Online Appendix

Luis Garicano and Claudia Steinwender, "Survive Another Day: Using Changes in the Composition of Investments to Measure the Cost of Credit Constraints"

Figure A1. Exit rates by domestic and foreign firms

Note: The solid line shows the exit rate (firms that went bankrupt over active firms) separately for foreign and domestic firms. The dashed lines show the 95% confidence interval of the rates.

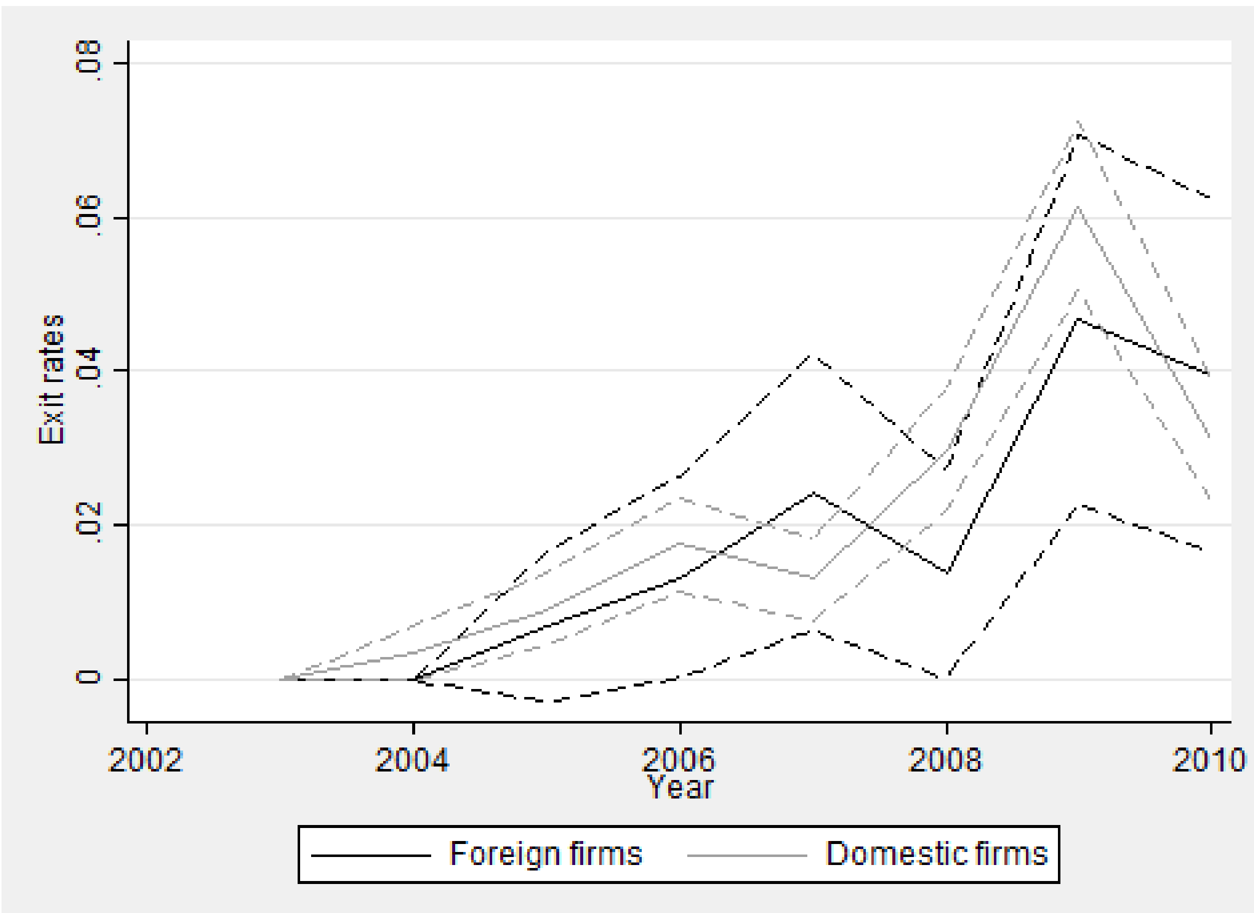

Table A1. Depreciation rates of different investment types

Investment type	Estimates in literature	Consolidated depreciation rate	Rank
Advertising and brand equity	• Landes/Rosenfield (1994): >50% for most industries; up to 100% for some industries • Corrado/Hulten/Sichel (2009) conclude on 60% from literature review, with some studies having larger and smaller depreciation rates (lower bound: Ayanian (1938)** with 7 years)	60%	1
Software/IT	• Corrado/Hulten/Sichel (2009): 33% for own-account software based on BEA (1994) • Tamai/Torimitsu (1992): 9 year average lifespan, ranging from 2 to 20 years • Spain accounting rules: 26% (IT equipment and software)	30%	2
R&D	• Corrado/Hulten/Sichel (2009): 20% based on literature review • Pakes/Schankerman (1984): 25% based on 5 European countries • Pakes/Schankerman (1986): 11-12% for Germany, 17-26% for UK, 11% for France • Nadiri/Prucha (1996): 12% • Bernstein/Mamuneas (2006): 18%-29% for different US industries	20%	3
Vehicles	• Spain accounting rules: 16%	16%	4
Machinery	• Spain accounting rules: 12% • BEA accounting rules: 10.31%-12.25%	12%	5
Furniture & office equipment	• Spain accounting rules: 10% • BEA accounting rules: 11.79%	10%	6
Buildings	• Spain accounting rules: 3% • BEA: 2-3% (industrial and office buildings)	n/a*	n/a*
Land	• Spain accounting rules: depends on land prices • BEA: depends on land prices	n/a*	n/a*

Notes: Spanish accounting rules are given in Table 2, "Tabla simplificada" of http://www.individual.efl.es/ActumPublic/ActumG/MementoDoc/MF2012_Coeficientes%20anuales%20de%20amortizacion_Anexos.pdf

* As the real estate crisis coincided with the credit crunch and resulted in large price drops in rest estate (e.g. of up to 90% in land), we have chosen conservatively not to include this in our analysis, see the text.

** Ayanian, Robert. 1983. "The Advertising Capital Controversy," The Journal of Business, Vol. 56, pp. 349-364.

Table A2. Robustness checks: different measures for time-to-payoff

