Survive another day: Does Uncertain Financing Affect the Composition of Investment?*

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Abstract

We expect firms that face financial constraints to prioritize shorter term investments over longer term ones. Using a high quality panel data set, and a difference-in-differences approach to control for demand effects, we study whether this has been indeed the case after the sharp deterioration of the financial conditions for firms in the European periphery. Specifically, we compare Spanish manufacturing firms which are foreign owned (and thus have alternative financing channels) to those which are Spanish owned (and thus financially constrained) along a large number of dimensions before and after the financial crisis. We show that, allowing for firm fixed effects to control for unobserved heterogeneity and for industry specific time effects, firms which are capital constrained reduce employment substantially more (by 6%); reduce investment drastically (by 19%); and reduce very substantially process innovation and information technology investment; but they increase their information technology outsourcing and do not significantly reduce advertising. This suggests lack of access to financing is indeed forcing Spanish owned firms to cut future oriented investments in order to survive for another day. Our findings are robust to a number of alternative approaches to control for unobserved, time varying heterogeneity, e.g. inverse propensity score reweighting, or comparing only within multinationals.

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1 Introduction

A large literature has established that financially constrained firms reduce their investments (e.g. Whited 1992, Carpenter et al. 1994, Hubbard et al. 1995, Bernanke 1996, Kaplan and Zingales 1997, Lamot 1997, Cleary 1999). Recent studies, using the world wide financial crisis in 2007/2008 as an exogenous shock to the credit supplied by banks, have confirmed this finding (e.g. Campello et al 2010, Duchin et al 2010, Almeida et al 2011, Kuppuswamy and Villalonga 2012).

What is less well understood is how credit rationing affects the composition of firm investments.[1] And yet, as Aghion et al. (2009) have argued, the impact of credit constraints on the composition of investment, particularly the share of short term versus long term investments, is an important determinant of the persistence of the shock, and also affects long-term economic growth. Understanding the impact of credit constraints on the composition of investment is the aim of this paper.

We start by presenting a simple model, based on Aghion et al (2009), of how firm choose the composition of investment in the face of credit constraints. Firms' investment choices fall into two categories: short-term investments, which have an immediate payoff, and long-term investments, which may have a higher payoff, but one which is realized only after a time lag. Absent liquidity constraints, firms equalize the value of the marginal dollar on each investment. But, under liquidity constraints, long term investments involve a risk, because firms might have to liquidate before the payoff period. This creates a wedge between the value of short and long term investments, as firms are willing to give up future payoffs in order to secure survival. Thus firms affected by financial constraints give up profitable long term investment opportunities in favour of worse (in NPV sense) short term ones.

The empirical part of this paper aims to test the prediction of this model. Specifically, we ask: do firms facing credit constraints cut those investments which pay-off further in the future by more than investments with a more immediate payoff?

In order to test the model, we need a taxonomy of investments by their time to payoff, or durability. We rely on an extensive literature (reviewed by Corrado et al (2009)) for a ranking of investment according to durability. Our reading of the evidence is that the most short lived

[1] A notable exception is Campello et al. (2010), who point out that firms cut technology and marketing investment by more than capital investment, but do not offer an explanation why certain investment types might be more affected than others.

investments are brand equity and advertising, followed by software and R&D, with equipment and capital investment being, on average, the longest lived.

To conduct our analysis we need a dataset with information on a detailed split of different investment choices. We use Spanish firm-level data from the Encuesta Sobre Estrategias Empresariales (ESEE, Survey of business strategies), a rich, high quality, long-term panel data set of Spanish manufacturing firms that includes detailed investment variables such as product innovation, process innovation, LAN, CAD, capital investment, and advertising. We use additional variables like software outsourcing, prices, and employment to complement the set of investment variables and draw a clear picture of firm decisions.

Our empirical strategy relies on a difference-in-differences approach to identify the effect of credit tightening on the investment decision of Spanish firms. Like some previous papers, we use the financial crisis in 2008 as an exogenous shock to credit supply. This is possible because the 2008 crisis was at its core a banking crisis. Previous research has established that the reduced bank liquidity translated into a reduction of credit supply to firms (e.g. Iyer et al 2010, Paravisini et al 2011, Ivashina and Scharfstein, 2010). This is particularly true for Spain, where the liquidity crisis was severe. Jimenez et al (2012) show that firms' access to loans in Spain was reduced after the financial crisis, and that firms were unable to substitute loans across less severely affected banks.

Foreign owned firms are less affected by the credit squeeze, since they have access to external finance via their parent companies (Desai et al 2004). Thus we use foreign owned firms as a control group for Spanish-owned firms. A worry is that these firms differ among a variety of other dimensions besides access to external funding. For example, Spanish owned firms in our data are typically smaller and less likely to export, therefore they might also have been subject to different demand shocks which would confound our analysis. To take this heterogeneity into account, all our analyses use firm and industry*year fixed effects to control for unobserved time-invariant firm characteristic, and industry specific shocks (e.g. demand shocks) that occur in some periods in some industries. Moreover, we present a variety of robustness checks. Most notably, we restrict the sample to multinationals, comparing Spanish owned to foreign owned multinationals. These firms are all large, have subsidiaries in many countries and are heavily export oriented, the only difference between them being the nationality of their majority shareholder. Alternatively, we use an inverse propensity score reweighting scheme based on the size, growth and export status and export development of firms before the financial crisis, which basically matches foreign owned firms to comparable Spanish ones. The results are the very similar, which gives us additional confidence

that we are picking up the right effect.

In none of our specifications do we see a differential effect of credit constraints on sales or exports, which increases our confidence that differential demand shocks are not driving the results. In addition, we show that we don't see our results in placebo tests, e.g. in non-crisis years, or for the 1993 economic crisis which was characterized by a demand shock rather than a liquidity shock.

Our results are consistent with the theoretical predictions: We do not observe a reduction in advertising, the investment category with the smallest time-to-payoff. Interestingly, however, financially constrained firms increased prices by more, suggesting they were harvesting customer loyalty at the expense of future market shares, an observation first made by Chevalier and Scharfstein (1995 and 1996).

On the other hand, the investment with the longest time-to-payoff, capital investment, faced the largest reduction: Spanish owned firms cut investment by 19% more than their foreign owned counterparts after the financial crisis hit. They also reduced employment by 6% more. Permanent employment (as opposed to outsourcing or temporary labour) is an investment in human capital, consistent with our notion of long-term investments.

Investments in IT and R&D have a medium-term payoff according to the literature. Indeed, we see moderate reductions of around 8-9% in IT equipment such as CAD, LAN and flexible systems. At the same time, firms' reliance on outsourced software application and programming increased substantially, by 10% and 14%, respectively. It appears that firms were substituting outsourced labour for these investment cuts, suggesting that, like in our theory, faced with credit constraints, firms replace the long term commitment implicit in having an internal IT labour force with the short term commitment allowed by outsourcing. Spanish owned firms are trying to rent rather than buy in order to survive the very near future.

Concerning R&D, the drop is also intermediate between the two extremes of advertising and tangible capital investment. Moreover product innovation has a more immediate payoff than process innovation, and the fact that we observe smaller reductions in product innovation (5%) than in process innovation (9%) is in accordance with our predictions.

In sum, we identify large changes in the composition of investment in Spanish firms, which are consistent with the patterns that the theory led us to believe: essentially no change in very short term investments (advertising), very large changes for fixed, durable investments, and intermediate changes for software/IT and R&D investments.

Our paper is structured as follows. We first develop a simple theoretical framework about the

composition of investments of credit constrained firms. We then go on to discuss briefly the evidence on the durability of investment, the case of Spain and the data. Finally we discuss our empirical identification strategy and present our results.

2 Theoretical Framework: Short vs. long run investment and liquidity risk

Most theoretical analysis of liquidity constraints aggregates all investment into one single decision (e.g. Kiyotaki and Moore, 1997). Instead, we assume that a profit maximizing firm must choose between two types of investment: **Short-term investments** k_t yield an immediate payoff of $f(k_t)$, while **long-term investments** z_t yield a higher payoff $(1+\rho)f(z_t)$, which is paid out at a later period. To capture this trade-off we rely on a model that is a simplified version of Aghion et al. (2009). The key difficulty of firms is that they have only with some probability λ_{t+1} enough liquidity to withstand the wait for the long term payoff. In other words, with probability $1-\lambda_{t+1}$ a liquidity crisis in the interim period may simply force the firm to liquidate. The probability of survival λ_{t+1} measures the probability that the entrepreneur will have enough funds to cover the liquidity shock and is allowed to depend on the levels of short and long term investments. Specifically, reallocating investments from long to short term increases the probability of survival, $\left(\frac{\partial \lambda_{t+1}}{\partial k_t} - \frac{\partial \lambda_{t+1}}{\partial z_t}\right) > 0$. The choice of how much short run and long run investment to undertake is then given by:

$$\max_{k_t, z_t} E_t \left[f(k_t) + \beta \lambda_{t+1}(1+\rho) f(z_t) - q_t k_t - q_t z_t \right]$$

where λ_{t+1} measures the probability that the entrepreneur will have enough funds to cover the liquidity shock, ρ is the additional productivity of long term investment, and the rest of terms have their usual meanings.

