enable investigation of the dynamics of the exporter distribution based on the whole universe of exporters.[6] Second, they allow us to observe their individual contributions to the value or diversity of exports in the sector to which they belong.

2.1. A glance at the 2008–2009 collapse

In the context of the recent crisis, a first glance at the data on French exporters seems to confirm the intuition from the theory that total trade responds initially to a shock by adjusting at the intensive margin. Fig. 1 points to a steep decline in the value of total exports after September 2008. The number of French exporters, which was decreasing since 2000, appears to have contracted further during the recent crisis, from 50,458 units in October 2008 to 46,616 units in April 2009. While seasonality and number of working days might be biasing the results to a degree, overall we can say that some 3800 firms ceased exporting, corresponding to 7% of the average number of monthly exporters over the ten-year period considered.[7] Finally, comparison of the data series relative to total export values versus data relating to the number of exporters suggests that most of the adjustment was at the intensive rather than the extensive margin.

[3] Similarly, during the 1987–92 US export boom, most of the adjustments took place at the intensive margin (Bernard and Jensen, 2004).

[4] While we consider all exporters located in France, whatever the nationality of their ownership, in the rest of the text we sometimes loosely describe our dataset as "French exporters".

[5] A detailed description of our dataset is available in Appendix A.

[6] While we use all the information collected by the French Customs, the data are subject to censoring of the smallest exporters: see Appendix A for further details.

[7] This figure may be overestimated since the value exported by some firms may have fallen below the reporting thresholds during the crisis. See Appendix A for more information on the threshold applying to the export reporting obligation.

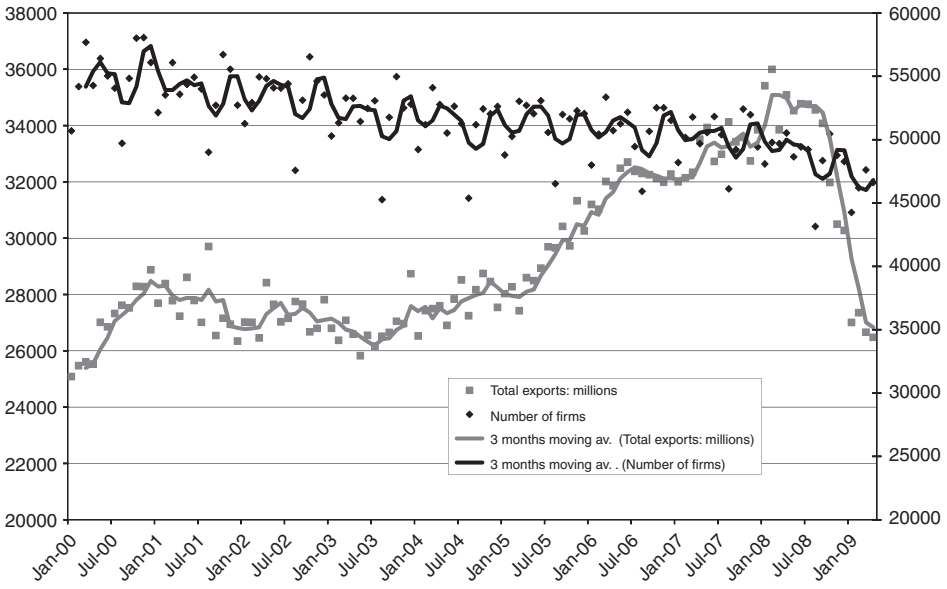


Fig. 1. Total value of French exports and total number of French exporters, January 2000–April 2009. Note: Chapters 97 ('Works of art, collectors' pieces and antiques'), 98 ('Special Classification Provisions'), and 99 ('Special Transaction Trade') of the HS2 classification, as well as monetary gold correspond to product categories without real economic significance and are accordingly dropped. 3-months moving averages. Left scale: euros.
Source: French Customs data, own calculations.

Fig. 1 shows only the net impact of entries and exits. Since most firms sell many products to many markets, the product and destination dimension need to be separated. We therefore decompose the trade margins.

2.2. Decomposition of the trade margins

The time dimension of the trade collapse, which in France started in September 2008 and ended around April 2009, necessitates the use of high frequency data: annual data would miss the key dynamics of the episode (Eaton et al., 2009). However, there are two problems with using monthly data. First, we need to control for seasonality and different patterns of working days (see Appendix 4). Second, the number of entries and exits appears larger than with lower frequency data, the discrepancy increasing with the level of data disaggregation (highest for individual products exported to individual destinations).

To cope with these problems, we rely on so-called *mid-point growth rates* (Davis and Haltiwanger, 1992; Buono et al., 2008). Mid-point growth rates are computed on elementary flows, defined here as monthly export flows by a French firm to a given destination for each CN-8 product (the detailed level of information available from French Customs data). Elementary monthly trade flows in a sector or product category can be classified into four types: created (positive extensive margin); destroyed (negative extensive margin); increased (positive intensive margin); and decreased (negative intensive margin). The difference between created and destroyed flows is the net extensive margin; the difference between increased and decreased flows is the net intensive margin.

For a firm i exporting a value x to a country c of product k at month t, the mid-point growth rate is defined as follows:

$$g_{ickt} = \frac{x_{ickt} - x_{ick(t-12)}}{\frac{1}{2}\left(x_{ickt} + x_{ick(t-12)}\right)}. \quad (1)$$

Similarly, the weight attributed to each flow g_{ickt} is given by the relative share of the flow in total exports, where *total* refers to the exports of the whole population of French exporters:

$$s_{ickt} = \frac{x_{ickt} + x_{ick(t-12)}}{\left(\sum_c \sum_i \sum_k x_{ickt} + \sum_c \sum_i \sum_k x_{ick(t-12)}\right)}. \quad (2)$$

Finally, the year-on-year growth rate of the total value of French exports is given by summing each individual flow g_{ickt} weighted by s_{ickt}[8]:

$$G_t = \left(\sum_c \sum_i \sum_k s_{ickt} * g_{ickt}\right). \quad (3)$$

Provided that monthly elementary trade flows can each be classified into four subsets, G_t can be computed by aggregating separate flows corresponding to the above mentioned four contributions: extensive positive (entry); extensive negative (exit); intensive positive (increase in existing flows); and intensive negative (reduction in existing flows).[9]

Table 1 compares the contributions of the intensive and extensive margins to the growth in French trade computed using alternative frequencies of trade data — monthly, quarterly and annual — averaged over two sub-periods, 2000–2007 and October 2008 to March 2009. As expected, at higher frequencies, the gross contributions (entries and exits) of the extensive margin are inflated. However, the net contributions depend less on the frequency of the data: on average between 2000 and 2007, the net extensive margin contributes to 57% of the growth rate of French exports at a monthly frequency, compared to 52% at a yearly frequency. During the crisis, the share of the net extensive margin ranged from 22% at a monthly frequency to 11% at a quarterly frequency. The use of higher frequency data, therefore, inflates the gross extensive margins and, to a lesser extent, its net contribution to aggregate export growth. Therefore, we focus our analysis on the contribution of net margins over time.

Fig. 2 graphs the contributions of total *net* margins between January 2007 and April 2009 and shows that trade adjustment during the crisis took place mainly at the intensive margin. The trough of −22

[8] G represents a good approximation of the log change in total exports.

[9] All flows corresponding to an entry will show a value of +2 and all flows corresponding to an exit will show a value of −2. Finally changes in the size of existing flows will show a value of between −2 and 0 if flows have decreased over time, and of 0 and +2 if flows have increased over time. A new flow may be a new exporting firm, a new destination served by an incumbent exporter, or a new product by an incumbent exporter to an already established destination.

