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Exporters, Importers and Credit Constraints

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Abstract
This paper analyses the interaction between credit constraints and trading behaviour. I construct a unique dataset containing firm-level trade transactions data, balance sheets and credit scores from an independent credit insurance company for Belgian manufacturing firms between 1999 and 2007. Firms are more likely to be exporting or importing if they enjoy lower credit constraints. Also, firms that have better credit rating export and import more, and more products to and from more countries. Whilst importing and exporting behavior are very similar in a static view, an analysis of how various margins of trade are related to credit constraints show a significant difference between the two. In the case of exports, it is the extensive margin of exports in terms of destinations that is significantly associated with credit constraints whereas for imports it is the extensive margin in terms of products.

JEL Classifications: F10, F14, G01, G20
Keywords: Credit constraints, international trade, firms' heterogeneity, imports, exports

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1 Introduction

When the economy enters a recession and a credit crunch shakes the financial sector, or simply when they suffer other types of shocks, firms might find it harder to access credit. This is likely to affect their operations, the investments and R&D they conduct and the way they develop and expand. There is however little empirical evidence on how important financial considerations are for the international expansion and activities of firms.

This paper considers the determinants of firm trading patterns by matching firm-level trade transactions data with individual, time-varying credit ratings. In particular, it seeks to analyse the interactions between financial or credit constraints on the one hand and exports and imports on the other. Whilst the analysis of firm-level trade has mostly focused on the relationship between trade and productivity, this paper contributes to a recent literature studying another critical determinant of trading decisions: the financial situation of the firm, and in particular the credit constraints it faces. Decisions by firms do not solely rely on productivity considerations given that firms might be financially-constrained. On the one hand, a bad financial situation might make its suppliers based abroad less willing to risk trading with the firm, hence affecting its imports. On the other hand, being credit constrained would prevent the firm from overcoming any fixed-costs associated with either exporting or importing. Based on a unique and detailed dataset, I find that firms that enjoy lower credit constraints and bankruptcy risk are more likely to be exporting. Firms that have better credit rating export more, and more products to more destinations. The same patterns hold for imports. Finally, I analyse how credit constraints matter for trade margins. For exports, although they are not positively correlated with product level margins nor the intensive margin, credit constraints affect the extensive margin of exports in terms of destinations. For imports, it is the contrary: credit worthiness is positively related with the extensive margin of imports in terms of products, but not the intensive margin nor the origin level margins. This brings novel insights on the differences between imports and exports choices. The detail of the datasets used is particularly suitable for the questions addressed. First, the trade and balance sheet data used covers the full sample of Belgian manufacturing, at the firm level, with detailed information on trade participation, but also on the destinations or origins and products traded. Using firm-level analysis in this paper allows a better understanding of how firms vary within a given sector. Second, the measure of credit constraint used is unique in its kind, a yearly measure of the creditworthiness of firms established by an institution external to the firm. By assessing financial constraints with a continuous credit rating rather than single and extreme default payment episodes implies that the effects identified do not only hold in the case of extreme credit constraints.

This paper contributes to two related areas of the literature. First, the relation between liquidity constraints and exports has been studied both in theory models and empirically. Heterogeneous firms models of international trade with liquidity-constrained firms yield several predictions on the equilibrium relationships between productivity, credit constraints and exports. Chaney (2005) provides a theoretical model of trade with heterogeneous firms à la Melitz (2003), introducing an exogenous liquidity constraint: credit constrained firms are less likely to export because they will find it more difficult to cover the fixed cost of exporting. In the model of Manova (2012), credit constraints interact with firm productivity, thus reinforcing the way

those firms with higher productivity select into exporting. More recently, Kohn et al. (2012) introduce financial constraints into a standard trade model in order to capture new exporters dynamics. The dynamic model of Caggese and Cunat (2011)shows how the link between financial constraints and exports can affect the gains from trade liberalisation. Empirically, the question has also been studied using different datasets. Several papers use the sector-level Rajan and Zingales (1998) measure of "external finance dependence" to examine how it affects exports. Manova (2008) shows how financial frictions and credit market development explain cross-country patterns of trade at the sector level. Export growth is proven to be slower in external finance dependent sectors in Iacovone and Zavacka (2009). Considering Belgian exporters as in this paper, Behrens et al. (2012) find that imports fell more during the recent recession in sectors with above median reliance on external finance. Analysing monthly US imports from countries with varying degrees of credit market tightness, Chor and Manova (2011) demonstrate that exports are less sensitive to the cost of external capital in industries relying less on external finance or less financially-vulnerable according to other measures, and that this sensitivity rose during the financial crisis.[1] Albornoz et al. (2012) analyse the sequential pattern of exports expansion by successful new exporters for Argentina and find that credit constraints do not explain these patterns.[2] The firm-level dimension of the dataset I use allows me to go beyond this type of sectoral analysis and exploit intra-sector variations. Others have used firm-level measures to capture credit constraints. Minetti and Zhu (2011) analyse a cross-sectional survey of Italian manufacturers and find that "credit rationed" firms are less likely to export and are likely to export less. Berman and Héricourt (2010) find similar results for developing countries, using financial ratios as measures of constraints. They find that financial constraints are not correlated with export values or export survival in those countries. Other authors also explore these questions by deriving measures of financial health and constraints from balance sheet financial ratios. Greenaway et al. (2007) find no ex-ante effect on the probability of becoming an exporter while Bellone et al. (2010) do. Askenazy et al. (2011) find that credit constraints negatively affect the entry into a new destination and increase the probability of exiting a market.[3] Exploiting data available from the international firm-level data from the World Bank Enterprise Surveys, Wang (2011) reports that the probability of exporting and the export volume increase with age, which is consistent with the hypothesis that firms need to accumulate enough collateral before they can borrow enough funds to profitably export. This paper extends this literature by analysing the extensive margins at the level of destinations and products as

[1] An important literature has studied the impact of financial crises on exports following the collapse in trade relative to GDP during the 2008 crisis was larger than predicted by standard econometric models. Ahn et al. (2011)describe the evidence on the importance of financial factors and trade finance to explain this episode. Other authors studying the crisis include Iacovone and Zavacka (2009), Levchenko et al. (2010) and Paravisini et al. (2011), while Amiti and Weinstein (2011) study past financial crises in Japan.

