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# The Role of Firm Size and Firm Age in Employment Growth: Evidence for Slovenia, 1996–2013

Biswajit Banerjee<sup>1</sup>, Manca Jesenko<sup>2,3</sup>

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## Abstract

Using a nonparametric regression approach, this paper examines the role of firm size and firm age in net employment growth and the differential response of firms to the business cycle. An inverse univariate relationship between firm size and net employment growth disappears after controlling for firm age. With age control, the relationship between net employment growth and firm size is positive but diminishes with firm size. Young firms exhibit higher job creation and destruction rates and higher net employment growth rates than mature firms. Small and young firms are more sensitive with regard to net employment growth to the cyclical downturn than large and old firms.

JEL: D22, J6, L25

Keywords: job creation, job destruction, net employment growth, firm size, firm age, Slovenia

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## 1. Introduction

Whether small businesses create more jobs than the larger ones is a subject of much debate. A well-known hypothesis on firm growth, the so-called Gibrat's law, is that growth rates of firms are independent of their size (see Sutton, 1997). However, findings of Birch (1981) and a large number of subsequent studies have led to the conventional wisdom that net employment growth is negatively related to firm size.

Davis et al. (1996) argue that relating firm-size and net job growth is prone to bias because of regression-to-the mean effects. Transitory shocks to employment or random measurement errors could result in firms being categorized smaller or larger than their "typical" size. If these transitory shocks or random measurement errors were not highly serially correlated, this would lead to upward bias in the estimated growth rate of small firms and downward bias in the estimated growth rate of large firms. To mitigate the effects of regression to the mean, Davis et al. (1996) propose using a classification based on the average size, measured as the simple average of firm size in base year  $t-1$  and current year  $t$ .<sup>4</sup> Based on the average size class method, Davis et al. find no systematic

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<sup>4</sup> The U.S. Bureau of Labor Statistics has developed an alternative methodology, the so-called dynamic size classification, which is also robust to regression-to-the mean effects. This methodology attributes job gains or losses to each of the size classes that the firm passes through in its growth or contraction. See Butani et al. (2006) for details.

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relationship between manufacturing plant size and employment growth in the United States.

Neumark et al. (2011) point out that the finding of Davis et al. (1996) does not hold in all cases. They cite studies on Canada, Greece, Netherlands, Sweden and the United Kingdom based on the average size class method that find greater net job growth in small businesses. In addition, in their own study on the United States for the period 1992–2004, based on the average size class method and nonparametric regression technique, Neumark et al. find that net job growth is greater in small firms and establishments.

Haltiwanger et al. (2010, 2013) argue that researchers may be confusing firm-size effects with the effects of firm age. New firms are an important source of net job growth and are typically small when they start operations. Thus, in the absence of controls for firm age (which is typical in much of the job flows literature), the finding of a negative relationship between firm size and net growth rates could be attributable to most new firms being classified in the small size classes. When controls are included for firm age and the average size classification is used, Haltiwanger et al. find a positive relationship between net growth and firm size. A similar result is obtained for Austria by Huber et al. (2012), for Canada by Dixon and Rollin (2012), for Hungary by Earle and Telegdy (2011), and for Ireland by Lawless (2014).

The findings on the relationship between net employment growth and firm age, with controls included for firm size, are less clear cut. Earle and Telegdy (2011) for Hungary, Haltiwanger et al. (2010, 2013) for the United States and Lawless (2014) for Ireland find that young firms grow more rapidly than the more mature firms but that the relationship is relatively flat after the age of 5 years. However, this finding is not supported by evidence from Austria and Canada. Huber et al. (2012) for Austria find that the average marginal impact on net job creation is greater for older firms than for young firms. For Canada, Dixon and Rollin (2012) find that employment growth declines sharply between one-year old and two-year old firms but that after the second year there is a positive relationship between firm age and employment growth.

A related issue is whether the cyclical dynamics of employment growth are different for firms of different size and age. Moscarini and Postel-Vinay (2012) find that in the United States, Denmark and France, large firms have higher net employment growth than small firms when unemployment is below trend, and lower net employment growth when unemployment is above trend. However, Fort et al. (2013) document cyclical dynamics across firms by both firm size and firm age and obtain a different pattern. They find that young, small firms are cyclically more sensitive than large and mature firms. In particular, the decline in net employment growth in the United States during the 2007–2009 recession experienced by young, small firms was higher than that experienced by large and mature firms.

In this paper we examine the role of firm size and firm age on job creation and net employment growth in Slovenia across all sectors of the economy during the period 1996–2013 and separately during three sub-periods of distinct cyclical dynamics: 1996–2003, 2004–2008, and 2009–2013. The first period, 1996–2003, includes the middle and late-transition periods prior to European Union (EU) accession. During this period, real GDP growth averaged about 4 percent annually while fluctuating around a mildly declining trend and net employment growth rate in the private sector fluctuated

narrowly around a horizontal trend of zero growth. The second period, 2004–2008, spans EU entry in 2004, the two-year stay in Exchange Rate Mechanism II, euro adoption in January 2007, and the eve of the onset of the global financial crisis. A mild expansionary phase began with EU entry in 2004 and both real GDP growth and net employment growth picked up pace and peaked with euro adoption in 2007. A slowdown began in Q4, 2008 as the impact of the global crisis and structural weaknesses in the banking system and fiscal sector began to be felt. The third period, 2009–2013, is one of prolonged recession. Real GDP growth and net employment growth turned sharply negative in 2009 and remained in negative territory in the subsequent years.