Table 1
Contributions to mid-point growth rates: monthly, quarterly and yearly data.

	2000–2007			Oct 2008–March 2009	
	Month	Quarter	Year	Month	Quarter
Total entry	31.6	24.8	17.0	24.0	17.6
Total exit	−29.9	−23.2	−15.5	−27.7	−19.4
Net extensive margin	1.7	1.6	1.5	−3.7	−1.8
Intensive positive	20.6	20.7	20.4	17.3	16.6
Intensive negative	−19.4	−19.3	−19.0	−30.8	−31.9
Net intensive margin	1.2	1.4	1.4	−13.5	−15.3
Total	3.0	2.9	2.9	−17.1	−17.1

Source: French Customs data, own calculations.
Note: Contributions in p.p. to the total growth rate in percent. Chapters 97 ('Works of art, collectors' pieces and antiques'), 98 ('Special Classification Provisions'), and 99 ('Special Transaction Trade') of the HS2 classification, as well as monetary gold, are dropped. Simple averages of contributions calculated for each year, with the exception of last row. Exporters are ranked according to the value of their exports within a sector.

percentage points in the net intensive margin occurred in February 2009.[10]

The contribution of the net extensive margin for firms, products and destinations appears to be of second order importance. Table 2 shows that the share of the net extensive margin in the overall change in the value of exports was 21% during the crisis, compared to 58% in normal times (2000–07). This pattern holds for all components of the extensive margin: entry and exit of firms, products or destinations. Lastly, it appears that firms' patterns of expansion to new countries have been maintained, possibly because the entry costs had already been incurred.[11]

The uneven results at the margins suggest that we should investigate the impact of the crisis on firms of different sizes. The margins are computed for four groups of firms ranked by the size of their sectoral exports: the smallest group includes the smaller 80% of exporters, the next ranked 80–95% percentile, the next 95–99% percentile and the largest group includes 1% of exporters. In order to construct each group, we rank firms according to their HS 2-digit sector of activity and the total value of exports relative to the exports of all other firms exporting in the same sector, for a given month.[12]

Turning to the results of our decomposition, the largest 1% of exporters mostly explains the aggregate numbers — both before and during the crisis (see Table 2) — reflecting the highly skewed distribution of exports. During the trade collapse, 75% of the intensive margin loss was absorbed by the largest 1% of exporters, which accounted for only 23% of the extensive margin. Large exporters absorbed the shock mostly through the intensive margin (accounting for 92% of their loss). Their contribution to the extensive margin was mainly at product level. Smaller exporters, on the other hand, recorded more important losses at the extensive margin. For the bottom 80% of exporters, 76% of total losses in exports came from the extensive margin, 53 percentage points from the firm extensive margin and 20 percentage points from the destination extensive margin. Adjustments during the crisis contrast with the relatively more proportionate contributions of each margin during the previous period of export expansion.

Overall, these results show that large firms absorbed the largest part of the 2008–2009 trade collapse, mainly at the intensive margin and by reducing their product portfolios. Nevertheless, small players were hurt by the crisis and many were forced to exit because they were unable to adjust.

2.3. Further characterizations of the trade collapse: the sectoral, geographic and price dimensions

In order to characterize the channels through which the trade collapse took place, we investigate whether, during the crisis period, sectoral and geographical specializations as well as price changes were important determinants of the patterns of the trade collapse. We check whether our findings differ for different sized firms.

Starting with the role of different geographic and sectoral specializations across firms, we conduct a shift-share decomposition. We can compute this decomposition algebraically. However, there is a drawback to algebraic methods, which is the dependence of the results on the ordering of the effects: first computing geographical effects and then sectoral effects yields a different result from doing the reverse. To overcome this problem and to evaluate the statistical significance of the results, we use an econometric method that allows us to capture the estimated parameters associated with sectoral and geographical fixed effects.[13] Specifically, we regress elementary growth rates (mid-point growth rates in our case) — weighted by s_{ickt} as defined above, i.e. exports at time t plus exports at time $t-12$ divided by the sum of total exports (all exporters, sectors and destinations) at times t and $t-12$ — for each period t on three sets of dummy variables: *country*, *sector*, *size-group*. Marginal averages (i.e. the marginal impact of a given sector or destination or size) are computed from the estimated fixed effects and compared to the unconditional estimations.[14] Decomposition of this variance shows that sector effects contribute more during the crisis (36%) than previously (29%). Country effects contribute 64% (71% before September 2008) and size effects account for less than 1%. Overall, the three sets of effects account for 27% of total export growth variance during the crisis (20% before the crisis).

Large and small exporters are similarly affected by the crisis if we control for the geographical and sectoral orientations of exports. Large exporters are disproportionately represented in adversely affected sectors (e.g. the car industry) or in exports to markets hit heavily by the crisis. Small firms are concentrated in destinations or sectors which were relatively less affected by the trade collapse, which cushioned their losses. However, there is a difference between large and small exporters related to the timing of events: the conditional figures suggest that the smallest exporters were hit earlier (starting in August 2008) than larger exporters, whose exports began to be downsized in the last quarter of 2008. We can use the estimated fixed effects to check to what extent particular destinations and products are driving our results.

If we look at the geographical dimension of the trade collapse we see that the geography of exports played a minor role, as confirmed by unusual synchronicity of the crisis at global level. The destinations that saw the highest reductions in exports are Europe (e.g. Spain, Portugal, United Kingdom) the United States and some important

[10] Our monthly frequency data potentially under-estimate the contribution of the intensive margin. The predominance of the intensive margin is confirmed in other studies of the trade crisis; see in particular Behrens et al. (2010) on Belgian firms.

[11] It is interesting that product churn reduced: a 37% reduction in the gross contribution of product exits partially compensates for the decrease in the gross contribution of product entries.

[12] An individual firm can belong to different quantiles in different sectors if it exports in more than one HS 2-digit category. Our definition is consistent with the choice of analyzing the universe of French exporters. Any other definition of quantile aimed at maintaining their population constant, would miss at least entry decisions.

[13] This method was developed in work on regional economics to provide a statistical basis for the geographical structural analysis Jayet (1993); it was applied recently to international trade by Cheptea et al. (2005).

[14] The estimated fixed effects are computed as deviations from the world sample average by normalizing the results. We use initial trade volumes as weights to redefine the effects. Technically, the simple average of the estimated effects is subtracted from each effect, including omitted ones. Notice that this method generates identical results regardless of the effects omitted in the estimation procedure. This normalization is aimed solely at simplifying interpretation of the results and does not alter the final results in any way.

