Small Firms' Productivity and Survival Performance in Mexico: an analysis based on economic census micro datasets

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In Mexico, the majority of firms are small. The efficiency with which they produce similar products or services differs considerably among them. This is not only due to differences in organization, location, choice of technology and ability of entrepreneurs, but also to misallocation of capital and labor among establishments, which in turn is induced by distortions in prices of inputs that imply a tax or a subsidy for some, but not for others.[2]

A comparison of corresponding figures for the Economic Census of 2008, 2003 and 1998 shows that their aggregate productivity has been stagnated for years (Buzio *et. al.*, 2012).[3] In addition, turnover among small firms can be very high (in 2009, over 4% of establishments with less than 100 workers closed down permanently while, in the same year, a large number of establishments opened up; this was in spite of a sharp drop in this year's GDP). The stagnation of aggregate productivity of small firms might be having high costs for the country, in terms of both, efficiency and welfare.

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[2]The misallocation of capital and labor among these establishments (relative to a situation in which output is maximized) can be attributed to the price of inputs being taxed or subsidized for some, but not for others. These distortions, in turn, are caused by poorly functioning credit markets, relative enforcement of employment regulations, barriers to entry and exit, trade barriers stifling competition and innovation, weak rules of law, lack of property rights, problems with public infrastructure for communication and transportation, corruption etc.

[3] These estimates were feasible for the Mexican economy because all establishment sizes, even if they have less than ten workers, are covered in the Mexican Censuses -a characteristic not found in census carried out in other countries.

This would be the case if closures of inefficient establishments during a year were compensated by openings of other establishments, whose survival perspectives and potential productive growth are not better than those of the exiting establishments.[4] It would also be the case –but with costs that are even higher- if what is happening is that a large number of inefficient firms continue to survive, while efficient firms, with high growth potential, are forced to exit.

Stated differently, stagnating aggregate productivity, together with high rates of establishments' turnover might be reflecting serious distortions in the Schumpeterian process of 'creative destruction', which should be moving resources away from less productive businesses, to more efficient new and expanding ones.

In spite of its relevance for an adequate policy and institutional design, given that the majority of workers are hired in small firms and of the implied costs of the distortions, there had been no data available in Mexico to assess the efficiency of this process. It is only recently that an adequate micro-database has been produced: this is a by-product of a follow-up activity of a large and representative sample of establishments in the 2008 economic census, conducted by the personnel of the National Institute of Statistics (INEGI). Its purpose was to find out what had happened with establishments with less than 100 workers, six-months after the 2008 Economic Census was conducted. Simultaneously with the follow-up activity of small establishments, INEGI also obtained information of establishments that opened up in 2009 and of the number of jobs created by them. For this purpose, its personnel designed a sample of geographical areas that were representative of the country, and for each one of them, corresponding data were collected.

We can now work with information for both 2008 and 2009 of more than 280000 small establishments -9% of the universe- which was obtained, on the one hand with the

[4]Due to the lack of reliable longitudinal data following the same establishment for years, we cannot assess the extent to which surviving small scale entrepreneurs become, after some years, medium size efficient firms. These assessments would allow us to rule out abnormal patterns in the life cycle dynamics of firms. (*Cfr.* Hsieh. Klenow, 2012, for an argument along these lines comparing Mexico, India and the U.S.A).

questionnaire of the economic census and on the other hand with their follow-up a year latter.

In this work we link the information for both years, by establishment, to address questions about their survival determinants and job creation and destruction at the margin, *viz.* related to permanent closures and opening up of new establishments.

For each one of the establishments in this micro-database we measure quantity and revenue productivities, using the conceptual framework developed by Hsieh and Klenow, 2009. These measurements enables us to assess two questions, namely: To what extent a permanent closure of an establishment during 2009 was associated with its quantity and revenue productivities, to its size, age and formality status and access to credit? and what does these relationships imply for the efficiency in which resources are allocated at the margin, *viz.* from closing to newly opened establishments.

This work is structured as follows. Section 2 discusses stylized facts of small establishments in Mexico. Section 3 presents the analytical framework deployed by Hsie and Klenow, 2009, which is the basis for our estimates. Section 4 has a description of the main characteristics of our micro-data bases. Section 5 has the estimates of establishments' quantity and revenue productivity and their dispersion among the sample of establishments. Section 6 presents and discusses results of the determinants of an establishment survival. We rely on two statistical models that enable us to control for size, age, sector to which the establishment belongs, formal/informal status and access to credit. These are probit and box-cox proportional hazard models. Section 7 analyses the implications that severance payments regulations have for the re-estructuring process of small firms. Section 8 presents concluding remarks.

2. Stylized facts from the Economic Census

The Mexican economic census is conducted each five years and covers all establishments' sizes. It measures economic activity taking place in private establishments with a fixed location in urban areas, and captures information on value added, number of workers, fixed capital stock, labor remunerations and access to financing and banking services, among other variables of an establishment's performance. The census classifies activities with considerable detail, up to 6-digits of the North American Industrial Classification System.

Buzio *et. al.,* 2012, conducted an analysis using data from three years of the economic census, 1998, 2003 and 2008. When they compared rates of growth in employment between 1998 and 2008 by size of establishments, they pointed out a worrisome pattern, namely that "workers moved towards smaller firms at the same time that these same firms lost relative importance in terms of value added in the economy"[5]

As it is shown in the lower part of table 1, which reproduces the results obtained by these authors, employment in establishments with less than 5 workers grew by 53% and in those with 6 to 10 by 69%; in contrast, employment in establishments with 11 to 50 workers grew by 30%, and in those with more than 50 by 24%.

The need to reverse this pattern to support productivity growth is evident when another stylized fact is considered. This is that establishments with less than 11 workers account for 46% of employment, 18% of capital and only 15% of value added. In contrast, those with more than 50, which are only 1% of all establishments registered in the 2008 census, contribute with 73% of value added, employing 15% fewer workers than establishments with less than 11 workers.

Table 1
Resource Allocation and Output

	Establishments	Workers	Capital	Value Added
Shares in 2008				
By Size				
[0-5]	89.7	37.8	13.2	10.3
[6-10]	5.8	8.8	4.5	4.6
[11-50]	3.6	14.9	10.2	12.5
[+50]	0.9	38.5	72.1	72.5
Growth 1998-2008				
By Size				

[5] Buzio *et. al*. 2012, p.15. The emphasis is ours. In a non-published note, these authors remark that 53% of establishments with less than 10 workers in the 2008 economic census were created after 2004 and that corresponding figure for those with less than 50, but more than 10 workers was 30.1%. This result suggests high rates of establishment destruction of small firms, when both figures are compared with net increase in the number of establishments across census.

[0-5]	31.9	53.3	69.6	68.7
[6-10]	72.1	68.8	111.2	89.6
[11-50]	33.8	30	105.3	98
[+50]	20.7	24	127.2	182.2

Source: *Buzio et. al.* 2012 based on Mexican Economic Census (INEGI)

Another pattern that a policy to support productivity growth must consider is the high turnover, that even in short periods of time, is exhibited by small firm in Mexico.

Data reflecting short run dynamics of establishments with less than 100 workers, captured during the largest drop in Mexican GDP since 1995 (8.2% during the first quarter of 2009 and 6.2% during 2009) indicates a relative large share of permanent closures. This is shown in table 2. It can be appreciated there that out of each 100 establishments existing by May 2009, six were driven out of business six months later and that even manufacturing, which is the less volatile sector, exhibits a closure rate of 4.5%.

Table 2
Share of Plants that closed down in 6 months after May 2009

	0-10 workers	11-30 workers	0-100 workers
Total	6.4	2.1	6.2
Manufacturing	4.5	2.3	4.4
Retail	6.1	1	6.08
Private non-financial Services	7.5	2.9	7.2

Shares in 2009 Census: 11.5% manufacturing, 40.9% retail, and 47.9 private non-financial.
Shares of Plants closures: (% manufacturing, 43% retail, 49% private non-financial).
Source INEGI

During the same period of time in which these permanent closures occurred, high rates of establishment creation were also registered. This highlights that, along with the high rates of job destruction of small firms, high rates of job creation, at the extensive margin, were taking place as well. This is in spite of the fact that the second semester of 2009 was a period of recession.[6]

3. Analytical framework

Our empirical work is based on the framework developed by Hsie and Klenow, 2009. These authors deploy a model of monopolistic competition with heterogeneous firms facing distortions in factor and output prices. These distortions introduce wedges between the marginal revenue products of capital and labor across establishments, misallocating resources and lowering aggregate quantity productivity. The framework allows for a distinction between physical and revenue productivity of a firm.

The negative effects of distortions on aggregate physical productivity are directly related to the variance of the firms' revenue productivity. A revenue productivity of a firm which is higher than the rest happens because of barriers and taxes that raise the its marginal product of capital and labor, rendering its size smaller than optimal.