The first order conditions are, with respect to k:

$$E_t \left[f'(k_t) \right] + \beta E_t \left[\frac{\partial \lambda_{t+1}}{\partial k_t} (1+\rho) f(z_t) \right] = q_t$$

and with respect to z:

$$\beta E_t \left[\lambda_{t+1}(1+\rho) f'(z_t) \right] + \beta E_t \left[\frac{\partial \lambda_{t+1}}{\partial z_t} (1+\rho) f(z_t) \right] = q_t$$

or, combining the two equations, we obtain the marginal condition:

$$E_t\left[f'(k_t)\right] = \beta E_t\left[(1-\tau_{t+1})(1+\rho)f'(z_t)\right]$$

where

$$\tau_{t+1} = (1-\lambda_{t+1}) + \left(\frac{\partial \lambda_{t+1}}{\partial k_t} - \frac{\partial \lambda_{t+1}}{\partial z_t}\right)\frac{f(z_t)}{f'(z_t)}$$

While in the first best, absent liquidity shocks, it should be the case that the marginal value of a dollar is equalized across both types of investments:

$$E_t\left[f'(k_t)\right] = \beta E_t\left[(1+\rho)f'(z_t)\right].$$

Thus the risk that the firm will run out of cash in period $t+1$ works exactly like a tax on investment τ_{t+1}, and reduces the value of the (a priori more profitable) long term investments relative to the first best. The first term of this wedge $(1-\lambda_{t+1})$ captures the probability of failure. The second term captures the marginal change in this probability as we reallocate investment from long term to short term. Given that reallocating investments from long term to short term reduces the probabity of survival, the tax wedge $\tau_{t+1} > 0$. Hence the reallocation away from long term investment opportunities to short term ones is higher the higher the probability of avoiding bankrupcy by doing this, the higher the probability of not having enough liquidity next period, and the lower the marginal productivity of long run investments.

In this model, credit constraints are liquidity shocks that reduce the probability of survival to the payoff period. The model predicts that credit constrained firms will reduce long term investment by more than short term investment in order to secure survival. In the following empirical section we aim to test this hypothesis.

3 Data and empirical strategy

In the empirical part of this paper we draw on the literature to specify the time-to-payoff of different investment types which allows us to test our theory. Then we present our data source, a Spanish firm level survey that encompasses very detailed information about our key outcome variables, a variety of different investment types. We go on to discuss our identification strategy, a difference-in-differences specification based on the ownership nationality of firms.

3.1 Identifying Long and Short Term Investments

The theory allows us to make predictions about the behavior of different investment variables depending on the horizon over which they pay off. For the model to guide our empirical work, we need a taxonomy of tangible and intangible investments by their durability. Accountants and growth accountants have undertaken a lot of work aiming to estimate the durability of tangible investments, but the literature on intangible investment lifespan is neither extensive nor conclusive.

The shortest lived investment category is brand equity and advertising. Landes and Rosenfield (1994) estimate the annual rates of decay of advertising to be 60%, using 20 two-digit SIC manufacturing and service industries. An upper bound on the econometric estimates is Ayanian (1983), who estimates a durability of up to 7 years.

The literature reports higher durability for software investments. The Bureau of Economic Analysis (BEA 1994) estimated a depreciation rate of 33% for a 5 year service life, according to Corrado et al (2009). Tamai and Torimitsu (1992) report a 10 years average life span for software, relying on industry estimates based on survey evidence.

The evidence on the average depreciation rates and average lifespans of R&D capital is more extensive, although the ranges are very wide. Adams (1990) estimates a depreciation rate of 9% to 13% for basic research. Pakes and Schankerman (1984) proposed 11% to 12% per year in some countries and 17% to 26% in the United Kingdom. Nadiri and Prucha (1996) estimated a rate of 12% for industrial R&D, while Bernstein and Mamuneas (2006) estimate the depreciation rate at 18%. For Europe, Pakes and Schankerman (1978), estimated a 25% average rate, while Pakes and Schankerman (1986) propose a range between 11% and 26%.

Finally, the longest lived investments involve fixed investment and equipment. According to the BEAs estimates[2], private non residential equipment has a durability of between 7 (office equipment) and 27 years (shipping), while private non residential structures last between 16 and 54 years.

According to this literature review we classify brand equity and advertising as "short term", software and R&D as "medium term", and capital investment as "long term" investments.

3.2 Data

We rely on the Encuesta Sobre Estrategias Empresariales (ESEE), a panel of Spanish manufacturing firms. This data has been collected by the Spanish government and the SEPI foundation every year since 1990. The survey covers around 1,800 Spanish manufacturing firms per year, surveying all

[2]Please see http://www.bea.gov/scb/account_articles/national/wlth2594/tableC.htm)

firms with more than 200 employees and a stratified sample of smaller firms. The coverage is about 50-60% of large firms, and 5-25% of small firms. The sample started out as a representative sample of the population of Spanish manufacturing firms. In order to reduce the deterioration of representativeness due to non-responding firms, every year new companies are re-sampled in order to replace exiting ones.

Table 1 presents summary statistics for the main variables that are the object of our analysis, before and after the crisis. The analysis shows that the credit crunch triggered by the financial crisis is reflected in the Spanish data: The credit ratio (total credit as a percentage of total assets) of firms fell by 3 percentage points after the crisis, from 57% to 54%. At the same time, average credit cost fell by 0.1 percentage points, from 4.38% to 4.28%. However, a closer look at the data shows that the credit cost didn't fall immediately: Instead, in 2008, they increased sharply to 4.66%. Together with the observed immediate drop in the credit ratio this suggests that we observe a credit supply rather than a credit demand shock immediately after the financial crisis hit. Credit cost fell only after 2009, a result of the low interest rates stipulated by the European Central Bank in order to stimulate economic growth. However, the credit ratio stays at the lower level even in those years.

The analysis aims to estimate the effect of the credit squeeze on a range of different firm decisions, with a focus on investment in technology, but also more broadly investment in capital, R&D, advertising, etc. Table 1 shows that employment, wages and investment of Spanish firms fell after the crisis, while process innovation increased and product innovation fell. Also sales and exports of Spanish firms fell, together with advertising expenses.

3.3 Empirical Strategy

The key identification problem we confront is to separate the supply from the demand aspects of the shock that hit Spain during the financial crisis, because - although some time later than other countries - Spain entered a recession in 2008. In order to tackle these challenges to identification, we apply a difference-in-differences specification where we compare the behaviour of firms that are affected by the credit crunch to the behaviour of firms that suffer less from restricted access to credit, while facing similar demand conditions. We shall experiment with different treatment and control groups along various dimensions.

Our main identification strategy consists in comparing stand alone Spanish firms with those that are part of a foreign multinational. The financial crisis reduced access to credit sharply in countries at the European periphery like Spain. However, while those belonging to a foreign group maintain

their access to credit, standalone Spanish firms are at the mercy of the now scarcer bank loans. The key challenge is that firms in foreign groups and those not in foreign groups are different along many dimensions besides access to credit. The aim of all of our analysis is to tackle this challenge.

In order to control for ex ante differences between Spanish and foreign owned firms, we use two types of fixed effects: Firm fixed effects allow us to control for unobserved, time invariant heterogeneity in firms' risks and demand for credit. In addition, industry*year specific fixed effects allow for industry specific demand shocks that were caused by the crisis. Our main strategy is thus to run panel regressions, including firm and industry*year fixed effects, where we ask: Once the credit crunch hits, how do the investment decisions of the more constrained (Spanish) firms differ from those of the foreign multinationals? Our baseline regression is as follows:

$$y_{it} = \beta_0 + \beta_1 (TG * after\ crisis)_{it} + firm\ FE + ind * year\ FE + \varepsilon_{it}$$

In all regressions, standard errors are two-way clustered at the firm and industry*year level, to allow for a correlation of the error within firms across years, and across firms in the same industry in a given year (e.g. any industry specific shock).