[2] There are also several papers on financial institutions and trade that show that export volumes from financially-vulnerable sectors are higher in financially-developed countries such as Beck (2002), Svaleryd and Vlachos (2005) and Hur et al. (2006).

[3] Other authors using financial ratios to study the correlations between exports and financial constraints include Campa and Shaver (2002) and Stiebale (2011).

well as considering financial constraints as a continuous measure.

A second area of the trade literature has empirically analysed firm-level imports. The fact that the import of new varieties leads to higher productivity and growth has been shown empirically both at the country level (Broda and Weinstein (2006)) and at the firm-level with imports of intermediates or reductions in input tariffs being associated with productivity gains (see Amiti and Konings (2007), Kasahara and Rodrigue (2008) or Goldberg et al. (2010)). Whilst my results do not contradict these findings, the question I address is whether financial constraints might prevent some firms from reaping the benefits of importing intermediaries. Besides, it adds some evidence to both the model of Antràs and Foley (2011) as well as their empirical finding that the contractual enforcement characteristics of an importer's country will affect the mode of trade finance chosen for the transaction. Besides, imports and exports have often been compared in the recent analysis of firm-level trade data. Descriptive evidence by Bernard et al. (2007), Muûls and Pisu (2009) or Halpern et al. (2005)show that importing firms share many attributes with exporters: they are both larger and more productive and product and country-level patterns of trade at the firm level are similar for both. Based on a theoretical model estimated with Chilean data, Kasahara and Lapham (2012) show the complementarities of exports and imports for the productivity and welfare gains of trade. This paper shows that imports and exports are different in some important dimensions when put in relation with credit constraints.

The remainder of the paper is organised as follows. Section 2 presents the data, and demonstrates in particular why the Coface score is an appropriate measure of credit constraints. Section 3 contains the empirical analysis of the links between export and import patterns and credit constraints at a given point in time, while section 4 takes a closer look at trade dynamics. Section 5 concludes.

2 Data

2.1 The Belgian Balance Sheet and Trade Transaction Data

This dataset provided by the National Bank of Belgium has been used in several papers analysing export and imports patterns and behaviour (Muûls and Pisu (2009), Behrens et al. (2012), Araujo et al. (2012) among others). It merges firm-level balance sheet and trade data for Belgium. The balance sheet part of the BBSTTD is used to extract firm-level annual characteristics, including employment, value added, profitability, sector of activity and to compute total factor productivity. The trade data includes the destinations and origins, products and value information.[4]

Manufacturing firms only are selected as belonging to sectors 15 to 36 of the NACE-BEL

[4]Given the difference of threshold for data to be available when a firm exports within the EU and outside the EU (see Muûls and Pisu, 2009), we do not consider as exporters or importers for a given year firms that trade only outside the EU and whose annual total of imports and exports is lower than 250,000 Euros.

classification. [5] The data is then merged into the Coface database, described in the following subsection, and only firms for which a Coface score is given for each year a balance sheet was available is kept in the dataset. All observations are kept in the resulting dataset, which is described in Table 3.

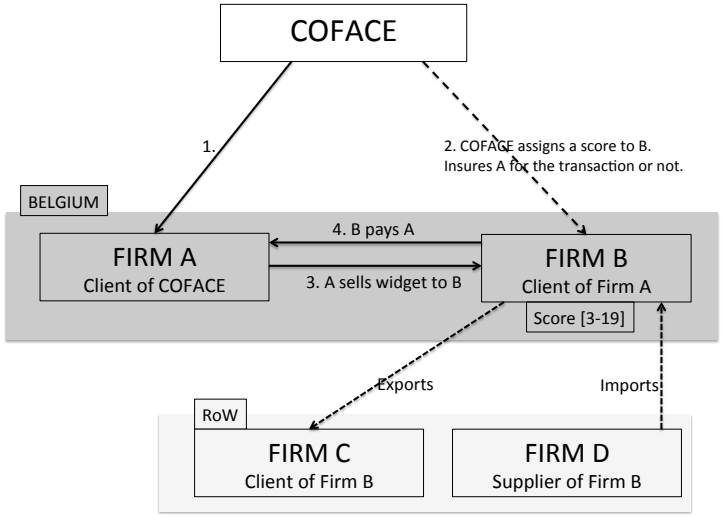
2.2 Measuring Credit Constraints: the Coface score

2.2.1 The Coface score

As a measure of credit constraints, I use the Coface Services Belgium Global Score for more than 9,000 Belgian manufacturing firms between 1999 and 2007. Credit insurance firms offer insurance policies to businesses that wish to protect their accounts receivable from loss due to commercial and political credit risks such as protracted default, overdue accounts, insolvency or bankruptcy. Established in France in 1945 as a credit insurance company, Coface is now an international firm, providing a range of services to facilitate business-to-business trade. Among these, it also provides credit worthiness information: through a worldwide network of credit information entities, it has constructed an international buyer's risk database on 44 million companies. Data from public and private sources are added to Coface's internal data in order to manage each company's rating and Coface's risk exposure on a continuous basis. Figure 1 provides an example of who the parties would be in a credit insurance contract. Belgian firm A is a client of Coface. It wants to sell a product to Belgian firm B and protect itself against the risk that B might default on paying for that product. As it would do for any transaction, it asks Coface whether it will be covered. Coface, if it hasn't already done so, will compute a score for B, and if it is high enough will insure the transaction. A will send the product to B in exchange for payment. If B defaults, Coface will pay A and seek to recover the amount from B. Imagine that Belgian firm B also exports goods to firm C and imports inputs from firm D. Neither B, C or D are clients of Coface, but because of its transaction with firm A, the credit rating score of firm B will be in the dataset.