Intuitively, the extent of misallocation is worse when there is greater dispersion of marginal products. In the absence of distortions, more resources would be allocated to firms with the highest physical productivity, until revenue productivity is equated across firms. In this case, of no dispersion in the distribution of revenue productivity, aggregate physical productivity is the highest that can be achieved. There will, however, be some dispersion in the distribution of firms' physical productivities.

In their model, industry output Y_s is a CES aggregate of M_s differentiated products,

$$Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where σ states for the elasticity of substitution between values added by plants.

The production function for each differentiated product is given by a Cobb-Douglas function.

[6] Related figures for other countries show that relative high turnover among small firms is not an exclusive feature of Mexico. (*Cfr*. Farrukh and Urata, 2002).

$$Y_{si} = A_{si} K_{si}{}^{\alpha} L_{si}{}^{1-\alpha} \quad (2)$$

where L_{si}, K_{si}, denote labor and capital services and α_s is the capital share, which is assumed the same for all firms in a given class. By contrast A_{si} which states for quantity productivity is different for each firm.

Two types of distortions affect firm's decisions. The first are output distortions, τ_{Ysi}, which impact the output price observed by the firm, and affect both capital and labor. Examples of these are high transportation costs. The second are factor price distortions, τ_{Ksi}, that affect the marginal product of capital. Examples of these are credit constraints. Letting w and R denote wages and the rental cost of capital, respectively, individual firm profits are given by:

$$\pi_{si} = (1-\tau_{Ysi}) P_{si} Y_{si} - wL_{si} - (1+\tau_{ksi}) RK_{si} \quad (3)$$

Here, P_s refers to the price of class of output Y_s. When distortions are present, the marginal revenue products are given by:

$$MRPK_{si} = \frac{R(1+\tau_{Ksi})}{(1-\tau_{Ysi})} \quad \text{and} \quad MRPL_{si} = \frac{w}{(1-\tau_{Ysi})}$$

Hsieh and Klenow distinguish between physical total factor productivity ($TFPQ_{si}$), measured by A_{si}, and total factor revenue productivity *($TFPR_{si}$)*, measured by $P_{si} A_{si}$.

$$TFPQ_{si} = A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s} (wL_{si})^{1-\alpha_s}} \quad (4)$$

$$TFPR_{si} = PA_{si} = \frac{P_{si} Y_{si}}{K_{si}^{\alpha_s} (wL_{si})^{1-\alpha_s}} \quad (5)$$

Since there are no individual establishment or product level prices, Hsieh and Klenow's model allows physical productivity estimation by assuming that product demand is given by $P_{si} = Y_{si}{}^{-1/\sigma}$.

Then, from equation (4) the following expression, which can be observed in the data, is obtained:

$$A_{si} = \frac{Y_{si}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} = \frac{\left(P_{si}Y_{si}\right)^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s}(wL_{si})^{1-\alpha_s}} \qquad (6)$$

In turn, an establishment's *TFPR* is proportional to a geometric average of the plant's marginal revenue products of capital and labor:

$$TFPR_{si} \propto (MRPK_{si})^{\alpha_s}(MRPL_{si})^{1-\alpha_s} \propto \frac{(1+\tau_{Ksi})^{\alpha_s}}{(1-\tau_{Ysi})} \qquad (7)$$

To measure TFPR, we use the following relationships:

$$1+\tau_{Ksi} = \frac{\alpha_s}{1-\alpha_s}\frac{w_s L_{si}}{RK_{si}} \qquad (8)$$

$$1+\tau_{Ysi} = \frac{\sigma}{\sigma-1}\frac{w_s L_{si}}{(1-\alpha_s)P_{si}Y_{si}} \qquad (9)$$

The elasticity of output with respect to capital in each sector (α_s) is given by one minus the labor share in the value added in the corresponding sector and R, the rental cost of capital is assumed a constant, equal to .1.

4. Characteristics of the micro-data base

Taking as the universe all the establishments with less than 100 workers that were registered in the directory the Mexican economic census of 2008, INEGI identified a representative sample (9% of the total) and visited all of them again, six months after this census was conducted.

In this second visit, a new questionnaire was applied to establishments that had not closed down, registering if they had continued with the same type of activities or if they had changed to another other one. The personnel of INEGI also registered which of those establishments that closed down did so on a temporary and which ones on a permanent basis.

Our work on closure determinants of establishments and job destruction at an extensive margin is based on the micro-dataset of establishments incorporated into that sample. For the same establishment, we have information captured by the census, which is linked to that captured with the followed-up activity.

In addition, in a simultaneous activity and for a sample of geographical areas that were representative of the country, personnel of INEGI also collected information about establishments that opened up during 2009 and of the number of jobs created by them.[7] This last activity covered 3,619 geographic areas (so-called AGEB) selected at the national level to be representative of the country.

The Economic Census provides information about establishments having access to credit and banking facilities (to smooth adverse temporary shocks) and paying social security system fees and fulfilling other obligations with their workers (when the answer is that they do not, we consider it to be in the informal sector). This feature was useful for the purpose of this study, since they capture market distortions in capital and labor markets faced by establishments.

The micro-data set that resulted from this activity is linked by its 6-digits classification of product and services to the other dataset. Our work on net job creation, at the extensive margin, during 2009, uses both of them.

From the initial sample design, a data base with 285 852 observations was assembled and this constituted our starting point. Its distribution by sector and size is presented in tables 3 and 4.

Table 3
Characteristics of the data set
Distribution of establishments by sector

Sector	Number of Establishments	Percent
RETAIL	153,851	53.82
MANUFACTURING	29,003	10.15
PRIMARY	45	0.02

[7] INEGI, the National Institute of Statistics and Geography, is the official body in charge of economic information in Mexico. The aim of this second visit was to update INEGI's establishment directory.

PRIVATE SERVICES	102,953	36.02
TOTAL		
Total	285,852	100

Table 4
Characteristics of the data set
Distribution by size of establishments

number of Workers	number of Establishments	Percent
1	96,358	33.83
2	87,545	30.73
3	40,712	14.29
4	20,206	7.09
5	10,904	3.83
5 to 10	17,747	6.23
10 to 15	4,690	1.65
15 to 20	2,170	0.76
20 to 50	3,451	1.21
50 to 100	1,056	0.37
Total	284,839	100

Table 5
Characteristics of the data set
Distribution by age of establishments

age of the Establishment	number of Establishments	Percent
0-5 years	136,780	47.85
6- 15 years	85,469	29.9
more than 16	63,602	22.25
Total	285,852	100.00

A number of observations had to be left out of the analysis due to missing information. As a result, we were effectively able to work only with 192 712 establishments.[8] Its distribution, by number of workers is presented in Table 6.[9]

[8] Most of them were left out because their value added was reported to be zero or negative (54976 observations). This is a problem that may bias our results. Also because they belonged to a six-digit class whose share of compensation in value added was greater than one (13699 observations). It would require an alternative method to estimate productivity to reincorporate these establishments into the analysis.

Table 6
Characteristics of the data set
Distribution by size of establishments

number of Workers	number of Establishments	Percent
1	58,448	30.3
2	60,771	31.5
3	29,507	15.29
4	14,871	7.71
5	8,210	4.26
5 to 10	13,193	6.84
10 to 15	3,403	1.76
15 to 20	1,485	0.77
20 to 50	2,388	1.24
50 to 100	653	0.34
Total	192,929	100

Most of them were left out because their value added was reported to be zero or negative (54976 observations). This is a problem that may bias our results.

Also left out were those that belonged to a six-digit class whose share of compensation in value added was greater than one (13699 observations). To include them requires an alternative method to estimate productivity.

Our data set has information related to an establishment's access to credit. it helps us to capture if lack of access to finance a liquidity problem may induce closures, even if establishments are relatively productive.

To include this information in our analysis, we define a *dummy* variable, dcredit, which takes a value of one if they answer they do and zero, otherwise. In this case around 16% of establishments in retail and manufacturing have access to credit, but only 12% in private non-financial services.[10]

[9]As it is apparent by comparing this table with Table 2, it seems to be unlikely that there is an attrition bias due to number of workers. However, further analysis is required to discard this and other possible sources of bias.

[10] It is worth mentioning that only one in five of formal establishments answered yes to the question of having access to credit.

In turn, we can also know if an establishment paid social security contributions or not. To capture this, we define another *dummy* variable, Imssdum, which takes a value of 1 if they pay and zero if not.

This captures the formal status of the firm. In our dataset, retail has only 12% of establishments classified as formal, whereas manufacturing and private non-financial services have, both of them, 16%.

