Labor Share and the Transmission of Liquidity Shocks*

Edoardo Maria Acabbi† Ettore Panetti‡ Alessandro Sforza§

December 2025

Abstract

We examine how firms' labor share shape their responses to sudden disruptions of short-term credit supply. Using administrative data on workers, firms and banks in Portugal and exploiting the 2008 global interbank market freeze as an exogenous contraction in bank short-term funding, we show that firms with higher labor share experience significantly larger employment losses and higher exit rates. To explain this heterogeneity, we examine how the labor share interacts with firms' liquid resources. Firms with high labor share face front-loaded payroll commitments, which tighten short-term financing needs. Consistent with this mechanism, we find that the strongest responses arise among high-labor-share firms with limited working capital or cash per worker. These firms also employ more specialized workers, making labor adjustments more costly. Finally, the interaction of the credit shock with high labor share generates a non-cleansing pattern of reallocation: high-productivity firms with high labor share experience similarly large employment losses and exit rates as firms with lower productivity and high labor share. Overall, our findings demonstrate that the labor share is a central channel through which credit supply shocks propagate to real firm outcomes.

*The paper previously circulated as "The Financial Channels of Labor Rigidities: Evidence from Portugal". Edoardo Maria Acabbi thanks Gabriel Chodorow-Reich, Emmanuel Farhi, Samuel G. Hanson and Jeremy Stein for their guidance and support. We thank Andrea Alati, Diana Bonfim, Andrea Caggese, Sergey Chernenko, Andrew Ellul, Emilia Garcia Appendini, Andrew Garin, Marco Giometti, Abhinav Gupta, Isaac Hacamo, Simon Jäger, Sudipto Karmakar, Lawrence Katz, Hyunseob Kim, David Martinez Miera, Adrien Matray, David Matsa, Steven Ongena, Marco Pagano, Pedro Portugal, Pablo Ruiz Verdu, Amit Seru, Boris Vallé, Vikrant Vig, Silvia Vannutelli, for their comments. We also thank António Antunes, Paulo Guimarães, Pedro Próspero, Marta Silva, Fátima Teodoro, Maria Lucena Vieira, Sujiao Zhao and the staff of the BPLim at Banco de Portugal. Edoardo Maria Acabbi acknowledges the financial support from the Comunidad de Madrid, the Spanish Ministry of Science and Innovation (project PID2020-114108GB-I00, CNS2022-135749 and PID2022-137707NB-I00), and the Fundación Ramón Areces. Ettore Panetti acknowledges financial support from the European Union – NextGenerationEU – and the Italian Ministry of Universities and Research (PRIN Project No. 20227N3BMK).

†Corresponding author, University of Mannheim, edoardo.maria.acabbi@uni-mannheim.de.

‡University of Naples Federico II and CSEF, ettore.panetti@unina.it.

§INSEAD, CEPR and CESifo, alessandro.sforza@insead.edu.

1 Introduction

Financial shocks affect firms unevenly: some contract sharply or exit, while others continue operating with limited disruption. Understanding the sources of this heterogeneity is central to assessing how financial shocks propagate through the real economy. A large literature emphasizes firm balance sheets, collateral, or bank–firm linkages as key determinants of vulnerability (Bernanke and Gertler, 1989; Khwaja and Mian, 2008; Chodorow-Reich, 2014). By contrast, less is known about the role of firms' labor cost structure in shaping their exposure to liquidity risk.

Labor is often considered a flexible input in production: firms can reduce employment or wages in response to adverse shocks, limiting their persistence. In practice, this assumption is at odds with real-world labor market institutions and production technologies. Firms' payroll obligations often need to be honored before revenues materialize. On top of that, separations from skilled workers are costly, given human capital accumulation and hiring and search frictions. These rigidities transform labor costs into quasi-fixed obligations (Oi, 1962), and firms with more rigid labor structures may require greater financial flexibility to withstand sudden funding shortfalls. Yet, direct evidence on the interaction between labor costs and liquidity shocks is still limited.

In this paper, we study how firms' labor cost structure, measured by their labor share, shapes their response to a sudden tightening of short-term credit supply. We use Portugal in the aftermath of the global interbank market freeze that followed the sudden default of Lehman Brothers in 2008 as a laboratory. Portuguese banks were heavily reliant on short-term foreign interbank borrowing to fund their operations. When this market dried up, Portuguese banks sharply transferred this liquidity shock to firms, by reducing short-term credit supply. Using detailed administrative data from the Bank of Portugal, including matched employer-employee records, firm accounts, bank balance sheets, and the full credit registry, we trace the heterogeneous impact of this credit shock across firms.

Our central finding is that the real effects of the credit shock were concentrated among firms with high labor share in value added. These firms reduced employment significantly more and faced a higher probability of exit compared to firms with lower labor share. Strikingly, the differences cannot be explained by ex-ante productivity differences. Instead, they reflect the inability of high-labor-share firms to adjust their cost structures rapidly when credit dries up.

We interpret this pattern through two complementary mechanisms. First, firms with high labor share have greater working capital needs: payroll obligations are inflexible and must be met regularly, whereas revenues are more volatile and lagged. In normal times, credit lines bridge this liquidity mismatch. When access to short-term credit contracts, high-labor-share firms face immediate cash-flow pressures. Second, high labor costs may stem from the presence of specialized human capital. Hiring and training skilled workers involves sunk costs, and firms are reluctant to dismiss them even in downturns. This rigidity reduces their ability to resize payroll, making them more vulnerable to financial shocks.

These mechanisms may also influence how resources reallocate during downturns. In principle, recessions can raise efficiency by eliminating low-productivity jobs and prompting the exit of unproductive firms, thereby shifting resources toward more productive uses, i.e., a cleansing effect. But when reallocation is constrained and the firms hit hardest are not the least productive, downturns can instead lower aggregate productivity, i.e., a sullying effect. Such outcomes are particularly common in episodes of financial turmoil, where frictions and liquidity disruptions distort the reallocation process (Barlevy, 2003). Consistent with this view, we find that high-productivity firms with high labor share suffer employment losses and exit rates comparable to those of lower-productivity firms with similarly high labor share, pointing to inefficient reallocation.

Our contribution to the existing literature is twofold. First, we document that labor costs drive the transmission of short-term credit shocks to firm outcomes. In this respect, we relate to the literature on the propagation of financial shocks through bank lending and their real effects (Khwaja and Mian, 2008; Ivashina and Scharfstein, 2010; Iyer et al., 2014; Chodorow-Reich, 2014; Bentolila et al., 2017; Berton et al., 2018; Moser et al., 2022). By focusing on the role of labor costs for the transmission of credit shocks, our paper further contributes to the literature on labor and finance, which examines how firms' labor obligations shape financing choices and capital structure (Simintzi et al., 2015; Serfling, 2016; Ellul and Pagano, 2019; Favilukis et al., 2020), affect the equity risk premium (Danthine and Donaldson, 2002), amplify the sensitivity of operating profits to economic shocks (Donangelo et al., 2019) and mediate firms' responses to monetary policy (Faia and Pezone, 2024), among others. While previous work by Favilukis et al. (2020) shows that labor obligations shape firms' financial structure in steady state, we show that they are central to understanding which firms contract or exit when liquidity suddenly dries up.

Second, we add to the debate on the cleansing properties of economic downturns. Early works (Davis and Haltiwanger, 1990, 1992) documented that recessions tend to reallocate resources toward more productive firms, consistent with a classic Schumpeterian creative destruction mechanism. More recent studies, however, challenge this view: Barlevy (2003); Ouyang (2009); Osotimehin and Pappadà (2015) and Kehrig (2015) question the unconditional existence of the cleansing effect and argue that financial frictions might attenuate it or turn it into sullying. Foster et al. (2016); Haltiwanger et al. (2022) similarly find that recent recessions featured less productivity-enhancing reallocation of inputs and a weaker cleansing dynamics in firm exits. In line with these findings, we leverage our setting and a rich set of data to provide evidence consistent with a non-cleansing effect of credit shocks, which impair efficient reallocation in the economy.

The rest of the paper proceeds as follows. Section 2 describes the data and institutional setting. Section 3 outlines and discusses our empirical strategy, and presents the baseline results. Section 4 digs deeper into possible mechanisms at play. Section 5 extends the analysis to the non-cleansing effects of the credit shock. Section 6 concludes.

2 Data, sample and definitions

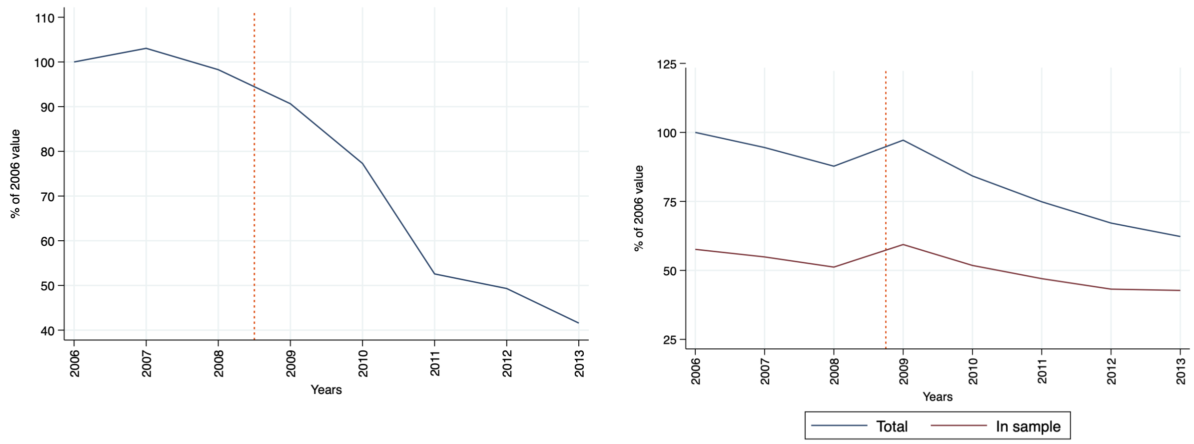
Our analysis draws on a unique combination of administrative data sources from the Bank of Portugal that provide a comprehensive view of firms, banks, and workers. At the heart of our dataset is the credit registry, which records the universe of bank–firm exposures in Portugal. This source is complemented with firm balance sheets, matched employer–employee records, and bank balance sheets. Linking these datasets allows us to follow how funding shocks to banks transmit into the supply of credit to firms, and from there into firms' employment and survival.

The empirical setting is Portugal in the years surrounding the Global Financial Crisis and the subsequent EU sovereign debt crisis. Portuguese banks were particularly exposed to the collapse of the interbank market that followed the default of Lehman Brothers in 2008: they relied heavily on short-term foreign borrowing to finance corporate lending. When this funding source dried up, short-term credit to firms contracted sharply (see Figure 1). The reliance on foreign wholesale funding varied substantially across banks, creating heterogeneous firm exposures depending on pre-shock credit relationships. This variation provides the foundation for our empirical design.[1]

The crisis that followed was not a single event. Following the collapse of Lehman Brothers, European financial markets experienced renewed turbulence during the subsequent sovereign

[1] In our sample, foreign interbank exposure as a percentage of total liabilities ranges between 10 and 25 percent.