[5] Note that in the BBSTTD, observations with a negative value-added or with less than one employee are dropped. Also firms from sector 232 (refined petroleum products) are excluded as their total factor productivity (TFP) measures are strong outliers.

Figure 1: Credit insurance



There is a large academic literature on bankruptcy prediction models such as that used to construct Coface's score (see for example the review by Balcaen and Ooghe (2006)). However, privately-computed probability of default or credit scores such as Coface's are naturally less well-known. Various datasets are compiled to construct the Coface score: the firm's financial statements (leverage, liquidity, profitability, size, etc.), its legal form, age and life cycle, location and information on its commercial premises as well as industry specific information. Data on payment incidents both with other firms and to the social security (ONSS) are also used. Finally legal judgments and the board structure are taken into account. For example, if a firm goes bankrupt it will negatively affect the score of all companies that have common board members. These various inputs are combined using several statistical methods and trial-and-error. The result is a score ranging from 3/20 to 19/20. Although the model predicts continuous scores they are rounded to unity in the obtained data. The score therefore contains information about the firm's quality, performance and productivity. However, two firms with equally valuable projects, and identical profitability and productivity can be very different in terms of financial health, board structure, and other elements that will determine their score and their access to credit. The empirical analysis will therefore control for a number of variables that could potentially influence both the Coface score and the trading activity, such as size, profitability and productivity of firms.[6] A firm's score varies from year to year: the average yearly change is 2 points (or 12.5% of the largest possible variation from 3/20 to 19/20) with a standard deviation of 2. The average difference between a firm's largest score over the time sample and its lowest

[6]Also, only 200 firms out of more than 13,000 manufacturing firms present in the BBSTD are not included in the Coface sample. Given these are mostly very small firms, controlling for these variables will avoid potential selection bias.

is 6 points. It is this variation that I exploit in my analysis below.

Importantly for the purpose of this paper, Coface's score does not include in its determination model any information on the firm's exports or imports.[7] Constructed as a bankruptcy risk measure, the score is highly correlated with how credit-constrained a firm is, reflecting the same type of information that a bank would use to decide whether it lends to a firm. Being determined independently by a private firm, it is unusual for such data to be available and has a great advantage on measures of credit constraints used in the literature so far: it is firm-specific, varies through time on a yearly basis[8] and allows for a continuous measure of the degree of credit constraint rather than classifying firms between two constrained or unconstrained categories. Compared to datasets on payment incidents that would identify a small subset of firms as being credit constrained[9], the Coface score ranks firms along the whole spectrum of ratings. Payment incidents would only be one of the elements affecting the score, in combination with many others.

Overall, the Coface score is a well-suited direct measure of creditworthiness used by other firms and by banks when extending loans, and I therefore use it in my empirical analysis to measure how credit-constrained firms are.

2.2.2 External validation

This section presents the correlation between the score and firm fundamentals. It also relates it to the important literature on credit constraints, in particular in corporate finance.

Given the methodology used to construct the score is not available publicly, it is shown here how correlated the score is with the firm's financial situation and productivity. A selection of financial ratios[10] measures each firm's solvency and investment.

[7] Trade data is not public information in Belgium and even if Coface would have such information through it's network of international clients, it does not enter in its score.

[8] Although the score is updated by Coface on a continuous basis, the data provided by the company for this paper only reports the score of each firm on December 31st.

[9] Bricongne et al. (2012) report that 4.7% of French exporters experienced a payment incident between January and April 2007.

[10] For examples of ratios computation using Belgian balance sheet formats, see Lagneaux and Vivet (2006)

Table 1: The correlation between the score and financial ratios and productivity

	Score				
	(1)	(2)	(3)	(4)	(5)
Financial independence	4.970***				
	(0.080)				
Borrowings coverage		0.448***			
		(0.029)			
EBITDA (Ln)			0.0717**		
			(0.027)		
Investment ratio				0.530***	
				(0.028)	
Productivity					0.0650**
					(0.023)
Employment	0.529***	0.468***	0.422***	0.554***	0.465***
	(0.024)	(0.026)	(0.028)	(0.025)	(0.026)
Observations	129541	129515	129542	130848	129471
Number of firms	19932	20030	19968	20091	19868
R-squared	0.08	0.01	0.01	0.01	0.01
Firm fixed effects	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES

Notes: Fixed-effect OLS regression ("Within" estimator). The dataset is an unbalanced panel of Belgian manufacturing firms from the BBSTTD with Coface score available and includes an average of 14,698 firms per year in 100 three-digit sectors over the period 1999 to 2007. Robust standard errors in parentheses; * denotes statistical significance at the 10% level; ** denotes statistical significance at the 5% level; *** denotes statistical significance at the 1% level. Includes constant and year dummies, not reported. The ratios are defined as follows: Financial independence = Equity capital / Total liabilities; Coverage of borrowings by cash flow = Cash flow / (Debt + Reserves + Deferred tax); EBITDA (Ln)=ln [Earnings before interest, taxes, depreciation, and amortization]; Investment ratio = Acquisitions of tangible fixed assets / Value added. The extreme observations (top and bottom percentile) for each ratio across all years are removed for the corresponding regression. Total Factor Productivity is measured according to Levinsohn and Petrin's (2003) method. Employment is in logarithm. The dependent variable is the credit rating score constructed for each year and each firm by Coface and ranges from 3 to 19. The variation in the number of observations is due to firms not reporting some of the variables used in the calculation of a given ratio in their balance sheet.