5. Analysis of productivity

For each one of the establishments in our micro-database, we measure quantity and revenue productivities, using the conceptual framework summarized in section 3. We also estimate variance of revenue productivities of establishments within a same 6-digit class of products and services.

The dispersion of revenue productivity reveals distortions in the allocation of capital and labor among these establishments. These are attributed to the price of inputs faced by establishments not being the same for all of them -that is taxed or subsidized for some establishments, but not for the others. These distortions are caused by poorly functioning credit markets, different degree of enforcement of employment regulations, barriers to entry and exit, barriers stifling competition and innovation, weak rules of law, lack of property rights, problems with public infrastructure for communication and transportation, corruption etc.

In this section, after the presentation of our estimates, we run regressions in which productivity –either quantity or revenue productivity (TFPQ or TFPR)- is the dependent variable to consider correlations with other variables that characterize the establishment, such as formality status, access to credit, size and age.

5.1 Estimates of productivity heterogeneity among establishments

We have three industries: manufacturing, retail and private non-financial services, divided in 6-digit class for products and services. We have 547 different classes and for each one of them, a capital share α_s is measured.

Following Hsie and Klenow, 2009, it is assumed that this share is the same for all establishments in a given class. Using equation (6) of section 2, we estimate A_{si} which states for quantity productivity, this is different for each establishment (the rental price of capital is fixed to R=0.10 and the elasticity of substitution between establishments' value added takes a value of $\sigma = 3$).

The dispersion in quantity productivity values implies that some establishments are able to produce much more output out of the same amount of inputs than others.

Even in the benchmark case in which capital and labor are allocated in the most efficient way, there will be some dispersion in the distribution of establishments' physical productivities. In this case, a sector's aggregate physical productivity is maximized since

Table 7
Quantity Productivity (TFPQsi)

		Retail	Manufacturing	Services	Total
Quantil 1	average	-0.640	-0.594	-0.689	-0.655
	Desv. Est	1.155	1.203	1.325	1.226
	Min	-4.366	-4.372	-5.006	-5.006
	Max	8.139	3.497	4.229	8.139
	N	21,157	3,135	14,515	38,807
Quantil 2	average	1.164	1.286	1.337	1.238
	Desv. Est	0.920	0.644	0.793	0.859
	Min	-2.209	-2.450	-2.668	-2.668
	Max	8.318	4.547	5.149	8.318
	N	21,213	3,062	14,398	38,673
Quantil 3	average	2.268	2.295	2.399	2.319
	Desv. Est	0.904	0.601	0.722	0.821
	Min	-0.874	-0.782	-0.680	-0.874
	Max	8.860	5.222	5.904	8.860

		Retail	Manufacturing	Services	Total
	N	20,986	3,071	14,385	38,442
Quantil 4	average	3.358	3.176	3.330	3.333
	Desv. Est	0.932	0.609	0.740	0.843
	Min	0.453	0.147	0.786	0.147
	Max	10.328	6.608	7.269	10.328
	N	20,935	3,075	14,413	38,423
Quantil 5	average	4.964	4.395	4.683	4.814
	Desv. Est	1.165	0.838	1.012	1.102
	Min	2.189	1.686	2.397	1.686
	Max	13.777	8.424	10.291	13.777
	N	20,991	3,041	14,335	38,367
Total	average	2.215	2.097	2.206	2.202
	St. Dev.	2.162	1.885	2.054	2.101
	Min	-4.366	-4.372	-5.006	-5.006
	Max	13.777	8.424	10.291	13.777
	N	105,282	15,384	72,046	192,712

Table 8

Revenue productivity (tfprsi)					
		Retail	Manufacturing	Services	Total
Quantil 1	average	-2.276	-2.066	-2.235	-2.244
	St. Dev.	0.641	0.786	0.748	0.697
	Min	-4.836	-4.919	-5.374	-5.374
	Max	0.123	0.885	0.107	0.885
	N	21,236	3,133	14,498	38,867
Quantil 2	average	-1.051	-0.854	-0.920	-0.986
	St. Dev.	0.377	0.345	0.328	0.364
	Min	-2.183	-2.334	-2.556	-2.556
	Max	0.649	1.173	1.191	1.191
	N	21,015	3,073	14,408	38,496
Quantil 3	average	-0.283	-0.229	-0.214	-0.253
	St. Dev.	0.370	0.308	0.284	0.337
	Min	-1.409	-1.481	-1.558	-1.558

	Max	2.057	2.209	2.386	2.386
	N	21,038	3,068	14,394	38,500
Quantil 4	average	0.468	0.341	0.419	0.440
	St. Dev.	0.412	0.341	0.338	0.382
	Min	-0.733	-0.922	-0.547	-0.922
	Max	5.001	3.247	2.841	5.001
	N	21,027	3,069	14,413	38,509
Quantil 5	average	1.584	1.153	1.349	1.462
	St. Dev.	0.687	0.542	0.626	0.670
	Min	0.019	0.210	0.140	0.019
	Max	6.527	4.516	5.448	6.527
	N	20,966	3,041	14,333	38,340
Total	average	-0.317	-0.341	-0.325	-0.321
	St. Dev.	1.411	1.202	1.314	1.360
	Min	-4.836	-4.919	-5.374	-5.374
	Max	6.527	4.516	5.448	6.527
	N	105,282	15,384	72,046	192,712

capital and labor are reallocated from less to more productive firms, given that all firms face same prices of inputs.[11]

In the lowest part of table 7 we present summary statistics of the estimates of quantity productivity for all 192 712 observations, by industry. In the rest of the table we present results by quintiles. That is, we divide the ordered data of the distribution function of all estimated productivities, by industry, into 5 equal-sized data subsets (quantiles).

In turn, using equations (9), (8) and (7), of section 2, we measure revenue productivity for each one of the establishments in our micro-data set.

[11] In a well functioning economy, firms that are more productive than their competitors win market share over time, hiring more labor and capital and expanding their production, hence firm size and productivity are correlated.

The lowest part of table 8 has the summary statistics of the estimates of revenue productivity for all observations, by industry. The rest of the table has corresponding results by quintiles.

5.2 Relationship of productivity with establishments' size, age, access to credit and formality status

We run regressions in which productivity –either quantity or revenue productivity (TFPQ or TFPR)- is the dependent variable. We include these indicators as deviations from their corresponding class means ((*i.e.* not in levels). Hence, the most productive establishment has the highest relative value in its class.

As explanatory variables, we include 9 dummies for size (omitted variable is the largest category, more than 50 workers), 8 dummies for age (omitted variable is the ones with more than 15 years). Regressions are run with and without dummy variables for credit and formality status.

The results are presented in tables 9 and 10. Regarding those for quantity productivity, we have that, as expected, size and age are positively related with productivity.

It is worth mentioning that being a formal establishment (*i.e.* paying social security fees for the workers) is highly correlated with productivity. However, it is also important to stress that this result does not necessarily imply causality. That is, it may be the case that high productivity establishments self-select into formality or that formality and size are related in a way that estimates are biased.

Table 9

Relationship between quantity productivity and size, age, access to credit and formal status

	Ordinary Least Squares							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	Retail	Retail	Manufacturing	Manufacturing	Services	Services
VARIABLES	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm	TFPQsi_norm