This paper follows the nonparametric regression approach used by Haltiwanger et al. (2010, 2013) and adds to the limited number of studies that have looked at the effects of firm size and firm age on job growth in a multivariate context. Besides, an inquiry in to the features of employment growth in Slovenia is of interest because the country is a member of the euro area. Being a member of a monetary union, Slovenia does not have the option of using exchange rate policy to respond to shocks and the importance of labor market flexibility as an adjustment mechanism becomes greater. The presence of significant institutional rigidities renders the task of macroeconomic stabilization more difficult. The findings on the type of firms where jobs are being created should be of use to policy makers in the formulation of employment promotion strategies.<sup>5</sup> In particular, the analysis will shed light on whether policies targeting firms based on size per se are sufficient or whether attention also should be focused on creating an environment that facilitates start-ups, irrespective of size. This issue is of considerable relevance for all EU member states, since supporting small and medium-sized enterprises (SME) is an important policy objective for them. The European Commission annually publishes fact sheets on trends and national policies affecting SMEs in individual member states (see, for example, European Commission, 2014).

The rest of the paper is organized as follows. Section 2 describes the data base, measurement of job flows, and methodology. Section 3 presents the empirical findings and Section 4 concludes.

## 2. Data, job flows definitions, and methodology

### 2.1 Data

The analysis in this paper is based on annual firm-level data from the Slovenian Business Register maintained by the Agency for Public Legal Records and Related Services (AJPES). The data base pertains to all *private* business entities, their subsidiaries, and other organization segments which perform profitable or non-profitable activities. Enterprises (including banks, insurance companies, investment funds and co-operatives), sole proprietors, legal entities governed by public law, and non-profit organizations have to present their annual reports to AJPES for the purpose of presenting them publicly and for tax and statistical purposes.

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<sup>5</sup> Needless to say, policy makers also have other goals in the formulation of employment-promotion strategies. These goals may include supporting innovation, productivity growth, skill-development, and taking care of disadvantaged groups.

The AJPES data base includes information on firms' financial statements, full-time equivalent (FTE) employment, industrial affiliation, location, and incorporation year of the firm to the business register. The analysis is confined to firms that have at least one FTE employee.

The sample data set comprises between 25,000 and 37,000 annual observations on firms over the 1996 to 2013 period. The FTE employment of the firms included in the sample accounted for each year, on average, about 58 percent of the total number of employees in the economy (national accounts measure). The gap is mainly explained by the exclusion of the government sector from the sample and by the fact that the national accounts measure of employees includes part-time workers. The trend in growth of FTE employment for the firms in the sample was broadly similar to that for the growth of the national accounts measure of employees (the simple correlation was 0.893).

Table 1 shows the distribution of firms and employment by current-year size and age, averaged over the sample period. Small firms, defined as having less than 10 FTE employees, constitute the bulk of the firms in the sample (82 percent) but account for a rather small share of total employment (14 percent). In contrast, firms in the largest size category of more than 249 employees represent less than 1 percent of the total number of firms, but they engage about 43 percent of all FTE employees. The age distribution is more even than the size distribution. Young firms (less than 5 years in age) account for about 36 percent of firms and 14 percent of employment, while the oldest group (15 years or more in age) contains about 18 percent of the firms and provides employment to 41 percent of the FTE workforce. Young firms have a higher proportion of small firms than the older firms.

Since each firm in the data set has a unique identification code, we are able to observe entry and exit of firms within the sample period. Each year, on average, new entrants amounted to 8.5 percent of the total number of firms while the number of exiting firms totaled 5.8 percent of the total number of firms. There were several instances of firms shutting down in any given year but resuming operations after a gap of two or more years. In such cases, the resumption of operation was treated as entry of a new firm. In the cases of mergers of pre-existing firms, information on the involved firms was combined together for the earlier years.

**Table 1. Distribution of firms and employment by size and age<sup>a</sup>**

		Share of each category in total number of firms (%)						
Age	0	1	2-4	5-9	10-14	15+	All age groups	
Size <sup>b</sup>								
0 to 1	5.5	3.9	7.7	9.2	5.0	3.1	34.3	
>1 to 9	2.7	3.5	9.6	15.7	9.8	6.8	48.1	
>9 to 24	0.3	0.4	1.4	2.9	2.3	2.0	9.3	
>24 to 49	0.1	0.1	0.5	1.0	0.9	1.0	3.5	
>49 to 99	0.0	0.1	0.2	0.6	0.5	0.7	2.2	
>99 to 249	0.0	0.0	0.1	0.4	0.4	0.6	1.7	
>249	0.0	0.0	0.0	0.2	0.2	0.4	0.9	
All sizes	8.7	8.1	19.6	30.0	19.0	14.7	100.0	

		Share of each category in total average employment (%)						
Age	0	1	2-4	5-9	10-14	15+	All age groups	
Size <sup>b</sup>								
0 to 1	0.3	0.3	0.5	0.6	0.3	0.2	2.2	
>1 to 9	0.6	0.8	2.2	3.8	2.5	1.8	11.7	
>9 to 24	0.3	0.4	1.4	2.7	2.2	1.9	8.8	
>24 to 49	0.2	0.3	1.0	2.2	2.0	2.2	7.9	
>49 to 99	0.2	0.3	1.1	2.6	2.2	3.4	9.7	
>99 to 249	0.3	0.4	1.3	4.4	3.6	6.4	16.3	
>249	0.3	0.4	1.7	8.6	8.9	23.5	43.4	
All sizes	2.2	2.8	9.2	24.9	21.7	39.3	100.0	

<sup>a</sup> Number of firms and employment are first calculated for each year and then averaged over all years.