Table 1 shows how strongly the Coface score is correlated with the financial situation of the company, in particular its solvency and investment intensity.[11] Solvency is measured with two ratios: financial independence and coverage of borrowings by cash flow. The strong correlation between these and the score shows that firms that are more able to meet their short- and long-term financial liabilities have a higher score. Financial independence, the ratio between equity capital and total liabilities, reflects how independent the firm is of borrowings. The coverage of borrowings by cash flow measures the firm's repayment capability, and its converse specifies the number of years it would take to repay its debts assuming its cash flow were constant. Higher scores are also associated with larger investment ratios, the acquisitions of tangible fixed assets over value added.

EBITDA (Earnings before Interests, Taxes, Depreciation and Amortisation) is a commonly used financial measure of the operational profitability and performance of the firm. It appears as being positively associated with the Coface score. I will include it as a control in the regression analysis below, in order to control for the effects of the profitability of a company. Productivity has been shown to be an important determinant of trade patterns. It is measured here as in Levinsohn and Petrin (2003). [12]

[11] Firm and year fixed effects are included in the OLS regression, thus also controlling for possible differences in, for example, risk premie across industries and years which might affect the Coface score and other financial measures differentially. Such controls will be included in many other regressions in the paper.

[12] TFP is computed in this approach by using materials as a proxy rather than investment, thus reducing the number of zero-observations often noted in the data for investment compared to materials. The results presented

Column (5) of Table 1 reports a positive but not perfect correlation of the Coface score with productivity, confirming that credit constraints and productivity are two different issues to be considered when analysing export behaviour.

The effects of financial constraints on firm behaviour are an important area of research in corporate finance. Compared with existing literature, the Coface score provides many advantages, as described above. One of the many approaches in the literature consists of sorting firms into financially-constrained and unconstrained types on a yearly basis by ranking firms according to different measures. In Almeida et al. (2004), firms in the top three deciles of their payout dividend ratio would be considered as less financially-constrained than firms in the bottom three. Allayannis and Mozumdar (2004) use total assets. I test in Table 2 whether the score is consistent with such classifications: in the two alternative classification criteria, it appears that unconstrained firms will have a significantly higher average Coface score than financially-constrained ones. This confirms that the Coface score offers a creditworthiness measure that is consistent with other measures used in the literature.

Table 2: Score of financially-constrained and unconstrained firms according to dividend payout ratio and total assets

Score	Mean	SE	Max	Min	N
Dividend payout					
Constrained	13.31	0.05	19	3	3808
Unconstrained	13.92	0.04	19	3	3808
Total assets					
Constrained	9.88	0.02	19	3	29687
Unconstrained	12.59	0.02	19	3	29687

Notes: See notes to Table 1. The mean Coface score, its standard error, maximum and minimum observations are reported for the different categories defined. Firms whose dividend payout is in the top 30 percentiles are considered as financially unconstrained, whereas those in the bottom 30 percentiles are financially constrained. The same is done with total assets. The mean test is passed, meaning that constrained firms have a lower score than unconstrained firms, in both criteria. This is robust to using only one cross-section of the data, or taking out observations within the top and bottom percentiles of each measure.

3 A static view on credit constraints and trade

3.1 Export or import status

I begin the empirical analysis by exploring the variation in credit scores between exporters and importers on the one hand and non-traders on the other. It appears that less credit-constrained firms are more likely to be trading. This is shown at first in the descriptive statistics presented in Table 3: on average, traders are not only significantly larger and more productive, they also have a significantly higher score, meaning they are more creditworthy and less liquidity-constrained.

below are robust to using alternative measures of Total Factor Productivity or the logarithm of labour productivity measured by value added per employee, rather than TFP.

Table 3: Descriptive statistics

	Non-Traders				Exporters				Importers			
	Mean	sd	Obs.	se	Mean	sd	Obs.	se	Mean	sd	Obs.	se
Score	10.5	3.78	86,442	0.01	12.4	3.81	37,804	0.02	12.4	3.76	40,931	0.02
Employment	7.76	18.48	86,442	0.06	102.3	329.32	37,804	1.7	98.2	317.76	40,931	1.6
Productivity	10.2	1.15	84,048	0.004	11.0	1.65	37,569	0.009	11.0	1.65	40,678	0.008
Operational profitability	439.1	1255.59	86,442	4.3	8488.8	41337.88	37,804	212.6	8164.1	40034.92	40,931	197.9
Wage	31.01	24.91	86,442	0.08	40.01	24.18	37,804	0.1	39.9	20.32	40,931	0.1
Age	15.7	12.18	86,437	0.04	23.5	16.75	37,801	0.09	23.5	16.60	40,928	0.08
Multinational	0.0029	0.05	86,442	0.0002	0.086	0.28	37,804	0.001	0.081	0.27	40,931	0.001
Number of countries					13.65	16.9	37,804		7.57	5.87	40,931	
Number of products					14.39	23.8	37,804		38.94	54.9	40,931	
Total export/import value					18.98	112.4	37,804		10.401	67.6	40,931	