dsize1	-2.305***	-2.022***	-2.001***	-1.711***	-2.956***	-2.591***	-2.480***	-2.226***
	(0.063)	(0.067)	(0.114)	(0.154)	(0.151)	(0.152)	(0.080)	(0.080)
dsize2	-2.168***	-1.936***	-1.929***	-1.679***	-2.636***	-2.246***	-2.268***	-2.077***
	(0.062)	(0.067)	(0.114)	(0.154)	(0.151)	(0.150)	(0.080)	(0.079)
dsize3	-1.958***	-1.783***	-1.796***	-1.612***	-2.249***	-1.893***	-1.985***	-1.835***
	(0.063)	(0.067)	(0.115)	(0.154)	(0.152)	(0.150)	(0.080)	(0.080)
dsize4	-1.765***	-1.658***	-1.663***	-1.568***	-2.056***	-1.723***	-1.743***	-1.648***
	(0.064)	(0.068)	(0.116)	(0.154)	(0.153)	(0.151)	(0.081)	(0.080)
dsize5	-1.546***	-1.503***	-1.454***	-1.440***	-1.901***	-1.634***	-1.517***	-1.478***
	(0.065)	(0.069)	(0.118)	(0.156)	(0.156)	(0.153)	(0.083)	(0.082)
dsize6	-1.091***	-1.149***	-0.856***	-0.994***	-1.497***	-1.279***	-1.191***	-1.218***
	(0.063)	(0.067)	(0.116)	(0.155)	(0.152)	(0.148)	(0.080)	(0.079)
dsize7	-0.614***	-0.794***	-0.381***	-0.699***	-0.949***	-0.830***	-0.729***	-0.832***
	(0.067)	(0.071)	(0.124)	(0.163)	(0.165)	(0.161)	(0.084)	(0.084)
dsize8	-0.427***	-0.600***	-0.219*	-0.504***	-0.491***	-0.436**	-0.572***	-0.677***
	(0.073)	(0.078)	(0.132)	(0.175)	(0.173)	(0.170)	(0.094)	(0.094)
dsize9	-0.170**	-0.392***	0.0497	-0.418**	-0.428**	-0.352**	-0.286***	-0.375***
	(0.068)	(0.073)	(0.124)	(0.167)	(0.168)	(0.165)	(0.086)	(0.085)
act1	-1.075***	-1.034***	-0.970***	-0.949***	-0.739***	-0.676***	-1.281***	-1.202***
	(0.014)	(0.014)	(0.019)	(0.019)	(0.047)	(0.051)	(0.023)	(0.024)
act2	-0.0493***	-0.0138	-0.0521**	-0.0378	0.00954	0.104*	-0.0659***	-0.00647
	(0.016)	(0.017)	(0.023)	(0.023)	(0.051)	(0.055)	(0.025)	(0.026)
act3	0.00262	0.0318*	0.0107	0.00512	-0.000829	0.122*	-0.0155	0.0477*
	(0.018)	(0.018)	(0.025)	(0.026)	(0.059)	(0.063)	(0.028)	(0.028)
act4	0.0274	0.0422**	0.0349	0.0170	-0.0190	0.0544	0.0209	0.0712**
	(0.019)	(0.019)	(0.026)	(0.027)	(0.061)	(0.067)	(0.029)	(0.029)
act5	-0.00690	0.0180	-0.00964	-0.00311	0.0665	0.128*	-0.0198	0.0267
	(0.019)	(0.020)	(0.027)	(0.028)	(0.061)	(0.066)	(0.031)	(0.031)
act6	0.0794***	0.0907***	0.0912***	0.0875***	0.110***	0.143***	0.0547***	0.0856***
	(0.013)	(0.013)	(0.018)	(0.019)	(0.040)	(0.044)	(0.021)	(0.021)
act7	0.105***	0.0960***	0.147***	0.123***	0.0432	0.0393	0.0554**	0.0642***
	(0.016)	(0.016)	(0.022)	(0.022)	(0.048)	(0.051)	(0.025)	(0.025)

dcredito		-0.0319***		0.0152		-0.0634		-0.0996***
		(0.012)		(0.017)		(0.040)		(0.020)
imssdum		0.660***		0.692***		0.674***		0.620***
		(0.014)		(0.022)		(0.036)		(0.019)
Constant	1.982**	1.984	2.059	1.210***	1.818**	0.906	1.451*	1.261**
	(0.856)	(1,581.161)	(3,282.585)	(0.307)	(0.880)	(0.885)	(0.816)	(0.620)
Observations	192,712	182,098	105,282	99,377	15,384	13,125	72,046	69,596
R-squared	0.098	0.103	0.075	0.075	0.140	0.173	0.133	0.141
F-test	116.1	.	.	154.3	46.29	52.03	109.4	119.1

Controls by economic branch

Robust standard errors in parentheses

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

Table 10

Relationship between revenue productivity and size, age, access to credit and formal status

	Ordinary Least Squares							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	All	Retail	Retail	Manufacturing	Manufacturing	Services	Services
VARIABLES	Tfprsi	tfprsi	tfprsi	tfprsi	tfprsi	tfprsi	tfprsi	tfprsi
dsize1	-0.186***	-0.0716	0.0521	0.247**	-0.496***	-0.401***	-0.378***	-0.296***
	(0.044)	(0.047)	(0.077)	(0.103)	(0.104)	(0.107)	(0.059)	(0.058)
dsize2	-0.314***	-0.225***	-0.121	0.0502	-0.537***	-0.383***	-0.445***	-0.396***

	(0.044)	(0.047)	(0.077)	(0.103)	(0.104)	(0.106)	(0.058)	(0.058)
dsize3	-0.300***	-0.243***	-0.149*	-0.0168	-0.432***	-0.282***	-0.389***	-0.361***
	(0.044)	(0.047)	(0.077)	(0.103)	(0.104)	(0.106)	(0.059)	(0.058)
dsize4	-0.269***	-0.249***	-0.160**	-0.0790	-0.390***	-0.252**	-0.321***	-0.325***
	(0.044)	(0.048)	(0.078)	(0.104)	(0.105)	(0.106)	(0.059)	(0.058)
dsize5	-0.203***	-0.217***	-0.126	-0.0907	-0.394***	-0.283***	-0.215***	-0.250***
	(0.045)	(0.048)	(0.080)	(0.105)	(0.107)	(0.107)	(0.060)	(0.059)
dsize6	-0.0294	-0.0949**	0.140*	0.0935	-0.250**	-0.150	-0.128**	-0.198***
	(0.044)	(0.047)	(0.078)	(0.104)	(0.104)	(0.104)	(0.058)	(0.057)
dsize7	0.102**	-0.0340	0.255***	0.0866	-0.127	-0.0616	0.0318	-0.0806
	(0.047)	(0.050)	(0.084)	(0.110)	(0.113)	(0.112)	(0.062)	(0.061)
dsize8	0.146***	0.0173	0.303***	0.164	0.0922	0.127	0.0410	-0.0678
	(0.051)	(0.055)	(0.089)	(0.118)	(0.119)	(0.118)	(0.069)	(0.068)
dsize9	0.151***	-0.00132	0.315***	0.0440	-0.0119	0.0354	0.0587	-0.0182
	(0.048)	(0.051)	(0.084)	(0.112)	(0.114)	(0.114)	(0.063)	(0.062)
act1	-0.695***	-0.673***	-0.630***	-0.625***	-0.432***	-0.374***	-0.832***	-0.782***
	(0.010)	(0.010)	(0.014)	(0.014)	(0.033)	(0.035)	(0.016)	(0.016)
act2	-0.0262**	-0.00756	-0.0391**	-0.0377**	0.0475	0.120***	-0.0287	0.00799
	(0.011)	(0.012)	(0.016)	(0.017)	(0.035)	(0.037)	(0.018)	(0.018)
act3	0.00440	0.0184	-0.00201	-0.0147	0.0326	0.127***	0.00254	0.0416**
	(0.013)	(0.013)	(0.018)	(0.018)	(0.041)	(0.043)	(0.019)	(0.020)
act4	0.0247*	0.0268**	0.0254	0.000411	0.0184	0.0699	0.0209	0.0531***
	(0.013)	(0.013)	(0.019)	(0.019)	(0.042)	(0.045)	(0.020)	(0.020)
act5	-0.0108	7.63e-05	-0.0254	-0.0294	0.0686*	0.107**	-0.00772	0.0214
	(0.014)	(0.014)	(0.020)	(0.020)	(0.042)	(0.045)	(0.021)	(0.021)
act6	0.0493***	0.0518***	0.0490***	0.0364***	0.0854***	0.115***	0.0416***	0.0623***
	(0.009)	(0.009)	(0.013)	(0.013)	(0.028)	(0.030)	(0.014)	(0.015)
act7	0.0617***	0.0521***	0.0817***	0.0589***	0.0371	0.0445	0.0367**	0.0420**
	(0.011)	(0.011)	(0.016)	(0.016)	(0.033)	(0.034)	(0.017)	(0.017)
dcredito		-0.0593***		-0.0276**		-0.0652**		-0.105***

		(0.009)		(0.012)		(0.027)		(0.014)
imssdum		0.386***		0.398***		0.396***		0.371***
		(0.010)		(0.016)		(0.025)		(0.014)
Constant	-0.740	-0.214	-0.0252	0.523**	-0.297	-0.777	0.361	0.0532
	(0.572)	(143.003)	(1,534.817)	(0.226)	(0.607)	(0.663)	(0.514)	(0.441)
Observations	192,712	182,098	105,282	99,377	15,384	13,125	72,046	69,596
R-squared	0.071	0.076	0.058	0.062	0.068	0.078	0.101	0.108
F-test	77.29	.	.	128.7	17.13	19.77	71.55	76.76

Controls by economic branch
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regarding the size and magnitude of the relationship between formality status and revenue productivity, results suggest that formal establishments would expand if reduction in distortions in the labor market attributed to different degree of enforcement of regulations were eliminated. That is, it is because of an implicit subsidy to the wage bill (*i.e.* social security contributions) that establishments with relative low productivity can expand their share of market.

6. Survival probabilities of establishments during the 2009 recession and its relationship with relative levels of productivity

Can the closures of establishments be viewed as part of a productivity-enhancing 'creative destruction' process? A necessary condition, for this to be the case, is to have the following two results:

On the one hand, establishments with lower quantity productivity are the ones with higher probabilities of permanent closure (for resources used by them to be released, so that they can be potentially used in more productive activities).