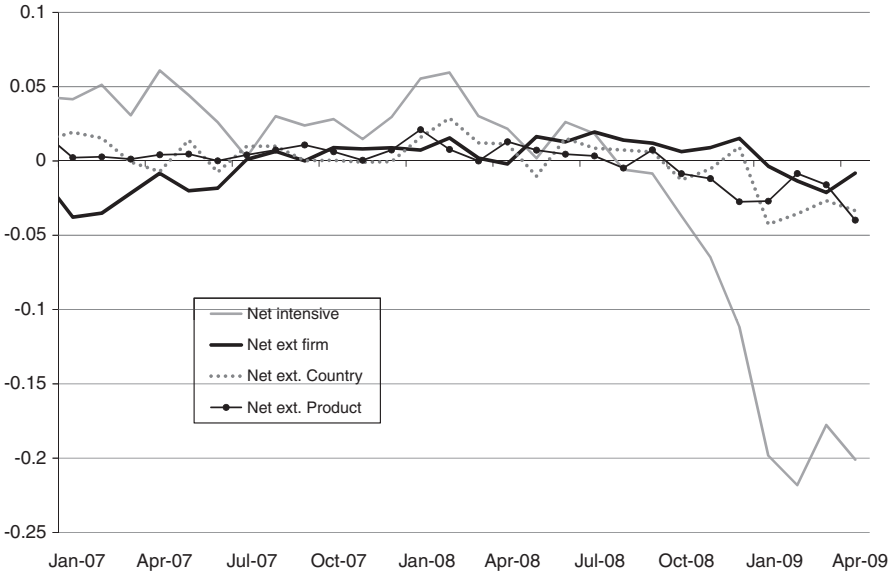


Fig. 2. Net margins' contributions to mid-point growth rates, French monthly exports (percent), January 2007–April 2009. Note: The net intensive margin is computed as the sum of the positive and negative intensive margin contributions; the net extensive margin is computed as the sum of entries and exits. Further details are provided in Section 2.2. Source: French Customs data, own calculations.

members of *Factory Asia* (Taiwan and China). There seems to be no clear pattern among the list of the least affected destinations (see Table 3). Even a breakdown by financial development and remoteness does not reveal any noteworthy differences across countries.

Regarding the sectoral dimension, we classify the HS 2-digit categories into broad sectors of activity: intermediate goods, consumption goods, automobiles, other transport, other equipment, plus a residual grouping. We find that 11 out of the 15 most adversely affected sectors are classified as intermediate goods (see Table 4), and that consumption goods dominate the least affected sectors.[15] If we aggregate sectors across broad categories, we find that more than one third of the deterioration is attributable to intermediate goods. This may be explained in part by the nominal changes linked to the bursting of the commodity price bubble: see below for a discussion. "Other equipment" and "automobiles" contribute a quarter and a fifth respectively to overall trade developments.

Lastly, if we decompose value flows into quantities and unit values this gives an idea of the role played by price adjustments in the period. We compute average price changes for total exports and vis-à-vis individual trade partners, using weighted averages of the elementary price changes.[16]

We decompose each elementary flow i as follows:

$$dln(value)_{i,t/t-12} = dln(quantity)_{i,t/t-12} + dln\left(\frac{value}{quantity}\right)_{i,t/t-12}. \quad (4)$$

We then aggregate elementary changes similar to a Tornqvist price index, using the following formula:

$$\sum_i w_{it}\ dln(value)_{i,t/t-12} = \sum_i w_{it}\ dln(quantity)_{i,t/t-12} + \sum_i w_{it}\ dln\left(\frac{value}{quantity}\right)_{i,t/t-12} \quad (5)$$

where the weight factor w_{it} is given by half the share of a flow over the total value of French exports in the two reference periods, i.e.

$$w_{it} = \frac{1}{2}\left(\frac{value_{i,t}}{\sum_i value_{i,t}} + \frac{value_{i,t-12}}{\sum_i value_{i,t-12}}\right). \quad (6)$$

Table 2
Contributions to mid-point growth rates, average 2006–2007 and average September 2008–April 2009, French monthly exports.

	Mean 2000/2007			Mean Sept. 2008/ April 2009			Credit constrained firms
	0–80	99–100	Total	0–80	99–100	Total	Total
Firm entry	1.3	1.8	6.4	1.0	1.2	4.7	5.3
Firm exit	−1.3	−1.5	−5.7	−1.3	−0.6	−4.7	−12.1
Net firm	0.0	0.3	0.8	−0.2	0.6	0.0	−6.8
Country entry	0.6	5.4	11.6	0.5	5.3	10.8	11.1
Country exit	−0.6	−5.0	−11.2	−0.6	−5.6	−12.5	−18.6
Net Country	0.0	0.4	0.4	−0.1	−0.3	−1.8	−7.5
Product entry	0.3	8.7	13.6	0.3	4.8	8.5	9.9
Product exit	−0.3	−8.2	−13.0	−0.3	−5.8	−10.1	−13.7
Net Product	0.0	0.5	0.6	0.0	−1.1	−1.6	−3.8
Net extensive margin	0.0	1.2	1.7	−0.3	−0.8	−3.4	−18.1
Intensive positive	0.4	13.2	20.6	0.3	11.1	17.5	14.5
Intensive negative	−0.3	−12.6	−19.4	−0.4	−20.7	−30.2	−29.4
Net intensive margin	0.0	0.6	1.2	−0.1	−9.6	−12.7	−14.9
Total	0.0	1.8	3.0	−0.4	−10.4	−16.2	−33.0

Source: French Customs data, own calculations.
Note: Contributions in p.p. to the total growth rate in percent. Chapters 97 ('Works of art, collectors' pieces and antiques'), 98 ('Special Classification Provisions'), and 99 ('Special Transaction Trade') of the HS2 classification, as well as monetary gold, are dropped. Margins are calculated as the weighted averages of the individual firms' contributions to the intensive and extensive margins. Exporters are ranked and assigned to each quantile group based on the value of their exports within a sector. Each first column comprises exporters in the 0–80 percentiles, each second column the largest 1% exporters. In the interests of simplicity, contributions for exporters in the 80–95 and 95–99 percentiles are not shown.

[15] The only consumption goods that show up in this "top-15", i.e. those in the category of "carpets and other textile floor coverings", are mainly used as inputs in the construction sector. Some intermediates are among the least affected sectors, but often are inputs in non-durable consumer goods production.

[16] We follow common practice (despite its shortcomings) and use changes in unit values as proxies for changes in prices (Schott, 2004).

Table 3
Most and least harmed destinations of French exports during the trade collapse.

Ranking	Country	Share in French exports, percent	f.e.[a]
Most harmed destinations			
1	Taiwan	0.46	−0.27
2	Chile	0.15	−0.21
3	Ukraine	0.23	−0.16
4	Spain	9.32	−0.16
5	Argentina	0.23	−0.12
6	China	2.30	−0.09
7	Portugal	1.23	−0.09
8	United Kingdom	8.08	−0.07
9	Slovenia	0.31	−0.06
10	United States of America	6.78	−0.06
11	Poland	1.61	−0.06
12	Turkey	1.40	−0.05
13	Denmark	0.72	−0.04
14	Romania	0.63	−0.04
15	Czech Republic	0.85	−0.03
Least harmed destinations			
35	Thailand	0.25	0.05
36	Finland	0.52	0.07
37	Tunisia	0.81	0.07
38	Brazil	0.78	0.07
39	Cote d'Ivoire	0.18	0.07
40	Canada	0.86	0.08
41	Russian Federation	1.44	0.08
42	Malaysia	0.36	0.08
43	Israel	0.30	0.09
44	Mexico	0.47	0.09
45	Switzerland	2.81	0.14
46	Australia	0.70	0.16
47	Egypt	0.30	0.16
48	Morocco	0.90	0.16
49	Nigeria	0.30	0.18
50	Algeria	1.10	0.36

Source: French Customs data, and own calculations.
Note: Only the 50 most popular destinations of French exports are reported in the Table.
[a] Normalized fixed effects (weighted average equals 0).