Notes: The dataset is an unbalanced panel of Belgian manufacturing firms from the BBSTTD with Coface score available and includes an average of 14,686 firms per year in 100 three-digit sectors over the period 1999 to 2007. Observations are at the firm-year level. The credit rating score constructed for each year and each firm by Coface ranges from 3 to 19. The multinational dummy (0/1) is derived from the Survey on Foreign Direct Investment. Productivity is measured as Total Factor Productivity according to Levinsohn and Petrin's (2003) method. Operational profitability is measured by EBITDA and is reported in thousand of Euros. Wage is reported in thousand Euros. Total export value is reported in million Euros. The means, standard deviations, numbers of observations and standard errors of means are reported. Exporters/Importers are firms that were exporting/importing a positive amount in that year. Non-traders were trading zero in that year.

This is confirmed when estimating the effects of different firm characteristics on the probability of exporting or importing in a given year with the following two separate specifications for importers or exporters:

$$Ex/Importer(0/1)_{i,t} = \alpha + \beta_1 CS_{i,t-1} + \beta_2 log(Empl) + \sum_{j=3} \beta_j FirmChar(j)_{i,t-1} + \{FE\} + \varepsilon_{i,t} \quad (1)$$

Where $Ex/Importer(0/1)_{i,t}$ is a dummy that takes the value 1 if firm i is an exporter/importer at time t and zero otherwise. $CS_{i,t-1}$ is the Coface credit score for firm i at time $t-1$ and additional firm characteristics are added: productivity, operational profitability, wage, age, employment and MNE status. Of course, many other factors might affect a firm's export status such as the current economic situation, and other characteristics of the firm. Other potential factors such as exchange rates, factor endowments, factor prices or industry demand will be common to all exporters of a sector in a given year. This is why I include firm, year and sector-year fixed effects in my specifications, denoted by {FE}, thus eliminating any bias that they could cause. I also compare the results to including only year and sector or firm fixed effects[13]. Including fixed-effects, controlling for firm-level observables and given the composition of the score described above, the residual effect of the Coface score is a good measure of credit constraints faced by a firm.

Given the number of fixed effects to be included in the specification, using a linear probability model in levels addresses the incidental parameters problem that affects non-linear fixed-effects estimates. This specification is used in Bernard and Jensen (2004) for a very similar binary choice problem despite the problems this might provoke (e.g. predicted probabilities outside the 0-1 range).

The first column of Table 4 replicates the result previously found in the literature that more

[13]Each firm only belongs to one sector, so only when firm fixed effects are not included, sector fixed effects are used to control for non time-varying sector-specific idiosyncrasies.

productive firms are more likely to export. The coefficient on the lagged credit score is positive and significant in column (2), confirming that firms which are less credit-constrained have a higher probability of being exporters. In that specification, the coefficient on productivity is not reduced compared to the first column, indicating the score captures the additional effect of credit constraints. Other firm characteristics are then included as controls: operational profitability, wage levels, age of the firm and multinational status. Column (3) shows the effect of productivity decreases and the credit score remains positively significant. When including the lagged export status variable, as in Bernard and Jensen (2004), the effect of productivity is insignificant in contrast with that of the score that is lower but significant as shown in column (4). Columns (5) and (6) show that the sign and significance of the score coefficient remains robust to including firm as well as year and sector-year fixed effects.

Table 4: Linear probability model on exporter status

Dependent variable:	**0/1 Dummy non-exporter/exporter**					
	(1)	(2)	(3)	(4)	(5)	(6)
Score		0.027***	0.026***	0.006***	0.009***	0.007***
ln(Score (t-1))		(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Productivity	0.101***	0.099***	0.011***	0.003	0.003	0.002
ln(TFP Lev-Pet (t-1))	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)
Operational profitability			0.114***	0.026***	0.037***	0.029***
ln(EBITDA (t-1))			(0.003)	(0.002)	(0.004)	(0.004)
Wage			-0.008**	-0.008***	-0.008**	-0.007**
ln(Wage (t-1))			(0.003)	(0.002)	(0.003)	(0.003)
Age			0.005***	-0.008***	0.024***	0.012***
ln(Age)			(0.001)	(0.001)	(0.005)	(0.004)
Foreign			0.005	0.002	0.001	-0.001
Dummy for MNE(t-1)			(0.006)	(0.003)	(0.010)	(0.008)
Existing exporter				0.800***		0.250***
Exporter/non-exporter (t-1)				(0.003)		(0.008)
Employment	0.125***	0.124***	0.045***	0.007***	0.026***	0.019***
ln(Employment (t-1))	(0.001)	(0.001)	(0.002)	(0.001)	(0.003)	(0.003)
Observations	107994	107994	107622	107622	107622	107622
Number of firms					18740	18740
R-squared	0.42	0.42	0.43	0.80	0.05	0.11
Firm fixed effects	No	No	No	No	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year fixed effects	No	No	No	No	Yes	Yes

Notes: See notes to Table 3. Robust standard errors in parentheses; ** denotes statistical significance at the 5% level; *** denotes statistical significance at the 1% level. Includes constant and 3-digit sector or sector-year dummies and year dummies, not reported. The dependent variable is a dummy indicating whether the firm exports or not in that year. (t-1) indicates the explanatory variable has been lagged by one year. Ln (x) is the natural logarithm of variable x. The Foreign dummy variable takes the value 1 if the firm is part of a multinational, 0 otherwise. It is obtained from the Survey on Foreign Direct Investment conducted by the National Bank of Belgium. In columns (4) and (6), the lagged dependent variable, a dummy indicating export activity in the previous year, is also included.

