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**INTER-ENTERPRISE CREDIT AND
ADJUSTMENT DURING FINANCIAL
CRISES: THE ROLE OF FIRM SIZE**

Fabrizio Coricelli and Marco Frigerio

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Abstract

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JEL Classification: N/A

Keywords: trade credit, Financial crises, SMEs

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Inter-Enterprise Credit and Adjustment During Financial Crises: The Role of Firm Size *

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September 2016

Abstract

Analyzing a large firm-level database for European countries, the paper shows that during the Great Recession trade credit amplified the liquidity squeeze on SMEs induced by the contraction of bank credit. Because of their generally weaker bargaining power in the inter-enterprise credit market, SMEs sharply increased their net trade credit and thus transferred financial resources to larger firms. The paper finds that the liquidity squeeze induced by trade credit had large negative effects on real activity by SMEs, contributing to the fall in employment, wages and investments.

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1 Introduction

The asymmetric impact of monetary policy across firms of different size has been a central theme in the so-called credit channel explaining contractionary effects of monetary tightening (Gertler and Gilchrist, 1994). Small and medium size firms (SMEs) are likely to suffer credit tightening more as they are unable to replace bank credit with alternative sources of financing, such as corporate bonds. Such asymmetric effects are likely to have been stronger during the Great Recession, as it has been the most severe financial crisis at the global level since the Great Depression. Therefore, it is worth asking whether SMEs suffered more than large firms during this episode and whether such asymmetric effect may account for the sharp output fall and the slow recovery during the Great recession, especially in Europe. The issue is particularly relevant in Europe because SMEs account for a large share of employment and value added in European countries. However, rather than on the role of frictions in bank credit for the heterogeneous transmission of the financial shock across different size classes, in this paper we focus on the role of frictions in trade credit. In this respect, one of the main frictions is likely to be the different bargaining power across firms of different size.

The macroeconomic dimension of trade credit and its connection with monetary/credit policy has been central to the monetary analysis in early post-War II period. For instance, in the influential Radcliffe Report (1959), which established the limits to monetary policy due to instability of money demand, trade credit played a central role as a way for firms to bypass the effects of monetary contractions. Such a theme was emphasized as well by Brechling and Lipsey (1963), Meltzer (1960) and Schwartz (1974). More recently, several contributions revived the interest on the macroeconomic dimension of trade credit. Ramey (1992) analyzed the relationship between money and trade credit in the US, while Kiyotaki and Moore (2001) stressed the role of trade credit chains in the magnification of idiosyncratic shocks. Raddatz (2010) provided empirical evidence on contagion effects of local shocks through trade credit chains. Furthermore, Love, Preve and Sarria-Allende (2007) and Love and Zaidi (2010) studied the behavior of trade credit during financial crises in 1990s in Asia and Mexico.

Following the macroeconomic approach, we focus on the liquidity transmission channel of trade credit and on the potential asymmetric behavior of trade credit across firms. During a phase of contraction in the supply of bank credit, trade credit may either provide a buffer or magnify the contraction in bank credit. Given our focus on firms heterogeneity and on the asymmetric effects of trade credit during the financial crisis, it is natural to focus on net trade credit, the dif-

ference between receivables and payables. Indeed, given that firms are generally both suppliers and customers in the supply chain and thus both lenders and borrowers in the credit chain, the liquidity effect acts through net trade credit. In fact, in normal times, net trade credit positions are not very large and the credit chain appears rather circular. Kalemli-Ozcan et al. (2014) have emphasized the strong correlation at the firm level between payables and receivables and Calvo and Coricelli (1996) highlighted the high degree of circularity of inter-enterprise credit in transition countries. We do not underestimate the importance of gross trade credit (receivables and payables) for the real equilibrium of a system. In fact, our focus on net credit is justified by our objective of detecting a transfer of liquidity from a group of firms, SMEs, to another, large firms, during financial crises. Therefore, our focus is on firms heterogeneity and on liquidity transfers across firms, rather than contagion effects through gross trade credit positions within production chains. In summary, our contribution is totally complementary to the analysis of gross trade credit and its impact on credit and production chains.

The importance of firm size has been emphasized in the analyses of trade credit. In particular, in the early literature there was a consensus on the redistribution of liquidity through trade credit from large to small firms (Radclyffe Report, 1959; Meltzer, 1960; Schwartz, 1974). The explanation rests on the idea that large firms are better endowed with liquid assets and, moreover, they have easier access to bank financing. However, in the empirical literature, the evidence on whether SMEs tend to be net recipients of trade credit has been mixed.¹ One aspect missing in the early literature is that SMEs may generally be overly represented as suppliers of inputs for larger firms. Therefore, for purely technological reasons, SMEs may be net suppliers of trade credit. The empirical analysis of determinants of net trade credit should thus disentangle the technological from the liquidity effects. In this paper, we tackle this issue by using the notion of *upstreamness* of production, namely the relative position of firms' production in the different stages of supply chains (Antras et al., 2012). Furthermore, in addition to firms' characteristics in terms of financial conditions and on the degree of upstreamness of their production, a key determinant of net trade credit is the relative bargaining power of firms in their credit relationship. Indeed, it is likely that large firms have stronger bilateral bargaining power with respect to SMEs, as large firms can more easily substitute their suppliers than SMEs can substitute one of their large customers. In our empirical analysis, we try to shed light on this aspect by using

¹Economic historians noted that SMEs may actually be net lender in the trade credit market (Thomas, 1978).

information from the input-output tables.

Closest to our work are the contributions by Love, Preve and Sarria-Allende (2007) and Love and Zaidi (2010), who investigate the behavior of trade credit during financial crises in Asia and Mexico during the 1990s. Their work is mainly aimed at showing that trade credit does not provide a buffer to the credit shock coming from the contraction of bank credit, typical of financial crises. Their focus is on gross trade credit, rather than net trade credit and the two papers concentrate one on large firms and the other on small and medium size firms.

We extend the previous literature on the role of trade credit during financial crises in four main directions. First, we focus on net trade credit as measure of liquidity pressure on firms, in line with early work by Meltzer (1960). Second, in relation to the potential asymmetric effects on SMEs, we introduce a novel approach to estimate differential bargaining power of SMEs, by using input-output tables to identify the average size of customer-suppliers. Third, we apply Angrist and Pischke (2008) two-stage approach to isolate the firm level, the industry level and country level determinants. Such two-stage approach allows us to tackle endogeneity problems and, at the same time, it allows us to properly identify industry and country level effects. Finally, we quantify the effects of net trade credit on firms' performance during the financial crisis, focusing on wage/employment changes and on investments.

Our main result is that during the Great Recession, European SMEs have been adversely affected by a sharp increase in net trade credit, which induced a squeeze in their liquidity. This phenomenon did not characterize large firms. Our econometric analysis shows that weaker bargaining power by SMEs in their inter-enterprise relationship contributes to explaining the asymmetric effect. Such effect varies as well depending on firms' characteristics, as more liquid SMEs are in a better position to provide trade credit to their customers. However, this may lead to a highly inefficient outcome, as better firms are those that suffer the larger liquidity shock through the trade credit market. In turn, the liquidity squeeze has a significant negative impact on wages and employment, as well as on investments, thus inducing long-term negative effects on SMEs' growth.

The paper is structured as follows. Section 2 briefly reviews the related literature. Section 3 contains our empirical analysis on determinants of the change in net trade credit during the Great Recession in Europe. Section 4 examines the potentially negative impact of net trade credit on investments and employment. Section 5 concludes.

2 The liquidity channel of trade credit: A brief overview of the literature

Trade credit theories can be divided in two types, one focusing on net trade credit and the other on gross trade credit. The net trade credit literature emphasizes the *redistribution* of liquidity through the trade credit channel. Liquidity-rich firms support liquidity-poor firms by extending trade credit during periods of tightening of financial constraints. This approach dominated the literature until the end of 1970s. Meltzer (1960), Brechling and Lipsey (1963), Schwartz (1974), in addition to the Radcliffe Report (1959) are examples of the early literature.

Theories based on gross trade credit have been pioneered by Ferris (1981), who emphasized the transaction cost channel of trade credit. According to Ferris (1981), firms facing an uncertain timing of delivery of goods can economize in cash inventories by relying on trade credit. As firms are typically both customers and suppliers in inter-enterprise transactions, irrespective of net trade credit positions, they can minimize their cash holdings by allowing inter-enterprise transactions to be effected through trade credit. Without trade credit, firms would have to hold large amounts of cash (or liquid assets) in order to effect their transactions. Therefore, for the enterprise sector as a whole, trade credit permits economizing on cash holdings. The higher the degree of circularity of the system (the closer, for each firm, is the value of purchases and sales to other firms), the closer net debt positions are to zero. Kalemli-Ozcan et al. (2014) develop a theory and provide empirical evidence on the importance of gross trade credit flows, by showing a high degree of correlation between payables and receivables at the firm level. Kim and Shin (2012) develop a theory of gross trade credit based on moral hazard in production chains. In activities that are not fully vertically integrated, trade credit provides a commitment to higher effort by firms involved in the production chain. As the expected returns to activities by each producer in the chain depend on the success in selling the final product at the end of the chain, trade credit creates incentives for all input producers to provide effort in order to ensure the success of the whole production chain. Interestingly, from such a model receivables are a function of payables and of sales of each firm. Furthermore, the model implies a Cobb-Douglas relationship between receivables on one side and payables and sales on the other, which ensures constant returns to scale in trade receivables. The important insight in this approach is that microeconomic theories of corporate finance trying to explain trade debt or trade credit are not very relevant, as each firm is both debtor and creditor in the production chain. Whether, on

net, a firm ends up being a creditor or debtor depends mainly by its position in the production chain. Kim and Shin theory is thus an equilibrium theory of trade receivables for an entire sector or country. Nevertheless, their theory implies that firms with different relative size are going to be characterized by different levels of net trade credit. Specifically, if a customer firm is large relative to its supplier, she is going to be a net creditor and in explaining her receivables sales will have a larger weight relative to payables. A relevant question is whether trade credit as a commitment device plays the same role in "normal" times and in financial crises. Conceivably, financial crises induce a sharp increase in uncertainty on the fate of the whole production chain, thus weakening the scope for trade credit as a commitment device.

Kiyotaki and Moore (2001) develop a theory of credit chains that encompasses both the gross and net trade theories. Indeed, in their model liquidity is transferred from liquidity-rich to liquidity-poor firms, but this occurs through a potentially long chain, which serves as contagion channel for localized shocks.

What happens during financial crises? Several studies analyzed the behavior of trade credit during financial crises, focusing on the relationship between bank and trade credit. Norden and van Kampen (2015) find that the substitutability between bank debt and trade credit tends to weaken during crises. As a result, trade credit behaves procyclically, thus amplifying the output fall during recessions. Nilsen (2002) argues that trade credit can help to redistribute resources from healthy to vulnerable firms, thus alleviating the negative effects of monetary contractions.² By contrast, Raddatz (2010) argues that during financial crises, rather than redistributing resources, trade credit is a source of contagion of financial shocks through the production chain, giving rise to a significant amplification mechanism.³

Therefore, liquidity effects of trade credit, in particular during financial crises, operate through two distinct channels.

The first channel, the *contagion channel*, may induce an evaporation of liquidity and thus determine a potential break-up of production chains, with a consequent output collapse.⁴

The second channel, the *redistribution channel*, may work in an ambiguous way during financial crises. One possibility is that liquidity-rich firms transfer resources to liquidity poor firms, thus alleviating the adverse effects of contraction

²See also Biais and Gollier (1997).

³See also Boissay and Gropp (2013).

⁴For instance, this effect has been noted during the Great Recession in connection with the collapse of international trade (Mora and Powers, 2009).

in bank credit. In this case, we would talk about a *substitution* effect between bank and trade credit. By contrast, trade credit can collapse as a result of the crunch in bank credit. This *complementarity* effect is consistent with the fact that in *normal times* commercial banks are likely to play *de facto* the role of lender of last resort for the trade credit market, as firms can access bank loans to absorb payments problems affecting individual firms. During a financial crisis banks are unlikely to play such role of lender of last resort, as they are the source of the financial shock (Coricelli and Frigerio, 2015).

In sum, the contagion channel can be seen as a link between production and credit chains. In normal times, the availability of trade credit may increase the division of labor by inducing a finer specialization in the production of intermediate goods through the production chain. Trade credit may thus play an important role in supporting more efficient resource allocation in normal times. However, the longer a production chain is, the higher is the exposure of the system to a potential collapse induced by an interruption of credit flows. This effect works irrespective of net credit positions and it works even in an environment of homogeneous firms. By contrast, the redistribution channel implies heterogeneity among firms. In this case, trade credit strongly depends on firm-level characteristics, some of which are undoubtedly related to firm size. Berger and Udell (1998), for example, show that trade credit is an essential source of financing for firms at an early stage of development, which are typically SMEs. Moreover, Giannetti, Burkart and Ellingsen (2011) find that suppliers provide more credit to customers with a higher market power, which is in turn related to firm size. Therefore, our focus on trade credit intersects with the broader theme of SMEs' dependence on external financing and thus the exposure of SMEs to financial shocks (see RELTIF Green Paper ⁵).

2.1 Trade credit and SMEs during financial crises

The behavior of SMEs in the trade credit market during financial crises has also been analyzed in the literature.⁶

⁵Giovannini et al. (2015).

⁶Carbo-Valverde, Rodriguez-Fernandez and Udell (2013) find that during the last financial crisis the capital expenditure of credit-constrained Spanish SMEs was increasingly funded with trade credit. However, the potentially higher importance of trade credit for the external financing of SMEs contrasts with the fact that large firms are generally in a better position than SMEs to negotiate the terms of payment of inter-enterprise credit and of credit to final customers (households and the public sector).

Since trade credit often involves firms that are tied by long-term relationships, suppliers are usually keen to provide trade credit to their customers in order to deal with potential sunk costs (Cunat, 2007). Therefore, when a relevant product-market relationship exists, trade creditors may be even more interested than banks to provide credit to troubled customers (Wilner, 2000). SMEs may lose important clients if they impose shorter payment periods. This may paradoxically lead SMEs to extend (and accept) terms of payment that are more favorable to large firms, in spite of the fact that their access to bank credit is already more constrained.

Love and Zaidi (2010) study the behavior of trade credit of SMEs in the context of the Asian financial crisis in the 1990s. During this episode, vulnerable and credit-constrained companies tend to reduce their supply of trade credit. However, vulnerable *small and medium private* firms are also unable to increase their reliance on trade credit (i.e. payables), either because their suppliers are in turn financially constrained or because they are not willing to assist firms that are financially constrained, especially if these customers have weak market power.⁷ This result contrasts with those obtained in Love, Preve and Sarria-Allende (2007) for a sample of large firms during the Asian and Mexican crises of the 1990s, in which they find that *large and publicly traded* firms manage to obtain a relatively higher amount of trade credit from suppliers in the aftermath of the crisis.

In this paper, focusing on Europe, we investigate whether the liquidity redistribution from SMEs to large firms has a more general application, and specifically whether it has been at work during the Great Recession. Accordingly, this paper analyzes the positioning of European SMEs with respect to trade credit and discusses the changes brought about by the global financial crisis.

3 Trade Credit and the financial crisis: Empirical analysis

Using a large firm-level dataset, we try to understand whether during (and in the aftermath of) the Great Recession, trade credit constitutes a relevant alternative source of financing for SMEs, or whether it contributes to drain available resources from their balance sheets to the benefit of large companies.

⁷See also Brennan, Maksimovics and Zechner (1988).

3.1 Data sample

Our analysis is carried out at the firm level using the Bureau Van Dijk Amadeus database. Firm-level data allow to take into account heterogeneity among firms and specific firm characteristics (such as size, age, financial health, profitability), which cannot be evaluated when analyzing macro-aggregated data. We developed a well-defined procedure in order to prepare and clean up data obtained from the database. First, in Amadeus there are many firm-year observations where the value of accounts payables and/or receivables is equal to zero. In our research we embrace the well-founded opinion that in many cases the zeros include missing or unknown information on trade credit. As a consequence, we only consider firms with positive values of account payables and account receivables.

Furthermore, data quality controls were used to drop firms with missing or unreliable data for all the variables of interest and outliers for determined financial ratios. In particular, the values of variables of interest below the first percentile and above the 99th percentile were discarded.

Finally, firm-year observations are included in our final sample only on the condition that they are available for at least two consecutive years, in order to guarantee their reliability and the existence of lagged data for the regressions.

As a result of this cleaning procedure, our final sample includes nearly 2 million firms and 8 million firm-year observations. The panel is unbalanced and the observations cover a period of ten years from 2004 to 2013. Firms in the sample are located in 31 European countries, although data coverage varies across countries. About 60 percent of the observations are related to firms located in France, Italy and Spain, whereas 15 percent are located in the Central-Eastern Europe. SMEs represent 98 percent of the total sample. The size classes are determined using information on the number of employees (when recorded) and turnover. The classification is based on the ceilings defined by the European Commission.⁸

The empirical analysis requires a sufficiently detailed industry classification of the firms included in the sample. In particular, we subdivide firms by NACE Rev.2 codes at the three-digit level, after excluding firms without an available code. Furthermore, we exclude industries that are outside the non-financial business economy: agriculture, forestry and fishing (section A of NACE Rev.2), financial and insurance activities (section K), public administration, education, health,

⁸Micro enterprises employ fewer than 10 workers and have an annual turnover not exceeding 2 million euro. 50 workers and a turnover of less than 10 million euro are the corresponding ceilings for small firms. For medium-sized enterprises, the cut-off points are 250 workers and a turnover of less than 50 million euro. The remaining firms are classified as large.

entertainment (sections from O to R) and other service activities (section S with the exception of division S95, repair of computers and personal and household goods). Following Klapper, Laeven and Rajan (2006), we also exclude mining and quarrying (section B) and utilities (sections D and E), which include highly regulated and state-owned firms. As a consequence of these exclusions, the final dataset is comprehensive of 199 NACE industries at the three-digit level. Most firms are almost equally distributed within the following activities: manufacturing (17.2 percent), construction (16.9 percent), wholesale trade (14 percent), retail trade (15.4 percent) and business services (14.6 percent). The remaining observations are in real estate activities (7.4 percent), transport and communication (8.9 percent), accommodation and food services (5.5 percent).