Figure 1: Credit dynamics in Portugal.



(a) Foreign short-term interbank liabilities. (b) Short-term credit.

Foreign short-term interbank liabilities are the sum of short-term deposits (up to one year) and repos where the counterparty is a foreign financial institution (with the exclusion of central banks). Short-term credit is credit with a maturity of less than one year, or liquid credit lines. The dotted line splits the sample into pre-period and post-period. Totals are expressed as a percentage of foreign interbank liabilities (left) and short-term regular credit (right) in 2006. In sample refers to the portion of credit associated with the firms included in our analysis, while total refers to the total amount of firms in the database. Source: Bank of Portugal and authors' calculations.

debt crisis between 2010 and 2012, which tightened credit through sovereign spreads and balance-sheet linkages. Portugal experienced two distinct disruptions to bank funding within a relatively short horizon. While our main focus is on the Global Financial Crisis, we also examine whether the patterns we uncover persist during the EU sovereign debt crisis, providing an opportunity to assess the robustness of our findings across different types of financial turmoil.

To construct our working sample, we restrict attention to private non-financial firms with at least nine employees.[2] Table 1 reports descriptive statistics for the pre-period (defined as the years from 2006 to 2008) in Panel A and the post-period (defined as the years from 2009 to 2012) in panel B. The average firm in our sample employed around 60 workers, reported annual sales close to €10 million, and borrowed from three different banking institutions. Short-term credit represented a large share (around 50 percent) of their total borrowing (regular credit, drawn and not overdue), making them highly sensitive to liquidity conditions. Descriptive statistics underscore the importance of bank credit and the heterogeneity of firms' cost structures.

[2]Nine employees is the threshold for the fourth quartile of employment distribution for Portugal.

Table 1: Firm-level descriptive statistics.

	Mean	SD	p25	p50	p75
Panel A: Pre-period					
Full-time equivalent employment	59.48	234.99	16.00	25.00	46.00
Wage bill	892	4,042	160	287	608
Sales	9,917	59,169	1,015	2,296	5,771
Total assets	8,597	70,475	837	1,864	4,555
No. of loans	3.08	1.84	2.00	3.00	4.00
Regular credit/Total assets	0.24	0.20	0.08	0.20	0.35
Short-term credit/Sales	0.12	0.20	0.01	0.06	0.16
Short-term credit/Wage bill	1.19	2.72	0.08	0.45	1.31
Panel B: Post-period					
Full-time equivalent employment	70.25	337.52	16.00	26.00	50.00
Wage bill	1,088	5,258	177	323	711
Sales	10,861	68,885	942	2,213	5,897
Total assets	11,749	1,6200	947	2,129	5,509
No. of loans	3.24	2.02	2.00	3.00	4.00
Regular credit/Total assets	0.24	0.32	0.07	0.20	0.36
Short-term credit/Sales	0.14	1.16	0.00	0.05	0.15
Short-term credit/Wage bill	0.97	2.65	0.03	0.30	1.03

Descriptive statistics for the sample of analysis (N = 14,864 firms). Full-time equivalent employment is the number of workers divided by full-time hours. Wage bill, sales, and total assets are in thousands of euros. No. of loans is the total number of credit relationships. Regular credit/Total assets is the ratio of total non-defaulting bank credit to total assets. Short-term credit/Sales is the ratio of short-term bank credit (maturity below one year plus credit lines with no definite maturity) to sales. The pre-period is defined as the years from 2006 to 2008, while the post-period is defined as the years from 2009 to 2012.

3 Empirical exercise

Our objective is to estimate how a tightening of bank short-term credit propagates to firms, and whether this effect depends on firms' labor shares. To do so, we exploit the collapse of the global interbank market in 2008, which severely hit Portuguese banks' access to short-term funding. Banks differed in their reliance on this market before the shock, and firms differed in the extent to which they borrowed from more exposed banks. This interaction generates quasi-exogenous variation in the supply of credit across firms at the onset of the interbank market freeze.

The credit variation S_i for firm i is calculated as the symmetric growth rate of short-term credit:[3]

$$S_i = \frac{D_i^{post} - D_i^{pre}}{\frac{1}{2}(D_i^{post} + D_i^{pre})}, \tag{1}$$

[3]This measure ranges between –2 and 2 and is widely used in the literature (Davis et al., 1996; Chodorow-Reich, 2014) because it accommodates the full spectrum of credit changes, from the initiation of a lending relationship to its complete termination, while limiting the influence of outliers on the empirical specification.

where D_i is defined as the sum of credit with maturity less than one year and liquid credit lines. We construct exposures to the shock at the firm level by combining information on pre-shock bank–firm credit relationships with banks' reliance on short-term foreign interbank funding in 2005, well before the shock, and we use it as an instrument for the measure of credit variation S_i. The measure follows the logic of shift-share instruments used in prior works (Khwaja and Mian, 2008; Chodorow-Reich, 2014; Paravisini et al., 2015), and exploits the fact that bank-firm relationships in Portugal are stable and long-lasting (Bonfim and Dai, 2017). We measure firm exposure to the shock by combining firm-bank credit shares in 2005 with banks' reliance on short-term foreign interbank liabilities in the same year. For firm i:

$$Z_i = \sum_{b \in \mathcal{B}_i} \omega_{ib} \cdot FD_b, \tag{2}$$

where ω_{ib} is the share of a firm i's short-term borrowing from bank b in 2005, $\mathcal{B}_i$ is the set of banks from which the firm borrowed in 2005 and FD_b is bank b's ratio of foreign short-term interbank liabilities to total assets. This measure captures the idea that a firm is more exposed if a greater fraction of its credit came from banks that were themselves more vulnerable to the interbank freeze. By construction, the variation is driven by bank-level funding structure in 2005, well before the onset of the shock. This reduces concerns that the measure simply reflects firm-level credit demand or endogenous matching between banks and firms. Additionally, in all empirical specifications we control for a set of firm level observables that capture the scale of a firm's operations – such as initial short-term credit, total assets, and sales – to ensure that firms with very small borrowing do not drive the estimated effects.

Our key hypothesis is that the consequences of credit contractions depend on firms' cost structure. We capture this through firms' labor share in value added, computed from balance sheet data before the shock. Labor share measures the extent to which a firms' value added is devoted to compensating labor through wages and related costs. We measure labor share as the ratio of total labor costs (wages, provisions, training and other staffing costs) to value added, averaged across 2005 and 2006.[4]

This metric reflects two complementary forms of rigidity in firms' cost adjustment. First, it proxies working capital needs through labor: firms with high labor share must allocate a

[4]We compute the labor at the beginning of our sample period to avoid capturing volatility close to the shock. All results are robust to alternative measures of labor share computed using (i) 2007 and 2008, or (ii) the entire pre-period from 2005 to 2008.

larger fraction of revenues to meet regular payroll, and therefore rely more on short-term credit to bridge this specific source of liquidity gaps. Second, it proxies for human capital adjustment costs: firms with high labor share often employ more specialized workers, whose dismissal and rehiring entail sunk costs. Both channels imply that high–labor-share firms will be more vulnerable when short-term credit contracts.[5]

To test our hypothesis, we allow the effect of the credit shock to vary with labor share, splitting the sample into two bins (above and below the median) of labor share. Our first empirical model is a difference-in-differences design that compares outcomes of more and less exposed firms before and after the interbank market freeze, while allowing for heterogeneous effects by labor share. We estimate:

$$Y_{i,t} = \gamma_i + \tau_t + \left(\sum_{k=1}^{2} \beta_k S_i \cdot \mathbb{1}\{LabSh_{bin} = k\} + \Gamma X_i \right) \cdot \mathbb{1}\{t = Post\} + \\ + FE_{i,t} + \varepsilon_{i,t} \quad t \in \{Pre, Post\}. \tag{3}$$

The outcome variable in equation (3), defined at the yearly level, is the log of total employment. S_i is the credit variation for a firm i defined in equation (1) that we instrument with Z_i as defined in equation (2). $LabSh_{bin}$ partitions firms according to their labor share (below or above the median) and $\mathbb{1}\{t = Post\}$ is a dummy for post-2008. Additionally, τ_t is a year fixed effect and γ_i is a firm fixed effect.

Our second specification is a linear probability model:

$$P(exit)_{i,t} = \tau_t + \sum_{k=1}^{2} \beta_k S_i \cdot \mathbb{1}\{LabSh_{bin} = k\} + \Gamma X_i + FE_{i,t} + \varepsilon_{i,t}, \tag{4}$$

where the outcome variable, defined at the yearly level, is a dummy equal to 1 if a firm exits in any year between 2009 and 2012, while τ_t is a year fixed effect.

In both equations (3) and (4), we include a set of controls X_i measured in 2005. In equation (3) we interact them with the post-shock dummy to allow for differential trends, while in equation (4) we keep them constant.[6]

Controls are grouped in 4 categories: balance checks, bank controls, firm controls and perfor-

[5] In this context, labor share should be viewed as a sufficient statistic for short-term labor-related cash-flow rigidity rather than as a technological primitive. It summarizes recurrent payroll obligations and the costs of adjusting specialized workers, both of which shape firms' financing needs when liquidity tightens.

[6] Running the same specification with all controls interacted with year dummies yields identical results.

mance controls.[7] Balance checks controls include the covariates correlated with our instrument in the pre-period (as shown in Figure 2). These variables are value added per employee in 2005, log of total assets and of total number of employees in 2005, symmetric credit growth between 2004 and 2005, debt-to-asset ratio and debt toward suppliers in 2005. Including these variables and their interactions with the post-treatment indicator helps control for differential trends in outcomes, which is essential given that our identification strategy relies on parallel trends rather than equality in levels.

Bank controls set comprises a list of bank–firm relationship characteristics, such as the number of bank connections and the total amount of credit received in 2005. These variables address potential endogeneity in the matching between firms and banks prior to the shock.

Firm controls expand the specification with a set of firm-level observables, including firm age, tangible assets, average turnover, cash-to-assets, tradable-goods-to-assets, fixed tangible assets, and the baseline labor share.[8] Firm performance controls capture pre-shock performance indicators such as return on assets (ROA), return on sales (ROS), log of sales and export-to-sales ratio.

Finally, $FE_{i,t}$ is a set of fixed effects by post-period, comprising dummies for 3-digit industrial sector, commuting zone, quintiles of firm age and size in 2005, and dummies for exporter status, firm with overdue loans in 2007, banking relationship with banks failed before 2014, firm capable of issuing bonds, firm with a single banking relationship.

The coefficients of interest are the βs. A positive value of β in the employment regression would indicate that the contraction in credit supply had stronger negative real effects on firms with higher labor share, while a negative coefficient of β in the exit regression indicates that the probability of firm exit is higher for firms with a high labor share. We cluster the standard errors at the bank-by-3-digit-industry level.