We can now perform separate shift-share analyses for quantities and unit-value changes.[17] Our results indicate that the contraction in exports for a number of commodities was mainly the result of changes in unit values.[18] This notwithstanding, in aggregate, the reduction in the volumes exported accounts for most of the collapse, with only a minor impact of price changes (Table 5).[19]

The breakdown of unit value changes by destination reveals that pricing to market strategies played a role. We find a positive 58% correlation between changes in euro-denominated prices (fixed effects from the shift-share analysis) and bilateral exchange rate changes: pass-through is incomplete.[20]

2.4. Evidence for financially constrained firms

We identify financially constrained firms by exploiting the database used by Aghion et al. (2010). Since 1992, French banks have been legally obliged to report to the *Système Interbancaire de Télécompensation*, within four business days, any incident of a firm failing to pay its creditors. These defaults on credits are called *Payment Incidents*. The Banque de France collects this information and makes it available weekly on paper or via the Internet to all commercial banks and other credit institutions. The Banque de France allows free access to the full histories of payment incidents for the previous 12 months.[21] Payment incidents can be regarded as a generator of credit constraints; failure to pay or a payment incident during the previous year will have a

Table 4
Most and least adversely affected sectors during the trade collapse.

Most harmed sectors				
Ranking	Sector	HS-2 code	Broad category	f.e.[a]
1	Lead and articles thereof.	78	interm	−0.51
2	Copper and articles thereof.	74	interm	−0.41
3	Ores, slag and ash.	26	interm	−0.29
4	Vehicles o/t railw/tramw roll-stock, pts; accessories.	87	autom	−0.27
5	Zinc and articles thereof.	79	interm	−0.26
6	Nickel and articles thereof.	75	interm	−0.24
7	Arms and ammunition. parts and accessories thereof.	93	other eqt	−0.22
8	Ships, boats and floating structures.	89	other transp	−0.19
9	Other vegetable textile fibers. paper yarn; woven fab	53	interm	−0.19
10	Carpets and other textile floor coverings.	57	cons	−0.17
11	Iron and steel.	72	interm	−0.16
12	Raw hides and skins (other than furskins) and leather.	41	interm	−0.16
13	Pulp of wood/of other fibrous cellulosic mat. waste etc.	47	interm	−0.15
14	Man-made staple fibers.	55	interm	−0.15
15	Man-made filaments.	54	interm	−0.14
Least harmed sectors				
Ranking	Sector	HS code	Broad category	f.e.[a]
81	Prod mill indust. malt. starches. inulin. wheat gluten	11	interm	0.16
82	Headgear and parts thereof.	65	cons	0.16
83	Toys, games; sports requisites. parts; access thereof	95	cons	0.16
84	Cocoa and cocoa preparations.	18	cons	0.18
85	Miscellaneous edible preparations.	21	cons	0.20
86	Railw/tramw locom, rolling-stock; parts thereof. etc.	86	other transp	0.20
87	Articles of leather. saddlery/ harness. travel goods etc.	42	cons	0.20
88	Meat and edible meat offal.	2	cons	0.21
89	Pharmaceutical products.	30	cons	0.23
90	Residues; waste from the food indust. prepr ani fodder	23	interm	0.25
91	Products of animal origin, nes or included.	5	interm	0.26
92	Prepr feathers; down. arti flower. articles human hair	67	misc	0.29
93	Live animals.	1	interm	0.30
94	Fertilizers.	31	interm	0.34
95	Coffee, tea, mat and spices.	9	cons	0.37

Source: French Customs data, and own calculations.
Note: HS 2-digit sectors. "interm"stands for intermediate products; "cons"for consumption goods, "other eqt"for other equipment and "other transp"for other transport material.
[a] Normalized fixed effects (weighted average equals 0).

[17] Important caveats to our analysis include that it is based exclusively on the intensive margin (continuous flows), and that we exclude all elementary flows without quantity reported (intra-EU trade flows for firms exporting overall less than 460,000 euros per year to the other 26 members of the EU). We believe that neither of these restrictions biases the data: we show in Section 2 that the intensive margin dominated the dynamics of trade during the crisis, and the threshold for intra-EU trade reporting is sufficiently low to be of second order importance.
[18] The sectors where contraction was driven by price changes include copper, lead, nickel, zinc, wood pulp and other vegetable textile fibers.
[19] The price index for French exports was 1.4% higher in April 2009 than in April 2008. It was nearly unchanged compared to April 2007 (−0.1%).
[20] We consider here the 50 top destinations for French exporters.
[21] This service has the sole purpose of providing to banks and other credit institutions information on their customers, to enable them to adapt their supply of credit to this information. We eliminate from the sample payment incidents recorded for technical reasons (mainly missing details related to bank account or issuer) or due to contested claims.

Table 5
Most and least adversely affected sectors: price and quantity decomposition.

Ranking	Sector	HS2 code	Broad cat	dlv	dlq	dlp
Most adversely affected sectors						
1	Furskin and artificial fur. manufactures thereof.	43	cons	−0.30	−0.37	0.06
2	Vehicles o/t railw/tramw roll-stock, pts and accessories	87	autom	−0.36	−0.35	−0.01
3	Lead and articles thereof.	78	interm	−0.84	−0.27	−0.56
4	Ores, slag and ash.	26	interm	−0.31	−0.23	−0.08
5	Machinery and mech appliance. parts, nuclear reactors, boilers	84	other eqt	−0.17	−0.21	0.04
6	Iron and steel.	72	interm	−0.22	−0.20	−0.02
7	Arms and ammunition. parts and accessories thereof.	93	other eqt	−0.29	−0.18	−0.11
8	Railw/tramw locom, rolling-stock and parts thereof. etc.	86	other transp	−0.52	−0.17	−0.35
9	Footwear, gaiters and the like. parts of such articles.	64	cons	−0.09	−0.17	0.08
10	Ships, boats and floating structures.	89	other transp	−0.23	−0.16	−0.06
11	Man-made staple fibers.	55	interm	−0.16	−0.16	0.00
12	Tin and articles thereof.	80	interm	−0.15	−0.14	−0.01
13	Special woven fab. tufted tex fab. lace. tapestries etc.	58	cons	−0.05	−0.13	0.08
14	Rubber and articles thereof.	40	interm	−0.08	−0.13	0.05
15	Man-made filaments.	54	interm	−0.16	−0.13	−0.03
Least adversely affected sectors						
81	Coffee, tea, mate and spices.	9	cons	0.23	0.21	0.03
82	Printed books, newspapers, pictures and other product etc.	49	cons	0.22	0.21	0.00
83	Meat and edible meat offal.	2	cons	0.23	0.22	0.01
84	Pharmaceutical products.	30	cons	0.27	0.22	0.05
85	Optical, photo, cinema, meas, checking, precision, etc.	90	other eqt	0.21	0.22	−0.01
86	Aircraft, spacecraft, and parts thereof.	88	other transp	0.28	0.22	0.06
87	Musical instruments. parts and access of such articles	92	cons	0.19	0.23	−0.04
88	Art of apparel and clothing access, knitted or crocheted.	61	cons	0.21	0.24	−0.03
89	Pulp of wood/of other fibrous cellulosic mat. waste etc.	47	interm	−0.12	0.24	−0.36
90	Toys, games and sports requisites. parts and access thereof	95	cons	0.27	0.25	0.02
91	Cereals.	10	interm	0.08	0.25	−0.17
92	Cork and articles of cork.	45	interm	0.27	0.28	−0.01
93	Articles of leather. saddlery/harness. travel goods etc.	42	cons	0.31	0.30	0.00
94	Live animals.	1	interm	0.48	0.50	−0.02
95	Umbrellas, walking-sticks, seat-sticks, whips, etc.	66	misc	0.37	0.64	−0.27

Source: French Customs data, own calculations.
Note: dlv = average change in value between t and t − 12; dlq = average change in quantity between t and t − 12; dlp = average change in unit value between t and t − 12; dlv = dlq + dlp. Average effects are computed as discussed in Eqs. (4)–(6). Normalized fixed effects (weighted average equals 0). Ranking of the sectors based on quantity impact.

negative and significant impact on the amount of any new bank loan. It will adversely affect the probability of contracting a new loan and the size of a new loan (Aghion et al., 2010).