On the other hand, establishments with low levels of revenue productivity, relative to the rest, are driven out of business (this is because these are the ones that confront subsidies, rendering them bigger than what would be the case if distortions were not affecting the process).

In this section we assess if these results are empirically rejected. For this purpose, we rely on two statistical models that enable us to control for size, age, sector to which the establishment belongs, formal/informal status and access to credit. These are probit and box-cox proportional hazard models.

6.1 Probit models

We estimate a number of Probit regressions. Each one of them has a dichotomical variable as a dependent variable which has a value of 1 if the establishment closed permanently in 2009 and zero otherwise.

The independent variables are size of the establishment and years of their existence in the market, together with variables of our interest, which are quantity productivity quintile for one set of Probit regressions and revenue productivity quintiles for the other set. We also include in one of the variants, corresponding *dummies* for formal status and access to credit. We run these Probit regressions controlling for sector of activity.

Table 11
Probit Regressions (permanent closures==1) with quintils of quantity productivity and size, age, access to credit and formal status

VARIABLES	(1) Probit_all	(2) MFX	(3) Probit_all	(4) MFX	(5) Probit_Retail	(6) MFX	(7) Probit_Retail	(8) MFX	(9) Probit_manuf.	(10) MFX	(11) Probit_manuf	(12) MFX	(13) Probit_services	(14) MFX	(15) Probit_services	(16) MFX
qntl_1	0.205***	0.0184***	0.198***	0.0173***	0.204***	0.0172***	0.197***	0.0162***	0.218***	0.0171***	0.193***	0.0142***	0.202***	0.0203***	0.203***	0.0197***
	(0.017)	(0.002)	(0.018)	(0.002)	(0.024)	(0.002)	(0.025)	(0.002)	(0.067)	(0.005)	(0.075)	(0.006)	(0.027)	(0.003)	(0.028)	(0.003)
qntl_2	0.143***	0.0129***	0.144***	0.0126***	0.157***	0.0132***	0.155***	0.0127***	0.0644	0.00505	0.0400	0.00294	0.139***	0.0140***	0.147***	0.0143***
	(0.018)	(0.002)	(0.018)	(0.002)	(0.024)	(0.002)	(0.026)	(0.002)	(0.070)	(0.005)	(0.078)	(0.006)	(0.028)	(0.003)	(0.028)	(0.003)
qntl_3	0.0618***	0.00555***	0.0643***	0.00562***	0.101***	0.00851***	0.0992***	0.00816***	0.0531	0.00416	0.0439	0.00323	0.0112	0.00112	0.0236	0.00230
	(0.018)	(0.002)	(0.019)	(0.002)	(0.025)	(0.002)	(0.026)	(0.002)	(0.070)	(0.005)	(0.078)	(0.006)	(0.029)	(0.003)	(0.029)	(0.003)
qntl_4	0.0383**	0.00344**	0.0347*	0.00303*	0.0531**	0.00448**	0.0499*	0.00410*	0.0611	0.00479	0.0364	0.00268	0.0162	0.00163	0.0171	0.00166
	(0.018)	(0.002)	(0.019)	(0.002)	(0.025)	(0.002)	(0.027)	(0.002)	(0.070)	(0.005)	(0.078)	(0.006)	(0.029)	(0.003)	(0.030)	(0.003)
dsize1	0.340***	0.0306***	0.842***	0.0736***	0.119	0.0100	3.636	0.299	0.292	0.0229	0.108	0.00798	0.593***	0.0596***	0.992***	0.0965***
	(0.130)	(0.012)	(0.266)	(0.023)	(0.178)	(0.015)	(108.322)	(8.913)	(0.435)	(0.034)	(0.447)	(0.033)	(0.220)	(0.022)	(0.381)	(0.037)
dsize2	0.233*	0.0209*	0.748***	0.0654***	-0.00280	-0.000236	3.522	0.290	0.183	0.0144	0.0390	0.00287	0.510**	0.0512**	0.924**	0.0899**
	(0.130)	(0.012)	(0.266)	(0.023)	(0.178)	(0.015)	(108.322)	(8.913)	(0.436)	(0.034)	(0.447)	(0.033)	(0.220)	(0.022)	(0.381)	(0.037)
dsize3	0.168	0.0151	0.676**	0.0591**	-0.0662	-0.00558	3.447	0.284	0.110	0.00862	-0.0285	-0.00210	0.442**	0.0443**	0.853**	0.0829**
	(0.131)	(0.012)	(0.266)	(0.023)	(0.179)	(0.015)	(108.322)	(8.913)	(0.437)	(0.034)	(0.447)	(0.033)	(0.221)	(0.022)	(0.381)	(0.037)
dsize4	0.0658	0.00591	0.571**	0.0499**	-0.108	-0.00906	3.400	0.280	-0.101	-0.00793	-0.267	-0.0196	0.297	0.0299	0.714*	0.0694*
	(0.131)	(0.012)	(0.266)	(0.023)	(0.180)	(0.015)	(108.322)	(8.913)	(0.440)	(0.034)	(0.451)	(0.033)	(0.222)	(0.022)	(0.382)	(0.037)
dsize5	0.0816	0.00734	0.609**	0.0533**	-0.105	-0.00882	3.438	0.283	-0.0215	-0.00168	-0.138	-0.0101	0.319	0.0321	0.745*	0.0725*
	(0.133)	(0.012)	(0.267)	(0.023)	(0.183)	(0.015)	(108.322)	(8.913)	(0.443)	(0.035)	(0.452)	(0.033)	(0.223)	(0.022)	(0.383)	(0.037)
dsize6	0.0239	0.00215	0.523**	0.0458**	-0.136	-0.0115	3.321	0.273	-0.0414	-0.00325	-0.163	-0.0120	0.238	0.0239	0.676*	0.0658*
	(0.131)	(0.012)	(0.266)	(0.023)	(0.181)	(0.015)	(108.322)	(8.913)	(0.438)	(0.034)	(0.447)	(0.033)	(0.221)	(0.022)	(0.381)	(0.037)
dsize7	0.0688	0.00619	0.561**	0.0490**	-0.110	-0.00929	3.332	0.274	-0.0353	-0.00276	-0.0903	-0.00665	0.297	0.0298	0.727*	0.0707*
	(0.137)	(0.012)	(0.270)	(0.024)	(0.193)	(0.016)	(108.322)	(8.913)	(0.464)	(0.036)	(0.472)	(0.035)	(0.227)	(0.023)	(0.385)	(0.037)
dsize8	-0.117	-0.0105	0.428	0.0374	-0.624**	-0.0526**	2.832	0.233	-0.425	-0.0333	-0.465	-0.0342	0.302	0.0303	0.733*	0.0713*
	(0.156)	(0.014)	(0.281)	(0.025)	(0.257)	(0.022)	(108.322)	(8.913)	(0.572)	(0.045)	(0.580)	(0.043)	(0.242)	(0.024)	(0.395)	(0.038)
dsize9	-0.106	-0.00955	0.381	0.0333	-0.349*	-0.0294*	2.999	0.247	-0.0317	-0.00249	-0.0555	-0.00408	0.140	0.0141	0.561	0.0545
	(0.144)	(0.013)	(0.276)	(0.024)	(0.206)	(0.017)	(108.322)	(8.913)	(0.483)	(0.038)	(0.490)	(0.036)	(0.236)	(0.024)	(0.392)	(0.038)
act1	0.801***	0.0720***	0.822***	0.0719***	0.809***	0.0681***	0.834***	0.0686***	0.683***	0.0535***	0.757***	0.0557***	0.820***	0.0823***	0.815***	0.0793***