3.1 Discussion

Our identification is similar in spirit to a triple difference-in-differences design, where we compare the evolution over time of outcomes for firms that are more versus less exposed to a credit shock and then further investigate heterogeneous responses for exposed firms based on their pre-determined labor share. Importantly, our causal identification does not assume, in line with the

[7] Appendix A.1 reports the exact list of controls and fixed effects used throughout the analysis.

[8] In all specifications, the labor share enters both interacted with our shocks and as a baseline control. This allows us to test if the labor share is a determinant of the transmission of the shock while also controlling for the direct channel of Favilukis et al. (2020).

existing literature (Simintzi et al., 2015; Matsa, 2018; Favilukis et al., 2020), that the labor share is randomly or exogenously distributed, or unrelated to firms' capital structure decisions.Instead, our design relies on the assumption that outcomes of firms with similar levels of pre-determined labor share but different bank relationships would have evolved along parallel trajectories absent the interbank shock (Olden and Møen, 2022).

Some considerations are in order and deserve discussion. First, Portugal was affected not only by the Global Financial Crisis but also by the EU sovereign debt crisis of 2010-2012. While both episodes led to a credit tightening, they operated through different channels. Our primary analysis focuses on the Global Financial Crisis, which provides the cleanest source of exogenous variation through the sudden interbank market freeze. In fact, while for the global interbank market freeze we can clearly identify a pre-period with no relevant financial shocks in the Portuguese economy, for the EU sovereign debt crisis the pre-period is a period of financial turmoil due to the Global Financial Crisis, making it harder to distinguish the effect of the second shock from the first. Nevertheless, in Section 4.3, we test the robustness of our results while accounting for firms' indirect exposures to sovereign debt through their banks.

Second, the assignment to banks' foreign interbank exposure must be as good as random conditional on observables. A possible concern is that firms with high labor share might have been more likely to borrow from fragile banks right before the shock, which could bias our estimates. Three features mitigate this issue. First, bank-firm relationships in Portugal are persistent and difficult to adjust in the short run (Bonfim and Dai, 2017). Second, it is important to have an adequate battery of observables and fixed effects. Figure 2a reports the balance checks for our sample. While the great majority of the covariates are not significant, we explicitly control for the trends related to the covariates that show mild significance in our regression. Besides including firm fixed effects and a large battery of controls, our exposure measure is based on bank funding structure in 2005, three years before the shock, limiting the scope for anticipatory matching.[9] In fact, if firms were able to re-sort after the shock, our instrument would not be able to predict credit variation in the first stage. Third, we examine whether banks cut credit differentially across firms based on observable characteristics, including labor share, and find no evidence of such patterns (Table B.1 in Appendix B).[10]

[9]Pre-shock employment and exit trends are similar across labor-share groups conditional on exposure, consistent with the identifying assumption of parallel trends. The firm fixed effects, year effects, and interactions of pre-determined controls with the post-period indicator absorb remaining differences in levels while allowing for heterogeneous underlying trajectories.

[10]Appendix B reports a loan-level analysis comparing changes in credit granted by banks with differing exposure

A central identification concern is that firms may endogenously match with banks along persistent dimensions such as sector, size, age, or internationalization patterns. For this reason, we follow the approach standard in the credit-supply literature and obtain identification conditionally, by comparing how the same firm adjusts borrowing from banks that were differentially affected by the interbank freeze. Firm fixed effects absorb all stable variation related to bank choice in the pre-period, so that identification comes solely from within-firm differences in exposure when the shock hits. This strategy is consistent with the empirical designs of Khwaja and Mian (2008); Chodorow-Reich (2014); Amiti and Weinstein (2018); Jimenez et al. (2014) and with the logic of the shift-share framework in Borusyak et al. (2022).

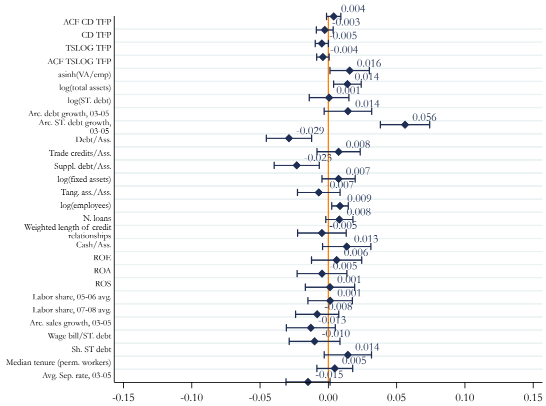
Although the regressions include an extensive set of controls and are saturated with firm and time fixed effects to absorb unobserved heterogeneity and differential post-shock trends at the firm level, we cannot entirely rule out potential sorting in bank–firm matching if it is based on firm-bank time-varying unobservables. Nonetheless, the three pieces of evidence discussed above substantially mitigate this concern.

A further identification concern arises from the possibility that firms' pre-shock credit shares across banks may themselves be correlated with banks' exposure to the foreign-funding shock. In a shift-share design such as ours, the identifying variation is intended to come from the shifters (i.e., banks' differing degrees of foreign interbank exposure) while the shares (i.e., firms' pre-existing credit allocations across banks) should be treated as predetermined. If firms that allocated a larger share of their borrowing to more exposed banks also differed systematically in their observable characteristics, the variation in exposure could partly reflect endogenous matching rather than the quasi-random shock hitting banks. This would undermine the key assumption that it is the shifters, rather than the shares, that generate exogenous variation in firm-level exposure.

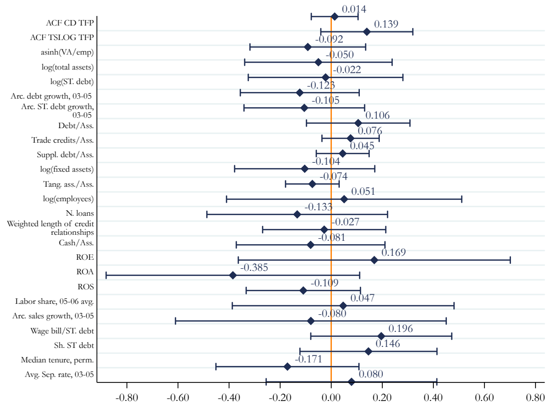
To investigate this concern, we follow the methodology proposed by Borusyak et al. (2022), which provides an appropriate balance test for shift-share designs. The idea is to examine whether share-weighted firm covariates are systematically related to banks' foreign-exposure shifters. Specifically, for each pre-shock firm characteristic, we compute the average value of that characteristic for each bank, weighting each borrowing firm by its pre-shock credit share with that bank. We then regress these share-weighted bank-level characteristics on the bank's

to foreign funding to the same firm. Table B.1 shows that banks do not adjust lending differentially based on a firm's labor share or productivity.

Figure 2: Balance checks.



(a) Standard balance checks.



(b) Borusyak et al. (2022).

Notes: Figure 2a presents coefficients and 95-percent confidence intervals from pairwise regressions in which each pre-shock firm-level observable (listed on the vertical axis) is regressed on the instrument Z_i defined in equation (2). These standard balance tests assess whether firms borrowing from more exposed banks differ systematically in observable characteristics prior to the shock. All regressions include the full set of fixed effects used in the main specification (3-digit industry, commuting zone, and firm age and size quintiles), and all variables, including Z_i, are standardized using the year 2005 (unless noted otherwise). Figure 2b reports coefficients and 95-percent confidence intervals from balance tests following the shift-share methodology of Borusyak et al. (2022). In this case, each covariate is weighted by the firm's pre-shock credit shares across its lenders, and the resulting share-weighted characteristics are regressed on banks' foreign-exposure shifters. This procedure evaluates whether the distribution of exposure across banks is correlated with firm observables, thereby testing directly whether the quasi-experimental variation arises from the shifters rather than from endogenous credit-share patterns. In both figures, standard errors are heteroskedasticity-robust.

foreign-exposure measure. This procedure directly tests whether banks that are more exposed to the shock tended to lend disproportionately to firms with particular observable traits, once weighted by the economic relevance of each firm-bank link.

Figure 2b reports the coefficients and confidence intervals from these regressions. The absence of statistically significant relationships across the full set of pre-determined covariates indicates that share-weighted firm characteristics are evenly distributed across banks with higher and lower foreign exposure. In other words, the credit shares do not load systematically onto the shifters. This finding reinforces the view that the quasi-experimental variation in our setting truly comes from the bank-level credit shock, rather than from endogenous sorting or selective allocation of credit across firms with particular attributes. Consequently, the identifying variation can be credibly interpreted as arising from the exogenous contraction in banks' foreign funding.

3.2 Results

In what follows, we start by presenting our baseline results on the role of firms' labor share for the transmission of the credit shock. Then, we extend our analysis in four directions by studying (i) the interaction of labor share with firms' own liquid resources, (ii) firms' workforce composition (iii) the effect of the EU sovereign debt crisis, and (iv) general-equilibrium effects. Finally, we conclude with an analysis of the interaction of firms' labor share with productivity, to highlight the possible presence of non-cleansing effects.

Table 2 reports the estimates of equations (3) and (4). Before turning to the estimates, it is useful to outline the expected patterns. If labor share amplifies firms' exposure to credit tightening, then the coefficient on S_i should be more positive (employment regressions) or more negative (exit regressions) for high-labor-share firms. Columns (1)–(5) progressively add fixed effects and groups of controls.[11] Two aspects deserve emphasis. First, controls and fixed effects in the employment regressions are interacted with the post-shock dummy, while in the exit regression we include firm fixed effects interacted with year dummies and constant controls. Second, all controls are measured in 2005, exploiting pre-shock variation and avoiding bad-control bias. Interacting these baseline values with the post-shock dummy enables estimation of deviations from initial firm-specific trends while allowing for distinct pre-shock trajectories.

Results in Table 2 confirm that, following the credit contraction, firms with an above-median labor share experience a statistically significant decline in employment and a higher probability of exit. The estimated coefficient on S_i * Labor share>median is positive and significant in the employment regressions (Panel A) and negative and significant in the exit regressions (Panel B), consistent with the notion that a high labor share amplifies firms' vulnerability to credit shocks.

The inclusion of fixed effects ensures comparisons among firms that are similar along multiple observable and unobservable dimensions. The sequential addition of control groups further mitigates the concern that results are driven by residual heterogeneity. The stability of the estimated coefficients in Panel A across specifications indicates that our results are robust to the inclusion of additional controls and fixed effects.

The results of this section highlight that the adverse effects of the credit shock are concentrated in a subset of firms with high labor share. One possible reason is that firms with high labor share have greater working capital needs: payroll obligations must be met regularly, while revenues are more volatile and lagged. When credit supply contracts, high-labor-share firms face immediate cash flow pressure. Another possibility is that high-labor-share firms have a special-

[11] As a robustness check, Table D.1 in Appendix D reports a similar exercise with the labor share calculated as the ratio of total labor costs to total sales, and shows no qualitative difference from the baseline results. We also calculate labor share as the ratio of total wage bill from Quadros de Pessoal (instead of total labor costs) to value added and to total costs of production, as a residualized measure by value added per employee, and over the period 2007-2008. All results are qualitatively the same, and are available upon request.