We then present a whole range of robustness checks. First, we try to avoid the endogeneity of the nationality of ownership by using as treatment the foreign ownership 2 years before the analysis. We then use the current share of Spanish ownership as treatment intensity, instead of discrete ownership variable, and also lag it by 2 years. We also allow for different linear time trends across treatment and control group.

There is still a concern that foreign owned firms might not be a suitable counterfactual group, as they tend to be bigger and more internationally oriented than the average Spanish firm. We do three different robustness checks to adjust for this difference, which leave our conclusions unchanged. First, we add a size control to the regressions as we worry that foreign owned firms tend to be larger than Spanish firms. Second, we pursue the analysis focusing only on multinational groups, both Spanish and foreign, to make the firms more comparable both in terms of their size and their international orientation. Third, we use inverse propensity score reweighting based on size and export status in all pre-crisis years in order to construct a comparable treatment and control group.

Finally, we undertake placebo tests. We conduct our entire analysis on every year in the 2000 decade, and find that the results turn only significant in the years of the financial crisis. We also compare the current results with the 1993 crisis, which was a demand driven recession, rather than a credit crunch like during the current crisis. Confirming our hypothesis, we find different results

for the demand-driven recession compared to the credit cruch of the recent financial crisis.

4 Results

4.1 Credit

In Table 2 we start by comparing credit of Spanish and foreign firms. The dependent variable is the total credit to asset ratio, and the main regressor is an interaction between a Spanish ownership dummy and a time dummy for the financial crisis (which is turned on in 2008 and after). Column (1) controls for industry specific demand conditions using the industry's exports and size as a time varying control. Also, firm level fixed effects allow us to control for any other time invariant unobserved firm heterogeneity. In other words, the table answers the question: Comparing two firms of the same size that are facing the same demand conditions, does the firm that happens to be Spanish suffer a significant drop in credit after the crisis? The answer is unambiguous and highly significant: Spanish firms suffer a drop in credit of around 2.3% (that is 230 basis points) after the crisis compared to non-Spanish firms. In column (2) we add time fixed effects to capture any common, time varying aspects of the crisis that are not yet captured by industry exports or size, and the effect is even stronger, 3.1%. Column (3) is our most demanding specification, which allows for industry specific time effects (and thus absorbs our previous industry specific controls), and the result is again stronger, with Spanish firms facing a credit drop of 3.8%. This is equivalent to a 6.6% drop in credit relative to the 2007 baseline of 57.8% credit to assets (with standard deviation of 22.9%) for Spanish firms before the crisis.

Table 3 compares the credit costs to Spanish and foreign firms using the same type of analyses, and finds no significant difference in our most demanding specification. The fact that the constraint is reflected in quantities rather than prices is consistent with most observations of price rigidities in Spain (e.g. large drops in employment and not in wages, large drops in housing sales with no/small initial drops in house prices). Also, while Spanish firms obtained less credit, the equality of credit cost shows that the underlying risk of the credit obtained is similar across Spanish and foreign owned firms.

4.2 Main Results: Impact of the crisis on investments

Table 4 analyzes firms' decisions. For ease of presentation we divide the decisions in two categories: we start with innovation and IT investment decisions, and then we discuss the rest of the decisions

on which we have data, e.g. employment, prices, advertising and other.

Innovation and Information Technology. Column (1) uses capital investment as a dependent variable, the investment type with the longest payoff period. Consistent with our theory, this variable is affected by most, dropping by around 19% in Spanish firms post crisis relative to non Spanish firms. R&D, our medium-term investment, is represented by product and process innovation. Columns (2) and (3) show that Spanish firms decrease product innovation by 5% and process innovation by 9%. Consistent with our theory, these effects are smaller than for capital investment. Although we don't have data on this, it seems plausible for product innovation to have a more immediate payoff than process innovation, explaining the difference in the impact between the two R&D types. Our other medium term investment type, investment in information technology, is also reduced, although not quite as strongly as capital investment, as can be seen in columns (4) to (5): the presence of computer aided design (CAD) suffers a relative drop of 8%, and the presence of local area networks (LAN) and of flexible manufacturing systems is reduced by around 10%. We found it interesting to report the impact on software outsourcing as well: It seems that, possibly substituting for these investment cuts in technology, firms' reliance on outsourced sofware programming and application increased substantially: by 14% and 10%, respectively.

Employment, Prices and Other choices. Columns (1) to (3) in the second panel of Table 4 show the differential behavior of Spanish owned firms in labour decisions. After the crisis, Spanish owned firms reduced employment by 5% while increasing overtime by more than half. The result was a reduction in the total wage bill of around 4%. This indicates that average wages didn't fall, otherwise the fall in employment would have resulted in a more than proportionate fall in the wage bill. It is not surprising that while wages are not reduced, employment is. Credit constrained firms in Spain adjust through employment and not wages. While in line with previous overwhelming evidence on the rigidity of wage bargaining in Spain, this result is if anything more surprising, as efficiency should dictate any creditors of the firm (including workers) to allow the firm to "borrow" when bank credit disappears. In other words, such a wage adjustment does not need to lead to any redistribution in the longer run.

In column (4) we use a firm specific price index as dependent variable, which we constructed from survey responses about the change in average sales prices (weighted across the product range). Price variables are rarely available in firm level data sets, and have therefore been rarely analyzed. The result is surprising: Credit constrained firms increase their prices by 2.7 percentage points. A rationale for this behaviour is consistent with our short term vs. long term investment view: Firms

might be able to increase current profits exploiting the habit persistence of their customers at the cost of reducing future profits from upset customers.

In column (5) we report our most "short term" investment type, advertising. The result shows that firms do not reduce their advertising, in line with the predictions of our theory.

Figure 1 shows a graphical representation of the results of some dependent variables: employment, investment, process innovation and advertising.

Finally, it is reassuring that we don't see a significant difference in treatment and control group in terms of sales and exports, as this suggests our strategy to control for demand shocks was successful, i.e. Spanish and foreign firms are *not* on different growth trajectories.

4.3 Robustness tests

As mentioned before, comparing Spanish owned and foreign owned firms might not be valid, as these firms might differ along a number of unobserved dimensions. For this reason we conduct a number of robustness checks using alternative specifications. These are reported in Table 5, where each row represents a different specification. Each regression follows our baseline setup by including a full set of firm fixed effects and industry*year fixed effects.

The first row in Table 5 presents our baseline results for comparison purposes. The second row defines the treatment group as ownership two years before the crisis, in order to allow for the possible endogeneity of foreign ownership. The third row uses a continuous ownership share instead of the discrete ownership dummy variable in the baseline specification. In other words, Spanish ownership becomes the treatment intensity. In the fourth row, we use the same treatment intensity of Spanish ownership share, but lag it by 2 years again.

The results are basically robust to all these specifications, with some weaker results for investment, CAD, flexible systems and employment when we use the lagged ownership variables. However, the drop in process innovation and LAN, as well as the increases in outsourcing, overtime hours and prices, and the insignificant effect on advertising persist.

In row 5 we return to our baseline specification, but now allow for a different linear trend in treatment and control group to deal with the worry that Spanish and foreign owned firms show different trends in their investment behaviour. Here the employment trend is still clear, the investment drop is of similar magnitude but more imprecise, the product and process innovation effects are consistent and IT outsourcing becomes smaller. Only our price increase result is reduced. In row 6 we return to the treatment intensity specification and add the differential linear trends. The

results are similar.

While we have controlled for unobserved time-invariant heterogeneity, one might worry about time varying unobserved heterogeneity of Spanish and foreign owned firms (that goes beyond a group-specific linear trend, which we have already controlled for above). If foreign firms were on a different growth trajectory than Spanish firms, this might impact our results of observing different raising of credit. The next three rows are concerned with this kind of unobserved, time-varying heterogeneity.

The simplest way to control for different growth trajectories is to control for size (i.e. log of sales), which we do in row 7 (note that the initial size is already absorbed by the firm fixed effect). The downside is that this variable is endogenous, so we have to be careful in interpreting it. But reassuringly, the results are basically unchanged, except for investment which is still of similar magnitude, but measured more imprecisely.