Table 5: Linear probability model on importer status

Dependent variable:	0/1 Dummy non-importer/importer					
	(1)	(2)	(3)	(4)	(5)	(6)
Score		0.040***	0.038***	0.011***	0.016***	0.015***
ln(Score (t-1))		(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Productivity	0.109***	0.106***	0.008**	0.005***	0.008**	0.009**
ln(TFP Lev-Pet (t-1))	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.003)
Operational profitability			0.127***	0.024***	0.032***	0.022***
ln(EBITDA (t-1))			(0.003)	(0.002)	(0.004)	(0.004)
Wage			-0.006*	-0.008***	-0.012***	-0.011***
ln(Wage (t-1))			(0.003)	(0.002)	(0.003)	(0.003)
Age			0.006***	-0.008***	0.018***	0.007*
ln(Age)			(0.001)	(0.001)	(0.005)	(0.004)
Foreign			-0.046***	-0.012***	0.000	0.000
Dummy for MNE(t-1)			(0.006)	(0.003)	(0.008)	(0.007)
Existing importer				0.809***		0.239***
Exporter/non-importer (t-1)				(0.003)		(0.008)
Employment	0.131***	0.130***	0.042***	0.009***	0.027***	0.021***
ln(Employment (t-1))	(0.001)	(0.001)	(0.003)	(0.001)	(0.003)	(0.003)
Observations	107,994	107,994	107,622	107,622	107,622	107,622
Number of firms					18,740	18,740
R-squared	0.45	0.45	0.46	0.81	0.03	0.09
Firm fixed effects	No	No	No	No	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	Yes	No	No
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year fixed effects	No	No	No	No	Yes	Yes

Notes: See notes to Table 4. Robust standard errors in parentheses; ** denotes statistical significance at the 5% level; *** denotes statistical significance at the 1% level. Includes constant and 3-digit sector or sector-year dummies and year dummies, not reported. The dependent variable is a dummy indicating whether the firm imports or not in that year.

Very similar results are obtained when estimating the effect of the Coface score on import status using exactly the same specifications. As shown in Table 5, one notable difference with export status is that the positive effect of productivity on the probability of being an importer remains strong and significant across the different specifications. Interestingly, I find that less financially-constrained firms have a higher probability of being importers. This is robust to including the full set of fixed-effects as well as the lagged importer status as shown in column (6). Whilst the effect of the score is stronger than in the case of exports, the coefficients are results are as significant as in the case of exporters. Import and export status are therefore correlated to credit worthiness in a very similar way.

3.2 Value, destinations, origins and products

Conditional on being a trader, it is also of interest to understand how credit constraints might affect the total value of exports or imports. Also, how might the number of countries being served or imported from and the number of products being traded be related to credit constraints? This is explored by specifying for each of these:

$$ln(y)_{i,t} = \alpha + \beta_1 CS_{i,t-1} + \beta_2 log(Employment) + \sum_{j=3} \beta_j FirmChar(j)_{i,t-1} + \delta_i + \delta_t + \delta_{st} + \varepsilon_{i,t} \quad (2)$$

where y is either total exports or imports value, number of destinations, number of origins or number of products, δ_i, δ_t and δ_{st} are respectively firm, year and sector-year fixed-effects. The result of such an OLS regression for each dependent variable are reported in Table 6, where

it appears that the lagged score affects positively and significantly total exports as well as the number of markets served by a firm. This is not true when looking at the number of products. This could be due to products being developed first for the domestic market of the firm: selling an additional product abroad has no incremental fixed cost to be overcome by the firm. In contrast, entering a new market requires some investment that can only be borne by firms that have low credit constraints. In the case of imports, the lagged score affects positively and significantly total imports as well as the number of products imported, in contrast with the corresponding result for exports. The coefficient on the number of origins is only statistically significant at the 10% level. A potential explanation for this result is that importers have no interest to import from many countries. The reason they are importing an input is that it is cheaper, better suited or of different quality than what they would obtain domestically. However, if they do not have a good financial health, foreign firms will be less willing to risk a payment default, limiting the range of their inputs they can import from abroad. These various results will be analysed more closely in section 4.

It is also interesting to note that in the case of exports, only total value are positively related to productivity while for imports, it is both the case of total value and the number of origins. A higher EBITDA is associated with higher total trade values as well as a larger number of countries and products for both imports and exports. This suggests that firms that reach a certain maturity make bigger margins on their products thus obtaining higher profitability and exports. A higher EBITDA might also reflect lower input costs which could be the result of a larger importing behaviour. Whilst the age of the firm and its wage levels are not significant, it appears that, unsurprisingly, multinational firms are also more likely to be "big exporters". This appears to be less the case for imports. Finally, the strong and large coefficient for the employment variable confirms that it is important to control for firm size when considering the trading decisions of firms.