Table 2: Baseline results: Employment and exit probability.

	(1)	(2)	(3)	(4)	(5)
Panel A: Log employment					
S_i * Labor share<median	0.032	0.035	0.032	0.038	0.040
	(0.036)	(0.040)	(0.039)	(0.039)	(0.039)
S_i * Labor share>median	0.102***	0.094***	0.095**	0.090**	0.089**
	(0.038)	(0.036)	(0.038)	(0.039)	(0.038)
1st-stage F statistic	19.90	18.81	18.15	18.10	18.04
Firms	14,010	13,783	13,783	13,760	13,758
FE	X	X	X	X	X
Balance checks		X	X	X	X
Bank controls			X	X	X
Firm controls				X	X
Performance controls					X
Panel B: Exit probability					
S_i * Labor share<median	0.007	0.008	-0.006	-0.009	-0.008
	(0.012)	(0.013)	(0.013)	(0.013)	(0.014)
S_i * Labor share>median	-0.008	-0.016	-0.029**	-0.029**	-0.028**
	(0.012)	(0.011)	(0.013)	(0.013)	(0.013)
1st-stage F statistic	20.47	17.61	18.11	18.16	17.88
Firms	14,000	13,773	13,773	13,749	13,747
FE	X	X	X	X	X
Balance checks		X	X	X	X
Bank controls			X	X	X
Firm controls				X	X
Performance controls					X

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share below and above the median. The 1st-stage F statistic is the weak identification Kleibergen-Paap rk Wald test. All regressions feature a set of controls and fixed effects as defined in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. ***p $<$ 0.01, **p $<$ 0.05, *p $<$ 0.1.

ized workforce, costly to train, hire and especially fire. In this case, high-labor-share firms might be more reluctant to dismiss specialized human capital, increasing their vulnerability to financial shocks and their probability to exit the market. We investigate both channels in Section 4.

4 Digging deeper

This section examines possible mechanisms and cross-sectional patterns that help explain why firms with high labor share are disproportionately affected by a contraction in short-term credit. In Section 3, we showed that these firms reduce employment more sharply and face higher exit rates, despite being comparable to low-labor-share firms in their pre-shock characteristics. This suggests that the labor share captures structural features of firms' cost composition that matter for their ability to adjust when credit conditions worsen.

A high labor share indicates that a large fraction of a firm's value added is devoted to compensating labor. In general, labor costs are recurrent and relatively inflexible, which may increase firms' dependence on short-term financing. When external credit contracts, firms with high labor costs may be more exposed, leading to sharper employment adjustments and a higher likelihood of exit.

In line with this argument, we organize the analysis around three dimensions linked to this interpretation. First, we study how firms' liquid resources (working capital and cash per worker) interact with the labor share in shaping the employment and exit responses to the credit shock. This allows us to assess whether the amplification documented in Section 3 reflects the liquidity needs associated with labor-intensive production.

Second, we describe the workforce composition of high-labor-share firms. These firms employ more specialized workers and rely less on temporary contracts, features that raise adjustment costs for the firm. Third, we examine how these mechanisms evolve over the four years following the shock, and how the global interbank market freeze of 2008 interacts with the subsequent EU sovereign debt crisis. This helps clarify the timing of the employment and exit responses and the contribution of each episode. Last, we assess the robustness of our results to alternative specifications of spatial trends and to estimating the model separately by year.

4.1 Liquidity

To shed light on the mechanism behind the stronger responses of high–labor-share firms to the credit shock, we examine how labor cost interacts with indicators of firms' liquid resources. In particular, we focus on two measures that capture different dimensions of short-term financial flexibility: working capital, defined as the difference between current assets and liabilities, and cash per worker.

Firms with high labor share devote a larger part of their expenditures to wages, which constitute recurring and relatively inflexible short-term obligations. Meeting these obligations requires either stable access to external finance or sufficient internal liquidity. When a credit supply shock tightens borrowing conditions, firms with limited liquid assets have fewer internal options to smooth these payments. This suggests that the interaction between labor share and liquidity should be informative about the mechanism through which the shock propagates.

Table 3: Liquidity.

	Cash per worker	Working capital
Panel A: Log employment		
S_i * Labor share<median		
* Liquidity<median	0.061	0.141
	(0.058)	(0.109)
* Liquidity>median	0.042	0.050
	(0.055)	(0.063)
S_i * Labor share>median		
* Liquidity<median	0.077*	0.131**
	(0.043)	(0.060)
* Liquidity>median	0.092	0.087
	(0.061)	(0.063)
Firms	13,751	9,749
Panel B: Exit probability		
S_i * Labor share<median		
* Liquidity<median	-0.002	-0.034
	(0.027)	(0.034)
* Liquidity>median	-0.006	0.009
	(0.015)	(0.018)
S_i * Labor share>median		
* Liquidity<median	-0.043**	-0.038*
	(0.017)	(0.023)
* Liquidity>median	-0.009	-0.020
	(0.020)	(0.023)
Firms	13,742	9,742

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share below and above the median. We further interact the independent variable and the dummies for labor share with dummies for firms' liquidity below and above the median, where liquidity is defined as cash per worker or working capital. All regressions feature the full set of controls and fixed effects as defined in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

The interaction patterns in Table 3 are consistent with this interpretation. Across our liquidity measures, the estimated coefficients indicate that the credit shock is more strongly associated with employment and survival outcomes when a high labor share coincides with lower levels of liquid resources. In other words, the sensitivity of labor-intensive firms to the credit contraction varies systematically with their ability to rely on internal funds. Firms with a high labor share and relatively low working capital or cash holdings per worker are those for which the credit shock translates most directly into operational strain.

Taken together, these patterns clarify the mechanism behind the main result of the paper. The central finding is that firms with a high labor share are more exposed to credit supply shocks. The interaction exercises show that this heightened sensitivity is linked to the liquidity needs implied by a labor-intensive cost structure: firms with a large share of wage-related current expenses require sufficient liquid resources to meet these obligations when external financing tightens. Consistent with this mechanism, the strongest responses to the credit shock arise among high–labor-share firms that also hold low stocks of working capital or cash. Liquidity helps reveal why labor costs amplify the real effects of a credit contraction.

4.2 Workforce composition

As an additional step toward characterizing the firms that exhibit a high labor share, we proceed in two steps. First, we examine how labor share correlates with the composition of the workforce. In Table D.2 we present correlation results of a set of regressions where we use the labor share of the firm as a dependent variable, and workforce characteristics as explanatory measures.

Firms with a high labor share tend to employ a greater proportion of specialized workers and rely less on temporary contracts. Moreover, high-labor-share firms have more managers than the average firm, and their workers are more educated and with a higher tenure within the firm. These patterns are consistent with the idea that labor-intensive firms have cost structures that embed more rigid and more costly forms of labor. Although these correlations do not speak directly to the causal mechanism, they help clarify the types of firms captured by the high–labor-share category.

Second, we construct an alternative measure of the labor share based solely on specialized workers and middle managers. We consider the share of wage bill for specialized workers and middle managers over total value added, and we re-estimate the baseline specification as of equations (3) and (4) using this modified definition of the labor share. Table 4 presents the

Table 4: Workforce composition.

Panel A: Log employment	
S_i * Specialized labor share<median	0.020
	(0.036)
S_i * Specialized labor share>median	0.083**
	(0.039)
Firms	13,152
Panel B: Exit probability	
S_i * Specialized labor share<median	-0.018
	(0.013)
S_i * Specialized labor share>median	-0.023*
	(0.013)
Firms	13,145

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for specialized labor share below and above the median. All regressions feature the full set of controls and fixed effects as defined in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. ***p < 0.01, **p < 0.05, *p < 0.1.

results. When using only specialized workers to construct the labor share, results in terms of employment as well as firm exit are very similar to the ones reported in the last column of Table 2, confirming that firms with a higher share of specialized labor experience a stronger response to the credit shock.

Overall, this evidence complements the previous findings in Section 4.1. High–labor-share firms not only face substantial and recurrent wage commitments, but these commitments are more likely to be tied to the presence of specialized workers whose employment is more costly to adjust, as they represent a quasi-fixed input in production (Oi, 1962). This characterization is consistent with the interpretation that firms with high labor share have limited flexibility in reducing labor costs, and react more strongly when short-term credit becomes scarce. While not a standalone mechanism, the patterns documented here further support the view that the labor share captures meaningful differences in the rigidity and financing needs of firms' operating structures.

4.3 The EU sovereign debt crisis

An additional source of economic stress during our sample period was the EU sovereign debt crisis, which unfolded from late 2010 onward and severely hit Portugal from 2011 to 2012. To assess whether this second shock affects our main results or allows us to have a better understanding of the mechanism, we explicitly extend the baseline specification to account for this shock.

We follow (Buera and Karmakar, 2022) and construct two different variables in the spirit of equation (2), defining firm exposure to the EU sovereign debt crisis as:

$$EUcrisis_i = \sum_{b \in \mathcal{B}_i} \omega_{ib} \cdot BankSovAssets_b^{2009}, \tag{5}$$

where the bank b holdings of sovereign assets as a share of total assets is calculated either by using the average throughout 2009 or by using only the fourth quarter of 2009. As before, firm-banks exposure weights ω_{ib} are fixed in 2005, to avoid firms' endogenously re-sorting in the post-crisis period.

We include $EUcrisis_i$ in the estimate of equations (3) and (4) splitting the time period in two, up to 2010 and up to 2012, to better understand if firms' dynamics change when explicitly accounting for the two different shocks in the same specification.

The results are reported in Table 5. In Panel A, firm-level employment among high-labor-share firms declines even after explicitly controlling for firm sovereign debt exposure both in the short sample (up to 2010) and in the longer one (up to the end of the post period). In Panel A, the coefficients on S_i * Labor share>median are very similar across all specifications, with and without the inclusion of explicit controls for the EU sovereign debt crisis. This stability in magnitude and significance indicates that the differential response of employment in firms with high vs. low labor share is not driven by the EU sovereign debt crisis.

Panel B instead shows that the effect on firm exit becomes stronger once the EU sovereign debt crisis hits. While we find no statistically significant impact in the short sample (up to 2010), the coefficient is negative and significant when extending the horizon to 2012. This suggests that the probability of firm exit rises only with some delay. A plausible interpretation of this result is that firms with high labor share adjusted employment downward in the immediate aftermath of the interbank market freeze but came under additional pressure in the period of the sovereign debt crisis.

Table 5: Firm sovereign exposure.