	(0.019)	(0.002)	(0.020)	(0.002)	(0.025)	(0.002)	(0.027)	(0.002)	(0.063)	(0.005)	(0.073)	(0.006)	(0.030)	(0.003)	(0.031)	(0.003)
act2	0.573***	0.0515***	0.593***	0.0519***	0.591***	0.0498***	0.610***	0.0502***	0.359***	0.0281***	0.421***	0.0310***	0.596***	0.0598***	0.599***	0.0583***
	(0.021)	(0.002)	(0.022)	(0.002)	(0.029)	(0.003)	(0.031)	(0.003)	(0.077)	(0.006)	(0.088)	(0.007)	(0.034)	(0.004)	(0.035)	(0.004)
act3	0.490***	0.0440***	0.508***	0.0444***	0.508***	0.0428***	0.532***	0.0438***	0.383***	0.0300***	0.418***	0.0308***	0.495***	0.0497***	0.490***	0.0477***
	(0.024)	(0.002)	(0.025)	(0.002)	(0.032)	(0.003)	(0.034)	(0.003)	(0.085)	(0.007)	(0.098)	(0.007)	(0.038)	(0.004)	(0.039)	(0.004)
act4	0.454***	0.0408***	0.467***	0.0408***	0.475***	0.0400***	0.493***	0.0405***	0.175*	0.0137*	0.167	0.0123	0.483***	0.0485***	0.476***	0.0463***
	(0.025)	(0.002)	(0.026)	(0.002)	(0.034)	(0.003)	(0.036)	(0.003)	(0.095)	(0.007)	(0.111)	(0.008)	(0.040)	(0.004)	(0.041)	(0.004)
act5	0.305***	0.0274***	0.323***	0.0283***	0.281***	0.0237***	0.293***	0.0241***	0.201**	0.0158**	0.246**	0.0181**	0.363***	0.0364***	0.373***	0.0363***
	(0.028)	(0.003)	(0.029)	(0.003)	(0.039)	(0.003)	(0.041)	(0.003)	(0.098)	(0.008)	(0.112)	(0.008)	(0.044)	(0.004)	(0.045)	(0.004)
act6	0.267***	0.0240***	0.288***	0.0252***	0.277***	0.0234***	0.303***	0.0249***	0.161**	0.0126**	0.195**	0.0144**	0.281***	0.0282***	0.285***	0.0277***
	(0.020)	(0.002)	(0.021)	(0.002)	(0.028)	(0.002)	(0.029)	(0.002)	(0.070)	(0.005)	(0.081)	(0.006)	(0.033)	(0.003)	(0.034)	(0.003)
act7	0.140***	0.0125***	0.145***	0.0127***	0.169***	0.0142***	0.174***	0.0143***	0.0500	0.00392	0.0302	0.00222	0.120***	0.0121***	0.124***	0.0121***
	(0.025)	(0.002)	(0.027)	(0.002)	(0.034)	(0.003)	(0.036)	(0.003)	(0.088)	(0.007)	(0.104)	(0.008)	(0.042)	(0.004)	(0.044)	(0.004)
dcredito			-0.0266*	-0.00233*			-0.0176	-0.00145			-0.149**	-0.0109**			-0.0215	-0.00210
			(0.016)	(0.001)			(0.021)	(0.002)			(0.068)	(0.005)			(0.026)	(0.003)
imssdum			-0.0477**	-0.00418**			-0.0306	-0.00251			-0.121	-0.00887			-0.0543	-0.00528
			(0.022)	(0.002)			(0.032)	(0.003)			(0.081)	(0.006)			(0.033)	(0.003)
Constant	-2.569***		-3.030***		-1.889***		-5.413		-2.179***		-1.948***		-2.808***		-3.177***	
	(0.326)		(0.403)		(0.281)		(108.322)		(0.445)		(0.464)		(0.371)		(0.487)	
Observations	191,876	191,876	181,228	181,228	105,197	105,197	99,256	99,256	15,049	15,049	12,765	12,765	71,630	71,630	69,207	69,207
Pseudo R-sq	0.0772		0.0786		0.0624		0.0652		0.0672		0.0819		0.0936		0.0914	

Controls by economic branch

Standard errors in parentheses

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

Table 12
Probit Regressions (permanent closures==1) with quintils of revenue productivity and size, age, access to credit and formal status

VARIABLES	(1) Probit_all	(2) MFX	(3) Probit_all	(4) MFX	(5) Probit_Retail	(6) MFX	(7) Probit_Retail	(8) MFX	(9) Probit_manuf.	(10) MFX	(11) Probit_manuf	(12) MFX	(13) Probit_services	(14) MFX	(15) Probit_services	(16) MFX
tfprsi_qntl_1	0.318***	0.0300***	0.163***	0.0143***	0.291***	0.0257***	0.169***	0.0139***	0.249***	0.0204***	0.0669	0.00492	0.364***	0.0383***	0.172***	0.0167***
	(0.016)	(0.002)	(0.018)	(0.002)	(0.022)	(0.002)	(0.025)	(0.002)	(0.058)	(0.005)	(0.069)	(0.005)	(0.025)	(0.003)	(0.027)	(0.003)
tfprsi_qntl_2	0.175***	0.0165***	0.100***	0.00876***	0.196***	0.0173***	0.116***	0.00955***	0.00856	0.000703	-0.0774	-0.00570	0.178***	0.0188***	0.107***	0.0104***
	(0.017)	(0.002)	(0.018)	(0.002)	(0.023)	(0.002)	(0.025)	(0.002)	(0.063)	(0.005)	(0.074)	(0.005)	(0.026)	(0.003)	(0.028)	(0.003)
tfprsi_qntl_3	0.102***	0.00962***	0.0708***	0.00620***	0.149***	0.0132***	0.113***	0.00931***	0.0854	0.00701	0.0427	0.00314	0.0413	0.00435	0.0202	0.00197
	(0.017)	(0.002)	(0.018)	(0.002)	(0.023)	(0.002)	(0.025)	(0.002)	(0.061)	(0.005)	(0.072)	(0.005)	(0.027)	(0.003)	(0.029)	(0.003)
tfprsi_qntl_4	0.0216	0.00203	0.00251	0.000220	0.0538**	0.00475**	0.0294	0.00242	-0.0943	-0.00775	-0.161**	-0.0119**	0.000477	5.02e-05	-0.00749	-0.000730
	(0.017)	(0.002)	(0.019)	(0.002)	(0.024)	(0.002)	(0.026)	(0.002)	(0.065)	(0.005)	(0.078)	(0.006)	(0.027)	(0.003)	(0.029)	(0.003)
dsize1			0.901***	0.0788***			3.673	0.302			0.166	0.0122			1.054***	0.103***
			(0.265)	(0.023)			(108.320)	(8.917)			(0.447)	(0.033)			(0.381)	(0.037)
dsize2			0.798***	0.0698***			3.553	0.292			0.0865	0.00636			0.976**	0.0950**
			(0.265)	(0.023)			(108.320)	(8.917)			(0.447)	(0.033)			(0.381)	(0.037)
dsize3			0.720***	0.0630***			3.472	0.286			0.0155	0.00114			0.898**	0.0874**
			(0.265)	(0.023)			(108.320)	(8.917)			(0.447)	(0.033)			(0.381)	(0.037)
dsize4			0.610**	0.0533**			3.420	0.282			-0.232	-0.0171			0.753**	0.0733**
			(0.266)	(0.023)			(108.320)	(8.917)			(0.450)	(0.033)			(0.382)	(0.037)
dsize5			0.644**	0.0564**			3.454	0.284			-0.109	-0.00803			0.781**	0.0761**
			(0.266)	(0.023)			(108.320)	(8.917)			(0.452)	(0.033)			(0.383)	(0.037)
dsize6			0.552**	0.0483**			3.331	0.274			-0.135	-0.00994			0.706*	0.0688*
			(0.266)	(0.023)			(108.320)	(8.917)			(0.447)	(0.033)			(0.382)	(0.037)
dsize7			0.582**	0.0509**			3.331	0.274			-0.0732	-0.00539			0.748*	0.0729*
			(0.269)	(0.024)			(108.320)	(8.917)			(0.473)	(0.035)			(0.385)	(0.038)
dsize8			0.442	0.0387			2.829	0.233			-0.471	-0.0347			0.746*	0.0726*
			(0.281)	(0.025)			(108.320)	(8.917)			(0.582)	(0.043)			(0.395)	(0.038)
dsize9			0.388	0.0340			2.988	0.246			-0.0479	-0.00352			0.569	0.0554
			(0.276)	(0.024)			(108.320)	(8.917)			(0.490)	(0.036)			(0.392)	(0.038)