<sup>b</sup> In the current year.

## 2.2 Employment flow definitions

We measure gross job flows in the standard way, following Davis and Haltiwanger (1992). Gross job creation in period  $t$  is measured as the sum of employment gains of all firms that expand or start operations between period  $t-1$  and period  $t$ . Similarly, gross job destruction at time  $t$  is the sum of employment losses (in absolute terms) of all firms that contract or shut down operations between  $t-1$  and  $t$ . Net employment change is the difference between gross job creation and gross job destruction.

To express the job flow measures as rates, we need to divide by sector size. Firm size at time  $t$  is calculated as the average employment between period  $t$  and  $t-1$ , i.e.  $x_{jt} = 0.5*(n_{jt} + n_{j,t-1})$ . Accordingly, the sector size is defined as  $X_{st} = \sum_{f \in S} x_{ft}$ , where  $S$  is the set of firms in sector  $s$ . The job creation rate ( $POS$ ) and job destruction rate ( $NEG$ ) can be expressed as the size-weighted average over firms' growth rates as follows:

$$POS_{st} = \sum_{g_{fst} > 0, f \in S} \left( \frac{x_{fst}}{X_{st}} \right) g_{fst}, \quad (1)$$

and

$$NEG_{st} = \sum_{g_{fst} < 0, f \in S} \left( \frac{x_{fst}}{X_{st}} \right) |g_{fst}|, \quad (2)$$

where  $g_{fst} = (\Delta n_{fst}/x_{fst})$  is the growth rate of employment in firm  $f$  in sector  $s$  in period  $t$ . This measure of  $g_{fst}$  allows for entry and exit, is symmetric for employment losses and gains, and lies within a closed interval  $[-2, 2]$ . Net employment growth rate ( $NET_{st}$ ) is equal to  $POS_{st} - NEG_{st}$ .

### 2.3 Methodology

Throughout the paper, we focus on the results based on the average-size classification as defined above.

Following Haltiwanger et al. (2013), we estimate a nonparametric regression equation in which net employment growth is regressed on firm size groups, firm age groups, interactions of firm size and age, and industry- and year-fixed effects.<sup>6</sup> The baseline or omitted groups in the specification of the dummy variables for firm size and age are, respectively, firms with more than 249 workers and firms that are more than 14 years old. All observations are employment-weighted, which means that the estimated coefficients are equivalent to employment-weighted cell means for each of the saturated cells. The effects of firm size are obtained by computing the partial effects of firm size holding the age distribution of employment constant at the sample mean. Similarly, the effects of firm age are obtained by computing the partial effects of firm age holding the size distribution of employment constant at the sample mean. For the ease of interpretation and a clearer perspective of the magnitudes of the effects, the effect of the baseline or omitted group is reported at its unconditional mean from the univariate relationship. In turn, the effects of the other groups are rescaled by adding the value of the unconditional mean for the baseline group. The relative differences between the various groups are not affected by the addition of the unconditional mean of the baseline group. Since the regression equation with interactions generates a very large number of estimated coefficients, we present the main results with the aid of figures.

We also examine the contribution to gross job creation and destruction by firm size and firm age groupings against the backdrop of their employment weight in the economy. This sheds light on the issue of whether firms that have the most jobs create the most jobs in absolute terms. This aspect is complementary to the analysis of employment growth in different groupings of firms. It is possible that larger firms may have lower or equal employment growth in percentage terms than smaller firms but in absolute terms they may be creating more jobs.

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<sup>6</sup> In an alternative specification, we also control for firm indebtedness by including outstanding bank debt of the firm in the previous year as an explanatory variable. The regression results show that the effect of outstanding bank debt in the previous year on net employment growth is positive and significant. However, the inclusion of firm indebtedness in the equation does not alter the findings on the influence on effects of size and age on job flows. The results are approximately the same also in the case when the outstanding bank debt of the firm was interacted with size and age (estimated interaction parameters were not significant).

Because of the sample properties, one needs to be careful in comparing the empirical findings with the results of other studies. One important difference is that our sample measures FTE employment and not head-count employment. Job flows based on FTE employment will be typically higher than that based on head-count employment, and are a more accurate measure of the response of employers to the business cycle. If firms introduce overtime work hours instead of hiring new workers when faced with increased demand for their products, it will be recorded as an increase in job creation in the FTE measure but not in the head-count measure. Similarly, if employers resort to shorter working hours rather than worker lay-offs during an economic downturn, the FTE measure will show a higher increase in job destruction than the head-count measure. A second notable aspect of the sample is that the unit of observation is the firm and not the plant. In analysis based on plant-level data, any firm-level reorganization that results in transfer of jobs across plants shows up in the measures of job creation and destruction.