Another dimension of time-varying, unobserved heterogeneity might be differences between companies that operate across countries and those that operate in a single country. Companies that operate in many countries belong to a corporate group, and this could provide companies with advantages that go beyond their access to capital. For example they might face a more diversified demand. Row 8 conducts our analysis only for companies that belong to a corporate group, presumably most of them are multinationals. The results are pretty remarkable. Even though the sample size drops very substantially (by more than half), the signs are all the same (except for sales, which is however small and insignificant across all specifications), the magnitudes are remarkably constant (except for employment, which is halved) and they mostly remain significant.[3]

Finally, another way to make the control group a more suitable counterfactual for the treatment group is inverse propensity score reweighting. By reweighting each observation by their (inverse) propensity score (the "likelihood" that a firm belongs to the treatment group, i.e. is under Spanish ownership) we aim to reproduce the distribution of Spanish firms more closely by foreign owned firms, and therefore also match the unobserved time varying heterogeneity better. We construct propensity scores based on sales and export status of all pre-treatment years. Our results, in row 9, are also robust to this test. Most of the results are numerically very close to the baseline specification, suggesting that selection is not a major concern in our analysis.

[3] We have used alternative definitions to proxy for "multinationals" in the data: e.g. by defining multinationals as those that have foreign affiliates, or those who have non-industrial plants in foreign countries, or share holdings in foreign countries. The results all show the same pattern as our main analysis in terms of signs and magnitudes of coefficients.

Our reading of the evidence is that although some results lose significance in some specifications, overall our results are highly consistent across a large number of different robustness specifications.

4.4 Placebo tests and IV regressions

Table 6 presents an even stronger check: It conducts placebo tests separately for each year (omitting the baseline year 2000). We expect a statistically significant effect on the interaction terms only for the years 2008 to 2010, i.e. after the financial crisis, and none before.

The placebo tests are in line with our analysis so far, showing significant results for most variables only in the post crisis years. The fall in investment is strongest in 2009, and fades out somewhat in 2010. Product innovation is not significant in any specific year after the crisis, but the coefficient turned negative in 2008 and all years after. The strongest and most persistent negative effect of the credit crunch is in process innovation, which is negative and significant in 2008 and all years after. The other technology variables are surveyed only every 4 years (2002, 2006 and 2010), so the placebo test is just conducted in 2006 and 2010. For all variables but CAD the drop in 2010 is strong compared to the pre-crisis observation in 2006.

The drop in employment as well as the rise in prices also is strikingly in line with the financial crisis and highly persistent over the post-crisis years. At the same time, advertising expenses don't change significantly over the whole period. In the bottom rows of the tables we conduct t-tests of testing for the difference in the treatment effects of 2008, 2009 and 2010 versus 2007 (and 2010 versus 2006 for variables that are surveyed only every 4 years), the last pre-treatment observation. Again, they confirm the drop in investment, technology, employment and wage bill in the post crisis years compared to last pre-crisis observation.

How different is this behaviour of firms from a "normal" recession, i.e. a recession not driven by credit squeeze? In order to address this issue and confirm that the observed effects are really due to the credit squeeze, we compare the reactions of firms with those in 1993, the last major, demand driven, Spanish recession before the financial crisis in 2008.

Table 7 shows that the 2008 crisis is "different": In a "normal", demand shock driven, recession, firms cut neither employment nor IT investment or outsourcing or outsourcing, however, they do cut product and process innovation. On the other hand, they reduce advertising expenditure and wages, the price effect is still there. Note that data for capital investment and LAN is not available in the survey before 1993. From the last two columns it is visible that the 1993 crisis was a demand driven crisis, as sales and exports fall for the treatment group.

Our main interest lies in understanding how limited access to credit affects the investment behaviour of firms. So far we have compared Spanish to foreign owned firms, but our main variable of interest is actually credit. We can therefore use the credit ratio of Table 2 as a regressor, and instrument it with Spanish ownership. Basically Table 2 becomes the first stage of this instrumental variable regression, while all the tables shown so far correspond to the "reduced form" version. Table 8 implements these IV regressions. The results are obviously in line with the reduced form results, but allow for a different interpretation: A reduction of access to credit by 1% in the credit ratio leads to 9% fall in investment. (Note that the signs are inverted as now the regressions describe the impact of credit, not lack therof.) Overall, the first stage is strong, as we have seen in Table 2, but since our sample is somewhat different for each dependent variable, we report the first stage F-statistics separately for each regression. The F-statistics is sufficiently large for all regressions except for investment.

5 Conclusions

Our analysis has two readings, a macro and a micro one: the macro view concerns Spain and the crisis in the eurozone, while the micro view focuses on finance and the decisions of firms.

On the macro side, the paper suggests that the breakdown of the single European capital market is likely to have long term effects on Spanish firms. Spanish firms which are affected by the credit squeeze cut investments with a medium- to long-term payoff, such as R&D, innovation and capital investment, by more than investment with a short-term payoff such as advertising. Credit constraints force Spanish firms to eat up their future and act as if only the immediate future, tomorrow, mattered. This is likely to have a long term impact on the Spanish economy, impeding recovery after the financial crisis, and reducing long-term economic growth.

On the micro side, our analysis teaches us about what firms do when they are worried about liquidity. We showed that, as the theory predicts, they prioritize investments that pay off in the near future, such as advertising and product innovation, over investments that have a more uncertain or long term payoff, like process innovation, information technology and capital investment. We also showed that firms cut employment, but not wages - probably a Spanish ideosyncracy - and, surprisingly, that firms increase prices significantly, probably aiming to harvest customer loyalty on the short run.

All in all, the credit crunch appears to be placing Spanish firms at a severe competitive disad-

vantage relative to their foreign competitors. Moreover, this disadvantage is likely to persist quite far into the future, given the investment and innovation drops that have long term implications for economic growth. Future research must quantify the impact of these innovation and investment decreases on GDP growth.

REFERENCES

Adams, James. 1990. "Fundamental Stocks of Knowledge and Productivity Growth." *Journal of Political Economy vol* 98 :673–702.

Aghion, Philippe, George-Marios Angeletos, Abhijit Banerjee, Kalina Manova. 2009. "Volatility and Growth: Credit Constraints and the Composition of Investement." *Journal of Monetary Economics,* Vol. 51, Issue 6, pp. 1077-1106.

Almeida, Heitor, Murillo Campello, Bruno Laranjeira, Scott Weisbenner, 2011. "Corporate Debt Maturity and the Real Effects of the 2007 Credit Crisis," *Critical Finance Review,* Vol 1, pp. 3–58.

Ayanian, Robert. 1983. "The Advertising Capital Controversy." *Journal of Business*, Vol. 56, pp. 349–64.

Bureau of Economic Analysis. 1994. "A Satellite Account for Research and Development." *Survey of Current Business, November, 34-71.*

Bernanke, Ben, Mark Gertler and Simon Gilchrist. 1996. "The Financial Accelerator and the Flight to Quality." *The Review of Economics and Statistics ,* Vol. 78, No. 1, pp. 1-15.

Bernstein, Jeffrey, I. and Theofanis P. Mamuneas, 2006 "R&D Depreciation, Stocks, User Costs and Productivity Growth for U.S. R&D Intensive Industries," *Structural Change and Economic Dynamics*, 17, 70–98.

Campello, Murillo, John R. Graham, Campbell R. Harvey. 2010. "The Real Effects of Financial Constraints: Evidence from a Financial Crisis." *Journal of Financial Economics*, Vol. 97, pp. 470-487.

Carpenter, Robert E., Steven M. Fazzari, Bruce C. Petersen, Anil K. Kashyap, Benjamin M. Friedman. 1994. "Inventory Investment, Internal-Finance Fluctuations, and the Business Cycle." Brookings Papers on Economic Activity, Vol. 1994, No. 2 pp. 75-138.

Chevalier, Judith A & Scharfstein, David S, 1995. "Liquidity Constraints and the Cyclical Behavior of Markups," *American Economic Review,* American Economic Association, vol. 85(2), pages 390-96

Chevalier, Judith A & Scharfstein, David S, 1996. "Capital-Market Imperfections and Countercyclical Markups: Theory and Evidence," *American Economic Review,* vol. 86(4), pages 703-25

Cleary, Sean. 1999. "The Relationship between Firm Investment and Financial Status." *Journal of Finance* , Vol. 54, No. 2, pp. 673-692.

Corrado, Carol, Charles Hulten, Daniel Sichel, 2009. "Intangible Capital And U.S. Economic Growth," *Review of Income and Wealth,* International Association for Research in Income and

Wealth, Vol. 55(3), pp. 661-685.