Table 6: Total exports, destinations and products

Dependent variable:	EXPORTS			IMPORTS		
	Total value ln (Total exports value)	**Destinations** ln (Number of destinations)	**Products** ln (Number of products)	**Total value** ln (Total imports value)	**Origins** ln (Number of origins)	**Products** ln (Number of products)
	(1)	(2)	(3)	(4)	(5)	(6)
Score	0.081***	0.033***	0.022	0.061***	0.016*	0.047***
ln(Score (t-1))	(0.028)	(0.012)	(0.015)	(0.022)	(0.010)	(0.014)
Productivity	0.142***	0.015	-0.015	0.115***	0.025***	0.025*
ln(TFP Lev-Pet (t-1))	(0.030)	(0.012)	(0.016)	(0.024)	(0.009)	(0.014)
Operational profitability	0.180***	0.054***	0.063***	0.194***	0.051***	0.092***
ln(EBITDA (t-1))	(0.033)	(0.013)	(0.016)	(0.028)	(0.010)	(0.016)
Wage	-0.107**	-0.005	0.030	-0.092**	0.005	-0.014
ln(Wage (t-1))	(0.046)	(0.019)	(0.026)	(0.038)	(0.016)	(0.022)
Age	-0.018	0.052*	-0.011	-0.026	-0.011	-0.042
ln(Age)	(0.067)	(0.031)	(0.037)	(0.054)	(0.024)	(0.035)
Foreign	0.186***	0.092***	0.125***	0.061	0.028*	0.048**
0-1 dummy	(0.063)	(0.027)	(0.032)	(0.042)	(0.014)	(0.024)
Employment	0.443***	0.215***	0.270***	0.403***	0.197***	0.310***
ln(Employment (t-1))	(0.046)	(0.019)	(0.025)	(0.040)	(0.016)	(0.025)
Observations	32,009	32,009	32,009	34,817	34,817	34,817
Number of firms	6,304	6,304	6,304	6,722	6,722	6,722
R-squared	0.08	0.08	0.07	0.09	0.07	0.08
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Sector-Year fixed effects	YES	YES	YES	YES	YES	YES

Notes: See notes to Table 4. Fixed-effect ("Within") regressions. Robust standard errors in parentheses; ** denotes statistical significance at the 5% level; *** denotes statistical significance at the 1% level. Includes constant, sector-year and year dummies, not reported.

These results clearly establish the relationship that exists between credit constraints and exporting and importing characteristics, even once productivity, size, profitability and other firm characteristics are controlled for.

4 The effects of credit constraints over time

This section shows how credit constraints affect the dynamics of traders' behaviour. Given the openness of the Belgian economy and its size, the number of firms starting to export within the sample is too low to lead to meaningful results. I therefore focus on understanding the impact of credit constraints on the growth in total imports and exports, decomposing them through the extensive and intensive margins of exporters and importers through time, both at the destination and the product level. This can be written as:

$$\Delta V_{i,t} = \Delta C_{i,t} \times \Delta P_{i,t} \times \Delta I_{i,t}$$

where $\Delta V_{i,t}$ is the growth in the total value of exports or imports between t-1 and time t, $\Delta C_{i,t}$ is the change in the number of markets exported to or imported from, i.e. the extensive margin in terms of countries, $\Delta P_{i,t}$ is the change in the number of products exported or imported, i.e. the extensive margin in terms of products, and finally $\Delta I_{i,t}$ the change in the average value exported/imported per country-product, what I denote the intensive margin. These margins are considered in turn for exports and imports.

4.1 Extensive and intensive margin for exports

I find in section 3.2 that firms with higher values of total exports and serving more destinations are also likely to have a higher credit score. This result is now explored further by analysing the effect of credit constraints on the growth in total exports and its components. According to the idea that there is a fixed cost to be overcome to enter a new market, credit constraints should matter for the decision of existing exporters to start exporting to an additional country, affecting the extensive margin of exports in terms of destinations. Whilst it could affect the increase in the number of products exported if these need to be tailored to a different demand, it should not however affect the intensive margin. Adopting a firm fixed effect estimation, and controlling for sector-year and year fixed effects, the first column of Table 7 shows that the increase in total exports relative to the previous year is positively related to creditworthiness. This can be attributed to an positive relation with the number of destinations served as shown in column (2). The extensive margin in terms of products exported or the intensive margin of trade to a given destination, the dependent variables of columns (3) and (4), are not affected by credit constraints. Credit constraints affect the ability of firms to cover the fixed cost of exporting to an additional destination. Yet, once the fixed cost has been borne, changing the number of products or the amount exported per product-destination is not dependent on the availability of credit. The number of existing destinations served is included in the specification to capture together with the firm's age the existing exporting activity effects on destination margins, but the results are robust to excluding it from the regression.

The coefficients on productivity are not significant when considering the extensive margins suggesting that in a dynamic setting it is important to also consider other determinants of trading patterns. Besides, being part of a multinational positively affect the increase in the number of destinations and products exported but not the intensive margin. Finally, the export levels, both in value, products or destinations in t-1 affect both the total growth as well as all three margins negatively: firms are less likely to grow in all dimensions if they are already strong exporters.