### 3. Empirical results

#### 3.1 Contributions to gross job flows by firm size and age: entire sample period

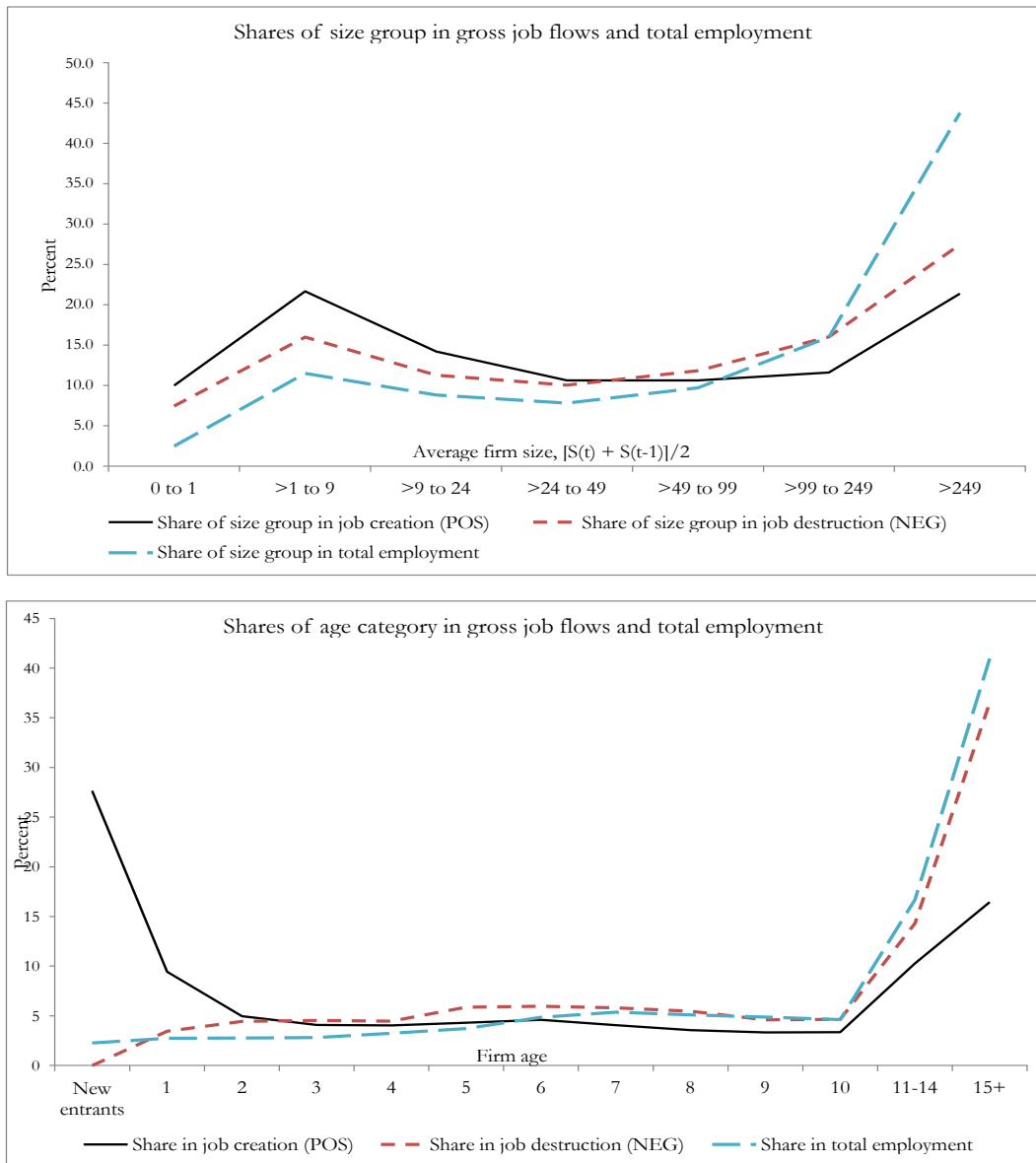
*Firm size.* Small firms and large firms contributed most to gross job creation but their contributions were not proportional to their share in total employment. Small firms accounted for a disproportionate share of gross job creation relative to their share in total employment while the job creation share of large firms was much smaller than their employment share (top panel, Figure 1). For example, firms with up to 9 workers accounted for about 32 percent of total gross job creation but for only about 14 percent of total employment. Firms in the largest size category of more than 249 workers accounted for 21 percent of job creation compared with about 44 percent of total employment. The share in gross job creation exceeded the employment share for firms in size groups up to 49 workers.

Large firms contributed more to gross job destruction than small firms (28 percent versus 23 percent). Still, small firms accounted for a higher share of job destruction than their employment share and firms in the largest size group accounted for disproportionately less. However, the gap between the two shares was narrower than in the case of gross job creation.

*Firm age.* New entrants and young firms were a major source of gross job creation, and accounted for a much higher share of gross job creation relative to their share in total employment (bottom panel, Figure 1). For example, new entrants alone accounted for about 28 percent of gross creation during the sample period but only about 2 percent of total employment. In all, firms aged four years or less (including new entrants) accounted for about one half of total gross job creation during the sample period but only about 14 percent of total employment. At the other end of the age spectrum, firms that were 10 years or more in age accounted for about 27 percent of total gross job creation and nearly 58 percent of total employment.



**Figure 1. Shares of firm size groups and age in gross job flows and employment, 1996–2013**



The share in total job destruction was considerably higher for older firms. Firms that were 10 years or more in age accounted for about one half of total job losses. For all age categories, the gaps between their share in job destruction and share in total employment were much narrower than in the case of gross job creation.