The number and share of exporters that experienced at least one payment incident in the preceding 12 months are relatively stable over the period: on average, 2855 exporters experienced at least one payment incident between January 2008 and April 2009. The figures are respectively 2943 during the crisis period (September 2008 to April 2009) and 2766 between January and August 2008 (versus 3003 in 2007). The share of monthly exporters hit by payment incidents slightly increased: 4.8% of French exporters during the January–April 2009 period compared to 4.3% and 4.7% respectively over the same periods in 2008 and 2007. The distribution by size of firms of a payment incident shows a higher number for the smallest players. Our Group 1 shows a ratio of 5.1% of firms affected in 2009 compared to 4.0%, 3.1% and 2.0% respectively for groups 2–4. The figures are similar for 2007 and 2008. The mean proportion of firms affected by payment incidents in our sample shows no clear sectoral pattern, and the dispersion is limited as shown in the last column of Table 8 in the Appendix: 70% of sectors show a ratio of 4% to 5%. The outliers are Cereals, Gums, Organic chemicals, Pharmaceutical products, Fertilizers, Ammunition (2%) and Ships (8%).

The decomposition of the margins for the sub-sample of financially constrained French exporters points to a limited increase in the negative contribution of the intensive margin, compared to the whole sample of French exporters (−14.9% compared to −12.7%, see the last column in Table 2). At the extensive margin, however, the negative contribution is large: i.e. −18.1% compared to −3.4%. The difference is explained mostly by firm exits (−6.8% compared to 0.0%) and by destination-country exits (−7.5% compared to −1.8%).

We can conclude, therefore, that both product and firm-specific features mattered during the trade collapse. In Section 3, we will exploit a dataset that matches individual firm exports with information on financial constraints and pre-crisis balance sheet data. This will allow us to quantify the relative contributions of the various determinants of the export collapse. Beyond demand and composition effects, we expect the impact of being financially constrained to affect mainly those firms in sectors that rely heavily on external finance.

3. The role of financial constraints in the failure of the export engine

The analysis in Section 2 indicates that demand, product and firm characteristics were all important in shaping the contraction in trade. This outcome is consistent with the story that the trade collapse was the result of a major fall in demand worldwide, compounded by composition and value chain effects, the elements that contribute to explaining sectoral heterogeneity. In addition, based on the financial origins of the crisis, it is likely that financial constraints played a significant role.

3.1. Estimation strategy

We want to examine whether financial constraints were a source of heterogeneity in how French exporters adjusted to the crisis. First we need to look at the measurement of the financial constraints faced by individual exporters during the crisis. As already explained, we identify financially constrained firms using data on payment incidents, which provide us with a time-varying indicator of credit constraints. Payment incidents generated credit constraints due to their negative

impact on the number of new bank loans (Aghion et al., 2010). This is a different measure from the firm-specific measure used by Minetti and Zhu (2011) based on the responses to a survey (conducted in 2001) which asked firms whether the amount of credit they had obtained was less than they had originally requested at the market interest rate. Based on this definition of financial constraint, 4.4% of Italian exporters were financially constrained and the value of their exports was reduced by 38%. Our measure is exhaustive and not based on survey data; it refers to the signal sent by defaulting firms to their lenders, not the actual constraint on lending. Nevertheless, the orders of magnitude in terms of constrained firms are similar in each approach.

Although payment incidents have been shown to generate credit constraint, this measure is not free of potential endogeneity bias. It also may capture some exporters that were experiencing difficulties and which failed because of a negative shock or low levels of competitiveness, which rendered them no longer able either to export or sell in the domestic market. The causality from financial constraint to export performance may be questionable, therefore. However, a payment incident does not necessarily reflect severe distress; it is an indication that payments were late. It is therefore very important that our estimation strategy should include controls for the individual characteristics of the exporters, including potential distress. All our estimations compare the impact of financial constraints on export performance before and during the crisis (i.e. before and after September 2008) using a difference-in-difference strategy: any additional impact due to the firm registering a payment incident, or signaling distress other than the greater financial constraint that accompanied the crisis, is thus controlled for. We check also whether these additional impacts are affecting all firms equally or firms belonging to those sectors that are the most dependent on external finance.

We also perform a series of robustness tests. First we focus on a subgroup of firms for which we have information on individual characteristics (net assets, productivity, dependence on external finance, cost of debt, leverage ratio) and interact these characteristics with the crisis dummy. As an alternative, for the largest sample of exporters, we rely on individual fixed effects in a double difference estimation strategy. We restrict our sample to firms that faced a financial constraint before and during the crisis so that we identify only the impact of financial constraints during the crisis on within firm variations over time. Thus, all unobserved characteristics — including distress — are controlled for before and after the crisis. Finally, we control for the financial structure, or more precisely, the ownership of the firm.

Still, such strategy does not fully rule out a reverse causality story whereby an idiosyncratic negative demand shock may lead to an incident of payment to creditors for the exporter. To be more precise, our control variables (firm fixed effects) cannot fully control for such an outcome since the negative demand shock for a firm's exports can be time varying. Yet, the mentioned shortcoming in our estimation strategy does not weaken our finding of limited impact of the credit channel since it can only lead to an overestimation of the impact of the credit channel on exports.

In Section 2, the mid-point growth rate was calculated for each firm at product level (CN 8), the most fine grained information available from the French Customs database. In the econometric analysis, we aggregate the product dimension of the data in sectors. Thus, we cumulate all products exported within a sector, at firm level, by destination. This categorization eliminates noise and makes the dataset more manageable; it also takes into account that the current crisis appears to have had a distinctive sectoral dimension.

3.2. Specification

Our baseline equation estimates exports growth over the period 2008 M1 to 2009 M4 by means of ordinary least squares (OLS), the choice of subperiod being constrained by computational capacity limits.

$$g_{ickt} = \alpha * d\ln(import)_{ckt} + \beta * PI_{it} + \gamma * PI_{it} * crisis + u_{ct} + v_{kt} + \varepsilon \quad (7)$$

Our dependent variable, the mid-point growth rate of firm i exports has three dimensions: time t, HS2 sector k and destination c. It is computed on flows in value. We observe the export performance of 105,310 firms that exported at least once during the period (recall that growth rates are computed also for entries and exits).

A first determinant of the change in exports is the demand for imports in the sector, and each firm's destination markets. We compute this demand as sectoral 'net' imports in each destination market, where French exports are subtracted from the destination's total imports. This procedure allows us to avoid endogeneity problems. Data provided by the International Trade Centre (ITC) records monthly imports up to 2009 M4 for a subset of 52 countries, which, however, represent about 84% of the value of French exports. Based on these figures, this variable is able to control for the well-documented 2008–2009 contraction in global demand and, to some extent, reflects the extremely skewed sectoral dimension of the crisis.