act1			0.829***	0.0726***			0.841***	0.0692***			0.767***	0.0565***			0.822***	0.0801***
			(0.020)	(0.002)			(0.027)	(0.002)			(0.073)	(0.006)			(0.031)	(0.003)
act2			0.594***	0.0520***			0.612***	0.0504***			0.426***	0.0313***			0.599***	0.0583***
			(0.022)	(0.002)			(0.031)	(0.003)			(0.088)	(0.007)			(0.035)	(0.004)
act3			0.508***	0.0445***			0.532***	0.0438***			0.417***	0.0307***			0.492***	0.0479***
			(0.025)	(0.002)			(0.034)	(0.003)			(0.098)	(0.007)			(0.039)	(0.004)
act4			0.467***	0.0409***			0.493***	0.0406***			0.167	0.0123			0.476***	0.0464***
			(0.026)	(0.002)			(0.036)	(0.003)			(0.111)	(0.008)			(0.041)	(0.004)
act5			0.324***	0.0283***			0.293***	0.0241***			0.241**	0.0177**			0.373***	0.0363***
			(0.029)	(0.003)			(0.041)	(0.003)			(0.112)	(0.008)			(0.045)	(0.004)
act6			0.288***	0.0252***			0.303***	0.0249***			0.195**	0.0144**			0.285***	0.0278***
			(0.021)	(0.002)			(0.029)	(0.002)			(0.081)	(0.006)			(0.034)	(0.003)
act7			0.144***	0.0126***			0.172***	0.0142***			0.0260	0.00191			0.124***	0.0121***
			(0.027)	(0.002)			(0.036)	(0.003)			(0.104)	(0.008)			(0.044)	(0.004)
dcredito			-0.0277*	-0.00242*			-0.0189	-0.00156			-0.147**	-0.0108**			-0.0223	-0.00217
			(0.016)	(0.001)			(0.021)	(0.002)			(0.068)	(0.005)			(0.026)	(0.003)
imssdum			-0.0555**	-0.00485**			-0.0392	-0.00323			-0.129	-0.00953			-0.0609*	-0.00593*
			(0.022)	(0.002)			(0.032)	(0.003)			(0.081)	(0.006)			(0.033)	(0.003)
Constant	-2.272***		-3.037***		-1.318***		-5.429		-1.737***		-1.908***		-2.264***		-3.183***	
	(0.281)		(0.402)		(0.212)		(108.320)		(0.104)		(0.467)		(0.280)		(0.486)	
Observations	191,876	191,876	181,228	181,228	105,197	105,197	99,256	99,256	15,049	15,049	12,765	12,765	71,630	71,630	69,207	69,207
Pseudo R-sq	0.0271		0.0779		0.0115		0.0647		0.0169		0.0828		0.0439		0.0907	

Controls by economic branch

Standard errors in parentheses

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

Results are shown in tables 11 and 12. The coefficients for the variables capturing productivity of an establishment are statistically significant and indicate that resources are released from the less productive establishments. They also indicate that the control variables, size and age have the expected signs and are statistically significant.

Column 4 of table 11, which presents estimated marginal effects indicates that, relative to those establishments with less than 15 workers those with 15 or more workers have substantially less probability of closing down -and that the probability of closing down after having at least15 workers is the same for all. A similar conclusion follows the first years: the probability of going out of business of an establishment that has not been at least four years in the market is twice the corresponding one of those that have.

6.2 Survival Analysis

The so-called hazard model is a better statistical procedure than a probit regression to analyze how productivity and likelihood of permanent closures are related,

These models are based on the concept of spell duration (number of years in the market) to estimate the hazard of a permanent closure; the focus is on the probability of survival past a certain number of years in the market and on the probability that the life spell of an establishment will equal or exceed a period of a given length. They can relate the time that passes before some event occurs to one or more covariates (explanatory variables).

In this subsection, we estimate Cox proportional hazard models. These assume that covariates multiplicatively shift the baseline hazard function. An advantage of these models is that the baseline hazard is given no particular parametrization and, in fact, is left unestimated. It is assumed that whatever the shape of the hazard over time, it is the same for every establishment.

The results of the hazard rates, which correspond to an exponential specification of the Cox model, are presented in tables 13 and 14.

The first row of column two indicates that establishments whose productivity is in the lowest 20% of the distribution have a hazard ratio which is, relative to the baseline, 2.4 times higher. That is, they they close down faster than the rest.

Table 13

SURVIVAL ANALYSIS

HAZARD FUNCTIONS (PROPORTIONAL HAZARD MODELS): Quantity productivity quintiles

VARIABLES	(1) All _t	(2) All _t	(3) Retail _t	(4) Retail _t	(5) Manufactur. _t	(6) Manufactur. _t	(7) Services _t	(8) Services _t
qntl_1	2.886***	2.420***	2.671***	2.383***	2.993***	1.990***	3.152***	2.502***
	(0.102)	(0.091)	(0.135)	(0.128)	(0.414)	(0.315)	(0.167)	(0.140)
qntl_2	1.943***	1.744***	1.974***	1.838***	1.718***	1.243	1.945***	1.692***
	(0.072)	(0.068)	(0.104)	(0.102)	(0.257)	(0.211)	(0.109)	(0.098)
qntl_3	1.436***	1.337***	1.549***	1.475***	1.470**	1.214	1.304***	1.193***
	(0.056)	(0.055)	(0.084)	(0.085)	(0.226)	(0.208)	(0.078)	(0.074)
qntl_4	1.222***	1.146***	1.255***	1.197***	1.307*	1.119	1.172***	1.091
	(0.049)	(0.048)	(0.071)	(0.072)	(0.205)	(0.195)	(0.071)	(0.069)
dsize2		0.849***		0.783***		0.861		0.976
		(0.022)		(0.028)		(0.103)		(0.040)
dsize3		0.733***		0.632***		0.688***		0.858***
		(0.026)		(0.033)		(0.097)		(0.044)
dsize4		0.565***		0.529***		0.406***		0.623***
		(0.030)		(0.041)		(0.082)		(0.047)
dsize5		0.604***		0.559***		0.467***		0.652***
		(0.041)		(0.061)		(0.110)		(0.062)
dsize6		0.505***		0.404***		0.422***		0.570***
		(0.032)		(0.046)		(0.088)		(0.048)
dsize7		0.476***		0.335***		0.420**		0.553***
		(0.062)		(0.083)		(0.181)		(0.090)
dsize8		0.331***		0.101***		0.177*		0.478***
		(0.079)		(0.071)		(0.180)		(0.125)
dsize9		0.296***		0.136***		0.487		0.346***
		(0.062)		(0.069)		(0.255)		(0.088)
dsize10		0.0940***		0		0.639		0.0783**
		(0.067)		(0.000)		(0.651)		(0.078)
dcredit		1.073**		1.049		0.856		1.237***
		(0.035)		(0.047)		(0.128)		(0.063)
imssdum		0.645***		0.861**		0.614***		0.489***
		(0.031)		(0.061)		(0.112)		(0.034)
Observations	192,712	182,098	105,282	99,377	15,384	13,125	72,046	69,596

Controls by economic branch.

Table 14

SURVIVAL ANALYSIS

HAZARD FUNCTIONS (PROPORTIONAL HAZARD MODELS): Revenue productivity quintiles

VARIABLES	(1) All _t	(2) All _t	(3) Retail _t	(4) Retail _t	(5) Manufactur. _t	(6) Manufactur. _t	(7) Services _t	(8) Services _t
tfprsi_qntl_1	2.243***	2.154***	2.128***	2.162***	1.840***	1.450***	2.473***	2.256***
	(0.076)	(0.077)	(0.105)	(0.112)	(0.232)	(0.208)	(0.125)	(0.120)
tfprsi_qntl_2	1.548***	1.566***	1.634***	1.673***	1.028	0.931	1.549***	1.538***
	(0.055)	(0.059)	(0.084)	(0.090)	(0.144)	(0.147)	(0.083)	(0.087)
tfprsi_qntl_3	1.282***	1.336***	1.438***	1.525***	1.190	1.143	1.127**	1.157**
	(0.047)	(0.052)	(0.075)	(0.083)	(0.161)	(0.175)	(0.065)	(0.069)
tfprsi_qntl_4	1.062	1.085**	1.142**	1.175***	0.818	0.742*	1.016	1.036
	(0.041)	(0.044)	(0.062)	(0.067)	(0.122)	(0.128)	(0.059)	(0.063)
dsize2		0.818***		0.755***		0.830		0.940
		(0.021)		(0.027)		(0.099)		(0.038)
dsize3		0.689***		0.596***		0.646***		0.805***
		(0.024)		(0.031)		(0.090)		(0.041)
dsize4		0.521***		0.491***		0.373***		0.572***
		(0.027)		(0.038)		(0.075)		(0.043)
dsize5		0.550***		0.511***		0.427***		0.593***
		(0.037)		(0.056)		(0.100)		(0.056)
dsize6		0.450***		0.359***		0.376***		0.509***
		(0.029)		(0.041)		(0.078)		(0.043)
dsize7		0.420***		0.287***		0.367**		0.501***
		(0.055)		(0.071)		(0.157)		(0.082)
dsize8		0.291***		0.0856***		0.151*		0.430***
		(0.069)		(0.061)		(0.152)		(0.112)
dsize9		0.251***		0.111***		0.408*		0.299***
		(0.052)		(0.056)		(0.213)		(0.076)
dsize10		0.0763***		0		0.531		0.0646***
		(0.054)		(0.000)		(0.539)		(0.065)
dcredit		1.068**		1.045		0.851		1.233***
		(0.035)		(0.047)		(0.128)		(0.063)
imssdu		0.630***		0.841**		0.596***		0.479***
		(0.030)		(0.060)		(0.109)		(0.033)

Observations	192,712	182,098	105,282	99,377	15,384	13,125	72,046	69,596

Controls by economic branch
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

All columns in the tables indicate that establishments whose productivity is in the highest three quantiles, are more likely to survive than those in the lowest two quantiles.