3.2 Net trade credit and firms' characteristics

Our main variable of interest at the firm level is the Net Trade Credit to Sales ratio, *NTCS*, with such ratio multiplied by 360 so that it can be expressed in terms of days, as a duration indicator. Negative (positive) values of net trade credit identify those firms that are net borrowers (lenders) with respect to trade credit.

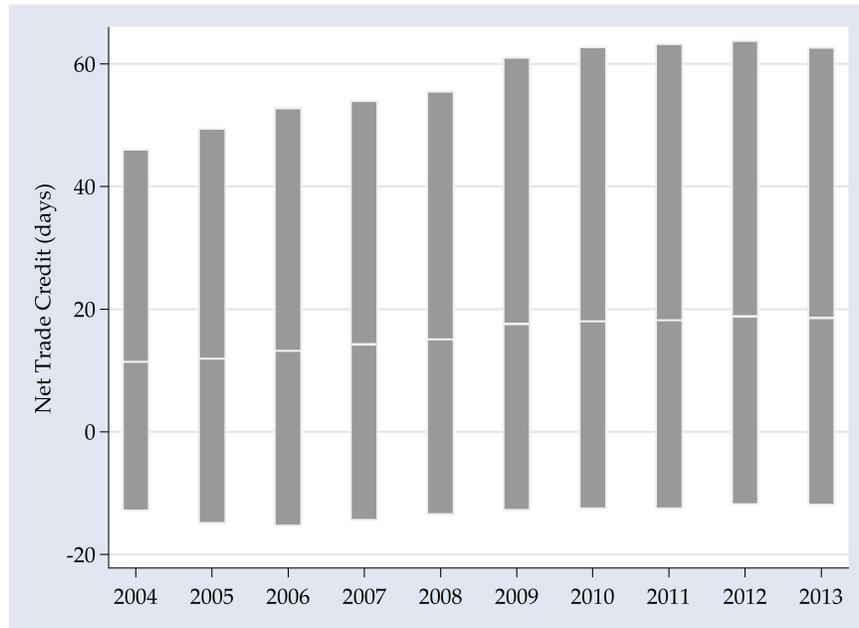
Fig. 1 shows that, throughout the sample period, the median level of *NTCS* increases from 11.4 days in 2004 to about 18 days in the aftermath of the financial crisis, i.e. the period 2010-2013. Therefore, with the crisis approaching its peak the exposure of the median firm to the rest of the system in terms of trade credit increases and, in later years, it remains at levels that are higher than those prevailing in pre-crisis years. In addition, heterogeneity is very high around the median values and it reaches its maximum levels in 2012, when the difference between the 75th percentile and the 25th percentile is equal to 75.8 days.

Fig. 2 provides data on *NTCS* of non-financial corporations broken down by macro-regions, age, size and industry group. These are time-invariant or slowly changing factors that can influence the levels of net trade credit across firms.

When differentiating by country groups (chart A), median values not only depend on specific country characteristics but also on the distribution of firms in each country. Looking at median values, net trade credit ratio tends to be higher in South-Western Europe and lower in Eastern Europe, with North-Western Europe lying in the middle.

Interestingly, net trade credit in our final sample shows a non-linear relationship with respect to firm size (chart B). Median levels of net trade credit are higher for small and medium enterprises (respectively 20.5 and 19.9 days) and lower for micro and large enterprises (respectively 14.5 and 16.2 days). However, hetero-

Figure 1: Net Trade Credit to Sales by Year



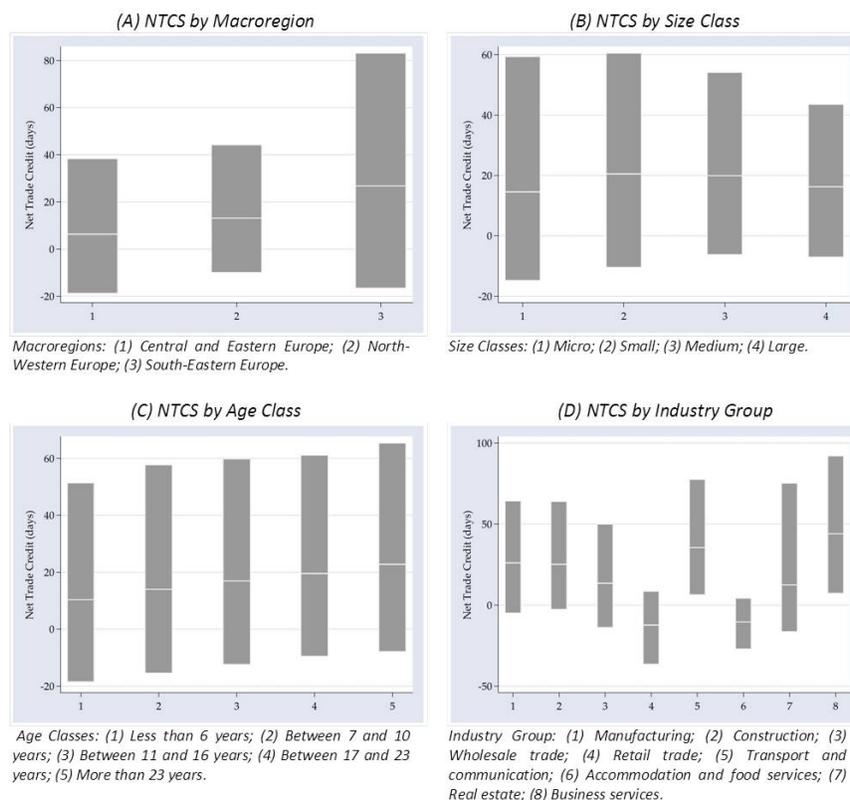
Inter-quintile range and median level of *NTCS* by year.

generosity within each class decreases with size and the more indebted firms (i.e. the lowest 25th percentiles, as positive net trade credit indicates a lending position) belong to the micro and small size classes.

Net trade credit also increases with the age of companies (chart C). Median values range from 10.3 day for youngest firms (first quintile by age corresponding to firms less than 6 years old) to 22.7 for oldest firms (fifth quintile by age corresponding to firms more than 23 years old). Consistently with Berger and Udell (1998), young firms face larger obstacles to borrowing funds from external sources and thus they are more likely to borrow from more established suppliers, while being more reluctant to lend to their customers.

Finally, the impact of trade credit on the balance sheet of a firm is strongly influenced by technological characteristics. As shown in Fig. 2, the median value of net trade credit is negative in *Retail Trade* and in *Accommodation and Food Services* (respectively -12.4 and -10.4 days), revealing that most of the enterprises within these industry groups are net borrowers in terms of trade credit. By contrast, *Business services* and *Transport and Communication* are the industry groups

Figure 2: Net Trade Credit to Sales by Year



Inter-quintile range and median level of *NTCS* by cluster.

with the highest positive values of net trade credit (44.1 and 35.5 days).

We next examine heterogeneity across industries by analyzing *NTCS* at the three-digit level industry classification. To emphasize structural characteristics, we first focus on pre-crisis values of *NTCS* for all the 199 industries within our sample. First, following the procedure applied in Raddatz (2010),⁹ we obtain a representative measure of *NTCS* for each firm in the sample by taking the firm-level median across the pre-crisis period 2004-2007. Then, the median of these

⁹Raddatz (2010) measures the relative use of trade credit across US manufacturing industries through two main ratios: the relative payables financing and the relative short-term debt to payables.

representative measures is taken within each three-digit NACE industry in order to define the representative pre-crisis ratios for each industry in Europe. These representative ratios are presented in Appendix B.1 (Table 15). Pre-crisis *NTCS* ranges from -31.5 days in *Retail Sale of Cultural and Recreation Goods in Specialized Stores* to 68.1 days in *Accounting, Bookkeeping and Auditing Activities; Tax Consultancy*.

This ranking seems to be influenced by the relative position in the production chain of each industry. Such relative position can be measured in relation to the degree of upstreamness of each sector. Upstreamness is defined as the average distance of any individual industry from final-good production. Antras et al. (2012) construct their measure of upstreamness using the US benchmark Input-Output (I-O) Tables from Bureau of Economic Analysis (BEA), which comprises 426 industries. We use their measure, under the assumption that upstreamness is a rather stable characteristic of industries across different countries.¹⁰ After reclassifying US industries in accordance to the NACE Rev.2 definitions, we apply the original procedure of Antras et al. (2012) to the reclassified industries in order to derive the upstreamness variable.¹¹

The values of upstreamness across NACE industries are listed in Appendix B.2 (Table 16). They range from a minimum of 1.007 for the *Manufacture of Motor Vehicles* to a maximum of 3.537 for the *Manufacture of Refractory Products*. By construction, these values can be interpreted as the number of production stages that separate a given industry from final costumers.¹²

Fig. 3 suggests a positive correlation between upstreamness and pre-crisis levels of *NTCS* (the correlation coefficient is 0.44). The net trade credit ratio is higher among those suppliers (upstream industries) that are more distant from the final customers. By contrast, net borrowers (negative values of *NTCS*) are concentrated among those (downstream) industries that are closer to the final customers.¹³ On

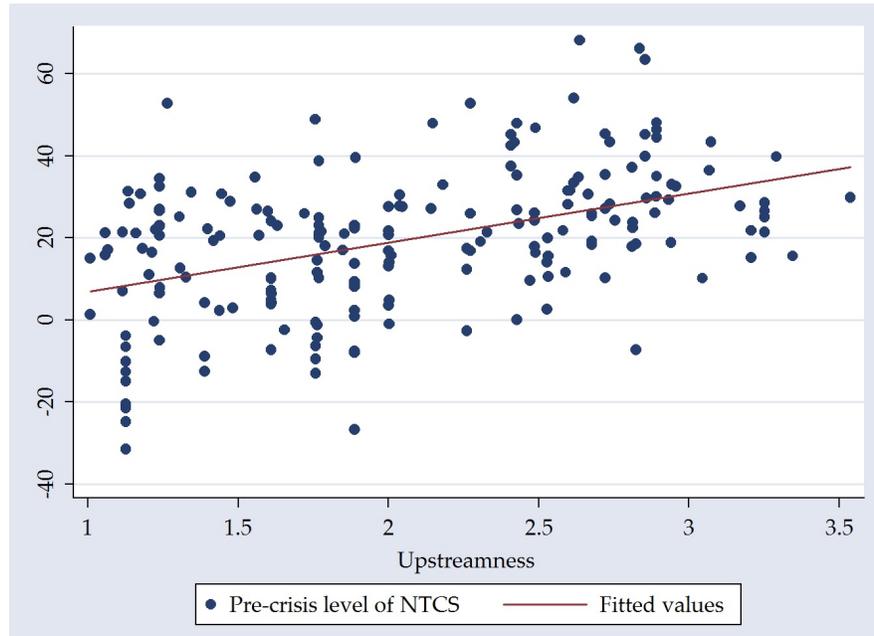
¹⁰Moreover, using European I-O tables, which are much less disaggregated, would have implied focusing on a much smaller, and thus more aggregated, set of sectors.

¹¹The concordance between US industries in the US benchmark I-O Tables and industries in the NACE Rev.2 classification is not perfect. The reclassification requires some minimal approximation and the aggregation within subgroups of NACE industries. Consequently, we finally obtain only 111 distinct values of upstreamness versus 199 NACE industries at three-digit level. So, some NACE industries in our ranking share the same level of upstreamness.

¹²Motor vehicles directly go to final customers while refractory products enter into use in production processes roughly 2.5 stages before final use.

¹³According to Kalemli-Ozcan et al. (2014), this result can be explained by referring to incentive compatibility constraints. In the production chain, the upstream firms are further away from their customers, and thus from the effects of their actions (low or high effort). As a result, they have

Figure 3: Upstreamness and pre-crisis *NTCS* by Industry



average, *NTCS* increases by 11-12 days for each additional stage of distance from final customers.

Moving to firm-level characteristics, Table 1 presents descriptive statistics on the relevant firm-level ratios. *Cash* is the ratio of cash and cash equivalent over total assets, assumed to be a good proxy of firms' liquidity. *Tangibility* is the ratio of tangible fixed assets over total assets. *Leverage* is the sum of long-term debt and loans divided by total assets. *ShortLev* is a possible alternative of the *Leverage* measure, considering only loans rather than the sum of long-term debt and loans, i.e. the short term. Finally, *Profitability* is operating profit over total assets, whereas *Cfw* is cash flow to total assets. Cash flow is obtained as the sum of profit (loss) for the period and depreciation.

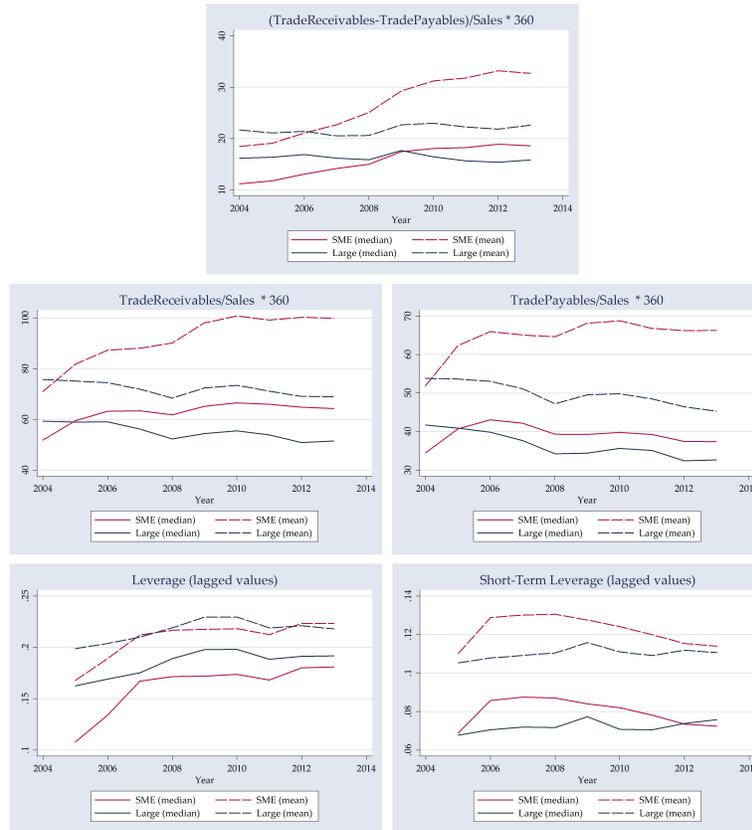
lower incentives for effort. Trade credit can provide the right incentives for higher effort, as the return to upstream firms depends on the efficient working of the whole chain.

Table 1: Summary Statistics (averages over 2004-2013)

SMEs							
Variable	Obs.	Mean	p25	Median	p75	St.Dev.	
Dep. Variable:							
NTCS	7,694,813	28.28	-13.19	16.48	59.24	97.31	
Control Variables:							
Cash	7,697,052	0.16	0.02	0.09	0.25	0.19	
Tangibility	7,773,541	0.21	0.04	0.12	0.31	0.23	
Leverage	7,770,109	0.15	0.00	0.06	0.26	0.19	
ShortLev	7,768,375	0.06	0.00	0.00	0.08	0.11	
Profitability	7,693,875	0.08	0.01	0.05	0.13	0.13	
Cfw	7,694,884	0.09	0.03	0.07	0.14	0.11	
Large companies							
Variable	Obs.	Mean	p25	Median	p75	St.Dev.	
Dep. Variable:							
NTCS	155,276	21.86	-7.10	16.23	43.60	64.03	
Control Variables:							
Cash	152,843	0.08	0.01	0.04	0.10	0.11	
Tangibility	155,597	0.29	0.10	0.25	0.43	0.22	
Leverage	155,369	0.18	0.00	0.12	0.31	0.19	
ShortLev	155,148	0.08	0.00	0.02	0.12	0.11	
Profitability	155,151	0.07	0.02	0.05	0.11	0.10	
Cfw	154,967	0.09	0.04	0.08	0.13	0.09	

Source: our elaboration on Amadeus data

Figure 4: Descriptive Statistics by Firm Size and Year



Our elaboration on AMADEUS data

3.2.1 Net trade credit and time-varying characteristics of the firms

Looking at the behavior of trade credit over time, Fig. 4 suggests that the dynamics of net trade credit has been different across firms of different size. In the ten years considered, net trade credit shows a much stronger increase for SMEs than for large firms. Furthermore, there is much larger asymmetry in the distribution of net trade credit in SMEs than in large firms, as shown by the larger difference between the mean and median values. In addition, these differences amplify as a result of the crisis.

Empirical data show that the increase of *NTCS* among SMEs is mostly due

to an increase of account receivables relative to sales, which is not accompanied by a corresponding increase in the ratio of account payables to sales. By contrast, in large firms both receivables and payables tend to decrease with respect to sales, and thus *NTCS* remains essentially stable. Therefore, the extension of credit maturity penalizes only SMEs.

Fig. 4 also shows the behavior of *Leverage* and *ShortLev* within the same sample. Interestingly, SMEs are characterized by a decline in Short-Term Leverage in the crisis years, which signals that the increase in net receivables of SMEs takes place in a context of increasing pressure on liquidity needs induced by the reduction on bank loans.

In Table 2, we report as well the results of an ANOVA analysis that permits to better quantify the changes in trade credit over time (see Love, Preve and Sarria-Allende, 2007). Specifically, we compare the pre-crisis years 2005-2007 with different periods during the crisis: 2008 as the starting year of the global financial crisis; 2009 as the year with major negative effects on the real economy; 2010-2011 as the initial recovery period; 2012-2013 as a second stage of difficulties for many countries, particularly in Europe's periphery. The analysis is conducted separately for SMEs and large firms.

Results from the ANOVA analysis confirm that the increase in net trade credit with respect to pre-crisis years is much larger among SMEs than in large companies and it is mostly due to the increase in receivables-to-sales ratios. The increase among SMEs is statistically significant starting from 2008 and continuously increases until 2012-2013. By contrast, the marginal increase among large companies attenuates after 2009 and its statistical significance declines.