A second determinant is the overall impact of the crisis, notwithstanding the demand and sectoral issues referred to above. Indeed, the general climate of uncertainty and its impact on business confidence, shortage of liquidity and more restricted access to the financing of business activities in some regions of the world, may have exacerbated the contraction in both activity and trade, beyond demand developments. To control for this we create a dummy variable that takes the value 1 from 2008 M9 onwards.

In addition to investigating the determinants of export performance, this paper aims also to investigate the impact of financial constraints. Our time-varying variable of credit constraints *Payment Incidents* (*PI* thereafter) is defined in Section 2 and discussed in Subsection 2.1. It is coded as a dummy variable that is equal to 1 if the firm experienced at least one payment incident in the preceding 12 months.

Country-time and HS2-time fixed effects act as sectoral deflators, controlling for any time-varying country and sectoral determinants, including the exchange rate and any sector specific shocks and also, to an extent, composition effects or sectoral differences in internationally fragmented production.

3.3. Results of the baseline estimations

The results of the baseline specification are reported in Table 6, columns (1) to (4). Experiencing a payment incident in the previous 12 months has a significant negative impact on firm exports in normal times. In the period of the crisis, this negative impact was heightened by 2 percentage points. This figure should be assessed against the background of a 17% year-on-year average drop in firm exports during the crisis. These results are relatively stable across estimations and also robust to the inclusion of different control variables.

The literature on the link between financial dependence and firm performance indicates that there is a sectoral dimension to the financial dependence of a firm: in general, the production function determines the type of financial needs that dominate in a sector (Rajan and Zingales, 1998). Thus, it is likely that in good times a well developed financial sector can be the source of comparative advantage in financially constrained sectors and in times of turmoil, this advantage will be reversed due to the shortage of credit. To control for the sectoral dimension, we construct an index of financial dependence for HS 2-digit industries similar to that in Rajan and Zingales (1998). Thus, our index of external financial dependence is equal to 1 minus the ratio of the mean of internal financing over the mean gross fixed capital formation over the period 2003–2007 for

Table 6
Microeconomic determinants of the trade collapse.

	(1)	(2)	(3) RZ<med.	(4) RZ>med.	(5) Weighted
dln(import)	0.065	0.065	0.072	0.050	0.285
	(0.004)	(0.004)	(0.006)	(0.006)	(0.002)
Incident of payment	−0.269	−0.258	−0.260	−0.253	−0.097
	(0.004)	(0.005)	(0.007)	(0.009)	(0.002)
Crisis*incident of payment		−0.021	0.007	−0.074	−0.078
		(0.007)	(0.009)	(0.013)	(0.005)
Obs.	6,154,401	6,154,401	4,185,385	1,969,016	6,154,401
R2	0.01	0.01	0.01	0.01	0.08
Nbr. firms	105,310	105,310	79,538	49,452	105,310
Time*sector f.e.	Yes	Yes	Yes	Yes	Yes
Time*country f.e.	Yes	Yes	Yes	Yes	Yes

Source: French Customs data, own calculations.
Note: Standard errors into parentheses. Intercept not reported.

each firm in the dataset.[22] Data are taken from the *FiBEn* database constructed by the Banque de France, which contains information on both flow and stock accounting variables for a large sample of French firms, and is based on fiscal documents, balance sheets and profit and loss statements.[23] We obtain the aggregation at the HS 2-digit sector by computing the median value across firms. As the technological needs of sectors are slow to evolve, we can assume that they are time-invariant over the period of estimation. The inclusion of sector-time fixed effects (on a monthly basis) allows us to control for sectoral volatility over the cycle. An innovation of our paper with respect to the related literature is that we calculate our indices of financial dependence based on a dataset of the firms included in our data-sample. We use this indicator to carry out separate regressions for sectors whose index of external financial dependence is below the median, and for sectors whose index is above the median. The results for the regression on sectors below the median are reported in Table 6, column (3); those for sectors above the median are presented in Table 6, column (4). The additional negative effect of the crisis on credit constrained firms seems to be driven entirely by developments in the sectors dependent on external finance. The differential impact in different sectors confirms also that our measure of credit constraint is not picking firms in distress.

Estimations weighted by the size of the firm's exports suggest a weaker effect of the *PI* variable in normal times, and a stronger effect during the crisis (column (5)). A possible reason for this is that larger firms are less affected by payment incidents in normal times when bank credit is not constrained, while small firms are always constrained, regardless of the banks' loan policies.

3.4. Robustness checks

In this section, we present our robustness analysis related to the potential endogeneity of the payment incident variable. First we enrich the baseline equation to control for a range of classic firm-level determinants of export performance, including size (net assets), productivity (value added per employee), and a set of three variables providing measures of the financial dependence of the firm. To do so, we rely on a restricted sample of exporters for which individual characteristics are observable. We observe the dependence on external finance (internal financing over gross fixed capital formation), the cost of debt (financial charges over value added) and the leverage ratio (debt over own funds). All the RHS firm-level variables, with the exception of *Payment Incidents*, are taken from the *FiBEn* database. Second, we retain the whole sample of exporters and control for unobservable characteristics with individual fixed effects.

We first control (column (6) in Table 7) for firm heterogeneity in size (net assets) and productivity. We derive a sample of 45,822 exporters out of a total sample of 105,310 firms exporting at least once between January 2008 and April 2009. As expected, firms of different sizes seem to be differently constrained by credit restrictions. Column (7) also includes the dependence on external finance (internal financing over gross fixed capital formation), cost of debt (financial charges over value added) and leverage ratio (debt over own funds). We restrict our sample to 38,888 firms. The inclusion of these additional firm level controls reduces the magnitude of the coefficient of payment incident, but not the additional significant impact that occurs during the crisis.

Column (8) in Table 7 shows the firm fixed effects to control for the unobservable individual characteristics of 95,756 firms. Compared to Table 6, here we retain only those firms that were observed twice as exporters in a sector between January 2008 and April 2009. Firms exiting in January 2008 or entering in April 2009 are no longer included in the estimation. Unobserved characteristics of firms experiencing a payment incident may reduce the average growth of exports, but do not bias our estimates since we adopt a double difference estimation strategy.

Column (9), Table 7, shows the impact of credit constraints during the crisis only on the within firm variation. We therefore compare the export performance of a given firm, before and after the crisis, rather than comparing credit constrained and unconstrained firms during the crisis, as above. The treated group is now firms that had a payment incident before September 2008 and which survived during the crisis. This restricts our sample to 75,819 firms. The control group excludes firms appearing after August 2008. The results confirm that exporting by financially constrained firms decreased more during the crisis compared to exporting by the same group of firms before the crisis.

The results in column (10) refer to another type of robustness test: data are consolidated by ownership, so that all French-based firms belonging to the same proprietary group are clustered together. More precisely, the trade flows from French-based subsidiaries are consolidated in one observation and the *Payment Incident* variable is averaged using exports as weights.

These robustness checks are in line with our initial results and overcome many of the shortcomings in our measure of financial constraint. Experiencing a payment incident during the previous 12 months reduces individual export performance under all circumstances. During the 2008–2009 crisis, the impact of financial constraints was heightened, in particular when controlling for unobserved characteristics of the firm. The robustness tests clearly indicate that also during the crisis, demand continued to be the key driver of exports. Furthermore, since a reverse causality between demand and the credit channel cannot be ruled out, the effect of credit constraints relative to demand might be even less important than estimated. Such outcome would reinforce our argument of a secondary role of financial constraints in explaining the trade collapse.