*Combining contributions of size and age.* A cross-classification of firms by size groups and age shows that there is considerable correlation between these two variables (Table 2). The bulk of new entrants (85 percent) were extremely small, employing only one worker.<sup>7</sup> Among firms with up to 9 workers, young firms (below 5 years in age including new entrants) accounted for more than one-half of gross job creation. Among

<sup>7</sup> Alternatively, about one fifth of firms with only one employee were new entrants.

firm size groups covering >9 to 99 workers, the shares of young firms and firms 5 years or older in gross job creation were similar. Among firms with more than 99 workers, the share of old firms in job creation was substantially higher than that of young firms.

**Table 2. Combined contributions of firm size and age to job creation and destruction, 1996–2013**

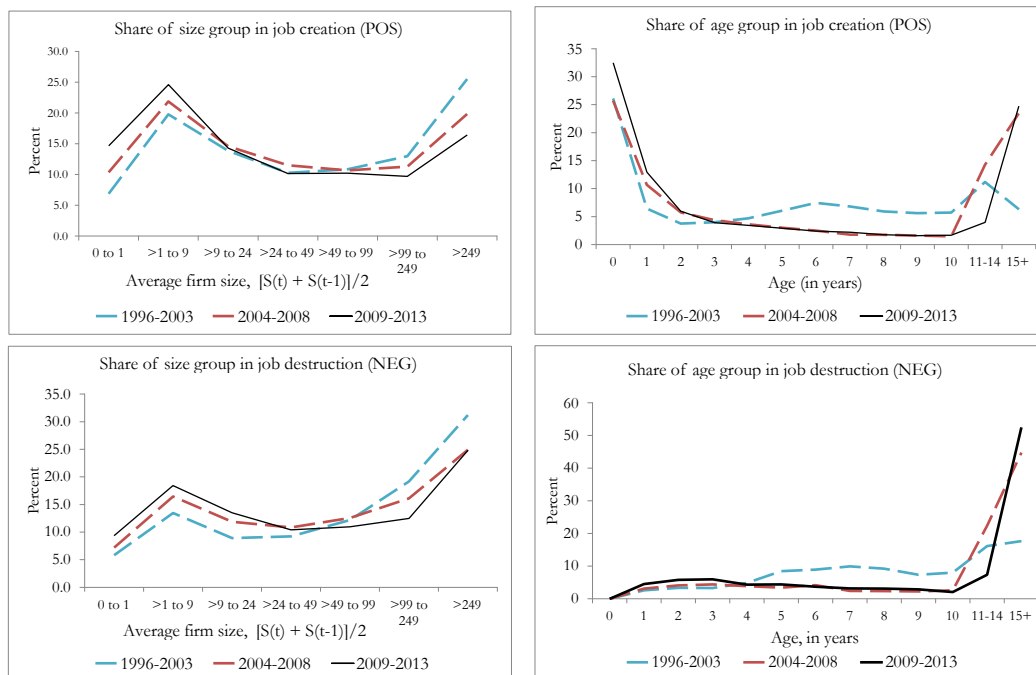
Average Size	Age	Job creation rate (POS) of each combination (rate/100)	Job destruction rate (NEG) of each combination (rate/100)	Net employment growth rate (NET) of each combination (rate/100)	Average share of each combination in total gross job creation (%)	Average share of each combination in total gross job destruction (%)	Share of combination in total average employment (%)	Number of firms
		(1)	(2)	(3) = (1) - (2)	(4)	(5)	(6)	
0 to 1	0 (New entrant)	2.000	0	2.000	7.81	0	0.65	2,169
0 to 1	1	0.172	0.208	-0.036	0.69	0.84	0.32	1,432
0 to 1	2-4	0.097	0.293	-0.195	0.69	2.03	0.53	2,577
0 to 1	5-9	0.076	0.282	-0.206	0.67	2.29	0.62	2,982
0 to 1	10-14	0.049	0.372	-0.323	0.26	1.32	0.32	1,575
0 to 1	15+	0.043	0.478	-0.435	0.13	0.73	0.20	979
>1 to 9	0 (New entrant)	2.000	0	2.000	6.10	0	0.51	312
>1 to 9	1	0.440	0.084	0.356	3.48	0.63	0.76	798
>1 to 9	2-4	0.156	0.136	0.020	3.97	3.44	2.17	2,559
>1 to 9	5-9	0.096	0.121	-0.024	4.80	5.46	3.88	4,412
>1 to 9	10-14	0.071	0.102	-0.031	2.17	3.52	2.52	2,789
>1 to 9	15+	0.039	0.196	-0.157	1.13	2.37	1.81	1,955
>9 to 24	0 (New entrant)	2.000	0	2.000	3.49	0	0.29	42
>9 to 24	1	0.443	0.095	0.347	1.74	0.35	0.37	94
>9 to 24	2-4	0.170	0.126	0.043	2.52	1.84	1.29	380
>9 to 24	5-9	0.101	0.108	-0.007	3.39	3.32	2.67	799
>9 to 24	10-14	0.065	0.132	-0.068	1.98	2.58	2.17	647
>9 to 24	15+	0.043	0.168	-0.125	1.16	2.53	1.90	570
>24 to 49	0 (New entrant)	2.000	0	2.000	2.33	0	0.19	13
>24 to 49	1	0.371	0.072	0.299	1.16	0.21	0.29	33
>24 to 49	2-4	0.151	0.119	0.032	1.78	1.34	1.00	128
>24 to 49	5-9	0.090	0.121	-0.031	2.38	3.05	2.12	279
>24 to 49	10-14	0.064	0.116	-0.051	1.75	2.35	1.98	256
>24 to 49	15+	0.038	0.164	-0.126	1.16	2.97	2.12	277
>49 to 99	0 (New entrant)	2.000	0	2.000	2.95	0	0.25	8
>49 to 99	1	0.317	0.096	0.221	0.88	0.26	0.25	15
>49 to 99	2-4	0.133	0.123	0.011	1.58	1.45	1.00	64
>49 to 99	5-9	0.076	0.114	-0.038	2.15	3.40	2.54	165
>49 to 99	10-14	0.053	0.087	-0.035	1.52	2.70	2.19	142
>49 to 99	15+	0.030	0.112	-0.082	1.51	4.16	3.35	217
>99 to 249	0 (New entrant)	2.000	0	2.000	2.28	0	0.19	3
>99 to 249	1	0.265	0.068	0.196	0.96	0.32	0.37	10
>99 to 249	2-4	0.093	0.095	-0.002	1.36	1.39	1.27	37
>99 to 249	5-9	0.062	0.098	-0.036	2.88	4.96	4.29	128
>99 to 249	10-14	0.040	0.073	-0.033	1.80	3.35	3.59	106
>99 to 249	15+	0.027	0.094	-0.066	2.34	6.83	6.29	187
>249	0 (New entrant)	2.000	0	2.000	2.50	0	0.21	1
>249	1	0.074	0.039	0.035	0.29	0.19	0.35	3
>249	2-4	0.061	0.062	-0.001	1.09	1.18	1.69	13
>249	5-9	0.054	0.055	-0.001	4.75	6.64	8.53	60
>249	10-14	0.039	0.057	-0.018	4.75	5.73	9.08	61
>249	15+	0.027	0.050	-0.023	7.66	14.28	23.87	131
All size groups	All ages	0.083	0.085	-0.002	100	100	100	29,407