Variables in the ANOVA analysis are all expressed in number of days. This implies that for SMEs the increase in *NTCS* reaches almost 12 days in 2012-2013, which corresponds to an increase of approximately 55 percent compared to pre-crisis levels.

The dynamics of *NTCS* for SMEs is dominated by the increase in receivables, coupled with a substantial stability of payables. For large firms, the fall in receivables is consistent with findings in Love, Preve and Sarria-Allende (2007). However, in contrast with their analysis, showing an increase in payables, we find that large firms reduced as well their payables.

In the next paragraph, we introduce a more detailed econometric analysis in order to identify the determinants of the dynamics of net trade credit across firms and years.

Table 2: ANOVA Analysis

SMEs				
Variable	2008	2009	2010-2011	2012-13
	vs. Pre-Crisis	vs. Pre-Crisis	vs. Pre-Crisis	vs. Pre-Crisis
Receivables/Sale	4.0097 (0.000)	11.9603 (0.000)	13.7631 (0.000)	13.9529 (0.000)
Payables/Sales	-0.0151 (1.000)	3.4713 (0.000)	3.0459 (0.000)	1.6015 (0.000)
NTCS	3.8980 (0.000)	8.0600 (0.000)	10.3310 (0.000)	11.7512 (0.000)
Large companies				
Variable	2008	2009	2010-2011	2012-13
	vs. Pre-Crisis	vs. Pre-Crisis	vs. Pre-Crisis	vs. Pre-Crisis
Receivables/Sale	-5.2746 (0.000)	-1.2676 (0.605)	-1.3743 (0.122)	-4.6537 (0.000)
Payables/Sales	-5.2643 (0.000)	-2.9362 (0.000)	-3.3143 (0.000)	-6.5904 (0.000)
NTCS	-0.3664 (1.000)	1.6873 (0.039)	1.6468 (0.005)	1.2302 (0.075)

The two tables report the difference in means between the periods indicated in each column and the pre-crisis years 2005-2007. The corresponding p-values, computed using the Bonferroni-adjusted significance level, are reported in parenthesis.

3.3 Basic regressions

In line with Love, Preve and Sarria-Allende (2007), we start with a simple model, which is estimated with firm-fixed effects.

The basic model is as follows:

$$NTCS_{i,t} = \alpha_i + \sum_{j=1,2} \beta_j \cdot Period_j + \beta_3 \cdot X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where α_i and $\varepsilon_{i,t}$ represent respectively a firm fixed effect and the error term. $X_{i,t-1}$ is the set of control variables that we introduced in section 3.2 (see Table 1). All variables in $X_{i,t-1}$ have a one-year lag to reduce endogeneity problems. $Period_1$ is the dummy variable for the period 2008-2011, which isolates the initial period of the financial crisis. $Period_2$ is a second dummy for the next time period, 2012-2013, characterized by a second stage of recessions and financial turmoil, associated with the sovereign debt crisis. The basic model compares $NTCS$ in 2008-2011 and 2012-2013 with $NTCS$ in the pre-crisis years 2005-2007, after controlling for some time-variant firm characteristics.

We estimate the basic model separately for SMEs and large firms. Table 3 presents the results. Standard errors are obtained after clustering errors on country and time, in order to take into account possible correlation among error terms within each country-year pair.

The inclusion of firm fixed effects does not alter the results of the previous graphical and ANOVA analyses. $NTCS$ significantly increases in crisis years, especially among SMEs. In 2012-2013 there is a further increase which affects only SMEs, while in large companies $NTCS$ returns to pre-crisis levels.

Moreover, the main results do not change when we include control variables (columns 2 and 4). Coefficients on *Cash* and *Tangibility* are negative, while the coefficient on *Leverage* is positive. All else equal, an increase in liquidity and tangible assets predicts a lower willingness of the firm to provide trade credit or its higher need of external financing from suppliers. An increase in *Leverage* anticipates exactly the opposite behavior.

The positive coefficient on *Cfw* implies that, *ceteris paribus*, larger cash flow is associated with higher ability to extend trade credit to customers, relative to trade credit received from suppliers. The negative coefficient on *Profitability* in the regression for SMEs (column 4) may seem counter-intuitive, but it could signal that businesses losing profitability are more willing extend credit in order to retain customers. This result is not new in the literature on trade credit, as emphasized

Table 3: Basic regressions

Dependent Variable: NTCS				
	Large Companies		SMEs	
	(1)	(2)	(3)	(4)
Y2008-2011	1.44*	1.50**	8.44***	8.34***
	[0.76]	[0.73]	[2.07]	[2.07]
Y2012-2013	0.47	0.76	15.25***	15.18***
	[1.00]	[0.93]	[3.14]	[3.05]
Cash (lag)		-17.21***		-15.11***
		[3.45]		[3.06]
Tangibility (lag)		-21.51***		-26.72***
		[2.99]		[3.18]
Profitability (lag)		10.57***		-6.35**
		[2.98]		[2.84]
Cfw (lag)		8.92**		16.65***
		[3.99]		[2.96]
Leverage (lag)		14.77***		17.03***
		[2.19]		[2.34]
Firm F.E.	YES	YES	YES	YES
N	146,062	140,952	7,422,076	6,964,200
r2	0.74	0.75	0.73	0.75

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Cluster-robust standard errors in brackets, after clustering by country-year. The set of dummies includes fixed effects by firm (coefficients not reported).

in Petersen and Rajan (1997).¹⁴

3.4 Empirical analysis of heterogeneous firm responses

The primary objective of our analysis is to assess how firm characteristics may affect the dynamics of net credit during the crisis. The behavior of trade credit at the firm level can vary depending on three dimensions: firms, country and industry. Consequently, our analysis is complicated by the fact that not all the explanatory variables that we are interested in are measured at the firm level. Mixed variables that are defined at different levels (i.e. that are not unique among firms within the same country or industry) may lead our regressions to underestimate the true standard deviations (Moulton, 1986) and may thus lead to an incorrect computation of the statistical significance of the coefficients.

We address this issue by implementing a two-step estimation approach, as suggested by Angrist and Pischke (2008). In the first stage, we estimate the impact of firm-level characteristics on the heterogeneous dynamics of *NTCS*, controlling for country, industry, country-period and industry-period fixed effects. In the second stage, which is based on a standard OLS model, we focus on the influence of country-level and industry-level characteristics on *NTCS*. Indeed, the dependent variables of the second stage are the coefficients of the country-period dummies and industry-period dummies that are estimated in the first stage.

In the first step, we introduce a vector of regressors defined at different levels:

- a. firm-level fixed effects α_i , which automatically incorporate time-invariant or slowly changing characteristics (such as country, industry and size);
- b. the two period dummies, $Period_1$ and $Period_2$, respectively indicating the time intervals 2008-2011 and 2012-2013;
- c. period-varying country dummies, obtained as the interaction term between $Period_j$ and $Country_z$;
- d. period-varying industry dummies, obtained as the interaction term between $Period_j$ and $Industry_k$;
- e. firm-level time-varying firm characteristics, represented by the set of lagged control variables $X_{i,t-1}$ already introduced in our basic regressions;

¹⁴Petersen and Rajan (1997) state that “firms in trouble may use the extension of credit to attempt to maintain their sales. This leads to a possible explanation of why profits are negatively correlated with receivables”.

- f. the interaction of period dummies $Period_j$ with time-varying firm characteristics, such as $Leverage_{i,t-1}$ and $Cfw_{i,t-1}$, or alternatively with time-invariant firm characteristics, such as dummy variables $Size_l$ distinguishing firms across 4 size classes (micro, small, medium and large).

The estimated coefficients on the interaction terms in (f) explain how changes in $NTCS$ depend on relevant characteristics at the micro level, including firms' financial position and their size class.

Table 4 presents the results of the first stage regressions.

In line with the results of our basic regressions, period dummies (non reported in the table) indicate that, *ceteris paribus*, $NTCS$ is about 9.5 days higher in 2008-2011 with respect to pre-crisis years and 17 days higher in 2012-2013. Even the estimated coefficients on time-varying firm characteristics are consistent with basic regressions.

Columns 1 and 2 show the heterogeneous dynamics of $NTCS$ for firms in different size classes.¹⁵ Column 2, in particular, reveals that the inclusion of control time-dependent variables does not change the results obtained in Column 1. The dummy for the *Micro* size class is omitted, so that the coefficients on the interaction term represent the differential effects with respect to the lowest size class. The coefficients on the interaction terms become more negative as we pass from smaller size classes to larger ones. This result seems to confirm that in crisis years 2008-2011 inter-enterprise credit tends to drain more financial resources than before the crisis from smaller firms to the benefit of larger companies. In 2012-2013 this heterogeneous impact of size classes on trade credit becomes stronger.

The differential impact of size classes on the dynamics of $NTCS$ may not reflect a pure size effect, but effects associated with characteristics that are strongly correlated with firm size. Among these characteristics, two could be potentially relevant. The first is firm age. Interestingly, when substituting *Age* quintiles to the *Size* dummies, we do not obtain an equally significant differential effect. This suggests that the differential effect across size classes cannot be attributed to an implicit comparison of younger firms versus more established companies. The second characteristic that could be strongly correlated with firm size is the market power of individual firms. From the Amadeus dataset we do not have informa-

¹⁵The size of firms included in the dataset is inevitably linked to the distribution of the sample across different industries and countries. Therefore, the inclusion in our regressions of fixed effects by firm, country-period and industry-period is necessary in order to distinguish issues involving the size of a firm (SMEs vs. large companies) from issues related to other specific characteristics of individual industries or countries.

Table 4: Heterogeneous firm responses

Dependent Variable: NTCS				
	(1)	(2)	(3)	(4)
Y2008-2011*Small	-2.61*** [0.14]	-2.49*** [0.14]		
Y2008-2011*Medium	-7.92*** [0.22]	-7.70*** [0.22]		
Y2008-2011*Large	-9.49*** [0.32]	-9.55*** [0.32]		
Y2012-2013*Small	-5.45*** [0.18]	-5.31*** [0.18]		
Y2012-2013*Medium	-14.77*** [0.29]	-14.64*** [0.29]		
Y2012-2013*Large	-16.73*** [0.41]	-16.91*** [0.42]		
Cfw (lag)		16.41*** [0.72]		16.33*** [0.72]
Y2005-2007*Cfw(lag)			14.19*** [0.81]	
Y2008-2011*Cfw(lag)			15.99*** [0.77]	
Y2012-2013*Cfw(lag)			19.75*** [0.87]	
Leverage (lag)		13.74*** [0.29]	13.73*** [0.29]	
Y2005-2007*Leverage(lag)				17.64*** [0.38]
Y2008-2011*Leverage(lag)				13.86*** [0.33]
Y2012-2013*Leverage(lag)				7.13*** [0.43]
Cash (lag)		-13.72*** [0.28]	-13.73*** [0.28]	-13.82*** [0.28]
Tangibility (lag)		-27.93*** [0.40]	-28.16*** [0.40]	-28.02*** [0.40]
Profitability (lag)		-6.36*** [0.60]	-6.44*** [0.60]	-6.32*** [0.60]
Firm F.E.	YES	YES	YES	YES
Period F.E.	YES	YES	YES	YES
Country-Period F.E.	YES	YES	YES	YES
Industry-Period F.E.	YES	YES	YES	YES
N	7,415,613	6,938,083	6,938,083	6,938,083
r2	0.71	0.72	0.72	0.72

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets. The set of dummies includes fixed effects by firm, period, country-period and industry-period (coefficients not reported).

tion on the customers and suppliers of each individual firm and their relative sizes and/or market shares. However, to capture the potential role of market power in the customer-supplier relationship, we use information from Input-Output (I-O) Tables and from data from Eurostat on the share of large companies within each industry. We perform this type of analysis in Section 3.5, in which we investigate the different impact of net trade credit at the industry level.

Finally, Column 3 shows the heterogeneous behavior of *NTCS* during the crisis in relation to the capacity of cash flow generation by firms. The positive coefficients on the interaction term increase over time, suggesting that *Cfw* determines an increasing heterogeneity in *NTCS*. This is broadly in line with Love, Preve and Sarria-Allende (2007), according to which financial crises lead to larger increases of *NTCS* among firms with a higher (lagged) cash flow.

By contrast, Column 4 shows that the positive coefficients on leverage decrease over time. Presumably, increasing dependence on bank credit may be a sign of weaker financial conditions in times of financial crises. Consequently, the positive impact that easier access to bank credit exerts on *NTCS* becomes weaker in the post-crisis period. *Ceteris paribus*, firms increasing their indebtedness are not more willing to extend trade credit to their customers, net of the credit they receive from suppliers.

This effect has also been emphasized by Love, Preve and Sarria-Allende (2007) for the case of the Asian and Mexican crises of the 1990s. A possible explanation is that with idiosyncratic liquidity shocks, firms with access to outside liquidity are the only ones that can stop the propagation of the shock with their *deep pockets*. However, if the crisis originates in the financial system, firms more dependent on bank credit may be those that propagate the shock through supply chains.

One possible objection to our analysis is that firm size may not be a relevant factor for firms belonging to industrial groups. The Amadeus database does not contain direct information on whether a firm belongs or not to a group. However, our analysis above has been based on data from consolidated balance sheets and therefore it nets out intra-group transactions. Nevertheless, we provide a further robustness check to our results by using the "degree of independence" indicator contained in Amadeus, which classifies firms on the basis of the share in the capital owned by other firms. Table 11 in Appendix A.1 reports results for the most independent firms, namely firms that do not have shareholders with more than 25 percent of firms capital. Results do not change for such subgroup of firms. Furthermore, we run the same regression for the sample of firms with shares of outside firms on their capital not larger than 50 percent and again results go through. In conclusion, we claim that our results are not affected by cross-controls of firms

with potential suppliers/customers.

3.4.1 Payables and Receivables

Our main focus is on Net Trade Credit and its role in the liquidity transmission channel across firms. It is nevertheless worth investigating whether the behavior of *NTCS* derives mainly from the behavior of receivables or of payables. This is also relevant to disentangle pure demand effects from other channels. Indeed, one possible reason for the increase in *NTCS* could be a fall in payables associated to a fall in purchases of inputs. However, if the increase is mainly due to an increase in receivables, such demand channel is not crucial. Furthermore, we can directly verify our conjecture on the high degree of circularity in trade credit, with receivables being strongly correlated to payables at the firm level. We first analyze whether Kim and Shin (2012) hypothesis of the presence of a country-specific Cobb-Douglas relationship between firms' receivables and payables and sales holds in our sample covering an episode of financial crisis. Indeed, in Table 5 we find evidence of such a Cobb-Douglas functional form, as the coefficients on payables and sales in a cross-section regression of receivables sum up to one. Interestingly, such a form is rather stable as it does not significantly change during the crisis period.¹⁶ An important implication of this stability result is that the main channel highlighted by Kim and Shin (2012) seems to represent more a stable structural characteristic explaining different levels of trade credit across countries, but it cannot account for changes taking place during financial crises.

We now turn to the analysis of firm-level behavior of payables and receivables within the same framework we used to estimate the behavior of net trade credit. Table 6 presents the results obtained focusing on the heterogeneous dynamics of Receivables to Sales and Payables to Sales for firms in different size classes. The estimated model replicates the one estimated in Column 1 and Column 2 of Table 4, with the only difference that we introduce Payables to Sales (Receivables to Sales) as additional regressor when the dependent variable is Receivables to Sales (Payables to Sales).

Results from Table 6 reveal that the dynamics of *NTCS* by size classes works mainly through accounts receivable rather than accounts payable, with Receivables to Sales (Column 1 and 2) decreasing with firm size. Indeed, the coefficients on size classes have to be interpreted relative to the omitted *Micro* size class. By

¹⁶As shown in Appendix A.2 (Table 12), differences across countries in the coefficients on payables and on sales are large, suggesting significant differences in the industrial structures and in financial arrangements across countries.

Table 5: Receivables, payables and sales

Dependent variable: log receivables				
Year	log payables	log sales	R^2	Obs.
2007	0.348	0.603	0.78	591,733
2008	0.343	0.605	0.78	591,733
2009	0.354	0.587	0.77	591,733
2010	0.365	0.577	0.77	591,733
2011	0.364	0.575	0.77	591,733
2012	0.365	0.565	0.77	591,733
2013	0.370	0.555	0.77	591,733

Cross-section OLS regression results from a balanced AMADEUS sample, after removing firms that did not report a positive figure for either receivables or payables.

contrast, for Payables to Sales (Column 3 and 4), the differential effects through different size classes are positive but statistically insignificant. Therefore, during the financial crisis the drainage of financial resources from small businesses through inter-enterprise credit took place primarily through an increase in receivables.

To sum up, firms suffering financial problems (e.g. low ability to generate cash flow) tend to increase their Payables to Sales (i.e. they postpone their payments) regardless of their size, as revealed by the fact that the behavior of Payables to Sales does not significantly differ across size classes. By contrast, large firms have a higher capacity than small firms to extract prompt payments of credits from their customers.

Overall, results confirm the findings for *NTCS*, which indicate that firms with higher cash-flow and higher leverage tend to provide more trade credit during the crisis, by increasing their receivables and decreasing their payables. Finally, a positive and highly significant correlation between receivables and payables confirms the presence of a degree of circularity in inter-enterprise credit, though far from perfect as the coefficients are around 0.45 in the regressions for payables and 0.33 in the regressions for receivables.