Desai, Mihir A. & C. Fritz Foley & James R. Hines, 2004. "A Multinational Perspective on Capital Structure Choice and Internal Capital Markets," *Journal of Finance,* American Finance Association, vol. 59(6), pages 2451-2487

Desai, Mihir A., C. Fritz Foley, Kristin J. Forbes. 2008. "Financial Constraints and Growth: Multinational and Local Firm Responses to Currency Depreciations", *The Review of Financial Studies,* Vol. 21, No. 6, pp. 2857-2888.

Duchin, Ran, Oguzhan Ozbas and Berk A. Sensoy. 2010. "Costly external finance, corporate investment, and the subprime mortgage credit crisis", *Journal of Financial Economics,* Vol. 97, issue 3, pp. 418-435.

Hubbard, R. Glenn, Anil K. Kashyap, Toni M. Whited. 1995. "Internal Finance and Firm Investment" *Journal of Money, Credit and Banking,* Vol. 27, No. 3 pp. 683-701.

Iyer, Rajkamal, Samuel Lopes, José-Luis Peydró, and Antoinette Schoar. 2010. "Interbank liquidity crunch and the firm credit crunch: evidence from the 2007-2009 crisis". Working paper.

Ivashina, Victoria, David Scharfstein. 2010. "Bank lending during the financial crisis of 2008," *Journal of Financial Economics,* Vol. 97(3), pp. 319-338.

Jimenez, Gabriel & Steven Ongena & Jose-Luis Peydro & Jesus Saurina, 2012. "Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications," American Economic Review, American Economic Association, vol. 102(5), pp. 2301-26.

Kaplan, Steven N. and Luizi Zingales. 1997. "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?". *Quarterly Journal of Economics* , Vol. 112, No. 1, pp. 169-215.

Kiyotaki, Nobuhiro and John Moore. 1997. "Credit Cycles." *Journal of Political Economy* , Vol. 105, No. 2 , pp. 211-248.

Kuppuswamy, Venkat and Belén Villalonga. 2012 "Does Diversification Create Value in the Presence Of External Financing Constraints? Evidence from the 2008–2009 Financial Crisis." Working Paper.

Lamont, Owen. 1997. "Cash Flow and Investment: Evidence from Internal Capital Markets" *Journal of Finance*, Vol. 52, No. 1, pp. 83-109.

Nadiri, M. Ishaq and Ingmar Prucha. 1996. "Estimation of the Depreciation Rate of Physical and R&D capital in the US manufacturing sector" (with I. Prucha), *Economic Inquiry*, Vol. 34 (1), pp. 43-56.

Pakes, A. and M. Schankerman, 1978, "The Rate of Obsolescence of Knowledge, Research Gestation Lags, and the Private Rate of Return to Research Resources," Working Paper No. 78-13, C.V. Starr Center for Applied Economics, New York University

Pakes, Ariel, and Mark Schankerman. 1984 "The Rate Obsolescence of Patents, Research Gestation Lags, and the Private Rate of Return to Research Resources." In *R&D, Patents, and Productivity*, edited by Zvi Griliches, 73–88. Chicago, il: University of Chicago Press, for the National Bureau of Economic Research

Pakes, A. and M. Schankerman, 1986, "Estimates of the Value of Patent Rights in European Countries during the Post-1950 Period," *Economic Journal*, 96, 1052–76,

Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon. 2011. "Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data." 2011. *NBER Working Paper* 16975.

Tamai, T. and Torimitsu, Y. 1992. "Software Lifetime and its Evolution Process over Generations," Proc. Conference on Software Maintenance, Orlando, Florida, pp. 63-69.

Whited, Toni M. 1992 "Debt, Liquidity Constraints, and Corporate Investment: Evidence from Panel Data," *Journal of Finance*, Vol. 47, No. 4 , pp. 1425-146.

APPENDIX
TABLES AND FIGURES

Table 1. Summary statistics.

Mean (Standard deviation)	Before crisis (2000-2007)	After crisis (2008-2010)	Change (t-test)
Credit			
Credit ratio (total credit/total assets)	0.57	0.54	-0.03***
	(0.23)	(0.24)	(-7.92)
Credit cost[1], %	4.38	4.28	-0.10***
	(1.19)	(1.31)	(-2.80)
Innovation and Information Technology			
Investment, mn EUR	5.67	2.72	-2.95
	(117.4)	(161.2)	(-1.22)
Share of firms conducting product innovation	0.21	0.19	-0.02***
	(0.41)	(0.39)	(-3.62)
Share of firms conducting process innovation	0.31	0.34	0.03***
	(0.46)	(0.47)	(3.73)
Share of firms using CAD	0.39	0.41	0.02
	(0.49)	(0.49)	(1.39)
Share of firms using a LAN	0.26	0.34	0.08***
	(0.44)	(0.47)	(6.35)
Share of firms using flexible manufacturing systems	0.26	0.30	0.04***
	(0.44)	(0.46)	(3.83)
Share of firms outsourcing software programming (fully or partially)	0.65	0.65	0
	(0.48)	(0.48)	(0)
Share of firms outsourcing software application (fully or partially)	0.70	0.70	0
	(0.46)	(0.46)	(0.14)
Employment, Prices and Other choices			
Employment[2]	260	203	-57***
	(780)	(682)	(-5.19)
Average overtime hours per employee	11.49	7.95	-3.54***
	(27.41)	(23.63)	(-9.25)
Wage bill, mn EUR	10.04	9.22	-0.82
	(32.85)	(33.89)	(-1.59)
Price index[3]	1.05	1.12	0.07***
	(0.11)	(0.20)	(23.07)
Advertising expenditure, mn EUR	152.61	118.77	-33.84**
	(967.77)	(993.00)	(-2.23)
Sales, mn EUR	74.50	64.37	-10.13**
	(348.96)	(300.70)	(-2.08)
Exports, mn EUR	28.11	24.43	-3.68
	(218.72)	(185.27)	(-1.22)

1 Total cost of a credit (including interest rates, but also other fees) as a percentage of obtained credit.

2 Employment is the number of employees as of 31 December of a given year. The number includes full time, part time, and temporary workers employed by the firm; but not temporary workers employed by temporary work agencies

3 The firm specific price index is 1 in 2000 (or in the first year the firm appears in the survey), and changes each year by the average price change of the firm's products, weighted by the product mix. Comparing the absolute price index across firms is not meaningful, our regressions use firm fixed effects and therefore rely on the comparison of the price index over time instead.

Table 2. Deleveraging of Spanish and foreign firms.

Notes: This table checks whether Spanish owned and foreign owned firms are affected differently by the credit squeeze. The dependent variable is credit ratio (total credit divided by total assets, ratio between 0 and 1). The main regressor is an interaction term of a Spanish ownership dummy (defined by <=50% foreign ownership in same year) and a time dummy variable that indicates the financial crisis (=1 in and after 2008). All columns include firm fixed effects. Columns (1) and (2) control for industry specific demand variables (Spanish exports to EU, Spanish exports to the World, domestic value added per industry) to capture industry specific demand shocks of the recession driven by the financial crisis. Export data is from the WITS database provided by the Worldbank, and Spanish value added per industry is from National Accounts data provided by the Spanish National Institute of Statistics (INE). Column (2) includes year fixed effects to capture common time effects. Column (3) includes a full set of industry*year specific fixed effects to capture any demand specific effects driven by the crisis (our industry controls are absorbed by these fixed effects and therefore omitted). All standard errors are two-way clustered at the firm and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 2000 and 2010.

DEPENDENT VARIABLE: Credit ratio (between 0 and 1)	(1)	(2)	(3)
Interaction term (Spanish firms) * (after 2008)	-0.0234***	-0.0306***	-0.0378***
	(0.00409)	(0.01000)	(0.0103)
ln(industry exports to EU)	0.00117	0.0501	
	(0.0351)	(0.0360)	
ln(industry exports to World)	-0.000615	-0.0339	
	(0.0352)	(0.0365)	
ln(industry value added)	0.00678	0.0179	
	(0.0125)	(0.0137)	
Observations	18,983	18,983	18,983
R-squared	0.006	0.003	0.002
Number of firmid	3,051	3,051	3,051
Firm FE	YES	YES	YES
Year FE	NO	YES	NO
Ind*Year FE	NO	NO	YES

Table 3. Credit cost of Spanish and foreign firms.