	Up to 2010			Up to 2012		
Panel A: Log employment						
S_i * Labor share<median	0.043	0.037	0.037	0.040	0.040	0.040
	(0.035)	(0.036)	(0.036)	(0.039)	(0.041)	(0.041)
S_i * Labor share>median	0.057*	0.055*	0.056*	0.090**	0.086**	0.087**
	(0.032)	(0.033)	(0.033)	(0.039)	(0.039)	(0.039)
EU crisis$_i^{2009}$		0.423**			0.589***	
		(0.175)			(0.203)	
EU crisis$_i^{2009Q4}$			0.216**			0.316**
			(0.107)			(0.125)
Firms	13,725	13,549	13,549	13,760	13,549	13,549
Panel B: Exit probability						
S_i * Labor share<median	0.002	0.004	0.004	-0.008	-0.002	-0.002
	(0.005)	(0.006)	(0.006)	(0.014)	(0.006)	(0.006)
S_i * Labor share>median	-0.004	-0.003	-0.004	-0.028*	-0.014**	-0.013**
	(0.005)	(0.006)	(0.006)	(0.013)	(0.006)	(0.006)
EU crisis$_i^{2009}$		-0.058*			-0.064*	
		(0.032)			(0.029)	
EU crisis$_i^{2009Q4}$			-0.031			-0.043**
			(0.020)			(0.018)
Firms	13,759	13,550	13,550	13,747	13,550	13,550

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). Columns from (1) to (3) refer to the sample up to 2010, and columns from (4) to (6) up to the full post-period. The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share below and above the median. We further control for firms' exposure to banks' sovereign debt holdings as defined in equation (5), considering bank holdings either in 2009 (columns (2) and (4)) or 2009Q4 (columns (3) and (6)). All regressions feature the full set of controls and fixed effects as detailed in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

4.4 General equilibrium spillovers

We further decompose the time dimension of the adjustment and examine firms' employment responses and exit probabilities year by year in Table 6. In this table, we also progressively introduce geographical controls to account for potential spatial spillovers and general equilibrium effects. Specifically, columns (5)–(8) include fixed effects for broader geographical units (districts), while columns (9)–(12) control for the smaller commuting zones as defined in Afonso and Venâncio (2016).[12] The inclusion of these controls helps capture local interactions among firms that may arise through input and output markets, as well as localized credit spillovers

[12] Districts correspond to 18 regional units as per the NUTS2 EU classification, and are less restrictive than commuting zones (91 commuting zones in mainland Portugal).

from affected to unaffected firms.

The results in Table 6 reinforce our main findings. The coefficients for employment in columns (5)–(8) are larger than those in columns (9)–(12), consistent with the notion that controlling for smaller geographical areas mitigates potential local spillovers and inter-firm interactions. The coefficients for exit are instead unaffected.

The year-by-year decomposition provides additional insights into the dynamics reported in Table 5. The probability of firm exit increases and becomes statistically significant after 2010, when the effects of the Global Financial Crisis and the EU sovereign debt crisis likely compounded. At the same time, surviving firms display a gradual and growing adjustment in employment structure over time. While frictions may have initially constrained labor adjustment in the immediate aftermath of the interbank market dry-up, surviving firms appear to adapt progressively, reshaping their employment composition as the shock period unfolds.

Table 6: General equilibrium effects.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$\leq$ 2009	$\leq$ 2010	$\leq$ 2011	$\leq$ 2012	$\leq$ 2009	$\leq$ 2010	$\leq$ 2011	$\leq$ 2012	$\leq$ 2009	$\leq$ 2010	$\leq$ 2011	$\leq$ 2012
Panel A: Log employment												
S_i * Labor share<median	0.051	0.034	0.021	0.022	0.057*	0.044	0.031	0.032	0.056	0.043	0.031	0.032
	(0.034)	(0.034)	(0.036)	(0.038)	(0.034)	(0.034)	(0.035)	(0.037)	(0.035)	(0.035)	(0.036)	(0.038)
S_i * Labor share>median	0.050	0.057*	0.068*	0.077**	0.054*	0.065**	0.075**	0.093**	0.047	0.057*	0.069*	0.077**
	(0.031)	(0.032)	(0.036)	(0.038)	(0.030)	(0.031)	(0.035)	(0.037)	(0.030)	(0.032)	(0.035)	(0.037)
Firms	13,550	13,726	13,739	13,749	13,550	13,726	13,739	13,749	13,549	13,725	13,738	13,748
District controls					X	X	X	X				
CZ controls									X	X	X	X
Panel B: Exit probability												
S_i * Labor share<median	0.003	0.002	-0.002	-0.004	0.003	0.002	-0.002	-0.004	0.003	0.002	-0.002	-0.004
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.007)	(0.005)	(0.005)	(0.006)	(0.007)
S_i * Labor share>median	-0.002	-0.004	-0.012*	-0.014**	-0.002	-0.004	-0.012*	-0.014**	-0.002	-0.004	-0.012*	-0.014**
	(0.004)	(0.005)	(0.006)	(0.006)	(0.004)	(0.005)	(0.006)	(0.006)	(0.004)	(0.005)	(0.006)	(0.006)
Firms	13,760	13,760	13,760	13,760	13,760	13,760	13,760	13,760	13,759	13,759	13,759	13,759
District controls					X	X	X	X				
CZ controls									X	X	X	X

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). In each group of columns (1)-(4), (5)-(8) and (9)-(12) results refer to the sample up to 2009, 2010, 2011 and 2012. The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share below and above the median. We further control for district and commuting zones in columns (5)-(8) and (9)-(12), respectively. All regressions also feature the full set of controls and fixed effects as detailed in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. *** p<0.01, ** p<0.05, * p<0.1.

5 Non-cleansing effect and the labor share

A natural subsequent question is whether credit contractions accelerate or hinder the reallocation of resources toward more productive firms. The traditional cleansing view of recessions (Schumpeter, 1942) suggests that downturns can improve aggregate efficiency by displacing weaker firms and allowing stronger ones to expand. Yet, some recent empirical studies have questioned whether this cleansing effect should arise, especially if financial frictions hinder resource reallocation (Barlevy, 2003; Ouyang, 2009). For example, in a study on employment dynamics and reallocation, Foster et al. (2016) show that the Great Recession was less cleansing than previous downturns, and hypothesize that financial frictions might be relevant to justify these findings.

We analyze the cleansing effect of the global interbank market freeze in two steps. First, we compare the transmission of the shock across productivity bins, calculated using pre-shock measures of total factor productivity and partitioning firms in low, medium and high productivity. Table B.1 (columns (3) and (9)) shows that the exposure of a bank to the interbank market freeze predicts the drop in credit irrespective of a firm's ex-ante level of productivity. This evidence reinforces the results in Section 3.2, pointing toward the idea that banks did not selectively cut credit to specific firms in response to the shock.

We investigate further along this idea, augmenting equations (3) and (4) to allow the effects of the shock on high-labor-share firms to vary across productivity bins. We estimate the following employment equation:

$$Y_{i,t} = \gamma_i + \tau_t + \left(\sum_{k=1}^{2} \sum_{j=1}^{3} \beta_{k,j} S_i \cdot \mathbb{1}\{LabSh_{bin} = k, TFP_{bin} = j\} + \Gamma X_i \right) \cdot$$

$$\cdot \mathbb{1}\{t = Post\} + FE_{i,t} + \varepsilon_{i,t} \quad t \in \{Pre, Post\}. \tag{6}$$

The exit regression instead reads:

$$P(exit)_{i,t} = \tau_t + \sum_{k=1}^{2} \sum_{j=1}^{3} \beta_k S_i \cdot \mathbb{1}\{LabSh_{bin} = k, TFP_{bin} = j\} + \Gamma X_i + FE_{i,t} + \varepsilon_{i,t}. \tag{7}$$

Table 7 presents the results for firm employment and exit probability by productivity bins, separately for high- and low-labor-share firms. First, both employment adjustment and exit rates are uniformly higher among high-labor-share firms, regardless of productivity. Second, within high-labor-share firms, the effects across productivity bins are statistically indistinguishable.

Table 7: Non-cleansing effects.

	Cobb-Douglas	Translog
Panel A: Log employment		
S_i * Labor share<median		
* Low productivity	0.020	0.074
	(0.043)	(0.047)
* Medium productivity	0.008	0.072
	(0.046)	(0.052)
* High productivity	0.022	-0.032
	(0.046)	(0.053)
S_i * Labor share>median		
* Low productivity	0.084***	0.113**
	(0.044)	(0.050)
* Medium productivity	0.142***	0.085**
	(0.051)	(0.041)
* High productivity	0.128**	0.121***
	(0.054)	(0.047)
Firms	13,223	13,256
Panel B: Exit probability		
S_i * Labor share<median		
* Low productivity	-0.006	-0.027
	(0.015)	(0.017)
* Medium productivity	-0.004	0.002
	(0.016)	(0.018)
* High productivity	0.003	-0.008
	(0.015)	(0.018)
S_i * Labor share>median		
* Low productivity	-0.054***	-0.042**
	(0.017)	(0.021)
* Medium productivity	-0.030*	-0.025**
	(0.017)	(0.013)
* High productivity	-0.046*	-0.035**
	(0.026)	(0.018)
Firms	13,215	13,248

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (6) and (7). The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share below and above the median. We further interact the independent variable and the dummies for labor share with dummies for terciles of productivity, estimated according to a three-factor gross output Cobb-Douglas (column (1)) and translog (column (2)) production function (Ackerberg et al., 2015). All regressions feature the full set of controls and fixed effects as detailed in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. *** p<0.01, ** p<0.05, * p<0.1.

Overall, the evidence indicates that the credit contraction affected firms in a way that was orthogonal to total factor productivity. Conditional on productivity, firms with high labor share experienced sharper employment losses and higher exit rates than otherwise similar firms with low labor share. This pattern is consistent with the interpretation that the credit shock disrupted the normal process of reallocation: survival was not determined by efficiency, but by the ability to adjust labor costs when financing conditions tightened.

These results point to a specific mechanism through which credit shocks may weaken allocative efficiency. The credit shock amplified by high labor share shifted the composition of surviving firms toward those that had a more flexible cost structure, but not toward the most productive ones. This evidence is consistent with a non-cleansing effect: the shock did not selectively remove the least efficient firms, but forced out productive firms constrained by high labor costs.[13]

6 Conclusions

This paper studies how firms' labor cost structure shapes their response to a sudden disruption in short-term credit supply. Using detailed administrative data from Portugal and an exogenous contraction in bank short-term funding triggered by the 2008 global interbank freeze, we find that the real effects of this shock are not evenly distributed across firms. Instead, they are systematically stronger for firms with a high labor share. These firms reduce employment more and face higher exit probabilities than otherwise similar firms with lower labor share.

Consistent with these results, we further show that high-productivity firms with high labor share suffer employment losses and exit rates comparable to those of lower-productivity firms with similarly high labor share, pointing to inefficient reallocation. This evidence informs the broader debate on whether recessions, especially those triggered by financial shocks, enhance or hinder allocative efficiency.