In the following sections, the estimated coefficients on the industry-period and country-period dummies obtained in the first stage regressions are used to create the dependent variable of the second stage of the analysis, which aims to identify

Table 6: Heterogeneous firm responses - Receivables and Payables

Dependent Variable:	Receivables to Sales		Payables to Sales	
	(1)	(2)	(3)	(4)
Y2008-2011*Small	-5.74*** [0.20]	-5.36*** [0.19]	-1.05*** [0.17]	-1.01*** [0.17]
Y2008-2011*Medium	-12.35*** [0.31]	-11.94*** [0.31]	1.30*** [0.28]	1.17*** [0.27]
Y2008-2011*Large	-13.90*** [0.43]	-13.84*** [0.42]	1.53*** [0.39]	1.78*** [0.37]
Y2012-2013*Small	-11.50*** [0.26]	-10.94*** [0.26]	-1.41*** [0.21]	-1.28*** [0.21]
Y2012-2013*Medium	-23.85*** [0.41]	-23.28*** [0.41]	1.68*** [0.34]	1.59*** [0.34]
Y2012-2013*Large	-25.79*** [0.59]	-25.56*** [0.58]	1.97*** [0.49]	2.50*** [0.48]
PayablesToSales	0.44*** [0.00]	0.46*** [0.00]		
ReceivablesToSales			0.33*** [0.00]	0.33*** [0.00]
Cfw (lag)		7.81*** [1.10]		-19.11*** [0.92]
Leverage (lag)		11.49*** [0.44]		-14.44*** [0.38]
Cash (lag)		-23.21*** [0.41]		2.74*** [0.33]
Tangibility (lag)		-40.25*** [0.62]		11.55*** [0.57]
Profitability (lag)		-15.68*** [0.92]		-7.00*** [0.76]
Firm F.E.	YES	YES	YES	YES
Period F.E.	YES	YES	YES	YES
Country-Period F.E.	YES	YES	YES	YES
Industry-Period F.E.	YES	YES	YES	YES
N	7,395,828	6,920,875	7,395,828	6,920,875
r2	0.73	0.74	0.70	0.71

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets. The set of dummies includes fixed effects by firm, period, country-period and industry-period (coefficients not reported).

the determinants of cross-industry and cross-country heterogeneity in the dynamic of *NTCS*. Fixed effects by country-period and industry-period represent a measure of *NTCS* that is appropriately cleaned from the influence of heterogeneity at the firm level. The second stage is based on standard OLS regressions, which include specific regressors that may possibly differentiate industries and countries in the dynamics of *NTCS* around the crisis years.

3.5 Heterogeneous impact on *NTCS* by industry

In this section, we concentrate on the heterogeneity by industry. The estimated coefficients that we use to build our dependent variable are those obtained from the regression represented in Column 2 of Table 4, referring to the first stage regressions. For each industry k in period j , we take the sum of the coefficient on $Period_j$ and of the coefficient on the interaction term $Industry_k \cdot Period_j$.¹⁷ Then, for both $Period_1$ (years 2008-2011) and $Period_2$ (2012-2013) we compute the differences of each industry-period term with respect to the pre-crisis period (years 2005-2007).

Let us consider the period 2012-2013. After excluding one single very influential observation, that actually refers to an exceptionally peculiar industry (i.e. *Manufacture of Military Fighting Vehicles*), we have 198 measures at the industry level, which represent the change in *NTCS* with respect to the pre-crisis years 2005-2007. Since the first stage regression served to filter out firm-level characteristics, the new dependent variables can be interpreted as reflecting the representative firm in each industry. These dependent variables range from a minimum of -19.8 days for the *Manufacture of Tobacco Products* to a maximum of 40.1 days for the *Development of Building Projects*.

All the values of $\Delta NTCS$ by NACE industry are listed in Appendix B.3 (Table 17). Mean and median values are very similar and slightly smaller than 14 days, while the standard deviation is equal to 8.1 days. This means that on average *NTCS* in the period 2012-13 was about 14 days higher than in the pre-crisis years. Similar results apply to the period 2008-2011. In this case, the dependent variable ranges from a minimum of -13.5 days for the *Manufacture of Tobacco Products* to a maximum of 23.3 days for the *Development of Building Projects*. Mean and median values are still very similar and slightly larger than 8 days, while the standard

¹⁷Since we estimate separate cross-industry regressions for $Period_1$ and for $Period_2$, we could limit to consider the coefficients on the interaction term, because the coefficient on $Period_j$ is constant within each period j . However, considering the sum of the two terms helps to clarify the economical meaning of our dependent variable.

deviation is equal to 4.8 days. For both post-crisis periods, relative to pre-crisis years, there is heterogeneity in the dynamics of *NTCS* and such heterogeneity is larger in 2012-2013 than in 2008-2011.

The second-stage analysis can shed light on two main issues discussed in Section 3.2. First, the degree of *upstreamness* of sectoral production may have significant effects on the probability that a firm is, for technological reasons, a net debtor or net creditor in the trade credit market. The relevant question is whether such degree of upstreamness helps to explain the behavior of net credit in the aftermath of the crisis. We find that upstreamness does not have a statistically significant effect on the net credit position at the sectoral level.¹⁸ Therefore, although upstreamness helps to explain the heterogeneous *levels* of *NTCS* across industries, it does not seem to have a significant influence on the heterogeneous *changes* in *NTCS* that followed the crisis.

Second, one of the main aspects of our analysis aims at capturing whether different bargaining power between firms in their customer-supplier relationship affects the behavior of net trade credit during the crisis period. As noted earlier, we do not have information at the firm level on the characteristics of their customers or suppliers. To shed light on this issue, we combine two sets of information at the sectoral level to derive the variable *RelativeSize*, which is given by the difference between the percentage of large firms within each industry and the weighted average of the percentage of large companies within the supplier and customer industries of the industry itself. The weights are based on information obtained from the U.S. Input-Output (I-O) Tables from the Bureau of Economic Analysis (BEA). With respect to suppliers, the weights represent the relative importance of goods (or services) produced by each industry as an input for the industry considered. With respect to customers, the weights represent the relative importance of each industry as a consumer of goods (or services) produced by the industry considered.

We compute the percentages of large firms within each industry from data from the Eurostat Structural Business Statistics. These measures are based on *Turnover* figures in year 2013.¹⁹ For each industry, weighted averages of the percentage of large companies are separately obtained for the suppliers and the customers. Then we take a simple average of the two measures and subtract it from the percentage of large companies within the industry itself.

¹⁸Results are not reported here, but available upon request.

¹⁹The choice of the year should not affect this variable, assuming that the ranking with respect to percentages of large firms remains stable within the relatively short time interval of our analysis.

The values of *RelativeSize* across NACE industries are listed in Appendix B.4 (Table 18). The higher is this measure of *RelativeSize* the higher is the presence of large companies in the industry considered, relative to industries that constitute its main customers and suppliers. Therefore, *RelativeSize* should be a good proxy of bargaining power of the *average* firm in a given industry. In other words, if a firm is a supplier producing in sector *i*, which is a sector with low average size of firms, and it sells to firms in sector *j*, which is characterized by a much higher average size, we infer that the supplier in sector *i* has a weak bargaining power with respect to its customer in sector *j*.

We also introduce the variable *Weight_Households_Customers*, which represents the relative weight of households as customers for the output of each industry. This measure as well is based on information from the Input-Output (I-O) Tables. *Weight_Households_Customers* can be partly assimilated to an upstreamness measure, since it assumes higher values in industries that are closer to the final customers. However, it only gives relevance to the last stage of the production process. From this point of view, *Weight_Households_Customers* is likely to capture an additional source of market power, i.e. the bargaining power of non-financial businesses with respect to individual households.

In addition, we consider the weighted average of the pre-crisis levels of leverage of customers (*Leverage_Customers*) and suppliers (*Leverage_Suppliers*) of each industry. The measure of pre-crisis leverage for each industry is based on AMADEUS data. First, we take the firm-level median of *Leverage* during the pre-crisis period 2004-2007. Then, the median of these measures is taken for each three-digit NACE industry in order to define the pre-crisis level of each industry for Europe as a whole. The weights used to obtain the weighted averages for customers and suppliers of each industry are those used to compute the *RelativeSize* variable.

All these measures are built excluding industries that are outside the non-financial business economy and other specific industries. In order to control for the omission of possibly relevant information arising from this exclusion, we add further regressors that measure the weight of the excluded industries (Agriculture, Financial Activities and Other Activities) as customers for the output of each industry and, also, as suppliers for the inputs of the industry itself.

Table 7 reports the results of the second stage regressions with respect to industry-period observations.

The OLS regression strongly supports our priors. We find that the coefficient on *RelativeSize* is negative and highly significant. The higher is the measure of *RelativeSize* of a given industry, the more it is able to contain the increase in

Table 7: Heterogeneous responses by industry

Dependent Variable: Changes in NTCS with respect to pre-crisis levels				
	2008-2011 vs. precrisis		2012-2013 vs. precrisis	
	(1)	(2)	(3)	(4)
RelativeSize	-4.90*** [1.75]	-5.08*** [1.85]	-8.62*** [2.26]	-7.98*** [2.39]
Weight_Households_Customers	-6.06*** [1.33]	-6.12*** [1.59]	-14.09*** [2.06]	-14.24*** [2.54]
Leverage_Customers	-59.50*** [14.61]	-59.16*** [16.32]	-140.67*** [20.80]	-140.49*** [24.03]
Leverage_Suppliers	-37.87*** [12.76]	-78.61*** [26.35]	-79.00*** [17.76]	-87.36*** [33.05]
Weight_Agriculture_Customers		1.75 [2.48]		-4.52 [4.30]
Weight_Financial_Customers		-5.89 [14.18]		0.03 [24.38]
Weight_Other_Customers		-5.37 [4.35]		-5.02 [6.02]
Weight_Agriculture_Suppliers		-8.80** [3.92]		-8.07 [5.50]
Weight_Financial_Suppliers		-15.68 [10.23]		0.62 [14.91]
Weight_Other_Suppliers		-10.61 [9.64]		1.07 [10.41]
_cons	15.93*** [1.29]	21.14*** [3.12]	30.73*** [1.87]	32.08*** [4.05]
N	198	198	198	198
r2	0.23	0.27	0.39	0.40

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets.

NTCS in the aftermath of the crisis. The negative coefficient on *RelativeSize* indicates that the bargaining power induced by market concentration and firms' size affects the dynamics of net trade credit in the aftermath of the crisis. This implies a redistribution of financial resources that is not driven by productivity and, consequently, a potential source of misallocation of resources.

Similarly, the negative coefficient on *Weight_Households_Customers* reveals that downstream industries in the last stage of production have a higher ability to contain their net trade credit by limiting the credit granted to households (whose bargaining power is limited) and possibly transferring liquidity problems to their suppliers.

Negative coefficients on *Leverage_Customers* and *Leverage_Suppliers* suggest that the possibility to contain the increase in net trade credit is higher for those industries whose customers and suppliers have an easier access to external finance, computed for the pre-crisis years. Therefore, even after the crisis, industries with higher access to outside liquidity can partially contribute to attenuate the propagation of liquidity shocks through their *deep pockets*.²⁰

The inclusion of control variables (Columns 2 and 4) does not alter the main results of the analysis.²¹

3.6 Heterogeneous impact on *NTCS* by country

We carry out a similar second stage analysis now focusing on coefficients on the country fixed effects. The analysis here is more illustrative, as the sample size (25 countries) is much smaller than the one available for the industry-level analysis.

The dependent variable refers to the representative firms of individual countries and it represents the changes in *NTCS* in post-crisis years with respect to the pre-crisis years 2005-2007. Table 8 presents the results of the second stage regressions with respect to country-period observations.

For the cross-country second stage regression we introduce two regressors. The first regressor is a measure of the *creditlessness* nature of the post-crisis period for each country. This measure is based on domestic credit to the private sector as a ratio to GDP, computed from the World Bank database. We compute the average growth rate of Credit-to-GDP in the pre-crisis period 2003-2007 and then we compare it with the average growth rate in the period 2008-2011 (for the

²⁰In line with Boissay and Gropp (2013).

²¹In addition, second stage regressions on payables and receivables broadly confirm the results and indicate that the main differences across small and large firms operate through receivables (see Tables 13 and 14 in Appendix A.2).

regression in Column 1) and in the period 2008-2013 (for the regression in Column 2). The difference gives respectively our measures of *Creditlessness*₁₁ and *Creditlessness*₁₃. The higher is the value of *creditlessness* the higher is the fall in credit growth within a country. The coefficient on this variable is not statistically significant, implying that the availability of bank credit in the aftermath the crisis is not a main contributor of heterogeneity in the dynamics of net trade credit.

The second regressor is GDP growth at the country level. We consider the average GDP growth in the period 2008-2011 (for the regression in Column 1) and in the period 2008-2013 (for the regression in Column 2), respectively defined as *GDPgrowth*₁₁ and *GDPgrowth*₁₃ in the table below. In this case the coefficients on GDP growth are statistically significant. The negative sign implies that *NTCS* increases more in countries where the recession has been more severe and the recovery slower. This may be a consequence of payment delays from final customers that propagate to all domestic firms along the production chain. One could define this generalized increase in *NTCS* as *involuntary* trade credit, reflecting default in payments rather than the voluntary extension of credit by the suppliers.

4 Trade credit and real adjustment

In this section, we try to quantify the implications of changes in net trade credit on both labor market variables and investments during the Great Recession. Against the background of great difficulties for non-financial corporations in raising funds from banks and financial institutions, we want to verify whether the increase in *NTCS* added significant financial pressure on firms, forcing them to reduce both labor costs (through reduction in wages and/or employment) and investment in fixed capital. Having found that SMEs have been adversely affected in their liquidity through an increase in their net trade credit position, we want to assess whether such increase in *NTCS* has been associated with a disproportionate fall in both wages/employment and investments. The potential effects on employment by SMEs are particularly relevant as SMEs are a main source of employment in European economies. Furthermore, the fall in investments would signal a long-lasting negative effect on growth of SMEs resulting from a liquidity squeeze through trade credit.

Because of obvious endogeneity problems, our analysis provides correlations and cannot identify causal effects. Nevertheless, the analysis can shed light on the association between liquidity squeeze from *NTCS* and lower wages/employment and investments. We begin with the analysis of investments. As dependent vari-

Table 8: Heterogeneous responses by country

Dependent Variable: Changes in NTCS with respect to pre-crisis levels		
	2008-2011 vs. precrisis	2012-2013 vs. precrisis
	(1)	(2)
Creditlessness11	-17.52 [19.29]	
GDPgrowth11	-177.48* [98.81]	
Creditlessness13		-8.28 [18.94]
GDPgrowth13		-475.52*** [138.63]
_cons	11.76*** [2.24]	19.06*** [3.13]
N	25	25
r2	0.14	0.35

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets.

able we use *InvestmentRatio*, which is the ratio of investment in fixed capital over the lagged value of tangible fixed assets. Investments are computed adding the value of depreciation and amortizations to the difference between tangible fixed asset at the end and the beginning of each period. Regressors include *NTCS* in addition to sales growth and control variables, which are in fact the same as those we used for the analysis of *NTCS*.

Results of these regressions are presented in Table 9. Coefficients on *NTCS* are negative in both the regression, suggesting that the increase in *NTCS* actually drains liquid resources that firms could otherwise use for investment purposes or for the support of current production.

Moreover, we can use the regression to quantify the fall in investments that is linked to the increase in *NTCS*, distinguishing SMEs and large firms. Fig. 5 reports the imputed changes in investment for large firms in the first quintile (smallest increase) of the distribution of changes in *NTCS* at the industry level, contrasted with SMEs in the fifth quintile of the distribution, thus the quintile with the largest increase in *NTCS* at the industry level. The magnitude of the implied change in investments is large, with a gap of more than 4 percentage points between the SMEs in industries with largest increase in *NTCS* and large firms in industries with the smallest increase. Furthermore, the adverse effect on investments is stronger in the second sub-period. For large firms, net trade credit in fact freed resources that could have been used for investments.

The potential effects of the liquidity crunch on employment is particularly relevant as SMEs play a central role in employment growth. We thus analyze the impact of the change in *NTCS* on wages and employment. Results are summarized in Table 10. As expected, the effect of an increase in *NTCS* negatively affects both wages (the wage bill) and employment. Coefficients in both estimations appear low, but they are economically relevant. Regarding the impact on the wage bill, an increase by 10 days of *NTCS* induces a reduction by 2 percentage points in the ratio of the wage bill to fixed tangible assets. Given that we measure the wage bill in terms of fixed tangible assets, the negative impact of the increase in *NTCS* on the wage bill suggests that labor may be particularly vulnerable to the liquidity squeeze. Looking at the adjustment in employment, the estimated coefficient indicates that an increase in 10 days in *NTCS* induces a reduction by 0.1 percent in employment. Given the large degree of heterogeneity across firms, it is worth computing the impact of the standard deviation on both the wage bill and employment. An increase of one standard deviation in *NTCS* produces a reduction of 12 percentage points in the wage bill and of 0.6 percent in employment, indicating that the effects of increasing net trade credit on wages and employment

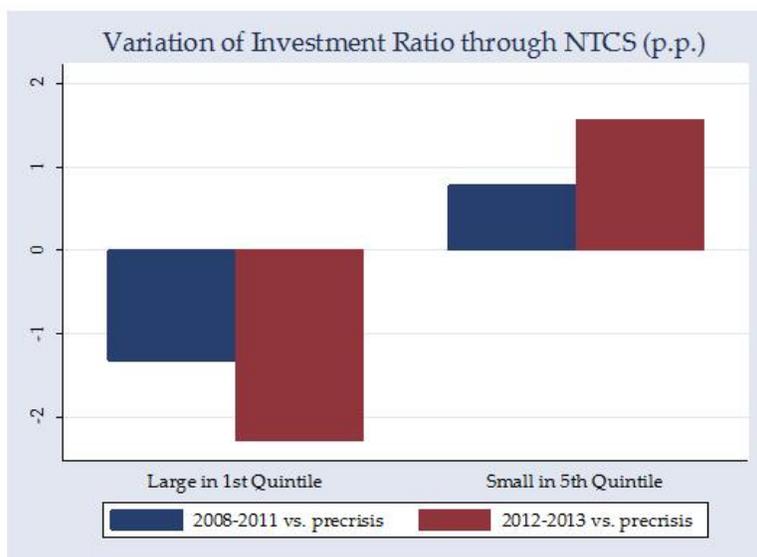
Table 9: Impact of *NTCS* on Investment in Fixed Tangible Assets

Dependent Variable: Investment Ratio [$INV_t \setminus TA_{t-1}$]		
	(1)	(2)
NTCS	-0.0009*** [0.0000]	-0.0011*** [0.0000]
Sales growth	0.0031*** [0.0001]	0.0034*** [0.0001]
Cash flow	0.0859*** [0.0004]	0.0787*** [0.0005]
Cash (lag)		0.2363*** [0.0106]
Tangibility (lag)		-5.1393*** [0.0154]
Profitability (lag)		0.3901*** [0.0200]
Cfw (lag)		-0.3483*** [0.0234]
Leverage (lag)		-0.5222*** [0.0084]
Firm F.E.	YES	YES
Period F.E.	YES	YES
Country-Period F.E.	YES	YES
Industry-Period F.E.	YES	YES
N	6,421,744	6,040,729
r2	0.35	0.39

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets. The set of dummies includes fixed effects by firm, period, country-period and industry-period (coefficients not reported).