3.5. Do financial constraints affect exports specifically?

Having established that financial constraints mattered for individual firms during the crisis, we next want to examine whether they caused exports to fall *more* than output. Since 80% to 90% of international trade "involves some form of credit, insurance or guarantee" (Auboin, 2009), a shortage of trade finance specifically, would impact international trade over and above domestic output and sales. Since exhaustive data on domestic output, sales or employment are not available on an intra-annual basis for French firms, we cannot

[22] We restrict our sample to firms that report data for at least 3 years during the period. We allocate each firm to its main HS2 sector and take the median value at the sector (HS2) level, keeping only sectors in which more than 30 firms report.

[23] The database contains accounting and financial data on all French companies with a turnover of at least 75,000 euros per year or with credit outstanding of at least 38,000 euros (see http://www.banque-france.fr/gb/instit/services/page2.htm). Annual accounting data are available for about 200,000 firms. These include almost 50% of exporters recorded by the French Customs database over the period 2007 M1–2009 M4 and about 80% of the firms with 20 to 500 employees.

Table 7
Microeconomic determinants of the trade collapse: robustness.

	(6)	(7)	(8) Firm f.e.	(9) Within	(10) Group	(11) Firm-HS2 f.e.
dln(import)	0.061	0.059	0.059	0.066	0.067	0.061
	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Incident of payment	−0.076	−0.083	−0.041	−0.181	−0.272	−0.073
	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.020)
Crisis*incident of payment	−0.043	−0.019	−0.107	−0.083	−0.033	−0.132
	(0.009)	(0.010)	(0.008)	(0.011)	(0.008)	(0.026)
ln(net assets)	−0.002	−0.004				
	(0.001)	(0.001)				
Crisis*ln(net assets)	0.001	0.003				
	(0.001)	(0.001)				
ln(VA/nbr employees)	0.023	0.024				
	(0.002)	(0.002)				
Crisis*ln(VA/nbr employees)	0.002	−0.002				
	(0.002)	(0.002)				
Internal financing/investment		0.000				
		(0.000)				
Crisis*int.financing/inv.		0.000				
		(0.000)				
Financial charges/VA		−0.022				
		(0.009)				
Crisis*financial charges/VA		0.054				
		(0.013)				
Leverage ratio		−0.001				
		(0.001)				
Crisis*leverage ratio		−0.003				
		(0.001)				
Incident of payment*distance						0.018
						(0.021)
Crisis*incident of payment*distance						−0.007
						(0.030)
Incident of payment*credit/GDP						0.040
						(0.021)
Crisis*incident of payment*credit/GDP						0.024
						(0.028)
Incident of payment*eurozone						0.003
						(0.013)
Crisis*incident of payment*eurozone						−0.001
						(0.017)
Obs.	4,593,495	4,155,614	6,144,847	5,955,245	5,509,445	5,700,608
R2	0.01	0.01	0.118407	0.01	0.01	0.16
Nbr. firms	45,822	38,888	95,756	75,819	91,759	53,982
Time*sector f.e.	Yes	Yes	Yes	Yes	Yes	Yes
Time*country f.e.	Yes	Yes	Yes	Yes	Yes	Yes

Source: French Customs data, own calculations.
Note: Standard errors into parentheses. Intercept not reported. All financial variables are computed from FIBEn/Centrale des Bilans, Banque de France.

directly test for an over-reaction of exports to domestic sales at firm level. However, an alternative way to identify a specific impact of trade finance on exports is to focus on the impact of credit constraint on different destination markets for an individual exporter.

Recent theoretical models suggest several country characteristics that would influence the response of exports to a shortage of trade finance.[24] Exporters and importers can appeal to different forms of trade finance — open account, cash in advance, or letter of credit — depending on the characteristics of the source and destination countries which will influence the risks and financing costs (Schmidt-Eisenlohr, 2010; Ahn, 2010). The time between production and delivery magnifies the negative impact of financing costs on trade flows, implying that credit constrained firms would reduce more their exports to more distant destinations (Schmidt-Eisenlohr, 2010). Feenstra et al. (2011) however shows that when firms borrow working capital and banks cannot observe whether firms use their loans to finance production for domestic sales or exports, credit constrained exporters would reduce their sales evenly across destinations. To test this potential link between freight time and credit constraints, we use the financial development of the destination market (credit over GDP) as a proxy for financing costs, and the bilateral geographical distance as a proxy for time between production and delivery. We define dummies for destination over the median of credit/GDP and distance and we control for a possible eurozone effect. These three determinants are interacted with the payment incident and the crisis dummies, while controlling for firm-sector fixed effects.

The results in Table 7 column (11) suggest that credit constraints affect exporters unevenly across destinations in normal times. We find that credit constraints cause bigger reductions in exports to destinations with larger financing costs, i.e. low credit/GDP ratio. However, this impact was not magnified during the crisis.[25] But, as shown above, financial constraints played a specific role in those sectors that were highly dependent on external finance. Our results are in line with recent empirical findings using different methodologies. Paravisini et al. (2011) find that the elasticity of Peruvian exports to credit during the crisis does not vary with distance to the destination market, using matched firm-credit data and identifying credit constraint through the differential impact of capital flow reversal on different banks during the crisis. Our results are also consistent with the proportional drop in domestic sales and exports found by Behrens et al. (2010) for Belgian exporters.

[24] Unlike Amiti and Weinstein (2009), "trade finance" covers all credits linked to international trade, whether a financial intermediary intervenes or not.

[25] Notice that distance interacted with incident of payment plays a significant role in neither normal times nor in crises.

3.6. Quantification

After showing that both supply and demand factors mattered, in the final step of our analysis we quantify the weight of financial constraints on aggregate exports, and for the subset of financially constrained firms. In Section 3.3 we observed that financially constrained exporters (exporters that experienced a payment incident in the previous 12 months) faced a non-trivial cost in terms of exports, a cost that was heightened during the trade crisis. This effect is explained totally by developments in sectors highly dependent on external finance. However, demand developments are the main driver of export developments. Hence, it is not clear how our estimates translate into the aggregate patterns.

In order to shed light on these issues, we compute the predicted midpoint growth rate twice, including and excluding the additional financial constraints during the crisis for the whole population of exporters, and also for the sub-sample of financially constrained exporters (Fig. 3). Even if other determinants of export performance (demand and export composition) dominate, credit constraints during the crisis significantly reduced exports for financially constrained firms: about 20% of the drop in exports by financially constrained firms can be explained by the variable *Payment Incidents*. However, in aggregate the impact is limited. Such conclusion is reinforced by a possible reverse causality which may lead to overestimated coefficients on the credit channel.

Overall, our results help to reconcile the opposite views in the literature regarding the determinants of the trade collapse. Financial constraints are a significant determinant of exports, but the effect of the additional constraints faced during the crisis, if any, was small: the number of firms hit by these constraints was similarly small and the drop in demand might be echoed in payment incidents. Also the effect was concentrated in those sectors relying heavily on external finance. Accordingly, the demand channel, including the related composition effects, played a big role during the crisis. These findings are in line with those in Eaton et al. (2009) and can be reconciled with findings showing an important role for credit constraints such as Chor and Manova (2010) and Amiti and Weinstein (2009). In particular, our results on the significance of financial constraints for financially constrained firms (20% of the predicted mid-point growth rate) are qualitatively similar to those found by Amiti and Weinstein (2009) for Japanese firms in the 1990s. Amiti and Weinstein find a 33% contribution, but not accompanied by a concurrent major contraction in demand worldwide. One important implication of the results from our quantification exercise is that, in the context of the 2008–2009 crisis, financial constraints hardly account for the portion of aggregate trade contraction that traditional macro and trade models are unable to explain.