The pattern for share in gross job destruction was somewhat different. Among firms up to 9 workers, the relationship between share in job destruction and age was inverted U-shaped. The share in job destruction increased with age in each size group beyond the 9 workers threshold, with the relationship becoming steeper as firm size increased.

### 3.2 Contributions to gross job flows over the business cycle: sub-sample analysis

The pattern of contribution to job flows during the different phases of the business cycle was broadly the same as that for the entire sample period. However, the evolution of shares of different size and age categories in gross job flows over the sample period indicates greater dynamism in the smallest and largest categories. As Figure 2 shows, the shares in both job creation and job destruction had increased over the sample period for firms with less than 10 workers and decreased for firms with more than 249 workers. Also, in both job creation and job destruction, the share of firms that were 15 or more years in age was higher during the period following EU membership in 2004 than in the earlier period. The share of new entrants in gross job creation was higher during the crisis period (2009–2013) than during the pre-crisis period.

Figure 2. Shares of firm size group and age in gross job flows: subsample evidence



Note: Firms 0 years in age are new entrants

### 3.3 Age, size and net employment growth: entire sample period

We now turn to the main results of the nonparametric regression equation in which net employment growth (NET) is regressed on firm size groups, firm age groups, interactions of firm size and age, and industry- and year-fixed effects.

### 3.3.1 Firm size and net employment growth

Consistent with most studies, there is an inverse univariate relationship between firm size and net employment growth (NET). Net employment growth falls steadily as firm size increases, but turns around slightly for the largest firms with more than 249 employees. Firms with up to 24 employees experienced positive average net job growth during the sample period, while firms in the range >24 to 49 employees experienced no net change in employment as a group and firms above 49 employees in size experienced net job loss (upper panel, Figure 3).

Controlling for firm age reveals a markedly different pattern from that observed in the univariate relationship between firm size and net employment growth. As the upper panel of Figure 3 shows, firm size continues to have an influence once we control for firm age but there is no evidence of smaller firms having higher net employment growth rates than larger firms. Net employment growth rises with firm size up to the >9 to 24 employees category, flattens out for the size groups in the >9 to 99 employees range, and increases mildly thereafter in the higher size categories.<sup>8</sup> The evidence is therefore broadly consistent with Gibrat's law for firms in the >9 to 99 employees range. Dixon and Rollin (2012) for Canada and Haltiwanger et al. (2010 and 2013) for the United States also found evidence in support of Gibrat's law if the smallest firms are excluded.

When the analysis is restricted to continuing firms only, we find an inverted U-shaped relationship between firm size and net employment growth. As the middle panel of Figure 3 shows, net employment growth for continuing firms rises with firm size up to 24 employees and declines thereafter.

Some of the difference in the growth-size relationship between all firms in the sample and continuing firms only can be explained by the pattern of firm exits. Job destruction from firm exit (which can be interpreted as the employment-weighted firm exit rate) follows a step-wise decreasing pattern by firm size irrespective of whether or not one controls for firm age (see bottom panel, Figure 3). The likelihood of exit is highest for firms with one FTE employee. Beyond this size, the exit rate drops markedly and remains flat for size groups in the >1 to 99 employees range and falls once again in larger firms. The decreasing step-wise pattern of exit rates combined with the inverted U-shaped relationship between net employment growth and size for continuing firms yields the positive concave relationship for all firms shown in the top panel of Figure 3.