Figure 5: Imputed changes in investments



are quantitatively relevant.

In sum, the liquidity squeeze induced by the increase in *NTCS* produces significant adverse effects on the real adjustment of firms, both on investments and on wages/employment. Given that SMEs are those that suffered the largest increase in *NTCS*, these results suggest that through the trade credit channel SMEs suffered a significant squeeze in their liquidity, which led to negative effects on their real activity.

5 Concluding remarks

In this paper, we have shown that in a period of financial crisis, trade credit is a relevant source of heterogeneity of effects on liquidity of firms characterized by different market power, financial characteristics and technologies. In particular, the evidence indicates that European SMEs have been squeezed in their liquidity during the Great Recession through an increase in their net trade credit. The evidence suggests that SMEs suffered because of their limited bargaining power in their credit relationship with larger firms. Financial characteristics of firms are also a significant determinant of net trade credit, suggesting that firms with *ex ante*

Table 10: Impact of *NTCS* on Wages and Employment

Dependent Variable:	$Wages_t/TangFixAss_{t-1}$		$\ln(N_t/N_{t-1})$	
	(1)	(2)	(3)	(4)
NTCS	-0.0008*** [0.0001]	-0.0020*** [0.0001]	-0.0001*** [0.0000]	-0.0001*** [0.0000]
Sales growth	0.0235*** [0.0009]	0.0205*** [0.0009]	0.0011*** [0.0000]	0.0011*** [0.0000]
Cash flow	1.2413*** [0.0046]	1.2520*** [0.0050]	0.0001*** [0.0000]	-0.0002*** [0.0001]
Cash (lag)		0.3594*** [0.0931]		0.0535*** [0.0024]
Tangibility (lag)		-26.2570*** [0.0807]		0.0290*** [0.0026]
Profitability (lag)		5.3809*** [0.1604]		0.1535*** [0.0046]
Cfw (lag)		-12.7595*** [0.1894]		0.0005 [0.0053]
Leverage (lag)		-3.8609*** [0.0579]		-0.0359*** [0.0021]
Firm F.E.	YES	YES	YES	YES
Period F.E.	YES	YES	YES	YES
Country-Period F.E.	YES	YES	YES	YES
Industry-Period F.E.	YES	YES	YES	YES
N	5,914,200	5,617,437	3,587,874	3,401,382
r2	0.71	0.72	0.28	0.29

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets. The set of dummies includes fixed effects by firm, period, country-period and industry-period (coefficients not reported).

higher availability of liquid assets or higher ability to generate cash flow tend to redistribute liquidity to other firms in the aftermath of the financial crisis. However, these financial conditions do not dominate the effect of firm size, as SMEs tend to provide more trade credit even after controlling for financial characteristics. The presence of a bias against SMEs liquidity due to weaker bargaining power is suggested by the analysis of the differential size of customer/suppliers. Firms concentrating their sales (purchases) to (from) sectors with higher concentration tend to supply more net trade credit during the crisis. Such relative bargaining power effect is highly significant, whereas technological aspects, such as the degree of upstreamness of production do not play a significant role during the crisis.

In addition, the average net trade credit ratio tends to be higher in countries where the recession is more severe (and the recovery slower), showing a significant relationship with the business cycle (proxied by real GDP growth) rather than the financial cycle (proxied by changes in the growth rate of bank credit to GDP). This is likely attributable to the difficulties of final customers (households and governments) who impose greater payment delays in countries where the real economy suffers a deeper recession. The existence of country effects suggests that payment delays do not affect only downstream companies, but to some extent they also propagate along the production chain.

This does not imply that the financial cycle is irrelevant for the development of net trade credit. In fact, significant period-dummy effects suggest that the financial crisis had a relevant impact on the net trade credit ratio irrespective of the differential impact of GDP growth at the country level. In addition, the significant coefficients on the interaction between firms' characteristics and period dummies also reveal that the period of financial turmoil had a relevant impact not only on the levels but also on the heterogeneity of net trade credit among firms.

Our analysis shows as well that the dynamics of net trade credit played a quantitatively large effect on real performance, both on labor market variables and on investments. Therefore, the additional liquidity squeeze induced by changes in net trade credit positions determined long run negative effects on firms. Given that SMEs displayed the largest increase in their net trade credit positions, they also suffered most in terms of investments. A particularly worrying phenomenon is that the liquidity squeeze on SMEs has been a persistent phenomenon, lingering at least 5 years (our sample ends in 2013) after the start of the financial crisis.

This analysis may have relevant policy implications as it sheds light on the peculiar vulnerabilities of SMEs that can arise during financial crises through the channel of trade credit.

Policy makers have been aware of these problems and have tried to implement

penalties for firms delaying their payments over 60 days.²²

However, punitive measures are unlikely to go at the heart of the problem, as trade credit is tied with real transactions that cannot easily be replaced by firms. An implication of weak bargaining power by SMEs is that it is unlikely they will resort to legal actions with respect to the large customers for their inputs. Perhaps, such punitive actions may be relevant for trade debts of public administrations.

More effective policies may act on the possibility for SMEs to use their receivables as collateral for credit lines. Similarly, a much more efficient and widespread use of factoring, together with an expansion of the market for trade credit insurance may lead to substantial positive effects. Furthermore, securitisation of trade receivables by pooling the positions of several SMEs could be introduced.

The drawing of policy actions to tackle corporate finance issues for SMEs may be essential in positively influencing employment and investment decisions of SMEs in the aftermath of a crisis. Indeed, policies that reduce financial constraints on SMEs constitute an essential instrument for reallocating resources towards better performing firms. The rationale for these policies is not that SMEs deserve subsidies in normal times, but that policy intervention is needed to shield SMEs from an inefficient squeeze in their liquidity.

²²For instance, the Directive 2011/7/EU of the European Parliament and of the Council of 16 February 2011 on combating late payment in commercial transactions, as well as the Law on the Modernization of the Economy has had in France since 2008, are meant to reduce delays in payments among firms, introducing interest payments on overdue payments (longer than 60 days) and fixed penalties. Member States were suppose to implement such regulations by 16 March 2013.

References

- Angrist, Joshua D, and Jörn-Steffen Pischke.** 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.
- Antras, Pol, Davin Chor, Thibault Fally, and Russell Hillberry.** 2012. "Measuring the Upstreamness of Production and Trade Flows." *American Economic Review*, 102(3): 412–16.
- Berger, Allen N, and Gregory F Udell.** 1998. "The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle." *Journal of Banking & Finance*, 22(6): 613–673.
- Biais, Bruno, and Christian Gollier.** 1997. "Trade credit and credit rationing." *Review of financial studies*, 10(4): 903–937.
- Boissay, Frederic, and Reint Gropp.** 2013. "Payment Defaults and Interfirm Liquidity Provision." *Review of Finance*, 17(6): 1853–1894.
- Brechling, F. P. R., and R. G. Lipsey.** 1963. "Trade Credit and Monetary Policy." *The Economic Journal*, 73(292): 618–641.
- Brennan, Michael J, Vojislav Maksimovics, and Josef Zechner.** 1988. "Vendor financing." *The Journal of Finance*, 43(5): 1127–1141.
- Calvo, Guillermo A, and Fabrizio Coricelli.** 1996. "Monetary policy and interenterprise arrears in post-communist economies: Theory and evidence." *The Journal of Policy Reform*, 1(1): 3–24.
- Carbo-Valverde, Santiago, Francisco Rodriguez-Fernandez, and Gregory F Udell.** 2013. "Trade credit, the financial crisis, and SME access to finance." In *26th Australasian Finance and Banking Conference*.
- Coricelli, Fabrizio, and Marco Frigerio.** 2015. "The Credit-Output Relationship During the Recovery from Recession." *Open Economies Review*, 26(3): 551–579.
- Cunat, Vicente.** 2007. "Trade credit: suppliers as debt collectors and insurance providers." *Review of Financial Studies*, 20(2): 491–527.
- Ferris, J Stephen.** 1981. "A transactions theory of trade credit use." *The Quarterly Journal of Economics*, 243–270.

- Gertler, Mark, and Simon Gilchrist.** 1994. “Monetary Policy, Business Cycles, and the Behavior of Small Manufacturing Firms.” *The Quarterly Journal of Economics*, 109(2): 309–340.
- Giannetti, Mariassunta, Mike Burkart, and Tore Ellingsen.** 2011. “What you sell is what you lend? Explaining trade credit contracts.” *Review of Financial Studies*, 24(4): 1261–1298.
- Giovannini, Alberto, Colin Mayer, Stefano Micossi, Carmine Di Noia, Marco Onado, Marco Pagano, and Andrea Polo.** 2015. “Restarting European Long-Term Investment Finance.” *Green Paper Discussion Document, Centre for Economic Policy Research (CEPR)*.
- Kalemli-Ozcan, Sebnem, Se-Jik Kim, Hyun Song Shin, Bent E Sørensen, and Sevcan Yesiltas.** 2014. “Financial shocks in production chains.” In *American Economic Association meetings, January*.
- Kim, Se-Jik, and Hyun Song Shin.** 2012. “Sustaining Production Chains through Financial Linkages.” *American Economic Review*, 102(3): 402–06.
- Kiyotaki, N, and J Moore.** 2001. “Credit chains.” *Mimeo*. Clarendon Lectures, University of Oxford, UK.
- Klapper, Leora, Luc Laeven, and Raghuram Rajan.** 2006. “Entry regulation as a barrier to entrepreneurship.” *Journal of Financial Economics*, 82(3): 591–629.
- Love, Inessa, and Rida Zaidi.** 2010. “Trade Credit, Bank Credit and Financial Crisis.” *International Review of Finance*, 10(1): 125–147.
- Love, Inessa, Lorenzo A Preve, and Virginia Sarria-Allende.** 2007. “Trade credit and bank credit: Evidence from recent financial crises.” *Journal of Financial Economics*, 83(2): 453–469.
- Meltzer, Allan H.** 1960. “Mercantile credit, monetary policy, and size of firms.” *The Review of Economics and Statistics*, 429–437.
- Mora, Jesse, and William Powers.** 2009. “Did trade credit problems deepen the great trade collapse?” In *The Great Trade Collapse: Causes, Consequences and Prospects*, ed. R. Baldwin. CEPR.

- Moulton, Brent R.** 1986. "Random group effects and the precision of regression estimates." *Journal of econometrics*, 32(3): 385–397.
- Nilsen, Jeffrey H.** 2002. "Trade Credit and the Bank Lending Channel." *Journal of Money, Credit, and Banking*, 34(1): 226–253.
- Norden, Lars, and Stefan van Kampen.** 2015. "The Dynamics of Trade Credit and Bank Debt in SME Finance: International Evidence." In *RBA Annual Conference Volume*. Reserve Bank of Australia.
- Petersen, Mitchell A, and Raghuram G Rajan.** 1997. "Trade credit: theories and evidence." *Review of financial studies*, 10(3): 661–691.
- Radcliffe Report.** 1959. "Report of the Committee on the Working of the Monetary System." London.
- Raddatz, Claudio.** 2010. "Credit chains and sectoral comovement: does the use of trade credit amplify sectoral shocks?" *The Review of Economics and Statistics*, 92(4): 985–1003.
- Ramey, Valerie A.** 1992. "The source of fluctuations in money: Evidence from trade credit." *Journal of Monetary Economics*, 30(2): 171–193.
- Schwartz, Robert A.** 1974. "An economic model of trade credit." *Journal of financial and quantitative analysis*, 9(04): 643–657.
- Thomas, William Arthur.** 1978. *The Finance of British Industry, 1918-1976*. Routledge.
- Wilner, Benjamin S.** 2000. "The exploitation of relationships in financial distress: The case of trade credit." *The Journal of Finance*, 55(1): 153–178.

Appendix

A Additional regressions

A.1 Robustness test to firms' independence

Table 11: Heterogeneous firm responses - Independence class: A

Dependent Variable: NTCS				
	(1)	(2)	(3)	(4)
Y2008-2011*Small	-2.40*** [0.69]	-2.06*** [0.69]		
Y2008-2011*Medium	-8.84*** [1.00]	-8.31*** [1.00]		
Y2008-2011*Large	-10.54*** [1.40]	-10.61*** [1.38]		
Y2012-2013*Small	-7.01*** [0.87]	-6.74*** [0.88]		
Y2012-2013*Medium	-17.56*** [1.24]	-17.77*** [1.24]		
Y2012-2013*Large	-20.09*** [1.72]	-19.86*** [1.69]		
Cfw (lag)		25.34*** [4.72]		25.23*** [4.72]
Y2005-2007*Cfw(lag)			16.40*** [5.21]	
Y2008-2011*Cfw(lag)			24.60*** [4.98]	
Y2012-2013*Cfw(lag)			39.97*** [5.73]	
Leverage (lag)		13.92*** [1.59]	14.09*** [1.60]	
Y2005-2007*Leverage(lag)				21.12*** [2.03]
Y2008-2011*Leverage(lag)				14.24*** [1.81]
Y2012-2013*Leverage(lag)				2.12 [2.27]
Cash (lag)		-18.10*** [1.71]	-18.26*** [1.71]	-18.27*** [1.71]
Tangibility (lag)		-28.44*** [2.23]	-28.84*** [2.23]	-28.58*** [2.24]
Profitability (lag)		-8.58*** [3.82]	-8.85*** [3.82]	-8.26*** [3.82]
Firm F.E.	YES	YES	YES	YES
Period F.E.	YES	YES	YES	YES
Country-Period F.E.	YES	YES	YES	YES
Industry-Period F.E.	YES	YES	YES	YES
N	278,480	261,718	261,718	261,718
r2	0.71	0.72	0.72	0.72

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets. The set of dummies includes fixed effects by firm, period, country-period and industry-period (coefficients not reported).

A.2 Additional regressions for receivables and payables

Table 12: Receivables, payables and sales: regressions by country (year 2007)

Dependent variable: log receivables				
Year	log payables	log sales	R^2	Obs.
Austria	0.07	0.94	1,065	0.62
Iceland	0.07	0.79	1,163	0.58
Germany	0.10	0.90	12,253	0.74
Finland	0.16	0.80	46,844	0.68
Luxembourg	0.16	0.72	255	0.66
Estonia	0.17	0.76	22,596	0.64
Norway	0.20	0.71	62,090	0.60
France	0.22	0.72	305,698	0.51
Portugal	0.23	0.70	113,969	0.60
Latvia	0.23	0.76	4,769	0.65
Lithuania	0.24	0.72	1,329	0.62
Slovakia	0.26	0.73	5,935	0.79
Hungary	0.27	0.66	6,018	0.69
Switzerland	0.28	0.82	191	0.73
Sweden	0.29	0.78	7,820	0.54
Czech Republic	0.30	0.66	21,351	0.78
Italy	0.30	0.63	324,143	0.65
Poland	0.31	0.64	26,583	0.79
Croatia	0.31	0.61	41,236	0.71
Greece	0.31	0.68	14,775	0.66
Bulgaria	0.32	0.68	16,340	0.55
Bosnia	0.35	0.62	8,178	0.71
Spain	0.36	0.62	17,214	0.67
Belgium	0.36	0.58	10,985	0.74
Ukraine	0.40	0.53	59,191	0.65
Russia	0.49	0.49	24	0.90
Slovenia	0.50	0.49	6,519	0.84

Cross-section OLS regression results from a balanced AMADEUS sample, after removing firms that did not report a positive figure for either receivables or payables. This table reports country-specific OLS coefficients estimated in the pre-crisis year 2007.

Table 13: Heterogeneous responses by industry - Receivables

Dependent Variable: Changes in the Receivables to Sales ratio with respect to pre-crisis levels				
	2008-2011 vs. precrisis		2012-2013 vs. precrisis	
	(1)	(2)	(3)	(4)
RelativeSize	-6.66*** [2.39]	-5.90*** [2.21]	-14.27*** [4.34]	-13.21*** [4.36]
Weight_Households_Customers	-7.62*** [1.88]	-8.60*** [2.13]	-20.25*** [3.45]	-20.14*** [4.31]
Leverage_Customers	-88.68*** [20.13]	-93.15*** [21.32]	-215.85*** [35.62]	-215.04*** [40.37]
Weight_Agriculture_Customers		0.58 [7.98]		-18.31* [9.47]
Weight_Financial_Customers		37.28* [19.82]		60.62* [33.46]
Weight_Other_Customers		-12.13** [5.87]		-8.43 [9.83]
._cons	18.61*** [1.38]	19.71*** [1.85]	38.23*** [2.79]	38.13*** [3.97]
N	198	198	198	198
r2	0.18	0.20	0.26	0.28

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Robust standard errors in brackets.

Table 14: Heterogeneous responses by industry - Payables

Dependent Variable: Changes in the Payables to Sales ratio with respect to pre-crisis levels				
	2008-2011 vs. precrisis		2012-2013 vs. precrisis	
	(1)	(2)	(3)	(4)
RelativeSize	0.60 [2.39]	-0.15 [2.47]	4.37 [3.12]	2.29 [3.07]
Weight_Households_Customers	2.30** [1.01]	1.60 [1.05]	4.03*** [1.43]	3.42** [1.39]
Leverage_Suppliers	-3.96 [14.23]	12.76 [25.30]	5.19 [20.45]	2.77 [33.78]
Weight_Agriculture_Suppliers		9.55** [4.00]		8.40 [5.18]
Weight_Financial_Suppliers		0.61 [15.45]		-19.92 [15.98]
Weight_Other_Suppliers		16.78 [16.94]		23.08 [23.13]
._cons	-1.74 [1.17]	-3.51 [2.96]	-4.66*** [1.69]	-3.91 [3.83]
N	198	198	198	198
r2	0.02	0.05	0.07	0.11

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Robust standard errors in brackets.