Notes: This table compares the credit cost of Spanish owned and foreign owned firms after the financial crisis. The dependent variable is the average credit cost (rate is between 0 and 100). The main regressor is an interaction term of a Spanish ownership dummy (defined by <=50% foreign ownership in same year) and a time dummy variable that indicates the financial crisis (=1 in and after 2008). All columns include firm fixed effects. Columns (1) and (2) control for industry specific demand variables (Spanish exports to EU, Spanish exports to the World, domestic value added per industry) to capture industry specific demand shocks of the recession driven by the financial crisis. Export data is from the WITS database provided by the Worldbank, and Spanish value added per industry is from National Accounts data provided by the Spanish National Institute of Statistics (INE). Column (2) includes year fixed effects to capture common time effects. Column (3) includes a full set of industry*year specific fixed effects to capture any demand specific effects driven by the crisis (our industry controls are absorbed by these fixed effects and therefore omitted). All standard errors are two-way clustered at the firm and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 2000 and 2010.

DEPENDENT VARIABLE: Credit cost (from 0 to 100) in %	(1)	(2)	(3)
Interaction term (Spanish firms) * (after 2008)	0.113	-0.0830	-0.0911
	(0.0742)	(0.222)	(0.200)
ln(industry exports to EU)	-1.600**	-0.537	
	(0.670)	(0.450)	
ln(industry exports to World)	1.306**	0.665	
	(0.656)	(0.439)	
ln(industry value added)	-0.0773	0.0140	
	(0.187)	(0.180)	
Observations	4,613	4,613	4,613
R-squared	0.015	0.002	0.000
Number of firmid	1,156	1,156	1,156
Firm FE	YES	YES	YES
Year FE	NO	YES	NO
Ind*Year FE	NO	NO	YES

Table 4. Investment vector of Spanish and foreign firms.

Notes: This table compares a variety of investment decisions of Spanish owned and Foreign owned firms after the financial crisis. The dependent variable is stated in the head of each column. The main regressor is an interaction term of a Spanish ownership dummy (defined by <=50% foreign ownership in same year) and a time dummy variable that indicates the financial crisis (=1 in and after 2008). All columns include firm fixed effects and a full set of industry*year specific fixed effects to capture any demand specific effects driven by the crisis. All standard errors are two-way clustered at the firm and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 2000 and 2010.

3A. Innovation and Information Technology

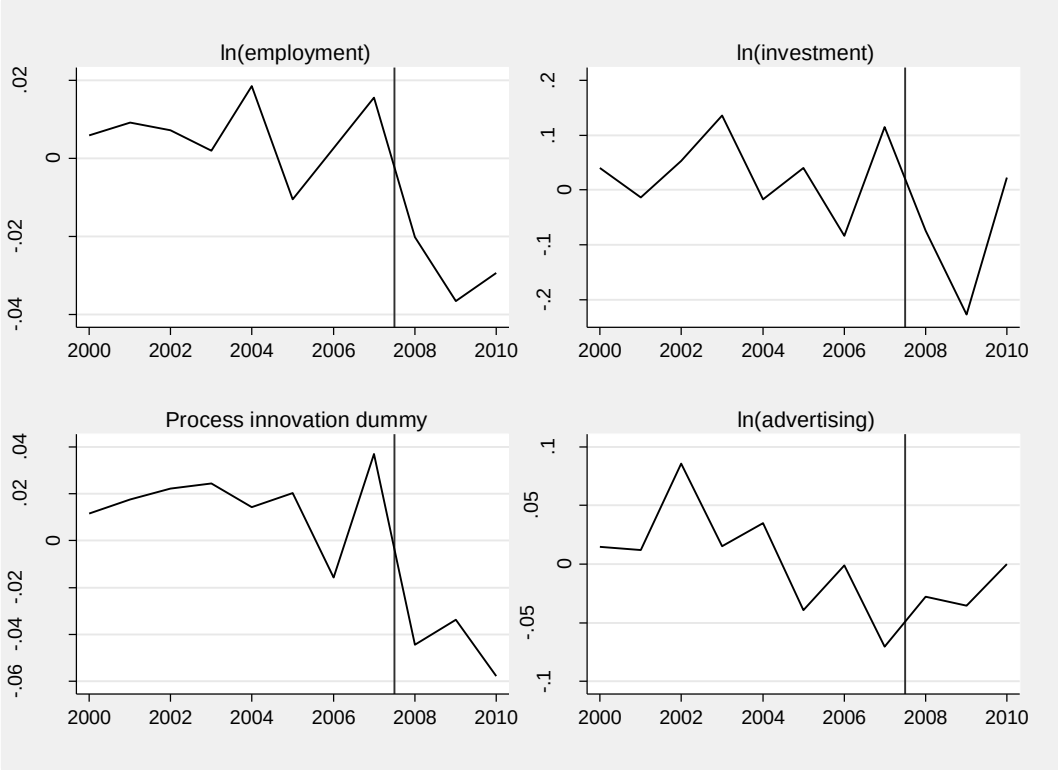
VARIABLES	(1) ln(investment)	(2) Product innovation dummy	(3) Process innovation dummy	(4) CAD dummy	(5) LAN dummy	(6) Flexible systems dummy	(7) Software programming outsource dummy	(8) Software application outsource dummy
Interaction term (Spanish firms) * (after 2008)	-0.187*	-0.053**	-0.088***	-0.076**	-0.096**	-0.11**	0.140***	0.104**
	(0.112)	(0.0227)	(0.0251)	(0.0384)	(0.0439)	(0.0429)	(0.0421)	(0.0404)
Observations	12,351	19,348	19,612	4,264	4,264	4,264	4,256	4,256
R-squared	0.000	0.001	0.001	0.002	0.003	0.003	0.004	0.003
Number of firmid	2,432	3,093	3,112	1,733	1,733	1,733	1,729	1,729
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES	YES

3B. Employment, Prices and Other choices

VARIABLES	(1) ln(employment)	(2) ln(average overtime hours)	(3) ln(wagebill)	(4) Price index (0 to 1)	(5) ln(advertising)	(6) ln(sales)	(7) ln(exports)
Interaction term (Spanish firms) * (after 2008)	-0.056***	0.630*	-0.038*	0.0271***	-0.041	-0.0500	-0.0602
	(0.0215)	(0.360)	(0.0208)	(0.00966)	(0.0606)	(0.0316)	(0.0578)
Observations	19,612	19,558	19,609	19,592	13,454	19,609	12,405
R-squared	0.001	0.001	0.001	3,104	0.000	0.001	0.000
Number of firmid	3,112	3,106	3,111	3,104	2,378	3,111	2,053
Firm FE	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES

Figure 1. Spanish owned versus foreign owned firms.

Notes: These graphs plot the difference of the average dependent variable (in title) between Spanish firms (defined by <=50% foreign ownership in same year) and foreign owned firms (defined by >50% foreign ownership in same year) over years, after controlling for industry specific year effects.



— Treatment group: Spanish firms (defined by <=50% foreign ownership in same year)

– – Control group: Foreign owned firms (defined by >50% foreign ownership in same year)

Table 5. Robustness checks

Notes: This table conducts a variety of robustness checks to our main specification as in the last table. The dependent variable is stated in the head of each column. Each row represents a different regression. Each regression includes a full set of firm fixed effects and industry*year fixed effects, just as in the baseline specification. Standard errors are two-way clustered at firm level and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. The regressions in the different rows are:

Baseline: Same as in table X. Treatment group: Spanish firms (defined by <=50% foreign ownership in same year); control group: foreign owned firms (defined by >50% foreign ownership in same year)

2. The treatment and control groups are defined based on foreign ownership 2 years before
3. The current share of Spanish ownership is used as treatment intensity
4. The treatment intensity is based on the Spanish ownership share 2 years prior
5. We return to our baseline specification, but now allow for a ***different linear trends*** in treatment and control group
6. We return to the treatment intensity specification (specification 3), but now allow for a ***different linear trends*** in treatment and control group
7. Add ln(sales) as control; use current share of Spanish ownership as treatment intensity
8. Use only multinationals defined as companies that belong to a corporate group; use current share of Spanish ownership as treatment intensity
9. Inverse propensity score reweighting method, based on average sales and exporter status in pre-treatment years (2000 to 2007)