### 3.3.2 Firm age and net employment growth

Young firms exhibit higher net employment growth than older firms. The growth-age relationship is broadly L-shaped: net growth decreases up to the age of six and flattens out in the subsequent age groups. The pattern is similar for continuing firms

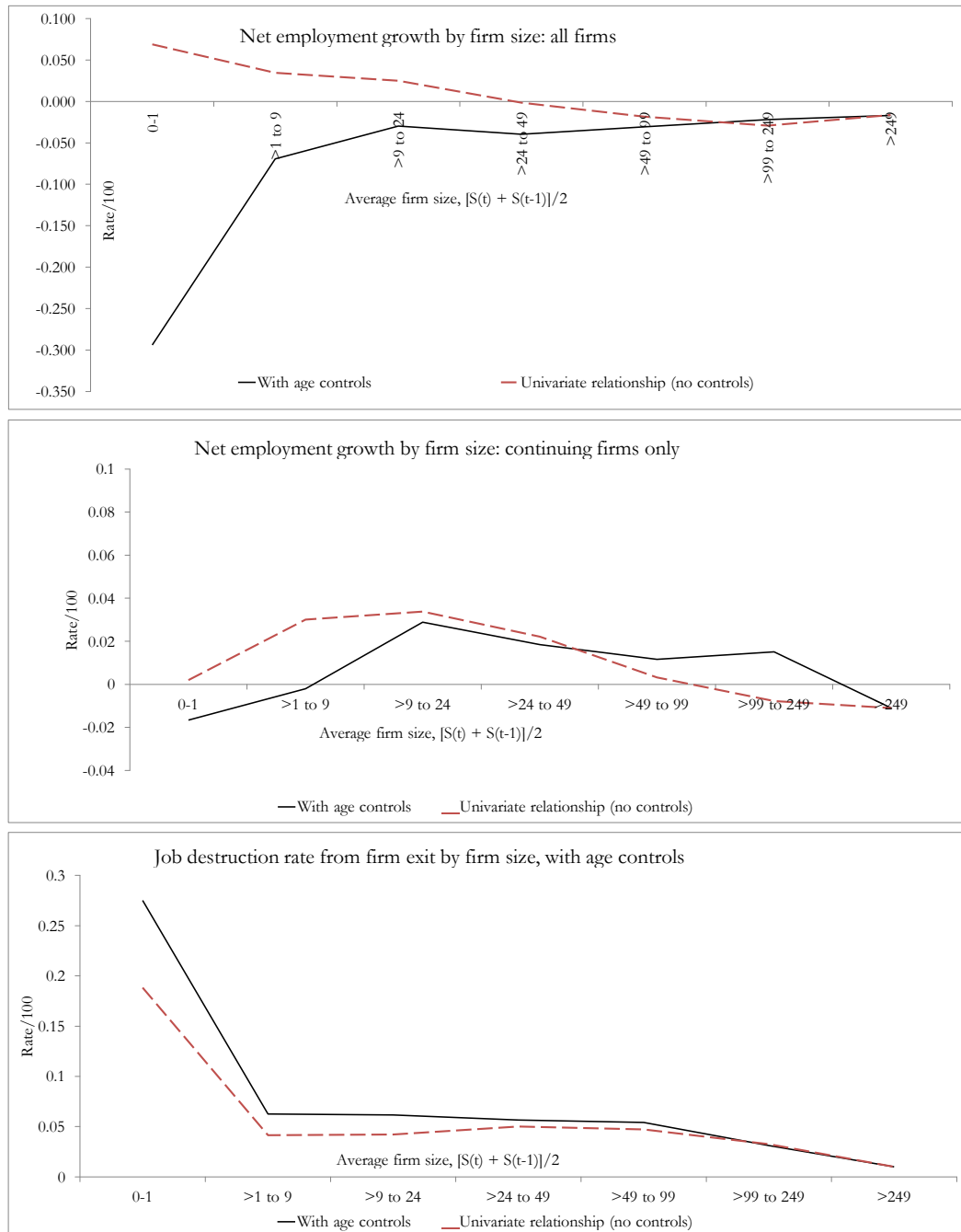
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<sup>8</sup> In the paper the results are presented in rescaled version, meaning that they are presented as the sum of unconditional mean and the sum of corresponding estimated regression parameters (regression equations included the main effects of size and age and their interaction). While testing for statistical significance of differences between the effect of different size and age groups would be possible in the case of non-rescaled version (as estimated parameters are realizations of multivariate normal random variable), in the case of rescaled version this is not possible due to unknown covariance matrix between unconditional mean and regression parameter estimates.