Notes: Regressions in Panel A replicate the specification in column (1) of Table 2, using different measures for time-to-payoff: (1) 1/depreciation rate; (2) rank of investment type (higher rank for more long term investments); (3) 4 categories: advertising (value 1), R&D, IT (value 2), vehicles (value 3), machinery, furniture (value 4); (4) 3 categories: advertising (value 1), R&D, IT (value 2), vehicles, machinery, furniture (value 3); (5) 3 categories: advertising (value 1), R&D, IT, (value 2), machinery, furniture (value 3); (6) depreciation rate.

Regressions in Panel B omit one investment category at a time to check whether any one category is driving the results.

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A. ROBUSTNESS CHECKS						
(Time-to-payoff measure)*	-0.020***	-0.033***	-0.062***	-0.089***	-0.097***	0.264***
after 2008 dummy	(0.006)	(0.009)	(0.014)	(0.022)	(0.022)	(0.089)
Observations	43,900	43,900	43,900	43,900	43,900	43,900
R-squared	0.582	0.582	0.582	0.582	0.582	0.582
PANEL B. EXCLUDING CATEGORIES						
(Time-to-payoff measure)*	-0.018**	-0.011	-0.033***	-0.019***	-0.021***	-0.017***
after 2008 dummy	(0.007)	(0.007)	(0.006)	(0.007)	(0.006)	(0.006)
Observations	33,780	36,763	36,383	33,521	40,375	38,678
R-squared	0.617	0.650	0.594	0.525	0.624	0.413
Excluded category	Advertising	Furniture	IT	Machinery	Vehicles	R&D

*** p<0.01, ** p<0.05, * p<0.1.

Table A3. Placebo tests: treatment effect by year

This table conducts the robustness checks of panel A in Table A2 with an interaction term separately for each year, and includes F-tests on the equality of coefficients.

DEPENDENT VARIABLE: ln(investment value)	(1)	(2)	(3)	(4)	(5)
(year==2004)*	-0.003	-0.005	-0.016	-0.021	-0.035
(Time-to-payoff measure)	(0.008)	(0.013)	(0.019)	(0.028)	(0.030)
(year==2005)*	-0.003	-0.004	-0.019	-0.013	-0.047
(Time-to-payoff measure)	(0.009)	(0.014)	(0.021)	(0.032)	(0.034)
(year==2006)*	0.005	0.008	0.004	0.010	-0.007
(Time-to-payoff measure)	(0.009)	(0.015)	(0.023)	(0.034)	(0.036)
(year==2007)*	0.004	0.007	-0.003	-0.009	-0.025
(Time-to-payoff measure)	(0.009)	(0.015)	(0.023)	(0.035)	(0.036)
(year==2008)*	-0.003	-0.003	-0.021	-0.034	-0.060
(Time-to-payoff measure)	(0.010)	(0.016)	(0.024)	(0.036)	(0.038)
(year==2009)*	-0.026**	-0.042**	-0.088***	-0.123***	-0.149***
(Time-to-payoff measure)	(0.010)	(0.017)	(0.025)	(0.038)	(0.040)
(year==2010)*	-0.032***	-0.053***	-0.101***	-0.134***	-0.161***
(Time-to-payoff measure)	(0.010)	(0.017)	(0.025)	(0.039)	(0.040)
Observations	43,900	43,900	43,900	43,900	43,900
R-squared	0.583	0.583	0.583	0.583	0.583
F tests on equality of coefficients:					
F-stat 2007=2008	0.752	0.695	0.888	0.752	1.476
p-val	0.386	0.404	0.346	0.386	0.224
F-stat 2007=2009	11.46	11.35	15.10	11.72	13.10
p-val	0.001	0.001	0	0.001	0
F-stat 2007=2010	15.86	15.74	18.99	13.34	14.80
p-val	0	0	0	0	0