5A. Innovation and Information Technology

VARIABLES		(1) ln(investment)	(2) Product innovation dummy	(3) Process innovation dummy	(4) CAD dummy	(5) LAN dummy	(6) Flexible systems dummy	(7) Software programming outsource dummy	(8) Software application outsource dummy
Baseline:	(Spanish firms)	-0.187*	-0.0535**	-0.0885***	-0.0759**	-0.0959**	-0.109**	0.140***	0.104**
	* (after 2008)	(0.112)	(0.0227)	(0.0251)	(0.0384)	(0.0439)	(0.0429)	(0.0421)	(0.0404)
2.	(Spanish firms 2 yrs ago)	-0.132	-0.0277	-0.0781***	-0.0512	-0.112**	-0.0273	0.146***	0.129***
	* (after 2008)	(0.123)	(0.0228)	(0.0280)	(0.0472)	(0.0526)	(0.0501)	(0.0530)	(0.0433)
3.	(Spanish ownership)	-0.204*	-0.0531**	-0.0866***	-0.0798**	-0.0919**	-0.119***	0.129***	0.103**
	* (after 2008)	(0.115)	(0.0234)	(0.0257)	(0.0393)	(0.0452)	(0.0413)	(0.0427)	(0.0408)
4.	(Spanish ownership 2 yrs ago)	-0.175	-0.0275	-0.0768***	-0.0447	-0.120**	-0.0489	0.134**	0.115***
	* (after 2008)	(0.126)	(0.0232)	(0.0285)	(0.0473)	(0.0548)	(0.0515)	(0.0542)	(0.0446)
5.	(Spanish firms)	-0.214	-0.0776***	-0.0830***	-0.181***	-0.0421	-0.0899	0.245***	0.0728
	* (after 2008)	(0.136)	(0.0245)	(0.0301)	(0.0585)	(0.0658)	(0.0723)	(0.0672)	(0.0621)
6.	(Spanish ownership)	-0.239*	-0.0745***	-0.0770**	-0.183***	-0.0296	-0.111	0.206***	0.0675
	* (after 2008)	(0.139)	(0.0259)	(0.0307)	(0.0582)	(0.0653)	(0.0718)	(0.0653)	(0.0604)
7.	(Spanish ownership)	-0.160	-0.0516**	-0.0835***	-0.0747*	-0.0867*	-0.112***	0.129***	0.105**
	* (after 2008)	(0.112)	(0.0233)	(0.0255)	(0.0394)	(0.0455)	(0.0418)	(0.0427)	(0.0408)
8.	(Spanish ownership)	-0.142	-0.0595**	-0.0428	-0.0770*	-0.0776	-0.0937**	0.148***	0.125**
	* (after 2008)	(0.125)	(0.0271)	(0.0293)	(0.0439)	(0.0551)	(0.0472)	(0.0455)	(0.0509)
9.	(Spanish firms)	-0.107	-0.0537**	-0.0931***	-0.110**	-0.0205	-0.0901*	0.131**	0.149**
	* (after 2008)	(0.189)	(0.0254)	(0.0303)	(0.0538)	(0.0390)	(0.0503)	(0.0569)	(0.0584)

5B. Employment, Prices and Other choices

VARIABLES		(1) ln(employment)	(2) ln(average overtime hours)	(3) ln(wage bill)	(4) Price index (0 to 1)	(5) ln(advertising)	(6) ln(sales)	(7) ln(exports)
Baseline:	(Spanish firms)	-0.0561***	0.630*	-0.0377*	0.0271***	-0.0415	-0.0500	-0.0602
	* (after 2008)	(0.0215)	(0.360)	(0.0208)	(0.00966)	(0.0606)	(0.0316)	(0.0578)
2.	(Spanish firms 2 yrs ago)	-0.0281	1.110***	-0.0189	0.02331**	-0.0412	-0.0201	0.00618
	* (after 2008)	(0.0233)	(0.407)	(0.0219)	(0.01055)	(0.0655)	(0.0351)	(0.0616)
3.	(Spanish ownership)	-0.0624***	0.681*	-0.0418**	0.02765***	-0.0506	-0.0533	-0.0577
	* (after 2008)	(0.0219)	(0.368)	(0.0213)	(0.00993)	(0.0612)	(0.0326)	(0.0597)
4.	(Spanish ownership 2 yrs ago)	-0.0366	1.177***	-0.0225	0.02422**	-0.0573	-0.0244	0.00383
	* (after 2008)	(0.0237)	(0.409)	(0.0226)	(0.01094)	(0.0662)	(0.0366)	(0.0639)
5.	(Spanish firms)	-0.0402**	0.664	-0.0219	0.01147	0.0195	-0.0102	-0.0260
	* (after 2008)	(0.0201)	(0.480)	(0.0212)	(0.00826)	(0.0633)	(0.0294)	(0.0726)
6.	(Spanish ownership)	-0.0512**	0.742	-0.0292	0.01217	0.00172	-0.0165	-0.0202
	* (after 2008)	(0.0211)	(0.473)	(0.0218)	(0.00894)	(0.0615)	(0.0307)	(0.0729)
7.	(Spanish ownership)	-0.0376**	0.721**	-0.0169	0.0290***	0.0133	n/a	-0.0428
	* (after 2008)	(0.0173)	(0.367)	(0.0154)	(0.00989)	(0.0554)	n/a	(0.0547)
8.	(Spanish ownership)	-0.0260	0.392	-0.0136	0.0296**	-0.00803	0.0290	-0.0223
	* (after 2008)	(0.0252)	(0.447)	(0.0237)	(0.0121)	(0.0746)	(0.0363)	(0.0677)
9.	(Spanish firms)	-0.0451	1.259*	-0.0326	0.0296***	-0.194	0.0337	-0.0400
	* (after 2008)	(0.0339)	(0.688)	(0.0355)	(0.0112)	(0.119)	(0.0696)	(0.103)

Table 6. Placebo tests

Notes: This table compares a variety of investment decisions of Spanish and Foreign firms in every year between 2001 and 2010. The dependent variable is stated in the head of each column. The regressors are interaction terms of a Spanish ownership dummy (defined by <=50% foreign ownership in same year) and a dummy variable that indicates the specified year. All columns include full sets of firm fixed effects and industry*year fixed effects. All standard errors are two-way clustered at firm level and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 2000 and 2010. In the rows at the bottom of the table we conduct four different F-tests: testing the equality of the coefficient on the 2007 interaction term and the coefficient on the 2008, 2009 and 2010 interaction terms, in order to check whether the financial crisis terms are significantly different from the pre-crisis year 2007. We also report the according p-values. The dependent variables in columns (4) to (8) are available only every four years, i.e. years 2002, 2006 and 2010.

6A. Innovation and Information Technology

VARIABLES	(1) ln(investment)	(2) Product innovation dummy	(3) Process innovation dummy	(4) CAD dummy	(5) LAN dummy	(6) Flexible systems dummy	(7) Software programming outsource dummy	(8) Software application outsource dummy
Interaction term (Spanish	-0.00716	-0.0113	0.0192					
firms) * (year=2001)	(0.0963)	(0.0289)	(0.0341)					
Interaction term (Spanish	0.0764	-0.00907	0.0245					
firms) * (year=2002)	(0.142)	(0.0297)	(0.0310)					
Interaction term (Spanish	0.167	0.0247	0.0228					
firms) * (year=2003)	(0.164)	(0.0290)	(0.0398)					
Interaction term (Spanish	-0.00986	0.0209	0.0118					
firms) * (year=2004)	(0.101)	(0.0329)	(0.0385)					
Interaction term (Spanish	0.0515	0.0559*	0.0109					
firms) * (year=2005)	(0.156)	(0.0297)	(0.0375)					
Interaction term (Spanish	-0.116	0.00975	-0.0346	0.0655*	-0.0433	-0.0138	-0.0639	0.0328
firms) * (year=2006)	(0.127)	(0.0286)	(0.0321)	(0.0341)	(0.0418)	(0.0431)	(0.0441)	(0.0380)
Interaction term (Spanish	0.117	0.0280	0.0210					
firms) * (year=2007)	(0.131)	(0.0297)	(0.0383)					
Interaction term (Spanish	-0.123	-0.0285	-0.0775**					
firms) * (year=2008)	(0.134)	(0.0295)	(0.0352)					
Interaction term (Spanish	-0.322**	-0.0347	-0.0713*					
firms) * (year=2009)	(0.161)	(0.0321)	(0.0401)					
Interaction term (Spanish	-0.00426	-0.0572	-0.104***	-0.0408	-0.119**	-0.117**	0.106**	0.121***
firms) * (year=2010)	(0.198)	(0.0379)	(0.0390)	(0.0426)	(0.0511)	(0.0494)	(0.0508)	(0.0460)
Observations	12,351	19,348	19,612	4,265	4,265	4,265	4,257	4,257
R-squared	0.001	0.001	0.002	0.003	0.003	0.003	0.005	0.003
Number of firmid	2,432	3,093	3,112	1,733	1,733	1,733	1,729	1,729
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
F-test 2007=2008 coef	2.457	9.741	11.72					
p-value	0.563	0.00904	0.00121					
F-test 2007=2009 coef	5.293	6.814	6.216					
p-value	0.0214	0.00180	0.0127					
F-test 2007=2010 coef	0.334	6.916	10.48					
p-value	0.117	0.00854	0.000618					
F-test 2006=2010 coef				6.699	2.808	4.891	14.52	4.200
p-value				0.00965	0.0938	0.0270	0.000138	0.0404