Complementary to the seminal contribution by Favilukis et al. (2020), our findings highlight the importance of financial frictions shaped by high labor share and point to potentially significant policy implications. As firms increasingly rely on specialized and harder-to-adjust workers, and as intangible forms of capital become more prominent (Sun and Xiaolan, 2019; Crouzet et al., 2022), understanding how firms finance their labor obligations becomes central to assess-

[13] It is important to emphasize that our results do not imply a reverse cleansing pattern. We do not find that low-productivity firms expand or survive disproportionately; rather, conditional on productivity, labor share becomes the key predictor of adjustment. The evidence therefore points to weakened allocative efficiency, not perverse selection.

ing their resilience to credit disruptions. Our results suggest a role for managerial practices and for policies that promote that promote more stable financing of labor costs or that reduce firms' exposure to front-loaded payroll commitments, in line with the evidence provided by Barrot and Nanda (2020).

Our arguments have implications for labor market policies, too. The operating leverage embedded in labor costs indicates that easing wage rigidity or other labor market frictions may also reduce firms' exposure to sudden credit tightening. Moreover, policies that alleviate the burden of current payroll rather than subsidizing new hiring, may be effective in periods of financial turmoil. Evidence on short-time work and furlough schemes supports this view, showing that such measures can preserve employment and stabilize firms when labor adjustment costs are high (Giupponi and Landais, 2023; Cahuc et al., 2018).

References

Ackerberg, Daniel A., Kevin Caves, and Garth Frazer. 2015. "Identification Properties of Recent Production Function Estimators." *Econometrica*, 83(6): 2411–2451.

Afonso, António, and Ana Venâncio. 2016. "The relevance of commuting zones for regional spending efficiency." *Applied Economics*, 48(10): 865–877.

Amiti, Mary, and David E. Weinstein. 2018. "How Much do Idiosyncratic Bank Shocks Affect Investment? Evidence from Matched Bank-Firm Loan Data." *Journal of Political Economy*, 126(2): 525–587.

Barlevy, Gadi. 2003. "Credit market frictions and the allocation of resources over the business cycle." *Journal of Monetary Economics*, 50(8): 1795–1818.

Barrot, Jean-Noel, and Ramana Nanda. 2020. "Can Paying Firms Quicker Affect Aggregate Employment?" *Journal of Finance*, 75(6): 3139–3173.

Bentolila, Samuel, Marcel Jansen, and Gabriel Jiménez. 2017. "When Credit Dries Up: Job Losses in the Great Recession." *Journal of the European Economic Association*, 16(3): 650–695.

Bernanke, Ben, and Mark Gertler. 1989. "Agency costs, net worth, and business fluctuations." *American Economic Review*, 79(1): 14–31.

Berton, Fabio, Sauro Mocetti, Andrea Presbitero, and Matteo Richiardi. 2018. "Banks, Firms, and Jobs." *Review of Financial Studies*, 31(6): 2113–2156.

Bonfim, Diana, and Qinglei Dai. 2017. "Bank size and lending specialization." *Economic Notes*, 46(2): 329–380.

Borusyak, Kirill, Peter Hull, and Xavier Jaravel. 2022. "Quasi-Experimental Shift-Share Research Designs." *Review of Economic Studies*, 89(1): 181–213.

Buera, Francisco, and Sudipto Karmakar. 2022. "Real Effects of Financial Distress: The Role of Heterogeneity." *Economic Journal*, 132(644): 1309–1348.

Cahuc, Pierre, Francis Kramarz, and Sandra Nevoux. 2018. "When Short-Time Work Works." CEPR Discussion Paper No. 13041.

Cardoso, Ana Rute, and Pedro Portugal. 2005. "Contractual Wages and the Wage Cushion under Different Bargaining Settings." *Journal of Labor Economics*, 23(4): 875–902.

Chodorow-Reich, Gabriel. 2014. "The Employment Effects of Credit Market Disruptions: Firm-level Evidence From the 2008-9 Financial Crisis." *Quarterly Journal of Economics*, 129(1): 1–59.

Crouzet, Nicolas, Janice C. Eberly, Andrea L. Eisfeldt, and Dimitris Papanikolaou. 2022. "The Economics of Intangible Capital." *Journal of Economic Perspectives*, 36(3): 29–52.

Danthine, Jean-Pierre, and John B Donaldson. 2002. "Labor Relation and Asset Returns." *Review of Economic Studies*, 69: 41–64.

Davis, Steven J., and John Haltiwanger. 1990. "Gross job creation and destruction: Microeconomic evidence and macroeconomic implications." *NBER Macroeconomics Annual*, 5: 123–168.

Davis, Steven J., and John Haltiwanger. 1992. "Gross job creation, gross job destruction, and employment reallocation." *Quarterly Journal of Economics*, 107(3): 819–863.

Davis, Steven J., John C. Haltiwanger, and Scott Schuh. 1996. *Job creation and destruction.* MIT Press.

Donangelo, Andrés, François Gourio, Matthias Kehrig, and Miguel Palacios. 2019. "The Cross-Section of Labor Leverage and Equity Returns." *Journal of Financial Economics*, 132: 497–518.

Ellul, Andrew, and Marco Pagano. 2019. "Corporate leverage and employees' rights in bankruptcy." *Journal of Financial Economics*, 133(3): 685–707.

Faia, Ester, and Vincenzo Pezone. 2024. "The Cost of Wage Rigidity." *Review of Economic Studies*, 91(1): 301–339.

Favilukis, Jack, Xiaoji Lin, and Xiaofei Zhao. 2020. "The elephant in the room: The impact of labor obligations on credit markets." *American Economic Review*, 110(6): 1673–1712.

Foster, Lucia S., Cheryl Grim, and John C. Haltiwanger. 2016. "Reallocation in the Great Recession: Cleansing or Not?" *Journal of Labor Economics*, 34(1, pt. 2): S293 – S331.

Giupponi, Giulia, and Camille Landais. 2023. "Subsidizing Labor Hoarding in Recessions: the Employment and Welfare Effects of Short Time Work." *Review of Economic Studies*, 90(4): 1963–2005.

Haltiwanger, John C, Henry R Hyatt, Erika McEntarfer, and Matthew Staiger. 2022. "Cyclical Worker Flows: Cleansing vs. Sullying." *NBER Working Paper No. 28802.*

Ivashina, Victoria, and David S. Scharfstein. 2010. "Bank lending during the financial crisis of 2008." *Journal of Financial Economics*, 97(3): 319–338.

Iyer, Rajkamal, José-Luis Peydró, Samuel da Rocha-Lopes, and Antoinette Schoar. 2014. "Interbank liquidity crunch and the firm credit crunch: Evidence from the 2007–2009 crisis." *Review of Financial Studies*, 27(1): 347–372.

Jimenez, Gabriel, Steven Ongena, Jose-Luis Peydro, and Jesus Saurina. 2014. "Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk Taking?" *Econometrica*, 82(2): 463–505.

Kehrig, Matthias. 2015. "The Cyclical Nature of the Productivity Distribution." mimeo.

Khwaja, Asim Ijaz, and Atif Mian. 2008. "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market." *American Economic Review*, 98(4): 1413–42.

Matsa, David A. 2018. "Capital Structure and a Firm's Workforce." *Annual Review of Financial Economics*, 10: 387–412.

Moser, Christian, Farzad Saidi, Benjamin Wirth, and Stefanie Wolter. 2022. "Credit Supply, Firms, and Earnings Inequality." CEPR Discussion Paper No. 16123.

Oi, Walter J. 1962. "Labor as a quasi-fixed factor." *Journal of Political Economy*, 70(6): 538–555.

Olden, Andreas, and Jarle Møen. 2022. "The Triple Difference Estimator." *Econometrics Journal*, 25(3): 531–553.

Osotimehin, Sophie, and Francesco Pappadà. 2015. "Credit Frictions and The Cleansing Effect of Recessions." *Economic Journal*, 127(602): 1153–1187.

Ouyang, Min. 2009. "The scarring effect of recessions." *Journal of Monetary Economics*, 56(2): 184–199.

Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon. 2015. “Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data.” *The Review of Economic Studies*, 82(1): 333–359.

Schumpeter, Joseph A. 1942. *Socialism, capitalism and democracy.* Harper and Brothers.

Serfling, Matthew. 2016. “Firing Costs and Capital Structure Decisions.” *Journal of Finance*, 71(5): 2239–2286.

Simintzi, Elena, Vikrant Vig, and Paolo Volpin. 2015. “Labor Protection and Leverage.” *Review of Financial Studies*, 28(2): 561–591.

Sun, Qi, and Mindy Z. Xiaolan. 2019. “Financing Intangible Capital.” *Journal of Financial Economics*, 133(3): 564–588.

Appendices

A Data description

A.1 Controls of the empirical specifications

The empirical specifications in the text include the following set of controls, unless otherwise specified:

- **Balance check controls**: value added per employee; log of total assets; log of total number of employees; symmetric credit growth between 2004 and 2005; debt-to-asset ratio; debt toward suppliers over assets.
- **Bank controls**: log level of short-term credit; short-term credit growth between 2004 and 2005; number of loans; weighted length of banking relationships; share of short-term credit in regular credit.
- **Firm controls**: financial leverage; cash over assets; trade credits over assets; share of fixed tangible assets in total assets; firm age; log of the average wage; share of temporary workers; average workers' turnover rate between 2003 and 2005; labor share.
- **Performance controls**: log of sales; ROA; ROS; share of exports in sales in 2006.
- **Fixed effects**: 3-digit industrial sector; commuting zone; quintiles of firm age and size; dummies for exporter status, firm with overdue loans in 2007, banking relationship with banks failed before 2014, firm capable of issuing bonds, firm with a single banking relationship.

When not differently specified, balance check controls, bank, firm and performance controls are all measured in 2005.

A.2 Credit registry: Central de Responsabilidades de Crédito

The *Central de Responsabilidades de Crédito* (henceforth CRC), is the credit registry of the Bank of Portugal. The dataset available for our period of analysis (up to 2013) features bank-firm exposures above 50 euros by the universe of Portuguese credit institutions at the monthly level. The dataset does not contain credit exposure by foreign banks towards Portuguese firms, but can contain credit from Portuguese banks to foreign owned firms residing and operating in Portugal.

The dataset contains information on the number of credit relationships, the corresponding amounts and the kind of exposure: short- and long-term, credit granted but still not materialized (potential), credit overdue, written-off or renegotiated. For our analysis, and given the time frequency in other data sources, we average debt exposures at the yearly level. We use "regular" credit in our specifications as a measure of credit, which corresponds to credit in good standing and in use by the firm. Credit is defined as short-term if the maturity is below 1 year or is a credit line with undefined maturity (post-2009 data) or is categorized as commercial, discount or other funding short-term pre-2009. We group together short-term loans, credit lines with defined short-term maturity and credit lines with undefined maturity because the latter category of credit lines comprehends all those exposures that, once withdrawn by the customer, should undergo renegotiation with the bank in order to be rolled-over. This feature makes them very liquid instruments that, similarly to short-term loans, is subject to short-term credit rates volatility and rollover risk. Credit lines always constitute above 3/4 of short-term credit as we define it. Long-term credit is obtained as the residual in regular credit.