Table A4. Foreign versus domestic firms

This table includes F-tests on equality of coefficients to Table 4, Foreign versus domestic firms.

DEPENDENT VARIABLE: ln(investment value)	(1) domestic only	(2) foreign only	(3) domestic only	(4) foreign only
Long term investment*	-0.029***	0.018		
after 2008 dummy	(0.006)	(0.014)		
(year==2004)*			-0.004	-0.002
Long term investment			(0.009)	(0.015)
(year==2005)*			-0.009	0.009
Long term investment			(0.010)	(0.018)
(year==2006)*			0.002	0.005
Long term investment			(0.010)	(0.020)
(year==2007)*			0.003	-0.003
Long term investment			(0.010)	(0.021)
(year==2008)*			-0.016	0.045**
Long term investment			(0.011)	(0.022)
(year==2009)*			-0.035***	0.006
Long term investment			(0.011)	(0.023)
(year==2010)*			-0.043***	0.005
Long term investment			(0.011)	(0.024)
Observations	35,346	8,479	35,346	8,479
R-squared	0.566	0.661	0.566	0.661
Sample	domestic firms	foreign firms	domestic firms	foreign firms
F tests on equality of coefficients:				
F-stat 2007=2008			4.719	7.697
p-val 2008			0.030	0.006
F-stat 2007=2009			15.25	0.213
p-val 2009			0	0.644
F-stat 2007=2010			20.51	0.153
p-val 2010			0	0.696

Table A5. Robustness checks foreign versus domestic firms

This table replicates the specification of column (1), Table 6 in the paper for the following subsets: (1) Only firms that have foreign non-industrial plants; (2) Only firms that have foreign shareholdings.

	(1)	(2)
(Time-to-payoff measure)* (domestic firm dummy)	0.005	0.003
	(0.041)	(0.023)
(Time-to-payoff measure)* (after 2008 dummy)* (domestic firm dummy)	-0.066*	-0.061**
	(0.039)	(0.024)
Observations	3,181	11,318
Partial R-squared	0.001	0.001
Number of firmyr	710	2,584
Firm*year FEs	YES	YES
Category*year FEs	YES	YES

Model to "The Interest Rate Channel and the Substitution Effect."

We can adjust our model to illustrate this differential effect of a demand shock. Consider that a demand shock lowers the output in the current period, i.e. the output of short-term investments, by factor $\gamma < 1$. The maximization problem becomes:

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

and the first order condition can be rearranged to yield:

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

with τ_{t+1} as before and $s = \frac{1}{\gamma} - 1 > 0$ acting as a subsidy rather than a tax on long-term investment. The recession might be longer lived than just one period, but as long as we expect the recession to end at some point, it will differentially reduce short-term investment by more.

Model to "Differential Depreciation."

An alternative argument for why demand shocks could reduce long-term investments by more than short-term investments involves the following model. We are grateful to an anonymous referee for providing this model.

Assume that firms use short-term capital K (with high depreciation rate δ_k) and long-term capital Z (with low depreciation rate δ_z) to produce output with a Cobb-Douglas production function with decreasing returns to scale and an aggregate demand (or productivity) shock A:

$y = AK^{\alpha}Z^{\beta}$. In this case, aggregate demand shocks affect both long and short-term capital in the same way, i.e. the elasticity of capital with respect to the demand shocks is the same for both types of capital.