B Rankings across industries at 3-digit level

B.1 Pre-crisis *NTCS*

Table 15: *NTCS* across European industries in pre-crisis years [1 of 3]

Industry [NACE Code]	Pre-crisis <i>NTCS</i>
Retail Sale of Cultural and Recreation Goods in Specialized Stores [47.6]	-31.5
Sale, Maintenance and Repair of Motorcycles and Related Parts and Accessories [45.4]	-26.7
Retail Sale of Other Goods in Specialized Stores [47.7]	-24.8
Retail Sale of Other Household Equipment in Specialized Stores [47.5]	-21.4
Retail Sale in Non-Specialized Stores [47.1]	-20.3
Retail Sale of Food, Beverages and Tobacco in Specialized Stores [47.2]	-14.9
Camping Grounds, Recreational Vehicle Parks and Trailer Parks [55.3]	-13.0
Retail Sale Via Stalls and Markets [47.8]	-12.6
Restaurants and Mobile Food Service Activities [56.1]	-12.5
Retail Trade Not in Stores, Stalls Or Markets [47.9]	-10.2
Hotels and Similar Accommodation [55.1]	-9.4
Beverage Serving Activities [56.3]	-8.8
Sale of Motor Vehicle Parts and Accessories [45.3]	-7.9
Sale of Motor Vehicles [45.1]	-7.5
Passenger Rail Transport, Interurban [49.1]	-7.3
Manufacture of Bakery and Farinaceous Products [10.7]	-7.3
Retail Sale of Automotive Fuel in Specialized Stores [47.3]	-6.5
Holiday and Other Short-Stay Accommodation [55.2]	-6.2
Development of Building Projects [41.1]	-5.0
Inland Passenger Water Transport [50.3]	-4.3
Retail Sale of Information and Communication Equipment in Specialized Stores [47.4]	-3.8
Travel Agency and Tour Operator Activities [79.1]	-2.6
Photographic Activities [74.2]	-2.4
Sea and Coastal Passenger Water Transport [50.1]	-1.3
Buying and Selling of Own Real Estate [68.1]	-0.9
Other Accommodation [55.9]	-0.5
Veterinary Activities [75.0]	-0.3
Repair of Personal and Household Goods [95.2]	0.1
Non-Specialized Wholesale Trade [46.9]	0.9
Manufacture of Motor Vehicles [29.1]	1.4
Maintenance and Repair of Motor Vehicles [45.2]	2.3
Wholesale of Food, Beverages and Tobacco [46.3]	2.5
Manufacture of Coke Oven Products [19.1]	2.7
Renting and Leasing of Personal and Household Goods [77.2]	2.9
Other Telecommunications Activities [61.9]	3.5
Processing and Preserving of Meat and Production of Meat Products [10.1]	3.9
Event Catering and Other Food Service Activities [56.2]	4.2
Passenger Air Transport [51.1]	4.2
Manufacture of Dairy Products [10.5]	4.4
Renting and Operating of Own Or Leased Real Estate [68.2]	4.9
Manufacture of Vegetable and Animal Oils and Fats [10.4]	4.9
Freight Air Transport and Space Transport [51.2]	6.4
Construction of Residential and Non-Residential Buildings [41.2]	6.6
Manufacture of Articles of Fur [14.2]	7.1
Processing and Preserving of Fruit and Vegetables [10.3]	7.2
Manufacture of Transport Equipment N.E.C. [30.9]	7.9
Other Specialized Wholesale [46.7]	8.1
Wholesale of Agricultural Raw Materials and Live Animals [46.2]	8.6
Wholesale of Household Goods [46.4]	9.4
Combined Facilities Support Activities [81.1]	9.7
Processing and Preserving of Fish, Crustaceans and Molluscs [10.2]	10.1
Transport Via Pipeline [49.5]	10.2
Manufacture of Other Food Products [10.8]	10.3
Organization of Conventions and Trade Shows [82.3]	10.4

NTCS across European industries in pre-crisis years [2 of 3]

Industry [NACE Code]	Precrisis NTCS
Manufacture of Agricultural and Forestry Machinery [28.3]	10.3
Manufacture of Furniture [31.0]	10.5
Sawmilling and Planing of Wood [16.1]	10.6
Building of Ships and Boats [30.1]	11.1
Inland Freight Water Transport [50.4]	11.6
Postal Activities Under Universal Service Obligation [53.1]	11.7
Other Reservation Service and Related Activities [79.9]	12.4
Manufacture of Bodies (Coachwork) for Motor Vehicles; Manufacture of Trailers and Semi-Trailers [29.2]	12.6
Wired Telecommunications Activities [61.1]	13.2
Wholesale of Other Machinery, Equipment and Supplies [46.6]	13.9
Manufacture of Refined Petroleum Products [19.2]	14.1
Real Estate Activities on a Fee Or Contract Basis [68.3]	14.1
Sea and Coastal Freight Water Transport [50.2]	14.5
Manufacture of Footwear [15.2]	15.1
Manufacture of Other Products of First Processing of Steel [24.3]	15.2
Manufacture of Products of Wood, Cork, Straw and Plaiting Materials [16.2]	15.6
Manufacture of Basic Iron and Steel and of Ferro-Alloys [24.1]	15.7
Renting and Leasing of Motor Vehicles [77.1]	15.7
Manufacture of Sports Goods [32.3]	15.9
Research and Experimental Development on Natural Sciences and Engineering [72.1]	16.4
Manufacture of Beverages [11.0]	16.5
Wireless Telecommunications Activities [61.2]	16.9
Technical Testing and Analysis [71.2]	17.0
Manufacture of Air and Spacecraft and Related Machinery [30.3]	17.0
Manufacture of Tobacco Products [12.0]	17.2
Manufacture of Domestic Appliances [27.5]	17.4
Manufacture of Electric Motors, Generators, Transformers and Electricity Distribution and Control Apparatus [27.1]	17.4
Manufacture of Tanks, Reservoirs and Containers of Metal [25.2]	17.9
Support Activities for Transportation [52.2]	18.0
Other Passenger Land Transport [49.3]	18.1
Manufacture of Tubes, Pipes, Hollow Profiles and Related Fittings, of Steel [24.2]	18.4
Freight Rail Transport [49.2]	18.7
Activities of Head Offices [70.1]	18.9
Manufacture of Parts and Accessories for Motor Vehicles [29.3]	19.2
Manufacture of Basic Precious and Other Non-Ferrous Metals [24.4]	19.3
Manufacture of Weapons and Ammunition [25.4]	19.4
Manufacture of Prepared Animal Feeds [10.9]	20.0
Manufacture of Other Special-Purpose Machinery [28.9]	20.1
Manufacture of Computers and Peripheral Equipment [26.2]	20.5
Other Specialized Construction Activities [43.9]	20.6
Publishing of Books, Periodicals and Other Publishing Activities [58.1]	20.7
Manufacture of Railway Locomotives and Rolling Stock [30.2]	20.8
Radio Broadcasting [60.1]	20.8
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery and Harness; Dressing and Dyeing of Fur [15.1]	21.1
Manufacture of General-Purpose Machinery [28.1]	21.1
Manufacture of Musical Instruments [32.2]	21.2
Manufacture of Games and Toys [32.4]	21.3
Manufacture of Articles of Concrete, Cement and Plaster [23.6]	21.4
Manufacture of Basic Chemicals, Fertilizers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms [20.1]	21.4
Manufacture of Wearing Apparel, Except Fur Apparel [14.1]	21.5
Cutting, Shaping and Finishing of Stone [23.7]	21.5
Television Programming and Broadcasting Activities [60.2]	21.8
Casting of Metals [24.5]	21.8
Manufacture of Plastics Products [22.2]	21.9
Manufacture of Optical Instruments and Photographic Equipment [26.7]	22.0
Manufacture of Soap and Detergents, Cleaning and Polishing Preparations, Perfumes and Toilet Preparations [20.4]	22.2
Wholesale of Information and Communication Equipment [46.5]	22.4
Manufacture of Pulp, Paper and Paperboard [17.1]	22.5
Building Completion and Finishing [43.3]	22.8
Manufacture of Batteries and Accumulators [27.2]	23.0
Manufacture of Metal Forming Machinery and Machine Tools [28.4]	23.1
Construction of Roads and Railways [42.1]	23.1
Wholesale on a Fee Or Contract Basis [46.1]	23.1
Manufacture of Glass and Glass Products [23.1]	23.6
Manufacture of Articles of Paper and Paperboard [17.2]	23.8
Manufacture of Grain Mill Products, Starches and Starch Products [10.6]	24.1
Manufacture of Structural Metal Products [25.1]	24.3
Warehousing and Storage [52.1]	24.3
Manufacture of Other General-Purpose Machinery [28.2]	25.0
Manufacture of Basic Pharmaceutical Products [21.1]	25.1
Manufacture of Knitted and Crocheted Apparel [14.3]	25.2
Manufacturing N.E.C. [32.9]	25.5
Manufacture of Other Fabricated Metal Products [25.9]	25.8

NTCS across European industries in pre-crisis years [3 of 3]

Industry [NACE Code]	Precrisis NTCS
Manufacture of Rubber Products [22.1]	26.0
Manufacture of Other Textiles [13.9]	26.0
Manufacture of Steam Generators, Except Central Heating Hot Water Boilers [25.3]	26.1
Manufacture of Cement, Lime and Plaster [23.5]	26.1
Sound Recording and Music Publishing Activities [59.2]	26.5
Manufacture of Paints, Varnishes and Similar Coatings, Printing Ink and Mastics [20.3]	26.6
Electrical, Plumbing and Other Construction Installation Activities [43.2]	26.7
Repair of Computers and Communication Equipment [95.1]	26.9
Manufacture of Medical and Dental Instruments and Supplies [32.5]	27.0
Construction of Other Civil Engineering Projects [42.9]	27.0
Motion Picture, Video and Television Programme Activities [59.1]	27.1
Office Administrative and Support Activities [82.1]	27.2
Manufacture of Electric Lighting Equipment [27.4]	27.6
Satellite Telecommunications Activities [61.3]	27.6
Manufacture of Man-Made Fibres [20.6]	27.8
Manufacture of Clay Building Materials [23.3]	27.8
Manufacture of Abrasive Products and Non-Metallic Mineral Products N.E.C. [23.9]	28.2
Preparation and Spinning of Textile Fibres [13.1]	28.3
Manufacture of Jewellery, Bijouterie and Related Articles [32.1]	28.5
Manufacture of Other Chemical Products [20.5]	28.6
Manufacture of Pharmaceutical Preparations [21.2]	29.0
Forging, Pressing, Stamping and Roll-Forming of Metal; Powder Metallurgy [25.5]	29.4
Renting and Leasing of Other Machinery, Equipment and Tangible Goods [77.3]	29.7
Manufacture of Refractory Products [23.2]	29.8
Advertising [73.1]	30.1
Manufacture of Other Porcelain and Ceramic Products [23.4]	30.5
Weaving of Textiles [13.2]	30.7
Manufacture of Communication Equipment [26.3]	30.7
Manufacture of Irradiation, Electromedical and Electrotherapeutic Equipment [26.6]	30.7
Manufacture of Other Electrical Equipment [27.9]	31.2
Manufacture of Consumer Electronics [26.4]	31.5
Manufacture of Wiring and Wiring Devices [27.3]	31.5
Manufacture of Pesticides and Other Agrochemical Products [20.2]	31.5
Manufacture of Electronic Components and Boards [26.1]	32.6
Construction of Utility Projects [42.2]	32.6
Freight Transport By Road and Removal Services [49.4]	33.0
Other Postal and Courier Activities [53.2]	33.2
Landscape Service Activities [81.3]	33.5
Demolition and Site Preparation [43.1]	34.5
Printing and Service Activities Related to Printing [18.1]	34.9
Manufacture of Instruments and Appliances for Measuring, Testing and Navigation; Watches and Clocks [26.5]	34.9
Translation and Interpretation Activities [74.3]	35.1
Repair of Fabricated Metal Products, Machinery and Equipment [33.1]	35.2
Business Support Service Activities N.E.C. [82.9]	35.4
Reproduction of Recorded Media [18.2]	36.5
Specialized Design Activities [74.1]	37.3
Security Systems Service Activities [80.2]	37.5
Manufacture of Military Fighting Vehicles [30.4]	38.8
Manufacture of Cutlery, Tools and General Hardware [25.7]	38.8
Other Information Service Activities [63.9]	39.6
Leasing of Intellectual Property and Similar Products, Except Copyrighted Works [77.4]	39.8
Activities of Employment Placement Agencies [78.1]	40.0
Private Security Activities [80.1]	42.5
Manufacture of Magnetic and Optical Media [26.8]	43.4
Treatment and Coating of Metals; Machining [25.6]	43.4
Finishing of Textiles [13.3]	43.4
Market Research and Public Opinion Polling [73.2]	44.5
Other Human Resources Provision [78.3]	45.3
Investigation Activities [80.3]	45.3
Activities of Call Centres [82.2]	45.5
Other Professional, Scientific and Technical Activities N.E.C. [74.9]	46.5
Research and Experimental Development on Social Sciences and Humanities [72.2]	46.8
Installation of Industrial Machinery and Equipment [33.2]	47.9
Legal Activities [69.1]	48.0
Management Consultancy Activities [70.2]	48.2
Computer Programming, Consultancy and Related Activities [62.0]	48.9
Software Publishing [58.2]	52.8
Architectural and Engineering Activities and Related Technical Consultancy [71.1]	52.8
Cleaning Activities [81.2]	54.1
Temporary Employment Agency Activities [78.2]	63.5
Data Processing, Hosting and Related Activities; Web Portals [63.1]	66.3
Accounting, Bookkeeping and Auditing Activities; Tax Consultancy [69.2]	68.1

B.2 Upstreamness

Table 16: Upstreamness across NACE industries based on U.S. data [1 of 3]

Industry [NACE Code]	Upstreamness
Manufacture of Motor Vehicles [29.1]	1.007
Manufacture of Footwear [15.2]	1.008
Manufacture of Games and Toys [32.4]	1.057
Manufacture of Sports Goods [32.3]	1.057
Manufacture of Tobacco Products [12.0]	1.066
Manufacture of Military Fighting Vehicles [30.4]	1.070
Manufacture of Articles of Fur [14.2]	1.115
Manufacture of Wearing Apparel, Except Fur Apparel [14.1]	1.115
Retail Sale of Other Goods in Specialized Stores [47.7]	1.126
Retail Sale of Other Household Equipment in Specialized Stores [47.5]	1.126
Retail Trade Not in Stores, Stalls Or Markets [47.9]	1.126
Retail Sale of Automotive Fuel in Specialized Stores [47.3]	1.126
Retail Sale of Cultural and Recreation Goods in Specialized Stores [47.6]	1.126
Retail Sale Via Stalls and Markets [47.8]	1.126
Retail Sale of Food, Beverages and Tobacco in Specialized Stores [47.2]	1.126
Retail Sale of Information and Communication Equipment in Specialized Stores [47.4]	1.126
Retail Sale in Non-Specialized Stores [47.1]	1.126
Manufacture of Consumer Electronics [26.4]	1.135
Manufacture of Jewellery, Bijouterie and Related Articles [32.1]	1.139
Manufacture of Musical Instruments [32.2]	1.160
Manufacture of Irradiation, Electromedical and Electrotherapeutic Equipment [26.6]	1.176
Manufacture of Domestic Appliances [27.5]	1.181
Building of Ships and Boats [30.1]	1.204
Manufacture of Beverages [11.0]	1.214
Veterinary Activities [75.0]	1.220
Manufacture of Optical Instruments and Photographic Equipment [26.7]	1.225
Demolition and Site Preparation [43.1]	1.238
Other Specialized Construction Activities [43.9]	1.238
Development of Building Projects [41.1]	1.238
Electrical, Plumbing and Other Construction Installation Activities [43.2]	1.238
Construction of Roads and Railways [42.1]	1.238
Construction of Residential and Non-Residential Buildings [41.2]	1.238
Construction of Other Civil Engineering Projects [42.9]	1.238
Construction of Utility Projects [42.2]	1.238
Building Completion and Finishing [43.3]	1.238
Manufacture of Transport Equipment N.E.C. [30.9]	1.240
Software Publishing [58.2]	1.265
Manufacture of Knitted and Crocheted Apparel [14.3]	1.306
Manufacture of Bodies (Coachwork) for Motor Vehicles; Manufacture of Trailers and Semi-Trailers [29.2]	1.306
Manufacture of Furniture [31.0]	1.326
Manufacture of Other Electrical Equipment [27.9]	1.344
Event Catering and Other Food Service Activities [56.2]	1.389
Restaurants and Mobile Food Service Activities [56.1]	1.389
Beverage Serving Activities [56.3]	1.389
Manufacture of Soap and Detergents, Cleaning and Polishing Preparations, Perfumes and Toilet Preparations [20.4]	1.399
Manufacture of Weapons and Ammunition [25.4]	1.418
Maintenance and Repair of Motor Vehicles [45.2]	1.438
Manufacture of Computers and Peripheral Equipment [26.2]	1.441
Manufacture of Communication Equipment [26.3]	1.445
Manufacture of Pharmaceutical Preparations [21.2]	1.475
Renting and Leasing of Personal and Household Goods [77.2]	1.483
Manufacture of Instruments and Appliances for Measuring, Testing and Navigation; Watches and Clocks [26.5]	1.557
Manufacture of Medical and Dental Instruments and Supplies [32.5]	1.562
Publishing of Books, Periodicals and Other Publishing Activities [58.1]	1.569

Upstreamness across NACE industries based on U.S. data [2 of 3]