A.3 Banks balance sheet dataset: Balanço das Instituições Monetárias e Financeiras

The "Balanço das Instituições Monetárias e Financeiras" (henceforth BBS) is the balance-sheet dataset for credit institutions. It is a proprietary dataset of the Bank of Portugal with the balance sheets of the universe of financial and monetary institutions operating in the country. In the dataset, for each balance-sheet item (liability or asset) it is possible to see which is the kind of counterparty involved (i.e. the kind of institution, government, private or non-governmental body, creditor or debtor), the maturity of the item in question if relevant (time deposits, on demand deposits, interbank long-term or short-term exposures) and the nationality of the counterparty (extra-EU or each EU country separately). The data are reported at the monthly level.

The measure of interbank funding is computed from this dataset as the ratio of the average (yearly) short-term foreign interbank borrowing by the bank over total assets. Foreign short-term interbank borrowing is computed as the sum of short-term deposits with maturity up to 1 year and repos where the counterparty is a foreign financial institution, excluding central banks.

In matching the BBS and the CRC, we also took care of harmonizing and making bank definitions consistent across datasets given the existence of many mergers and acquisitions in the Portuguese banking system during the period. Each M&A event between 2000 and 2013 (for institutions with at least 1 percent of total credit in a given month) was taken into consideration in order to make sure that credit flows across institutions were accounted for, and definitions of bank codes across datasets and across time were consistent.

A.4 Banks balance sheet dataset: Sistema Integrado de Estatísticas de Títulos

The *Sistema Integrado de Estatísticas de Títulos* (henceforth SIET) is a proprietary dataset of the Bank of Portugal. It includes debt securities (i.e. banknotes, commercial papers, bonds, etc.) with maturity both short term (up until 1 year) and long term (more than 1 year), and capital (i.e. shares and other means of participation) but neither derivatives nor REPOs. For both debt securities and capital, SIET collects data on emissions and portfolio holdings. For emissions, SIET collects flows and stocks relative to national issuers, on a title-by-title and issuer-by-issuer bases. For portfolio holdings, SIET collects flows and stocks on an investor-by-investor and title-by-title basis. Through SIET we obtain holdings of sovereign debt.

A.5 Firm level financial statement data: Central de Balanços

The *Central de Balanços* (henceforth CB) is a firm-level balance-sheet and income statement database, managed by the Bank of Portugal. It consists of a repository of yearly economic and financial information on the universe of non-financial corporations operating in Portugal from 2005 to 2013. It includes information on sales, balance-sheet items, profit and loss statements, and cash flow statements (after 2009) for all private firms in Portugal. The CB builds on the *Informaçào Empresarial Semplificada*, an administrative firms' balance-sheet dataset managed by the Ministry of Finance and Public Administration.

After 2009, in order for the data to comply with international accounting standards, there has been a major overhaul of the variables definitions in the dataset, from the *Plano Oficial de Contabilidade* (POC) to the *Sistema de Normalização Contabilística* (SNC).

The dataset contains information on firms' balance sheets and income statements. We use information on total assets, fixed assets, current assets, total debt, and interest expenditures, cash-flow and capital expenditures (after 2009), cash balances, exports and export status, trade credits, debt towards suppliers, inventories, return on equity, assets and sales, salaries, total employee related, revenues, costs and breakdowns (among which intermediate inputs, materials and services), profits. We compute value added by adding back employee related expenditures to the firm EBITDA.

Given the dataset's time-consistent coverage of firms operating in Portugal, we use it to identify firm exits as well. The procedure to identify a firm exit combines different criteria. First, we rely on the CB to categorize whether a firm is active, suspended activity or closed down. Second, we flag all the cases in which the firm has 0 employees the next year but has a positive number of employees in a given year. Third, we check whether a firm disappears from the dataset in any given year that is not 2013 and does not re-appear at any time. Fourth, we label as exits the instances in which a firm disappears for more than two years.

A.6 Labor market data: Quadros de Pessoal

The *Quadros de Pessoal* (henceforth QP) is a longitudinal matched employer-employee dataset, containing detailed data at the workers' and firms' level on employment composition for the firms and individual worker characteristics. The data are collected and managed by the Ministry of Labour and Social Solidarity, that draws on a compulsory annual census of all the firms employing at least one worker at the end of October each year. It does not cover the public administration and non-market services, whereas it covers partially or fully state-owned firms, provided that they offer a market service. The dataset covers approximately 350,000 firms and 3 million employees per year.

The dataset is available at the Bank of Portugal from 1982 to 2013, and is hierarchically made up by a firm-level dataset, an establishment-level dataset and a worker-level dataset. The firm level dataset contains information on the firm location (from regional to the parish level, which corresponds to a neighborhood), industry of operation (CAE rev. 2.1 until 2006 and CAE rev. 3, based on NACE-Rev. 2 Statistical classification of economic activities in the European Community), total employment, total sales, ownership structure and legal incorporation. Analogous information is available on the establishment-level dataset.

The worker level dataset provides detailed information on worker characteristics and contracts. Information includes workers' gender, age, detailed occupational code (the *Classificação Nacional de Profissões* (CNP94) up to 2009 and the *Classificação Portuguesa das Profissões* (CPP2010) from 2010 onward, which is based on ISCO08 International Occupational Classification Codes), detailed educational level, qualification within the firm (managerial qualification, specialized workforce or generic workers, besides trainees). At the contract level, it is possible to know the precise hiring date, the kind of contract (fixed-term or open-ended), the hours arrangement (full-time versus part-time), the effective number of hours worked, and information on the compensation. For each worker, it is possible to obtain information on the base pay, any extra paid in overtimes or other extra-ordinary payments and other irregular pay components.

The unique worker identifier is based on the workers' social security number, and its coverage and reliability of the data is high.

A.7 Combined dataset and data processing

BBS and CRC are merged by means of bank identifiers, while QP is merged to CRC using the firm identifier. As in Cardoso and Portugal (2005), we account for sectoral and geographical specificities of Portugal by restricting the sample to firms based in continental Portugal. We further exclude firms in agriculture, fishing, energy (extraction, mining and distribution), the construction sector and the financial sector itself. We only consider firms with a credit relationship with any bank in 2005, which must survive until 2009 to be present in the period of time after the credit shock. We focus on firms with at least 9 employees, which is the threshold for the fourth quartile in the distribution of firms' sizes in the years before 2009. In order to reduce measurement noise, we consider only firms with no data gaps in the pre-period. Concerning workers, we consider single-job, full-time workers between 16 and 65 years old, and working between 25 and 80 hours (base plus overtime) per week. Each worker in QP has a unique identifier based on his or her social security number. We drop from the sample a minority of workers with an invalid social security number and with multiple jobs. If a worker is employed in a particular year, we observe the corresponding firm identifier for that year. We also perform some consistency and sanity checks in selecting the relevant banks to be included in the analysis. More precisely, we exclude from the analysis the very small banks that disappear from the dataset before 2009. We also exclude from the set those banks for which foreign interbank funding is intra-banking-group funding from the foreign headquarter to the Portuguese subsidiary.

B Exposure-level analysis

This section provides exposure-level evidence that banks did not selectively cut credit to particular firms in response to the liquidity shortfall. Establishing this is crucial to ensure that our empirical estimates reflect firms' responses to an exogenous contraction in credit supply rather than bank-driven reallocation across borrowers.

We estimate the following specification:

$$S_{i,b} = \beta FD_b + \mu_i + \varepsilon_{i,b}, \tag{B.1}$$

where $S_{i,b}$ is the symmetric growth rate of short-term credit exposure of firm i to bank b, computed as the change between the 2006–2007 and 2009–2010 averages (as in equation (1)). The variable FD_b denotes the bank's pre-shock ratio of foreign short-term interbank liabilities to total assets. Firm fixed effects μ_i absorb all time-invariant firm heterogeneity, isolating within-firm variation in credit supply—i.e., changes in lending to the *same* firm by banks with different interbank exposures. Following Khwaja and Mian (2008), this approach identifies the semi-elasticity of credit supply for firms with multiple banking relationships.

Table B.1 reports the coefficients and standard errors from a series of specifications based on equation (B.1). In columns (1)–(11), the dependent variable is the symmetric growth rate of short-term credit to firm i; column (12) instead considers the growth rate of total credit, in the spirit of Iyer et al. (2014). Our baseline specification in column (1) includes firm fixed effects and uses FD_b as the main regressor. The estimated semi-elasticity is negative and significant: a one–percentage-point increase in a bank's foreign short-term interbank exposure is associated with a 2.1–percentage-point decline in short-term credit to the same firm between 2006–2007 and 2009–2010.

Columns (2) and (8) examine whether this effect varies with firms' labor cost structure. In these specifications, FD_b is interacted with dummies for firms with labor share below or above the median. The estimated coefficients are very similar in magnitude and always negative, indicating that more exposed banks cut credit in the same fashion for firms with low and high labor share.

Columns (3) and (9) allow the semi-elasticity to differ across terciles of firm productivity, where productivity is estimated using a three-factor gross-output Cobb–Douglas production function. Again, the coefficients associated with low-, medium-, and high-productivity firms are all negative and of comparable size. Consistent with our main identification strategy, there is no evidence that banks cut credit to firms based on their productivity level.

Columns (4) and (5) address the concern that our results may be contaminated by the onset of the EU sovereign debt crisis. These regressions add controls for banks' ratio of sovereign debt holdings to total assets, measured in 2009 and 2009Q4, respectively. While these sovereign-exposure controls are themselves significant, the coefficient on FD_b remains very close to the baseline estimate, reinforcing the interpretation that our instrument captures an interbank liquidity shock that is distinct from sovereign-risk dynamics.

Columns (6)–(11) explore robustness to alternative sets of fixed effects and to sample definition. In columns (1)–(5) and (12), we include firm fixed effects. Column (6) removes firm fixed effects and additional controls, providing a bare specification. Columns (7)–(11) drop firm fixed effects but instead saturate the regressions with a set of other fixed effects: 3-digit industry, commuting zone, age and size quintiles, a dummy for being an exporter in 2005, a dummy for overdue loans in 2007, a dummy for the ability to issue bonds, and a dummy indicating whether the firm has any loan with a failing bank up to 2014. Most specifications are estimated on the subsample of firms with multiple bank relationships; columns (6) and (11) use the complete sample of firms. Across these specifications, the estimated semi-elasticity of short-term credit with respect to FD_b varies modestly, supporting the view that our baseline results are not driven by particular sample restrictions or by unobserved matching effects between firms and banks.

Finally, column (12) replaces FD_b with the overall ratio of interbank liabilities to assets in 2005 (domestic and foreign), denoted ID^{2005}, and considers the growth rate of total credit as the dependent variable, mirroring the specification in Iyer et al. (2014). The estimated effect of interbank exposure on total credit is negative and of similar order of magnitude to their benchmark result, despite differences in sample and bank consolidation. This confirms that the interbank market freeze translated into a sizable reduction in bank lending.