Table 7: Extensive and intensive margins

Dependent variable:	EXPORTS				IMPORTS			
	Growth	**Destination Extensive margin**	**Product Extensive margin**	**Intensive margin**	**Growth**	**Origin Extensive margin**	**Product Extensive margin**	**Intensive margin**
	Δ ln (total value of exports)	Δln (number of dest.)	Δln (number of products)	Δln (mean value per prod. per dest.)	Δ ln (total value of imports)	Δln (number of origins)	Δln (number of products)	Δln (mean value per prod. per orig.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Score	0.053**	0.028***	0.019	-0.004	0.051***	0.015*	0.035***	-0.001
ln(Score (t-1))	(0.023)	(0.010)	(0.013)	(0.022)	(0.019)	(0.009)	(0.012)	(0.019)
Productivity	0.105***	0.014	-0.006	0.065***	0.072***	0.015*	0.015	0.013
ln(TFP Lev-Pet (t-1))	(0.025)	(0.010)	(0.013)	(0.019)	(0.020)	(0.008)	(0.012)	(0.016)
Operational profitability	0.060**	0.031***	0.044***	-0.020	0.137***	0.039***	0.062***	0.057***
ln(EBITDA (t-1))	(0.025)	(0.011)	(0.013)	(0.023)	(0.023)	(0.009)	(0.012)	(0.021)
Wage	-0.100**	-0.022	0.016	0.010	-0.063*	0.007	-0.012	-0.018
ln(Wage (t-1))	(0.044)	(0.019)	(0.025)	(0.039)	(0.037)	(0.015)	(0.021)	(0.035)
Age	-0.179***	-0.022	-0.067**	0.041	-0.166***	-0.054**	-0.102***	0.081**
ln(Age)	(0.054)	(0.027)	(0.033)	(0.047)	(0.046)	(0.022)	(0.029)	(0.041)
Foreign	0.080*	0.053***	0.080***	0.049	0.038	0.023**	0.034*	-0.001
Dummy for MNE(t-1)	(0.044)	(0.019)	(0.025)	(0.036)	(0.033)	(0.012)	(0.019)	(0.028)
Value of exports/imports at t-1	-0.605***			-0.352***	-0.698***			-0.366***
ln(imports or exports (t-1))	(0.017)			(0.014)	(0.017)			(0.015)
Number of countries at t-1		-0.663***				-0.758***		
ln(number of destinations (t-1))		(0.013)				(0.012)		
Number of products at t-1			-0.711***				-0.683***	
ln(number of products (t-1))			(0.011)				(0.013)	
Employment	0.287***	0.150***	0.207***	0.172***	0.312***	0.154***	0.227***	0.178***
ln(employment (t-1))	(0.039)	(0.017)	(0.023)	(0.034)	(0.036)	(0.015)	(0.021)	(0.028)
Observations	29,619	29,619	29,619	29,619	32,253	32,253	32,253	32,253
Number of firms	5,645	5,645	5,645	5,645	6,037	6,037	6,037	6,037
R-squared	0.30	0.34	0.37	0.12	0.33	0.39	0.35	0.13
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector-Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: See notes to Table 4. Firm fixed effect regressions ("Within" estimator). Robust standard errors in parentheses; ** denotes statistical significance at the 5% level; *** denotes statistical significance at the 1% level. Includes constant, not reported. Only observations in which the firm is exporting (columns 1-4) or importing (columns 5-8) are kept. Δ indicates the value of a variable at time t minus it's value at time t-1.

4.2 Extensive and intensive margin for imports

There is a strong statistical relationship between the growth of imports and the Coface score at t-1. However, in contrast with the results for exports, when decomposing it, credit worthiness appears as strongly significantly correlated with the extensive margin in terms of imported products rather than countries, as shown in columns (6) and (7) of Table 7. The coefficient for the extensive margin in terms of import origins is only significant at the 10% level. This suggests that liquidity matters for expanding the range of imported inputs, but not for importing from more destinations. Similarly to exports, the intensive margin is unaffected by credit constraints. Note that the coefficients on operational profitability, age, multinational status and employment are very similar to the case of export destinations.

A lower credit score can affect importing dynamic patterns for two reasons. First the firm might face a fixed cost in order to import more products from more markets if there is an information and search cost to be overcome to find a supplier of a specific input. This could be inside a country the firm already imports from or in a new origin country. In such cases, having a lower credit rating will imply the firm could be credit constrained and not have sufficient

liquidity to pay such a fixed cost. A second channel is related to the default risk reflected in the score: foreign companies will be less willing to take this risk if the importer has a lower credit rating. The results in Table 7 show that these two effects are stronger for the extensive margin in terms of products. They reinforce the findings from section 3.2 that considered the same questions in a static setting.These could reflect the fact that contrarily to exports where more destinations imply larger markets, the primary rationale for imports is the necessity to source inputs that are not available domestically. The novel finding is that at the firm level, the relationship between credit constraints and trade margins is different for imports and exports.

5 Conclusion

In this paper, I show that credit constraints matter for export and import volumes and patterns. A precise and complete dataset on trade transactions at the firm level for the Belgian manufacturing sector is combined to a unique and very useful yearly measure of credit constraints faced by firms, a creditworthiness score constructed independently by a credit insurance company. These allow me to examine the relationship between credit constraints and trade in a new way. My main contribution is to show that credit constraints matter across the spectrum, not only in cases of payment defaults and that they matter differently for exports and imports.

It is shown that firms which are less credit-constrained, more productive and profitable have a higher probability of being exporters or importers. Such firms are also likely to report larger total trade values. While credit constraints are positively associated with the total number of destinations exported, this is not true in the case of products. Conversely, the number of countries imported from is not correlated with credit constraints whilst the number of imported products is.

Finally, this result also holds in a dynamic setting by decomposing the growth of exports and imports. Credit constraints are not associated with a change in the number of products exported. However, I find that the growth in the number of destinations served is positively affected by the Coface score measure. This supports the hypothesis that entering a new market implies fixed costs for exporters. On the other hand, the reverse is true for imports: the incremental number of inputs imported by a firm is increased by a rise in its credit score whilst this will not affect strongly the number of countries of origin. This might reflect the impact of its financial situation on both a firm's potential to pay the fixed cost of sourcing an additional input from abroad, as well as the willingness of its potential suppliers to take the risk it might default.

These results confirm the link between credit constraints and export and import patterns. They also highlight the potential role of government agencies in reducing the fixed costs of entry to new markets or of importing new inputs. Exploring further the links between financial constraints and trading behaviour, by using firm level information on specific products' domestic sales vs exports, could shed further light on the links between the dynamics of trade and financial constraints.

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