4. Conclusion

Our paper addressed the question of whether firm characteristics prevailed over other determinants, including demand and product characteristics, in the 2008–2009 trade collapse. Using a unique dataset of French firms matching export data and financial constraints, we find that both products and firm characteristics mattered. Most of the 2008–2009 trade collapse can be attributed to the unprecedented demand shock and product characteristics. The contribution of the net intensive margin of the top 1% exporters explains three-fifths of the drop in French exports during the crisis. Smaller exporters were forced to reduce the range of destinations served or cease exporting. Credit constraints emerge as an aggravating factor. Credit constrained firms are defined as those firms that experienced a payment incident in the previous 12 months. Although other determinants of export performance dominated (namely, demand and export composition), credit constraints during the crisis significantly worsened the export positions of financially constrained firms, accounting for about 20% of the drop in exports of these firms. However, as the share of these firms is small and their number did not increase much during the crisis the overall impact of credit constraints on trade was limited. Due to possible reverse causality, such limited impact is clearly an upper bound of the effect of the credit channel.

An important implication of the results of our quantification exercise is that, in the context of the 2008–2009 crisis, financial constraints hardly account for the portion of *aggregate* trade contraction that traditional macro and trade models are unable to explain.

We controlled for many dimensions of the trade collapse episode in our analysis. We accounted and controlled for concurrent important factors, including composition effects and exchange rate changes, by the inclusion in our estimations of import demand at sectoral level on destination markets, sector and country fixed effects, and by carrying out relevant decompositions of the margins of adjustment. We controlled also for firm ownership, consolidating data by group. We developed methods to work with high frequency data,

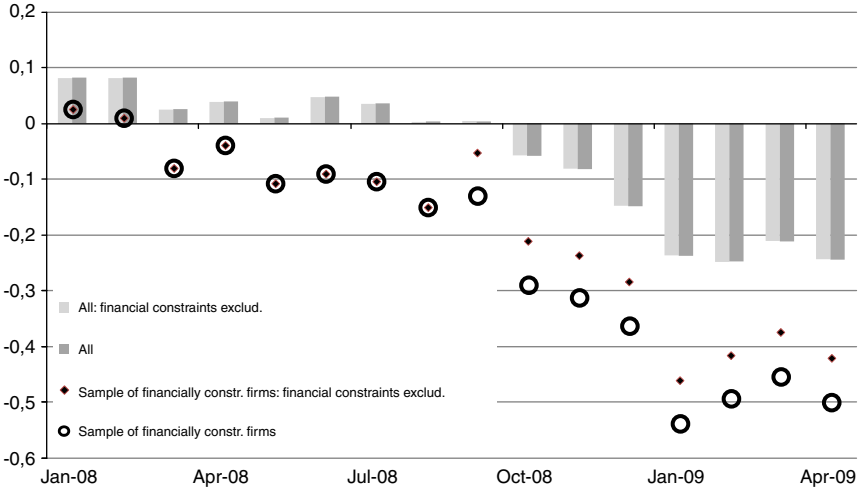


Fig. 3. Predicted midpoint growth rate for financially constrained firms versus all firms. Note: computed from specification (5) in Table 6. The light gray bars "All: financial constraints exclud." show the predicted mid-point growth rates where additional financial constraints during the crisis equal to zero for the whole sample of French exporters. The dark gray bars "All" show the predicted mid-point growth rates given the actual financial constraints for the whole sample of French exporters. The diamonds "Sample of financially constr. firms: financial constraints exclud." show the predicted mid-point growth rates where additional financial constraints during the crisis equal to zero. The circles "Sample of financially constr. firms" show the predicted mid-point growth rates given the actual financial constraints for this sub-group of French exporters.

discussing potential biases arising from their use and comparing results with the results for annual data where applicable. We have provided direct evidence on firms' financial constraints and their variation over the crisis period.

There are avenues for further work using firm level data. Firstly, matching techniques could provide information about what distinguishes firms that thrived in adversity from other firms in the sample. This would require a dedicated analysis. Secondly, the magnification effect of value chains referred to in many papers, is deserving of in-depth, stand-alone analysis. This is beyond the scope of the current paper and requires input–output tables at firm level; we have this information only at the sectoral level. Thirdly, addressing whether domestic sales were less badly affected than exports would shed light on the specificities of exporting activity.

Appendix A. Description of firm level export data

We rely on individual firm exports recorded monthly by the French Customs. The period covered is 2000 M1 to 2009 M4. We exclude from the data the items belonging to HS2 Chapter 97 ('Works of art, collectors' pieces and antiques'), 98 ('Special Classification Provisions'), and 99 ('Special Transaction Trade') as well as monetary gold. Each exporter is identified by a unique official identification number (SIREN). Each exporter ships its products in one or more product categories defined at the Combined Nomenclature 8-digit level, comprising some 10,000 different categories. Each category of product exported by a given firm can be shipped to more than one market. Accordingly, the most fined grained information available in the French Customs database is the value exported each month by a French resident firm in a CN8 category to each destination country. From a simple statistical point of view, the resulting four-dimensional data point is defined as an elementary flow. On average, 629,000 elementary flows were recorded monthly over the period 2005 M1 to 2009 M4. Changes in trade flows over time may originate from changes in any of the following: number of exporters, number of products, destination markets served and value shipped per each elementary flow. In our analysis, we use the above level of detail in Section 2. By contrast, in the econometric analysis in Section 3, we aggregate the product dimension of the data in HS 2-digit sectors. Thus, our dependent variable comprises export flows, where each data point corresponds to the value of exports in all the exported products categorized under CN 8-digit categories belonging to the same HS 2-digit sector by each French exporter to each destination country. In other words, we cumulate all products exported within a sector at the firm level, by destination.[26] Consolidating, at the firm-level, the additional information on the product dimension in the sectoral information helps to evaluate the results. As well as eliminating noise from the data and making the dataset more manageable, this categorization takes into account that the current crisis appears to have had a distinctive sectoral dimension, as stylized facts from aggregate data suggest (strongest effect on durable goods, financial dependence of firms clearly following a sectoral dimension, etc.).

It should be remembered that our dataset is subject to some limitations linked to data-censoring. While we use all the information collected by the French Customs, the exports' reporting obligation applies only if a firm exports above a legal threshold. More specifically, two different size thresholds apply, one for extra-EU trade and one for intra-EU trade. For exports to non-EU countries, firms have an obligation to declare their exports if the yearly cumulated value of their exports is 1000 euros or more. For exports to other EU Member states, the declaration is compulsory if the yearly cumulated value of exports to the other 26 EU Member states taken together is larger than 150,000 euros. These size thresholds may bias negatively the extensive margin, since small firms are more subject to extensive margin adjustments (see findings in Section 2). Using monthly data, however, it is unclear how this issue could be tackled effectively. Moreover we are interested in changes over time, and not in absolute figures. Hence we consider this issue of second order importance.

Finally, it should be noted that there is considerable seasonality in our dataset and the number of working days is an important determinant of monthly exports. We deseasonalize the data by applying the coefficient of adjustment used by the French Customs to broad categories of products, and focus on year-on-year variations, which means that month m of year t is compared to the same month of year $t-1$.[27]

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[26] A firm can appear several times in the database, if it exports CN8 products belonging to more than one HS2 sector. Note however that, each time, only its exports relative to the relevant sector are taken into account.

[27] See the French Customs website for more detail on the above mentioned coefficients of adjustment (http://www.douane.gouv.fr/).

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