Table B.1: Exposure-level regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
FD_b	-2.104***			-2.151***	-2.186***	-2.145***	-2.192***			-2.159***	-2.237***	
	(0.229)			(0.221)	(0.218)	(0.251)	(0.251)			(0.248)	(0.247)	
FD_b * Labor share $<$ median		-2.017***						-2.153***				
		(0.274)						(0.257)				
FD_b * Labor share $>$ median		-2.237***						-2.360***				
		(0.258)						(0.264)				
FD_b * Low productivity			-1.778***						-2.068***			
			(0.327)						(0.320)			
FD_b * Medium productivity			-2.234***						-2.328***			
			(0.255)						(0.273)			
FD_b * High productivity			-2.311***						-2.272***			
			(0.348)						(0.367)			
$\text{BankSovAssets}_b^{2009}$				-6.501***								
				(0.576)								
$\text{BankSovAssets}_b^{2009Q4}$					-4.226***							
					(0.369)							
ID^{2005}												-0.432***
												(0.121)
Firms	9,927	9,509	9,509	9,927	9,927	9,927	13,937	13,147	13,147	9,927	13,933	10,413
Firm FE	X	X	X	X	X							X
Additional FE							X	X	X	X	X	
Sample	Multi-loan	Multi-loan	Multi-loan	Multi-loan	Multi-loan	Multi-loan	All-firm	Multi-loan	Multi-loan	Multi-loan	All-firm	Multi-loan

The table reports coefficients and standard errors (in parentheses) of the covariates of the model specified as defined in equation (B.1). In columns (1)-(11), the dependent variable is the symmetric growth rate of short-term credit to firm i as in equation (1). In column (12), the dependent variable is the growth rate of total credit as in Iyer et al. (2014). In columns (1)-(11), the independent variable FD_b is a bank's b ratio of foreign short-term interbank liabilities to total assets, interacted with dummies for labor share below or above the median (columns (2) and (8)) and dummies for terciles of productivity (columns (3) and (9)) estimated according to a three-factor gross output Cobb-Douglas production function. In column (4) and (5), we further control for banks' ratio of sovereign debt holdings to total assets, considering holdings either in 2009 (column (4)) or 2009Q4 (column (5)). In column (12), the independent variable ID^{2005} is the overall ratio of interbank liabilities to assets in 2005 (domestic and foreign). In columns (1)-(5) and (12), we control for firm fixed effects. In column (6), there are no additional controls, whereas in columns (7)-(11) we control for additional fixed effects: 3-digit industry, commuting zone, age and size quintiles, dummy for exporter 2005, dummy for overdue loans in 2007, dummy for firm capable of issuing bonds, dummy indicating whether the firm has any loan with a failing bank up until 2014. Samples are firms with loans with more than one bank, except for columns (6) and (11) where we use the complete sample of firms. Standard errors clustered at the firm and bank-by-3 digits industry level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

C Instrument properties and identification

This appendix provides additional background and evidence related to the identifying variation. A general concern in settings with long-standing bank–firm relationships is that persistent aspects of matching may correlate with banks' pre-shock characteristics, potentially confounding the interpretation of differential credit adjustments. Our goal here is to document why, in the Portuguese context, these issues appear limited once the empirical specification conditions on firm fixed effects and predetermined controls.

Firms differ across many persistent dimensions—industry, size, age, internationalization, capital structure, and relationship history—which naturally shape their banking portfolios. Unconditional correlations between firm observables and banks' foreign interbank exposures would therefore reflect these enduring patterns rather than violations of the identification strategy. For this reason, our empirical design follows the conditional approach standard in the credit-supply literature (e.g., Khwaja and Mian, 2008; Chodorow-Reich, 2014; Amiti and Weinstein, 2018; Jimenez et al., 2014). Identification comes from comparing how the same firm adjusts borrowing from banks that were differentially affected by the interbank market freeze. Firm fixed effects absorb all time-invariant components of bank choice, and the specification includes a wide set of predetermined controls. In a shift–share framework (Borusyak et al., 2022), this corresponds to evaluating balance conditional on the same specification used in the first stage.

Figure 2b reports a set of such conditional balance exercises. Once we condition on firm fixed effects and predetermined covariates, the exposure measure shows no systematic relationship with lagged firm characteristics such as assets, leverage, value added per worker, labor share, ROA, workforce measures, or the number of pre-shock banking relationships. Appendix Table B.1 complements this evidence by showing that banks more reliant on foreign interbank funding reduce short-term credit similarly across firms with different productivity levels or labor share. These patterns suggest that the exposure variation is not mechanically related to borrower composition.

Two additional features of the Portuguese banking system are worth noting. First, while the market is moderately concentrated – similar to many settings studied in the literature – firms typically maintain more than one credit relationship, and this multi-bank structure was already well established before the shock. This ensures that there is within-firm heterogeneity in exposure to the interbank freeze.

Second, although banks may differ in their business focus, existing work on Portuguese institutions (e.g., Bonfim and Dai, 2017) suggests that such patterns are stable over time and largely unrelated to short-term funding structure such as foreign interbank borrowing. Moreover, any persistent specialization would be absorbed by the firm fixed effects in our specification, since identification comes from differences in how the same firm adjusts borrowing across lenders.

One possible way to show that our instrument isolates the 2008 interbank-driven credit shock and is not confounded by the subsequent sovereign debt crisis, is to estimate the following falsification regression:

$$\Delta D_i^{2013-2010} = \theta \, \Delta D_i^{2010-2006} + \gamma Z_i + \Lambda X_i + \eta_i. \tag{C.1}$$

Here, the dependent variable $\Delta D_i^{2013-2010}$ is the absolute change in short-term credit between 2010 and 2013, a period dominated by sovereign-risk dynamics rather than interbank market stress. The key regressor $\Delta D_i^{2010-2006}$ controls for pre-2010 credit dynamics, while Z_i is the firm-level shift–share instrument defined in equation (2), and X_i collects the usual firm-level controls. The coefficient of interest is γ. If the sovereign crisis had propagated through the same channel as our instrument, then our instrument Z_i would retain predictive power in this later period, implying $\gamma \neq 0$. Conversely, $\gamma \approx 0$ would indicate that the instrument is relevant *only* for the liquidity shock originating in the interbank market freeze and does not load onto subsequent macro-financial disturbances.

Table C.1 reports the results of this falsification exercise. In all columns, the coefficient on Z_i is small, statistically indistinguishable from zero, and unstable in sign once we condition on pre-2010 credit changes. Columns (4) and (5) further control for firms' exposure to banks' sovereign debt holdings in 2009Q4—using either 2005 or 2009 bank relationships to define exposure—and the estimates of γ remain close to zero. These findings confirm that the instrument does not predict credit changes after 2010, as expected if it captured the 2008 liquidity shock rather than the later sovereign crisis.

Overall, the combined evidence from Tables B.1 and C.1 indicates that the variation in short-term credit associated with banks' foreign interbank exposures does not reflect systematic differences across firms nor the subsequent sovereign debt crisis, and is therefore consistent with a liquidity shock originating in banks' funding conditions.

Table C.1: Instrument properties, robustness.

	(1)	(2)	(3)	(4)	(5)
$\Delta D_i^{2010-2006}$	-0.220***	-0.231***	-0.252***	-0.253***	-0.250***
	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)
Z_i	0.240	-0.041	-0.142	-0.170	-0.147
	(0.277)	(0.257)	(0.259)	(0.261)	(0.260)
EU $\text{crisis}_i^{2009Q4 \mid \mathcal{B}_i^{2005}}$				-0.990*	
				(0.589)	
EU $\text{crisis}_i^{2009Q4 \mid \mathcal{B}_i^{2009}}$					-1.235**
					(0.629)
Firms	12,883	12,865	12,059	12,059	11,880
FE		X	X	X	X
Controls			X	X	X

In all columns, the dependent variable is the absolute change in short-term credit between 2010 and 2013. The independent variables are the absolute change in short-term credit between 2006 and 2010, and the instrument Z_i as defined in equation (2). Columns (4) and (5) control for firms' exposure to banks' sovereign debt holdings in 2009Q4 as defined in equation (5), considering banks with which the firm has a relationship either in 2005 (column (4)) or 2009 (column (5)). The sample consists of firms with short-term credit relationships in 2010. All regressions feature a set of controls and fixed effects as detailed in Appendix A.1. Standard errors clustered at the bank-by-3-digit-industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

D Additional tables and figures

Table D.1: Labor share in sales: Employment and exit probability.

	(1)	(2)	(3)	(4)	(5)
Panel A: Log employment					
S_i * Labor share<median	0.015	0.030	0.031	0.032	0.030
	(0.034)	(0.035)	(0.036)	(0.036)	(0.036)
S_i * Labor share>median	0.120***	0.109***	0.107***	0.108***	0.107***
	(0.042)	(0.041)	(0.040)	(0.041)	(0.041)
Firms	14,057	13,883	13,883	13,809	13,805
FE	X	X	X	X	X
Balance checks		X	X	X	X
Bank controls			X	X	X
Firm controls				X	X
Performance controls					X
Panel B: Exit probability					
S_i * Labor share<median	0.003	0.002	-0.004	-0.004	-0.004
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
S_i * Labor share>median	-0.003	-0.006	-0.012**	-0.013**	-0.013**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Firms	14,057	13,833	13,833	13,808	13,804
FE	X	X	X	X	X
Balance checks		X	X	X	X
Bank controls			X	X	X
Firm controls				X	X
Performance controls					X

The table reports IV coefficients (2nd stage) and standard errors (in parentheses) of the covariates of the model specified as in equations (3) and (4). The dependent variables are the log level of the total number of employees (Panel A) and a dummy variable taking value 1 if firm i exits in any year between 2009 and 2012 (Panel B). The independent variable S_i is the symmetric growth rate of short-term credit to firm i as in equation (1) instrumented by Z_i as in equation (2) and interacted with dummies for labor share in sales below and above the median. All regressions feature a set of controls and fixed effects as detailed in Appendix A.1. Standard errors in parentheses, clustered at the bank-by-3-digit-industry level. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table D.2: Correlations of observables with the labor share.

	Labor share
Share of managers	0.138***
Share of specialized workers	0.061***
Share of temporary workers	-0.031***
Median tenure (perm.)	0.131***
Share of high-education workers	0.128***

The table reports OLS coefficients of pairwise regressions where the dependent variable is the labor share and the independent variables are workforce characteristics at the firm level. Share of manager is the share of managers in the total workforce of the firm. Share of specialized workers is the share of team leaders and specialized production workers over the total workforce of the firm. Share of temporary workers is the share of the workforce with a temporary contracts over the total workforce of the firm. Median tenure is the median tenure of the workforce with a permanent contract. Share of workers with high education is the share of the workforce with college degree or above over the total workforce of the firm. All regressions feature the full set of controls and fixed effects as detailed in Appendix A.1. *** p<0.01, ** p<0.05, * p<0.1.