To see this, consider that firms maximize static profits taking prices r and p of short term and long term capital, resp., as given:

$$\max_{K,\ Z} AK^{\alpha}Z^{\beta} - rK - pZ$$

First order conditions are $A\alpha K^{\alpha-1}Z^{\beta} = r$ and $A\beta K^{\alpha}Z^{\beta-1} = p$ and yield optimal long-term and short-term capital:

$$K = A^{\frac{1}{1-\alpha-\beta}} \left[\frac{\alpha}{r}\left(\frac{\beta}{\alpha}\frac{r}{p}\right)^{\beta}\right]^{\frac{1}{1-\alpha-\beta}}$$

and

$$Z = A^{\frac{1}{1-\alpha-\beta}} \left[\frac{\beta}{p}\left(\frac{\alpha}{\beta}\frac{p}{r}\right)^{\alpha}\right]^{\frac{1}{1-\alpha-\beta}}$$

It can easily be seen that the elasticity of both long term and short term capital with respect to the demand shock A is the same, $\frac{1}{1-\alpha-\beta}$.

Investments in long and short-run capital stock (denoted by lower case letters) and depreciation determine the accumulation of capital stock: $K_{t+1} = (1-\delta_K)\,K_t + k_t$ and $Z_{t+1} = (1-\delta_Z)\,Z_t + z_t$. In steady state investments are $k = \delta_K K$ and $z = \delta_Z Z$. In a recession, the negative aggregate demand shock will lead capital stocks to change by the same percentage (say $-x\%$), but because of the different depreciation rates this translates into a different percentage change in long-term and short-term investments. More specifically, long-term investment will change by

$$\frac{z_{t+1} - z_t}{z_t} = \frac{(\delta_Z Z - x\% * Z) - \delta_Z Z}{\delta_Z Z} = -\frac{1}{\delta_Z} * x\%$$

and short-term investment will fall by $\frac{1}{\delta_K} * x\%$. Since $\frac{1}{\delta_Z} > \frac{1}{\delta_K}$, long-term investment will fall by more in percentage terms.

Note, however, if we normalize the change in investment by capital stock (instead of investment), we should not expect to see a differential effect. If (even firm specific) demand (or productivity) shocks are driving the results, they are netted out across investment types:

$$\frac{z_{t+1} - z_t}{Z} = \frac{(\delta_Z Z - x\% * Z) - \delta_Z Z}{Z} = -x\%$$

Magnitude of demand effect

While this means that we cannot reject that firms with more short-term credit face the same demand shocks, we can also not reject that they face a slightly larger negative demand shock. In order to be conservative, let's take the coefficient seriously and assume that credit constrained firms, i.e. firms with more short-term credit before the crisis, faced on average a 1.1% higher negative demand shock than foreign firms. Is this consistent with the magnitude of our effect? The theory above would predict that a 1.1% demand shock would reduce long-term investments by $\left(\frac{1}{\delta_Z} - \frac{1}{\delta_K}\right) * 1.1\%$, which equals 9% when we compare the investments with the longest vs. the shortest investment horizon in our data. However, using the evidence from column (2) in Table 8 long-term investment gets reduced by $\left(\frac{1}{\delta_Z} - \frac{1}{\delta_K}\right) * 4.2\%$, which equals 35%, and is statistically significantly larger than 9%. Even when being conservative and taking out a potential demand shock, a large effect remains that cannot be explained by the recession. The same is true when using ownership as a measure of credit constrained firms.

Construction of capital stock

Capital stock is constructed by the law of motion: $K_{t+1} = (1 - \delta)K_t + I_t$, using actual investment and depreciation rates by category as described in the text. For the first year of observation capital stock is approximated by steady state capital stock $K_{SS} = I/\delta$ using average investment within firm i and category c across all periods.

TFP estimation

TFP is estimated by the Levinsohn-Petrin method with separate regressions by industry and furthermore includes a correction for both changes in input or output prices which are used as firm specific inflators (input and output price changes are asked in the survey).

Economic significance of effect

Our preferred specification in column (1) in Table 2 tells us that investment falls by 2 percentage points for a unit increase in the inverse depreciation rate. When we compare advertising (the investment category with the highest depreciation rate) to furniture and office equipment (the category with the lowest depreciation rate), the inverse depreciation rate increases by 8.3, so we need to multiply the regression coefficient by this value. This leads to our main result: Investment in office equipment gets reduced by 17 percentage points more than advertising expenditure.

Note that the reduction of long-term investments due to the crisis is not clearly visible on the aggregate in Table 1. While our regressions present a micro perspective of what is happening at the firm level, giving each firm equal weight, the macro view using aggregate investment weighs large investments more. The effect that we find is heterogeneous and applies only to credit constrained firms (more in the next section) which tend to have smaller investments, while unconstrained firms with large investments tend to be unaffected or even increase their long term investment. Therefore the effect on the aggregate is washed out.