Industry [NACE Code]	Upstreamness
Sound Recording and Music Publishing Activities [59.2]	1.600
Manufacture of Dairy Products [10.5]	1.610
Processing and Preserving of Fruit and Vegetables [10.3]	1.610
Manufacture of Bakery and Farinaceous Products [10.7]	1.610
Processing and Preserving of Meat and Production of Meat Products [10.1]	1.610
Processing and Preserving of Fish, Crustaceans and Molluscs [10.2]	1.610
Manufacture of Vegetable and Animal Oils and Fats [10.4]	1.610
Manufacture of Grain Mill Products, Starches and Starch Products [10.6]	1.610
Manufacture of Other Food Products [10.8]	1.610
Freight Air Transport and Space Transport [51.2]	1.611
Passenger Air Transport [51.1]	1.611
Manufacture of Batteries and Accumulators [27.2]	1.632
Photographic Activities [74.2]	1.655
Manufacture of Other Textiles [13.9]	1.722
Computer Programming, Consultancy and Related Activities [62.0]	1.756
Camping Grounds, Recreational Vehicle Parks and Trailer Parks [55.3]	1.759
Other Accommodation [55.9]	1.759
Holiday and Other Short-Stay Accommodation [55.2]	1.759
Hotels and Similar Accommodation [55.1]	1.759
Inland Freight Water Transport [50.4]	1.764
Inland Passenger Water Transport [50.3]	1.764
Sea and Coastal Freight Water Transport [50.2]	1.764
Sea and Coastal Passenger Water Transport [50.1]	1.764
Manufacture of Railway Locomotives and Rolling Stock [30.2]	1.768
Manufacture of Other Special-Purpose Machinery [28.9]	1.769
Manufacture of Agricultural and Forestry Machinery [28.3]	1.769
Manufacture of Cutlery, Tools and General Hardware [25.7]	1.769
Manufacture of General-Purpose Machinery [28.1]	1.769
Manufacture of Metal Forming Machinery and Machine Tools [28.4]	1.769
Manufacture of Other General-Purpose Machinery [28.2]	1.769
Cutting, Shaping and Finishing of Stone [23.7]	1.776
Other Passenger Land Transport [49.3]	1.790
Manufacture of Air and Spacecraft and Related Machinery [30.3]	1.848
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery and Harness; Dressing and Dyeing of Fur [15.1]	1.855
Sale of Motor Vehicle Parts and Accessories [45.3]	1.889
Wholesale on a Fee Or Contract Basis [46.1]	1.889
Other Specialized Wholesale [46.7]	1.889
Sale of Motor Vehicles [45.1]	1.889
Non-Specialized Wholesale Trade [46.9]	1.889
Wholesale of Food, Beverages and Tobacco [46.3]	1.889
Sale, Maintenance and Repair of Motorcycles and Related Parts and Accessories [45.4]	1.889
Wholesale of Information and Communication Equipment [46.5]	1.889
Wholesale of Household Goods [46.4]	1.889
Wholesale of Other Machinery, Equipment and Supplies [46.6]	1.889
Wholesale of Agricultural Raw Materials and Live Animals [46.2]	1.889
Other Information Service Activities [63.9]	1.891
Other Telecommunications Activities [61.9]	2.001
Radio Broadcasting [60.1]	2.001
Satellite Telecommunications Activities [61.3]	2.001
Wired Telecommunications Activities [61.1]	2.001
Wireless Telecommunications Activities [61.2]	2.001
Television Programming and Broadcasting Activities [60.2]	2.001
Renting and Operating of Own Or Leased Real Estate [68.2]	2.002
Real Estate Activities on a Fee Or Contract Basis [68.3]	2.002
Buying and Selling of Own Real Estate [68.1]	2.002
Renting and Leasing of Motor Vehicles [77.1]	2.009
Manufacture of Clay Building Materials [23.3]	2.038
Manufacture of Other Porcelain and Ceramic Products [23.4]	2.038
Manufacture of Electric Lighting Equipment [27.4]	2.048
Motion Picture, Video and Television Programme Activities [59.1]	2.143
Legal Activities [69.1]	2.148
Freight Transport By Road and Removal Services [49.4]	2.182
Travel Agency and Tour Operator Activities [79.1]	2.261
Other Reservation Service and Related Activities [79.9]	2.261
Manufacture of Electric Motors, Generators, Transformers and Electricity Distribution and Control Apparatus [27.1]	2.261
Technical Testing and Analysis [71.2]	2.273
Architectural and Engineering Activities and Related Technical Consultancy [71.1]	2.273
Manufacture of Rubber Products [22.1]	2.274
Manufacture of Parts and Accessories for Motor Vehicles [29.3]	2.307
Manufacture of Articles of Concrete, Cement and Plaster [23.6]	2.330
Security Systems Service Activities [80.2]	2.409
Private Security Activities [80.1]	2.409

Upstreamness across NACE industries based on U.S. data [3 of 3]

Industry [NACE Code]	Upstreamness
Investigation Activities [80.3]	2.409
Manufacture of Magnetic and Optical Media [26.8]	2.421
Repair of Personal and Household Goods [95.2]	2.427
Installation of Industrial Machinery and Equipment [33.2]	2.427
Repair of Fabricated Metal Products, Machinery and Equipment [33.1]	2.427
Repair of Computers and Communication Equipment [95.1]	2.427
Manufacture of Glass and Glass Products [23.1]	2.435
Combined Facilities Support Activities [81.1]	2.471
Manufacture of Structural Metal Products [25.1]	2.486
Manufacture of Steam Generators, Except Central Heating Hot Water Boilers [25.3]	2.486
Manufacture of Tanks, Reservoirs and Containers of Metal [25.2]	2.486
Research and Experimental Development on Social Sciences and Humanities [72.2]	2.490
Research and Experimental Development on Natural Sciences and Engineering [72.1]	2.490
Manufacture of Refined Petroleum Products [19.2]	2.529
Manufacture of Coke Oven Products [19.1]	2.529
Manufacture of Prepared Animal Feeds [10.9]	2.530
Sawmilling and Planing of Wood [16.1]	2.532
Manufacture of Products of Wood, Cork, Straw and Plaiting Materials [16.2]	2.532
Manufacture of Plastics Products [22.2]	2.581
Postal Activities Under Universal Service Obligation [53.1]	2.590
Manufacture of Pesticides and Other Agrochemical Products [20.2]	2.598
Manufacture of Abrasive Products and Non-Metallic Mineral Products N.E.C. [23.9]	2.599
Manufacture of Wiring and Wiring Devices [27.3]	2.606
Landscape Service Activities [81.3]	2.618
Cleaning Activities [81.2]	2.618
Printing and Service Activities Related to Printing [18.1]	2.633
Accounting, Bookkeeping and Auditing Activities; Tax Consultancy [69.2]	2.637
Weaving of Textiles [13.2]	2.665
Manufacture of Tubes, Pipes, Hollow Profiles and Related Fittings, of Steel [24.2]	2.677
Manufacture of Other Fabricated Metal Products [25.9]	2.677
Manufacture of Basic Precious and Other Non-Ferrous Metals [24.4]	2.677
Manufacturing N.E.C. [32.9]	2.677
Organization of Conventions and Trade Shows [82.3]	2.722
Activities of Call Centres [82.2]	2.722
Office Administrative and Support Activities [82.1]	2.722
Business Support Service Activities N.E.C. [82.9]	2.722
Finishing of Textiles [13.3]	2.737
Preparation and Spinning of Textile Fibres [13.1]	2.737
Warehousing and Storage [52.1]	2.755
Specialized Design Activities [74.1]	2.812
Support Activities for Transportation [52.2]	2.812
Manufacture of Articles of Paper and Paperboard [17.2]	2.814
Manufacture of Pulp, Paper and Paperboard [17.1]	2.814
Passenger Rail Transport, Interurban [49.1]	2.824
Freight Rail Transport [49.2]	2.824
Data Processing, Hosting and Related Activities; Web Portals [63.1]	2.837
Other Human Resources Provision [78.3]	2.855
Temporary Employment Agency Activities [78.2]	2.855
Activities of Employment Placement Agencies [78.1]	2.855
Renting and Leasing of Other Machinery, Equipment and Tangible Goods [77.3]	2.860
Manufacture of Cement, Lime and Plaster [23.5]	2.888
Advertising [73.1]	2.891
Other Professional, Scientific and Technical Activities N.E.C. [74.9]	2.893
Translation and Interpretation Activities [74.3]	2.893
Market Research and Public Opinion Polling [73.2]	2.893
Management Consultancy Activities [70.2]	2.893
Forging, Pressing, Stamping and Roll-Forming of Metal; Powder Metallurgy [25.5]	2.935
Activities of Head Offices [70.1]	2.941
Other Postal and Courier Activities [53.2]	2.943
Manufacture of Electronic Components and Boards [26.1]	2.958
Transport Via Pipeline [49.5]	3.046
Reproduction of Recorded Media [18.2]	3.068
Treatment and Coating of Metals; Machining [25.6]	3.074
Manufacture of Man-Made Fibres [20.6]	3.172
Casting of Metals [24.5]	3.208
Manufacture of Other Products of First Processing of Steel [24.3]	3.208
Manufacture of Paints, Varnishes and Similar Coatings, Printing Ink and Mastics [20.3]	3.254
Manufacture of Basic Chemicals, Fertilizers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms [20.1]	3.254
Manufacture of Basic Pharmaceutical Products [21.1]	3.254
Manufacture of Other Chemical Products [20.5]	3.254
Leasing of Intellectual Property and Similar Products, Except Copyrighted Works [77.4]	3.292
Manufacture of Basic Iron and Steel and of Ferro-Alloys [24.1]	3.347
Manufacture of Refractory Products [23.2]	3.537

B.3 $\Delta NTCS$

Table 17: Changes in *NTCS* by industry (2012-2013 vs. pre-crisis years) [1 of 3]

Industry [NACE Code]	$\Delta NTCS$
Development of Building Projects [41.1]	40.07
Construction of Residential and Non-Residential Buildings [41.2]	37.69
Construction of Other Civil Engineering Projects [42.9]	35.92
Data Processing, Hosting and Related Activities; Web Portals [63.1]	34.80
Construction of Roads and Railways [42.1]	31.75
Renting and Leasing of Other Machinery, Equipment and Tangible Goods [77.3]	30.47
Building of Ships and Boats [30.1]	29.33
Construction of Utility Projects [42.2]	28.31
Architectural and Engineering Activities and Related Technical Consultancy [71.1]	27.82
Manufacture of Articles of Concrete, Cement and Plaster [23.6]	27.71
Electrical, Plumbing and Other Construction Installation Activities [43.2]	27.46
Buying and Selling of Own Real Estate [68.1]	26.99
Manufacture of Railway Locomotives and Rolling Stock [30.2]	26.42
Research and Experimental Development on Natural Sciences and Engineering [72.1]	26.35
Leasing of Intellectual Property and Similar Products, Except Copyrighted Works [77.4]	26.07
Demolition and Site Preparation [43.1]	26.05
Renting and Operating of Own Or Leased Real Estate [68.2]	25.97
Reproduction of Recorded Media [18.2]	25.61
Manufacture of Structural Metal Products [25.1]	24.82
Cutting, Shaping and Finishing of Stone [23.7]	24.55
Other Professional, Scientific and Technical Activities N.E.C. [74.9]	23.48
Renting and Leasing of Motor Vehicles [77.1]	23.14
Other Specialized Construction Activities [43.9]	22.74
Building Completion and Finishing [43.3]	22.57
Landscape Service Activities [81.3]	22.20
Manufacture of Coke Oven Products [19.1]	22.00
Legal Activities [69.1]	21.80
Private Security Activities [80.1]	21.75
Combined Facilities Support Activities [81.1]	21.75
Cleaning Activities [81.2]	21.70
Manufacture of Products of Wood, Cork, Straw and Plaiting Materials [16.2]	21.68
Business Support Service Activities N.E.C. [82.9]	20.61
Manufacture of Paints, Varnishes and Similar Coatings, Printing Ink and Mastics [20.3]	20.36
Other Telecommunications Activities [61.9]	20.31
Real Estate Activities on a Fee Or Contract Basis [68.3]	19.80
Manufacture of Glass and Glass Products [23.1]	19.64
Other Accommodation [55.9]	19.51
Management Consultancy Activities [70.2]	19.49
Activities of Call Centres [82.2]	19.30
Manufacture of Communication Equipment [26.3]	19.29
Other Human Resources Provision [78.3]	18.91
Sea and Coastal Freight Water Transport [50.2]	18.74
Wired Telecommunications Activities [61.1]	18.70
Manufacture of Bodies (Coachwork) for Motor Vehicles; Manufacture of Trailers and Semi-Trailers [29.2]	18.69
Renting and Leasing of Personal and Household Goods [77.2]	18.62
Transport Via Pipeline [49.5]	18.57
Office Administrative and Support Activities [82.1]	18.39
Sound Recording and Music Publishing Activities [59.2]	18.23
Satellite Telecommunications Activities [61.3]	18.03
Inland Passenger Water Transport [50.3]	17.99
Manufacture of Tanks, Reservoirs and Containers of Metal [25.2]	17.97
Accounting, Bookkeeping and Auditing Activities; Tax Consultancy [69.2]	17.82
Sea and Coastal Passenger Water Transport [50.1]	17.66
Manufacture of Electric Motors, Generators, Transformers and Electricity Distribution and Control Apparatus [27.1]	17.27

Changes in *NTCS* by industry (2012-2013 vs. pre-crisis years) [2 of 3]

Industry [NACE Code]	$\Delta NTCS$
Security Systems Service Activities [80.2]	17.18
Repair of Personal and Household Goods [95.2]	17.16
Market Research and Public Opinion Polling [73.2]	17.15
Radio Broadcasting [60.1]	17.11
Manufacture of Furniture [31.0]	17.03
Wireless Telecommunications Activities [61.2]	16.99
Manufacture of Games and Toys [32.4]	16.84
Repair of Computers and Communication Equipment [95.1]	16.64
Technical Testing and Analysis [71.2]	16.61
Passenger Air Transport [51.1]	16.59
Wholesale of Other Machinery, Equipment and Supplies [46.6]	16.58
Other Specialized Wholesale [46.7]	16.14
Retail Sale of Other Household Equipment in Specialized Stores [47.5]	16.06
Other Passenger Land Transport [49.3]	15.98
Repair of Fabricated Metal Products, Machinery and Equipment [33.1]	15.85
Retail Sale of Information and Communication Equipment in Specialized Stores [47.4]	15.80
Advertising [73.1]	15.77
Installation of Industrial Machinery and Equipment [33.2]	15.61
Manufacture of Cement, Lime and Plaster [23.5]	15.51
Printing and Service Activities Related to Printing [18.1]	15.46
Computer Programming, Consultancy and Related Activities [62.0]	15.38
Manufacture of Agricultural and Forestry Machinery [28.3]	15.37
Postal Activities Under Universal Service Obligation [53.1]	15.30
Manufacture of Tubes, Pipes, Hollow Profiles and Related Fittings, of Steel [24.2]	15.30
Manufacture of Abrasive Products and Non-Metallic Mineral Products N.E.C. [23.9]	15.21
Travel Agency and Tour Operator Activities [79.1]	15.11
Sale of Motor Vehicle Parts and Accessories [45.3]	15.11
Translation and Interpretation Activities [74.3]	15.09
Research and Experimental Development on Social Sciences and Humanities [72.2]	15.01
Publishing of Books, Periodicals and Other Publishing Activities [58.1]	15.00
Motion Picture, Video and Television Programme Activities [59.1]	14.97
Other Information Service Activities [63.9]	14.96
Wholesale on a Fee Or Contract Basis [46.1]	14.92
Wholesale of Information and Communication Equipment [46.5]	14.82
Camping Grounds, Recreational Vehicle Parks and Trailer Parks [55.3]	14.63
Maintenance and Repair of Motor Vehicles [45.2]	14.62
Manufacture of Pesticides and Other Agrochemical Products [20.2]	14.47
Temporary Employment Agency Activities [78.2]	14.37
Sale of Motor Vehicles [45.1]	14.37
Sawmilling and Planing of Wood [16.1]	14.36
Manufacture of Sports Goods [32.3]	14.33
Activities of Head Offices [70.1]	14.19
Manufacture of Motor Vehicles [29.1]	14.07
Photographic Activities [74.2]	14.06
Manufacture of Other Fabricated Metal Products [25.9]	13.86
Event Catering and Other Food Service Activities [56.2]	13.85
Manufacture of Wearing Apparel, Except Fur Apparel [14.1]	13.80
Non-Specialized Wholesale Trade [46.9]	13.73
Other Postal and Courier Activities [53.2]	13.67
Other Reservation Service and Related Activities [79.9]	13.61
Manufacture of Other Textiles [13.9]	13.45
Manufacture of Other General-Purpose Machinery [28.2]	13.29
Inland Freight Water Transport [50.4]	13.28
Manufacture of Magnetic and Optical Media [26.8]	13.23
Specialized Design Activities [74.1]	13.12
Software Publishing [58.2]	12.94
Processing and Preserving of Fish, Crustaceans and Molluscs [10.2]	12.89
Wholesale of Household Goods [46.4]	12.55
Manufacture of Computers and Peripheral Equipment [26.2]	12.42
Manufacture of Other Special-Purpose Machinery [28.9]	12.14
Retail Sale Via Stalls and Markets [47.8]	12.11
Retail Sale of Cultural and Recreation Goods in Specialized Stores [47.6]	12.07
Manufacture of Other Porcelain and Ceramic Products [23.4]	12.02
Investigation Activities [80.3]	12.01
Retail Sale of Other Goods in Specialized Stores [47.7]	11.80
Manufacture of Knitted and Crocheted Apparel [14.3]	11.72
Freight Transport By Road and Removal Services [49.4]	11.71
Manufacture of Soap and Detergents, Cleaning and Polishing Preparations, Perfumes and Toilet Preparations [20.4]	11.68
Wholesale of Agricultural Raw Materials and Live Animals [46.2]	11.62
Holiday and Other Short-Stay Accommodation [55.2]	11.53
Manufacture of Other Food Products [10.8]	11.44
Retail Trade Not in Stores, Stalls Or Markets [47.9]	11.35

Changes in *NTCS* by industry (2012-2013 vs. pre-crisis years) [3 of 3]