Regarding the covariate size, it must be pointed out that the smallest establishment is the omitted variable. Hence, given that all coefficients are below one, statistically significant and decreasing in value as size of establishments increases, we conclude that the smaller the size, the higher the hazard of closing down. The coefficient of the covariate capturing the formal/informal status of the establishment, imssdum, is statistically significant and indicates that it increases survival probabilities directly. This is in addition to the effect that the formality status has by being positively correlated with one that must with productivity levels and productivity, as it was discussed in the previous subsection.

By contrast, having access to credit has neither the direction nor the relevance that was expected. For retail and manufacturing having access to credit is not statistically significant, whereas for services it is. It indicates that establishments in services that have access to credit have a hazard ration that is, relative to the baseline, 2.4 times higher. An explanation of this result is that the burden of the debt of establishments decreases the probability of survival.

The variable that is captured in the first four rows of table 13 is the quantity productivity and the one captured in the first four rows of table 14 is revenue productivity. As it can be appreciated by comparing the two tables, results do not differ when one definition of productivity is used instead of the other. They both indicate the same results.

7. Employment protection legislation, establishments' closures and productivity dispersion.

Results obtained in the previous sections show that small establishments that were driven out of business during the economic recession of 2009 were relatively less productive than those that survived.

It might be the case that openings of other establishments, whose survival perspectives and potential productive growth are not better than those of the exiting establishments, is not contributing to solve the problem of stagnation of aggregate productivity of small firms. However, if this is the case, policy measures and institutional changes must be designed to address the problems faced by new firms and not to preserve jobs by supporting unproductive firms that are at risk of being driven out of business.

This process can be very costly for most workers losing their jobs. This is specially the case because of the apparent ineffectiveness of prevailing employment protection norms in Mexico, which require compensation payments for employer-initiated dismissals. Because these regulations are rarely enforceable by small firms, they do not operate as a form of insurance against risks to which workers are exposed to.[12]

According to Mexico´s employment protection regulations, workers must be compensated with severance payments, when job separations are employer-initiated. Although it is supposed to be applied by all firms, actual payments reported by establishments in our micro-dataset show that they do not correspond with labor turnover experience by them.

Indeed, results presented in tables 17 and 18 show that, most establishments pay less than 1% of wage bill in severance payments. It is only establishments with more than 30 workers that pay, on average 1.5% of their wage bill. By age of establishment, there is no

[12]A threat to employees to exercise their right is not very credible, when it comes from workers characterized by intertemporal substitution rates and by being credit constraint: a long waiting period to see any money at all, the fees to be paid to the lawyer defending his or her case and the uncertainty of the results of the lawsuit might explain a large number of settlements before starting arbitration. These factors explain why employers pay nothing at all or that they settle a worker dismissal case exchanging a lower than mandated by law pay which is effective immediately, for the larger but uncertain indemnity established by law somewhere in the future (Jaramillo and Saavedra p. 299).

clear pattern, having between 3 and 5 years is not a different share than those with only 2 years in the market.

Table 17
Severance pay as a percentag of Wage bill in 2008

number of Workers	severance payments
1	0.150
2	0.135
3	0.414
4	1.753
5	0.402
5 to 10	0.549
10 to 15	0.926
15 to 20	0.876
20 to 50	1.562
50 to 100	1.595

Table 18
Severance pay as a percentag of Wage bill in 2008

Age of establishment	severance payments
1	0.191
2	0.316
3	0.274
4	0.246
5	0.187
6	1.586
7- 15 years	0.419
more than 16	0.416

Due to the high and uncertain transaction costs attached to job dismissals, a large percentage of employers, especially in small establishments, avoid severance payments regulations by relying on temporary contracts or with hiring practices that are characteristic of an informal sector.

Some small firms are even induced by these regulations to remain small, thereby losing the opportunities to become productive, rather than expanding their size and scope of production. This is because they tend to work informally with relatives and to hire workers relying on references from people they know, thereby depending on these social networks to enforce agreements and to establish thrust worthy job relationships. This is a way to reduce the implied risk of having labor conflicts and of being exposed to their associated costs (which, in their case, can lead them to bankruptcy). The inefficiencies of this matching procedure of firms with workers and the limited scope for its application might be part of an explanation of why Mexico is characterized by its abnormally large share of small firms that are stagnant in size and productivity.

In the economic literature, it has been established that exit from the market by a firm is preceded by a period in which, both, its output and productivity decline (a pattern called 'shadow of the death', Cfr. Calderón-Madrid and Voicu, 2011).

Accordingly, one would expect that establishments closing down in 2009 have gone through a previous period of dismissals of workers in 2008. In addition, if severance payments regulations were respected, we would find that those establishments most likely to closed down in 2009 reported, in 2008, a higher percentage of severance payments as a share of wages during than the rest.

To test if this correlation holds, we define probabilities of permanent closure, as the estimated values of the probit regression presented in the first column of table 11 of section 6.1. That is, the estimated probability of closure of an establishment, determined by the quintile in which its quantity productivity resulted, relative to the rest of its class, by its size, age, formality status and if it has access to credit.

Table 19 presents the results obtained by running a regression in which severance payments, relative to wage bill, reported by establishments for the year 2008 is the dependent variable and the regressors are probability of permanent closure during the subsequent year, the age and size of the establishment (Lact and Lsize, respectively).

As it is apparent in this table, establishments with a high probability of closure, which are those likely to be under the "shadow of the death" –*i.e.* to had experienced a previous output and productivity decline and hence adjustments in their labor force- did not pay dismissed workers more than what the rest of firms did. This suggests that these kinds of regulations are not fulfilled among small establishments during economic slowdowns.

Table 19

Severance payments and expected probability of closure

Linear regression dependent variable:
severance payments paid by an establishment as a share of its wage bill

	Retail		Manufacturing		Services	
Number of observations		34203		9300		34266
R-squared		0.0003		0.0213		0
	Coef	T	Coef	T	coef	T
probability of permanent closure	-0.27	0.08	0.06	0.19	0.13	0.28
Lact	-0.01	0.09	0.00	0.13	0.00	0.26
Lsize	0.00	0.30	0.01	0.00	0.00	0.00
Const	0.02	0.11	-0.01	0.03	-0.01	0.24

8. Concluding Remarks

In this work we found that those establishments with the lowest productivity were the ones with higher propensity to go out of business during the slowdown of the economy in 2009. This suggests that resources used by them were released, so that they can be potentially used in more productive activities.

The framework used in this study also enabled us to capture that establishments with relative low levels of revenue productivity -namely those that that confronted subsidized price of inputs, rendering them bigger than what would be the case if distortions were not affecting the process, were the least likely to survive.

These results imply that permanent closures of establishments with less than 100 workers partly correspond with a productivity-enhancing 'creative destruction' process that should characterize a dynamic economy –which is constantly going through a processes of reallocation of resources with firms that closed down and other that open.

A further condition is required for the processes of reallocation of resources, analyzed in this paper, to be considered productivity-enhancing. This is that the openings of new establishments with survival perspectives and potential productive growth that are better than those of the exiting the market.

The stylized facts indicating stagnation of both, aggregate productivity of small firms and of the earnings of workers hired by them, suggests that this latter condition might not be fulfilling in the Mexican economy. The analysis of this potential problem was beyond the scope of this work and is left for future study.

Whether this condition is fulfilled or not, an implication of the results of this work is that attempts to preserve jobs by supporting unproductive firms that are at risk of being driven out of business, should not be a policy guideline. Instead, policy measures and institutional changes must be designed to achieve two related purposes: to address problems faced for the creation of new firms so that they can be potentially more productive than exiting ones and to reduce distortions that create a dispersion of revenue productivity among establishments, because some enjoy subsidized price of labor and capital, while others don't.

We stressed that job destruction implied by establishment closures took place simultaneously with significant figures of job creation at the extensive margin. However, it should not be disregarded how costly the process reallocation of resources can be for workers losing their jobs, when they do not find another one immediately –or when they are forced to take another job for which they are overqualified and hence earn less.

The apparent ineffectiveness of prevailing employment protection norms in Mexico increases these costs: we found indicators showing that regulations related to severance payments are rarely fulfilled among small establishments and therefore do not operate, as they should, as a form of insurance against risks to which workers are exposed to.

The implication of our results is that a change from the current severance payments mechanism to an unemployment insurance system would mitigate earning losses of workers during the restructuring process of job creation and destruction of jobs and have an additional effect in terms of efficiency. Since workers cannot afford spending longer time searching for a job that matches his or her skills better (Calderón-Madrid, 2008), subsidizing searching behavior of the unemployed might be required to facilitate the Shumpeterian process of 'creative destruction'.

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