6B. Employment, Prices and Other choices

VARIABLES	(1) ln(employment)	(2) ln(average overtime hours)	(4) ln(wage bill)	(5) Price index (0 to 1)	(6) ln(advertising)
Interaction term (Spanish firms) * (year=2001)	-0.00237	-0.465	0.00132	-0.0229***	0.0211
	(0.0157)	(0.388)	(0.0145)	(0.0066)	(0.0345)
Interaction term (Spanish firms) * (year=2002)	-0.00481	-0.702	0.00824	-0.014**	0.104**
	(0.0154)	(0.442)	(0.0153)	(0.0057)	(0.0480)
Interaction term (Spanish firms) * (year=2003)	-0.0135	-0.600	-0.00668	-0.0084	0.0165
	(0.0145)	(0.394)	(0.0166)	(0.0057)	(0.0584)
Interaction term (Spanish firms) * (year=2004)	0.00459	-0.630	0.00469	0.0012	0.0364
	(0.0191)	(0.424)	(0.0185)	(0.0063)	(0.0541)
Interaction term (Spanish firms) * (year=2005)	-0.0337	-0.466	-0.0312	0.0019	-0.0641
	(0.0222)	(0.435)	(0.0214)	(0.0076)	(0.0479)
Interaction term (Spanish firms) * (year=2006)	-0.0211	0.0873	-0.0100	0.0087	-0.0271
	(0.0215)	(0.438)	(0.0205)	(0.0096)	(0.0687)
Interaction term (Spanish firms) * (year=2007)	-0.00901	-0.0182	-0.00427	0.0188	-0.113
	(0.0269)	(0.514)	(0.0276)	(0.0124)	(0.0742)
Interaction term (Spanish firms) * (year=2008)	-0.0535**	0.234	-0.00776	0.0204*	-0.0645
	(0.0269)	(0.487)	(0.0265)	(0.0122)	(0.0769)
Interaction term (Spanish firms) * (year=2009)	-0.0759***	0.777	-0.0648**	0.0295**	-0.0747
	(0.0294)	(0.563)	(0.0289)	(0.0119)	(0.0777)
Interaction term (Spanish firms) * (year=2010)	-0.0703**	0.211	-0.0628**	0.0379***	-0.0336
	(0.0322)	(0.462)	(0.0315)	(0.0138)	(0.104)
Observations	19,612	19,558	19,609	19,592	13,454
R-squared	0.001	0.001	0.001	0.004	0.001
Number of firmid	3,112	3,106	3,111	3,104	2,378
Firm FE	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES
F-test 2007=2008 coef	6.582	0.286	0.0289	0.0345	0.587
p-value	0.0103	0.171	0.865	0.102	0.599
F-test 2007=2009 coef	10.93	1.873	7.325	1.296	0.277
p-value	0.000944	0.593	0.00680	0.853	0.437
F-test 2007=2010 coef	5.760	0.191	4.527	2.676	0.603
p-value	0.0164	0.662	0.0334	0.255	0.444

Table 7. Comparison with the last economic crisis: 1993

Notes: This table compares a variety of investment decisions of Spanish and Foreign firms after the economic crisis in 1993. The specification is analogous to our "baseline specification" in table 3. The dependent variable is stated in the head of each column. The main regressor is an interaction term of a Spanish ownership dummy (defined by <=50% foreign ownership in same year) and a dummy variable that indicates the economic crisis in 1993 (=1 in and after 1993). All columns include full sets of firm fixed effects and industry*year fixed effects. All standard errors are two-way clustered at firm level and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 1990 and 1995. Note, the variables investment and LAN dummy were not available before 1993.

7A. Innovation and Information Technology

VARIABLES	(1) Product innovation Dummy	(2) Process innovation dummy	(3) CAD dummy	(4) Flexible systems dummy	(5) Software programming outsource dummy	(6) Software application outsource dummy
Interaction term (Spanish firms) * (after 1993)	-0.0481** (0.0235)	-0.0623*** (0.0230)	0.0219 (0.0333)	0.00884 (0.0416)	-0.0496 (0.0410)	0.00227 (0.0406)
Observations	11,026	11,328	2,824	2,826	2,920	2,920
Partial R-squared	0.001	0.001	0.000	0.000	0.001	0.000
Number of firmid	2,286	2,301	1,412	1,413	1,460	1,460
Firm FE	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES

7B. Employment, Prices and Other choices

VARIABLES	(1) ln(employment)	(2) ln(average overtime hours)	(3) ln(wage bill)	(4) Price index (0 to 1)	(5) ln(advertising)	(6) ln(sales)	(7) ln(exports)
Interaction term (Spanish firms) * (after 1993)	0.0423** (0.0174)	-0.515 (0.367)	-0.0281 (0.0174)	0.0164** (0.00790)	-0.0918 (0.0584)	-0.113*** (0.0233)	-0.166** (0.0655)
Observations	11,338	9,177	11,254	11,307	7,215	11,265	5,879
Partial R-squared	0.001	0.001	0.001	0.001	0.001	0.005	0.003
Number of firmid	2,301	2,160	2,292	2,290	1,691	2,293	1,287
Firm FE	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES

Table 8. Using Spanish ownership as instrument for credit crunch

Notes: This table shows 2SLS regressions of a dependent variable (stated in the head of each column) on the main regressor credit (total credit in percent of assets), using the interaction of Spanish ownership share with a dummy indicating the crisis (=1 in 2008, 2009 and 2010) as instrument for credit. The first stage of these regressions we have already shown in Table 1 before, however, we report the F-statistics of the first stage in the last row. All columns include full sets of firm fixed effects and industry*year fixed effects. All standard errors are two-way clustered at firm level and industry*year level. *** p<0.01, ** p<0.05, * p<0.1. Observations are between 2000 and 2010.

8A. Innovation and Information Technology

VARIABLES	(1) ln(investment)	(2) Product innovation dummy	(3) Process innovation dummy	(4) CAD dummy	(5) LAN dummy	(6) Flexible systems dummy	(7) Software programming outsource dummy	(8) Software application outsource dummy
Credit in % of assets	8.988	1.280**	2.334***	2.275*	2.497*	3.419**	-2.953**	-2.385*
(between 0 and 1)	(6.766)	(0.628)	(0.864)	(1.330)	(1.316)	(1.590)	(1.337)	(1.301)
Observations	12,058	18,718	18,983	4,087	4,087	4,087	4,079	4,079
Partial R-squared	-0.318	-0.252	-0.484	-0.661	-0.799	-1.335	-0.783	-0.531
Number of firmid	2,389	3,030	3,051	1,669	1,669	1,669	1,665	1,665
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES	YES
First stage	3.251	15.19***	14.59***	9.001***	9.001***	9.001***	9.169***	9.043***
(p-velue)	(0.0728)	(0.0001)	(0.0002)	(0.0039)	(0.0039)	(0.0039)	(0.0036)	(0.0039)

8B. Employment, Prices and Other choices

VARIABLES	(1) ln(employment)	(2) ln(average overtime hours)	(3) ln(wagebill)	(4) Price index (0 to 1)	(5) ln(advertising)	(6) ln(sales)	(7) ln(exports)
Credit in % of assets	1.709**	-16.84*	1.159**	-0.639**	0.817	1.615*	2.451
(between 0 and 1)	(0.678)	(10.00)	(0.591)	(0.2949)	(1.407)	(0.924)	(1.904)
Observations	18,983	18,931	18,983	18,965	13,167	18,983	12,099
Partial R-squared	-0.622	-0.227	-0.306	-0.668	-0.020	-0.324	-0.096
Number of firmid	3,051	3,045	3,051	3,044	2,334	3,051	2,028
Firm FE	YES	YES	YES	YES	YES	YES	YES
Ind*Year FE	YES	YES	YES	YES	YES	YES	YES
First stage	14.59***	14.99***	14.59***	14.62***	11.19***	14.59***	8.892***
(p-value)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.001)	(0.0002)	(0.0032)