Industry [NACE Code]	$\Delta NTCS$
Veterinary Activities [75.0]	11.10
Manufacture of Air and Spacecraft and Related Machinery [30.3]	11.08
Manufacture of Consumer Electronics [26.4]	10.92
Manufacturing N.E.C. [32.9]	10.90
Manufacture of General-Purpose Machinery [28.1]	10.75
Manufacture of Medical and Dental Instruments and Supplies [32.5]	10.34
Manufacture of Steam Generators, Except Central Heating Hot Water Boilers [25.3]	10.26
Manufacture of Jewellery, Bijouterie and Related Articles [32.1]	10.21
Television Programming and Broadcasting Activities [60.2]	10.03
Finishing of Textiles [13.3]	10.03
Manufacture of Beverages [11.0]	9.75
Wholesale of Food, Beverages and Tobacco [46.3]	9.75
Support Activities for Transportation [52.2]	9.71
Manufacture of Plastics Products [22.2]	9.59
Manufacture of Musical Instruments [32.2]	9.50
Freight Rail Transport [49.2]	9.49
Manufacture of Electronic Components and Boards [26.1]	9.37
Manufacture of Cutlery, Tools and General Hardware [25.7]	9.19
Forging, Pressing, Stamping and Roll-Forming of Metal; Powder Metallurgy [25.5]	9.18
Manufacture of Other Electrical Equipment [27.9]	8.97
Passenger Rail Transport, Interurban [49.1]	8.77
Manufacture of Irradiation, Electromedical and Electrotherapeutic Equipment [26.6]	8.74
Sale, Maintenance and Repair of Motorcycles and Related Parts and Accessories [45.4]	8.71
Manufacture of Prepared Animal Feeds [10.9]	8.70
Freight Air Transport and Space Transport [51.2]	8.64
Manufacture of Instruments and Appliances for Measuring, Testing and Navigation; Watches and Clocks [26.5]	8.56
Manufacture of Other Chemical Products [20.5]	8.53
Manufacture of Clay Building Materials [23.3]	8.53
Retail Sale in Non-Specialized Stores [47.1]	8.53
Manufacture of Refractory Products [23.2]	8.42
Manufacture of Basic Iron and Steel and of Ferro-Alloys [24.1]	8.33
Manufacture of Bakery and Farinaceous Products [10.7]	8.07
Retail Sale of Automotive Fuel in Specialized Stores [47.3]	7.82
Retail Sale of Food, Beverages and Tobacco in Specialized Stores [47.2]	7.80
Treatment and Coating of Metals; Machining [25.6]	7.76
Manufacture of Articles of Fur [14.2]	7.65
Manufacture of Footwear [15.2]	7.49
Casting of Metals [24.5]	7.33
Manufacture of Parts and Accessories for Motor Vehicles [29.3]	7.29
Warehousing and Storage [52.1]	6.99
Manufacture of Wiring and Wiring Devices [27.3]	6.85
Manufacture of Metal Forming Machinery and Machine Tools [28.4]	6.76
Manufacture of Basic Pharmaceutical Products [21.1]	6.54
Restaurants and Mobile Food Service Activities [56.1]	6.54
Organization of Conventions and Trade Shows [82.3]	6.45
Processing and Preserving of Meat and Production of Meat Products [10.1]	6.16
Manufacture of Articles of Paper and Paperboard [17.2]	5.92
Manufacture of Basic Precious and Other Non-Ferrous Metals [24.4]	5.90
Hotels and Similar Accommodation [55.1]	5.65
Manufacture of Rubber Products [22.1]	5.25
Processing and Preserving of Fruit and Vegetables [10.3]	5.24
Preparation and Spinning of Textile Fibres [13.1]	5.05
Manufacture of Electric Lighting Equipment [27.4]	5.00
Manufacture of Basic Chemicals, Fertilizers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms [20.1]	4.85
Manufacture of Refined Petroleum Products [19.2]	4.68
Manufacture of Dairy Products [10.5]	4.48
Manufacture of Pharmaceutical Preparations [21.2]	4.47
Manufacture of Vegetable and Animal Oils and Fats [10.4]	4.46
Activities of Employment Placement Agencies [78.1]	3.52
Manufacture of Transport Equipment N.E.C. [30.9]	3.49
Manufacture of Pulp, Paper and Paperboard [17.1]	3.43
Manufacture of Domestic Appliances [27.5]	3.26
Manufacture of Other Products of First Processing of Steel [24.3]	2.82
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery and Harness; Dressing and Dyeing of Fur [15.1]	1.44
Manufacture of Optical Instruments and Photographic Equipment [26.7]	1.23
Manufacture of Weapons and Ammunition [25.4]	-0.63
Manufacture of Grain Mill Products, Starches and Starch Products [10.6]	-0.67
Weaving of Textiles [13.2]	-1.30
Beverage Serving Activities [56.3]	-5.49
Manufacture of Batteries and Accumulators [27.2]	-7.50
Manufacture of Man-Made Fibres [20.6]	-11.42
Manufacture of Tobacco Products [12.0]	-19.82

B.4 RelativeSize

Table 18: *RelativeSize* of NACE industries based on EU data [1 of 3]

Industry [NACE Code]	RelativeSize
Treatment and Coating of Metals; Machining [25.6]	-0.382
Reproduction of Recorded Media [18.2]	-0.344
Manufacture of Magnetic and Optical Media [26.8]	-0.291
Specialized Design Activities [74.1]	-0.246
Cutting, Shaping and Finishing of Stone [23.7]	-0.231
Finishing of Textiles [13.3]	-0.222
Manufacture of Structural Metal Products [25.1]	-0.221
Manufacture of Other Products of First Processing of Steel [24.3]	-0.208
Translation and Interpretation Activities [74.3]	-0.190
Other Professional, Scientific and Technical Activities N.E.C. [74.9]	-0.190
Building Completion and Finishing [43.3]	-0.188
Printing and Service Activities Related to Printing [18.1]	-0.186
Veterinary Activities [75.0]	-0.176
Forging, Pressing, Stamping and Roll-Forming of Metal; Powder Metallurgy [25.5]	-0.175
Manufacture of Musical Instruments [32.2]	-0.168
Transport Via Pipeline [49.5]	-0.167
Development of Building Projects [41.1]	-0.145
Manufacturing N.E.C. [32.9]	-0.142
Manufacture of Jewellery, Bijouterie and Related Articles [32.1]	-0.139
Manufacture of Articles of Fur [14.2]	-0.136
Other Specialized Construction Activities [43.9]	-0.129
Preparation and Spinning of Textile Fibres [13.1]	-0.125
Repair of Computers and Communication Equipment [95.1]	-0.107
Repair of Personal and Household Goods [95.2]	-0.107
Demolition and Site Preparation [43.1]	-0.096
Manufacture of Plastics Products [22.2]	-0.093
Manufacture of Other Fabricated Metal Products [25.9]	-0.092
Advertising [73.1]	-0.086
Leasing of Intellectual Property and Similar Products, Except Copyrighted Works [77.4]	-0.082
Manufacture of Refractory Products [23.2]	-0.074
Photographic Activities [74.2]	-0.073
Activities of Head Offices [70.1]	-0.071
Market Research and Public Opinion Polling [73.2]	-0.064
Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery and Harness; Dressing and Dyeing of Fur [15.1]	-0.053
Renting and Leasing of Other Machinery, Equipment and Tangible Goods [77.3]	-0.052
Office Administrative and Support Activities [82.1]	-0.047
Activities of Call Centres [82.2]	-0.047
Organization of Conventions and Trade Shows [82.3]	-0.047
Business Support Service Activities N.E.C. [82.9]	-0.047
Electrical, Plumbing and Other Construction Installation Activities [43.2]	-0.039
Buying and Selling of Own Real Estate [68.1]	-0.037
Renting and Operating of Own Or Leased Real Estate [68.2]	-0.037
Real Estate Activities on a Fee Or Contract Basis [68.3]	-0.037
Freight Transport By Road and Removal Services [49.4]	-0.036
Motion Picture, Video and Television Programme Activities [59.1]	-0.032
Accounting, Bookkeeping and Auditing Activities; Tax Consultancy [69.2]	-0.029
Passenger Rail Transport, Interurban [49.1]	-0.024
Freight Rail Transport [49.2]	-0.024
Manufacture of Other Textiles [13.9]	-0.013
Casting of Metals [24.5]	-0.013
Support Activities for Transportation [52.2]	-0.011
Sale of Motor Vehicles [45.1]	-0.006
Sale of Motor Vehicle Parts and Accessories [45.3]	-0.006
Sale, Maintenance and Repair of Motorcycles and Related Parts and Accessories [45.4]	-0.006

RelativeSize of NACE industries based on EU data [2 of 3]

Industry [NACE Code]	RelativeSize
Maintenance and Repair of Motor Vehicles [45.2]	-0.004
Restaurants and Mobile Food Service Activities [56.1]	-0.001
Event Catering and Other Food Service Activities [56.2]	-0.001
Beverage Serving Activities [56.3]	-0.001
Management Consultancy Activities [70.2]	0.011
Manufacture of Man-Made Fibres [20.6]	0.011
Legal Activities [69.1]	0.019
Sawmilling and Planing of Wood [16.1]	0.025
Manufacture of Other Chemical Products [20.5]	0.028
Wholesale on a Fee Or Contract Basis [46.1]	0.037
Wholesale of Agricultural Raw Materials and Live Animals [46.2]	0.037
Wholesale of Food, Beverages and Tobacco [46.3]	0.037
Wholesale of Household Goods [46.4]	0.037
Wholesale of Information and Communication Equipment [46.5]	0.037
Wholesale of Other Machinery, Equipment and Supplies [46.6]	0.037
Other Specialized Wholesale [46.7]	0.037
Non-Specialized Wholesale Trade [46.9]	0.037
Manufacture of Articles of Concrete, Cement and Plaster [23.6]	0.041
Manufacture of Abrasive Products and Non-Metallic Mineral Products N.E.C. [23.9]	0.041
Hotels and Similar Accommodation [55.1]	0.046
Holiday and Other Short-Stay Accommodation [55.2]	0.046
Camping Grounds, Recreational Vehicle Parks and Trailer Parks [55.3]	0.046
Other Accommodation [55.9]	0.046
Architectural and Engineering Activities and Related Technical Consultancy [71.1]	0.049
Technical Testing and Analysis [71.2]	0.049
Installation of Industrial Machinery and Equipment [33.2]	0.056
Manufacture of Sports Goods [32.3]	0.057
Renting and Leasing of Motor Vehicles [77.1]	0.066
Cleaning Activities [81.2]	0.067
Landscape Service Activities [81.3]	0.067
Warehousing and Storage [52.1]	0.072
Data Processing, Hosting and Related Activities; Web Portals [63.1]	0.074
Manufacture of Footwear [15.2]	0.076
Repair of Fabricated Metal Products, Machinery and Equipment [33.1]	0.081
Manufacture of Paints, Varnishes and Similar Coatings, Printing Ink and Mastics [20.3]	0.081
Renting and Leasing of Personal and Household Goods [77.2]	0.081
Manufacture of Bodies (Coachwork) for Motor Vehicles; Manufacture of Trailers and Semi-Trailers [29.2]	0.081
Other Passenger Land Transport [49.3]	0.087
Construction of Residential and Non-Residential Buildings [41.2]	0.088
Manufacture of Cutlery, Tools and General Hardware [25.7]	0.094
Manufacture of Furniture [31.0]	0.099
Weaving of Textiles [13.2]	0.100
Sound Recording and Music Publishing Activities [59.2]	0.102
Manufacture of Products of Wood, Cork, Straw and Plaiting Materials [16.2]	0.112
Manufacture of Tanks, Reservoirs and Containers of Metal [25.2]	0.116
Sea and Coastal Passenger Water Transport [50.1]	0.126
Sea and Coastal Freight Water Transport [50.2]	0.126
Inland Passenger Water Transport [50.3]	0.126
Inland Freight Water Transport [50.4]	0.126
Other Information Service Activities [63.9]	0.144
Construction of Other Civil Engineering Projects [42.9]	0.148
Manufacture of Articles of Paper and Paperboard [17.2]	0.155
Manufacture of Other Electrical Equipment [27.9]	0.163
Combined Facilities Support Activities [81.1]	0.169
Manufacture of Wearing Apparel, Except Fur Apparel [14.1]	0.173
Manufacture of Metal Forming Machinery and Machine Tools [28.4]	0.177
Manufacture of Other General-Purpose Machinery [28.2]	0.177
Manufacture of Electronic Components and Boards [26.1]	0.182
Construction of Utility Projects [42.2]	0.186
Travel Agency and Tour Operator Activities [79.1]	0.187
Other Reservation Service and Related Activities [79.9]	0.187
Manufacture of Transport Equipment N.E.C. [30.9]	0.190
Manufacture of Parts and Accessories for Motor Vehicles [29.3]	0.207
Manufacture of Irradiation, Electromedical and Electrotherapeutic Equipment [26.6]	0.208
Manufacture of Steam Generators, Except Central Heating Hot Water Boilers [25.3]	0.209
Manufacture of Clay Building Materials [23.3]	0.216
Manufacture of Other Special-Purpose Machinery [28.9]	0.217
Manufacture of Prepared Animal Feeds [10.9]	0.217
Computer Programming, Consultancy and Related Activities [62.0]	0.225
Manufacture of Glass and Glass Products [23.1]	0.227
Software Publishing [58.2]	0.230
Manufacture of Knitted and Crocheted Apparel [14.3]	0.230

RelativeSize of NACE industries based on EU data [3 of 3]

Industry [NACE Code]	RelativeSize
Manufacture of Basic Precious and Other Non-Ferrous Metals [24.4]	0.232
Manufacture of Coke Oven Products [19.1]	0.241
Manufacture of Wiring and Wiring Devices [27.3]	0.242
Processing and Preserving of Fish, Crustaceans and Molluscs [10.2]	0.242
Publishing of Books, Periodicals and Other Publishing Activities [58.1]	0.244
Manufacture of Basic Pharmaceutical Products [21.1]	0.245
Manufacture of Electric Lighting Equipment [27.4]	0.249
Manufacture of Bakery and Farinaceous Products [10.7]	0.251
Research and Experimental Development on Natural Sciences and Engineering [72.1]	0.274
Research and Experimental Development on Social Sciences and Humanities [72.2]	0.274
Construction of Roads and Railways [42.1]	0.275
Manufacture of Other Porcelain and Ceramic Products [23.4]	0.279
Private Security Activities [80.1]	0.281
Security Systems Service Activities [80.2]	0.281
Investigation Activities [80.3]	0.281
Activities of Employment Placement Agencies [78.1]	0.288
Temporary Employment Agency Activities [78.2]	0.288
Other Human Resources Provision [78.3]	0.288
Manufacture of Beverages [11.0]	0.293
Manufacture of Pesticides and Other Agrochemical Products [20.2]	0.300
Manufacture of Grain Mill Products, Starches and Starch Products [10.6]	0.303
Manufacture of Tubes, Pipes, Hollow Profiles and Related Fittings, of Steel [24.2]	0.310
Manufacture of Basic Chemicals, Fertilizers and Nitrogen Compounds, Plastics and Synthetic Rubber in Primary Forms [20.1]	0.313
Retail Sale in Non-Specialized Stores [47.1]	0.317
Retail Sale of Food, Beverages and Tobacco in Specialized Stores [47.2]	0.317
Retail Sale of Automotive Fuel in Specialized Stores [47.3]	0.317
Retail Sale of Information and Communication Equipment in Specialized Stores [47.4]	0.317
Retail Sale of Other Household Equipment in Specialized Stores [47.5]	0.317
Retail Sale of Cultural and Recreation Goods in Specialized Stores [47.6]	0.317
Retail Sale of Other Goods in Specialized Stores [47.7]	0.317
Retail Sale Via Stalls and Markets [47.8]	0.317
Retail Trade Not in Stores, Stalls Or Markets [47.9]	0.317
Manufacture of Medical and Dental Instruments and Supplies [32.5]	0.327
Processing and Preserving of Fruit and Vegetables [10.3]	0.338
Manufacture of Instruments and Appliances for Measuring, Testing and Navigation; Watches and Clocks [26.5]	0.345
Manufacture of Electric Motors, Generators, Transformers and Electricity Distribution and Control Apparatus [27.1]	0.357
Manufacture of Agricultural and Forestry Machinery [28.3]	0.359
Manufacture of Cement, Lime and Plaster [23.5]	0.366
Processing and Preserving of Meat and Production of Meat Products [10.1]	0.366
Manufacture of Soap and Detergents, Cleaning and Polishing Preparations, Perfumes and Toilet Preparations [20.4]	0.380
Manufacture of Vegetable and Animal Oils and Fats [10.4]	0.388
Manufacture of Optical Instruments and Photographic Equipment [26.7]	0.397
Manufacture of Games and Toys [32.4]	0.403
Manufacture of Computers and Peripheral Equipment [26.2]	0.406
Manufacture of Batteries and Accumulators [27.2]	0.411
Manufacture of Rubber Products [22.1]	0.414
Manufacture of General-Purpose Machinery [28.1]	0.433
Manufacture of Pulp, Paper and Paperboard [17.1]	0.433
Other Postal and Courier Activities [53.2]	0.442
Manufacture of Basic Iron and Steel and of Ferro-Alloys [24.1]	0.443
Manufacture of Communication Equipment [26.3]	0.457
Manufacture of Dairy Products [10.5]	0.467
Building of Ships and Boats [30.1]	0.478
Manufacture of Other Food Products [10.8]	0.482
Manufacture of Refined Petroleum Products [19.2]	0.494
Postal Activities Under Universal Service Obligation [53.1]	0.538
Manufacture of Domestic Appliances [27.5]	0.541
Passenger Air Transport [51.1]	0.566
Freight Air Transport and Space Transport [51.2]	0.566
Manufacture of Weapons and Ammunition [25.4]	0.573
Manufacture of Railway Locomotives and Rolling Stock [30.2]	0.591
Radio Broadcasting [60.1]	0.598
Television Programming and Broadcasting Activities [60.2]	0.598
Manufacture of Consumer Electronics [26.4]	0.630
Wired Telecommunications Activities [61.1]	0.635
Wireless Telecommunications Activities [61.2]	0.635
Satellite Telecommunications Activities [61.3]	0.635
Other Telecommunications Activities [61.9]	0.635
Manufacture of Motor Vehicles [29.1]	0.677
Manufacture of Pharmaceutical Preparations [21.2]	0.701
Manufacture of Air and Spacecraft and Related Machinery [30.3]	0.713
Manufacture of Tobacco Products [12.0]	0.791