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and for all firms considered together, and is robust to controlling for firm size (upper and middle panel, Figure 4).<sup>9</sup>

Figure 3. Net employment growth and firm exit by firm size, 1996–2013

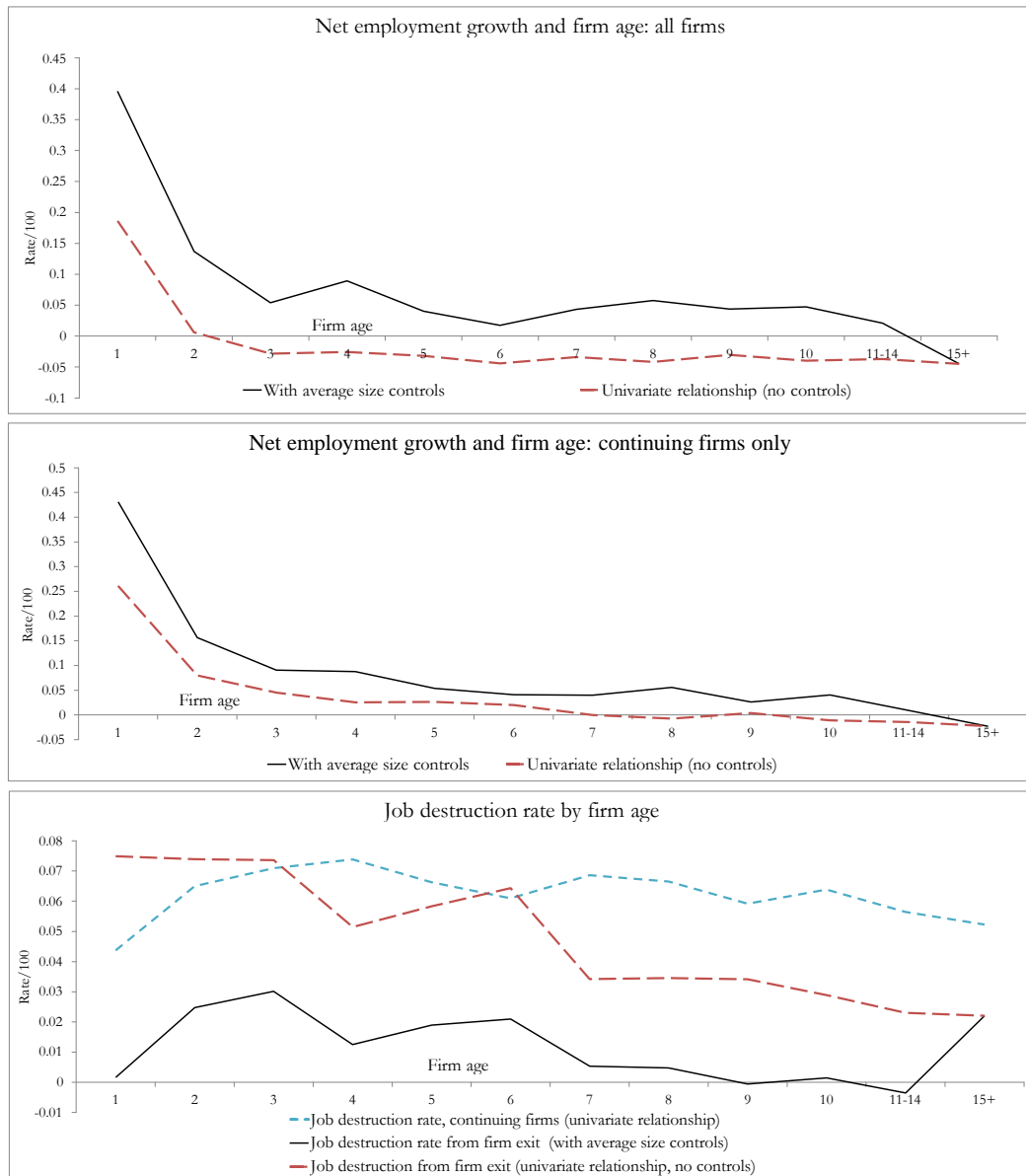


Note: The lines in the figures represent partial effects calculated from the regression parameter estimates, as explained in the methodology section.

<sup>9</sup> Net employment growth rate of new entrants is not shown in the figure. By construct, using the methodology of Davis et al. (1996), net employment growth for new entrants is equal to 2.

Our finding of a weak relationship between net employment growth and firm age beyond a certain threshold is broadly similar to that obtained by Haltiwanger et al. (2013) for the United States and Lawless (2014) for Ireland.

Figure 4. Net employment growth and firm exit by firm age, 1996-2013



Note: The lines in the figure with controls represent partial effects calculated from the regression parameter estimates, as explained in the methodology section. Net employment growth of new entrants is not shown in the figure. By construct, using the methodology of Davis et al. (1996), net employment growth for new entrants is equal to 2.

The patterns of net employment growth by firm age observed in the upper and middle panels of Figure 4 were associated with higher job creation and destruction rates for young firms than mature firms (see Table 2). The job destruction rate from firm exit, controlled for firm size, increases with age up to three years, suggesting that the first three years are particularly critical for new entrants. For higher age categories, especially

beyond six years of age, the job destruction rate on account of contraction of continuing firms is relatively more important than job loss through firm exit (bottom panel, Figure 4).

These findings are in line with learning models of firm growth. According to these models, firms face *ex ante* uncertainty about their cost parameters or efficiency level but accumulate relevant information over time through the process of production on the basis of which they decide whether to exit or to remain. The contribution of learning about initial conditions to job flows typically diminishes as the length of tenure of the firm increases (see Jovanovic, 1982). The findings are also consistent with models where it takes time for firms to build up capital (Foster, Haltiwanger and Syverson, 2012) or firms to build up reputation in credit markets (Evans and Jovanovic, 1989)

### 3.4 Employment growth over the business cycle: subsample analysis

The evidence shows that there are differential cyclical patterns across firm size and firm age groups. In particular, small firms and young firms are more sensitive during the cyclical downturn than large firms and older firms. We focus on the results of the nonparametric regression equation estimated with controls.

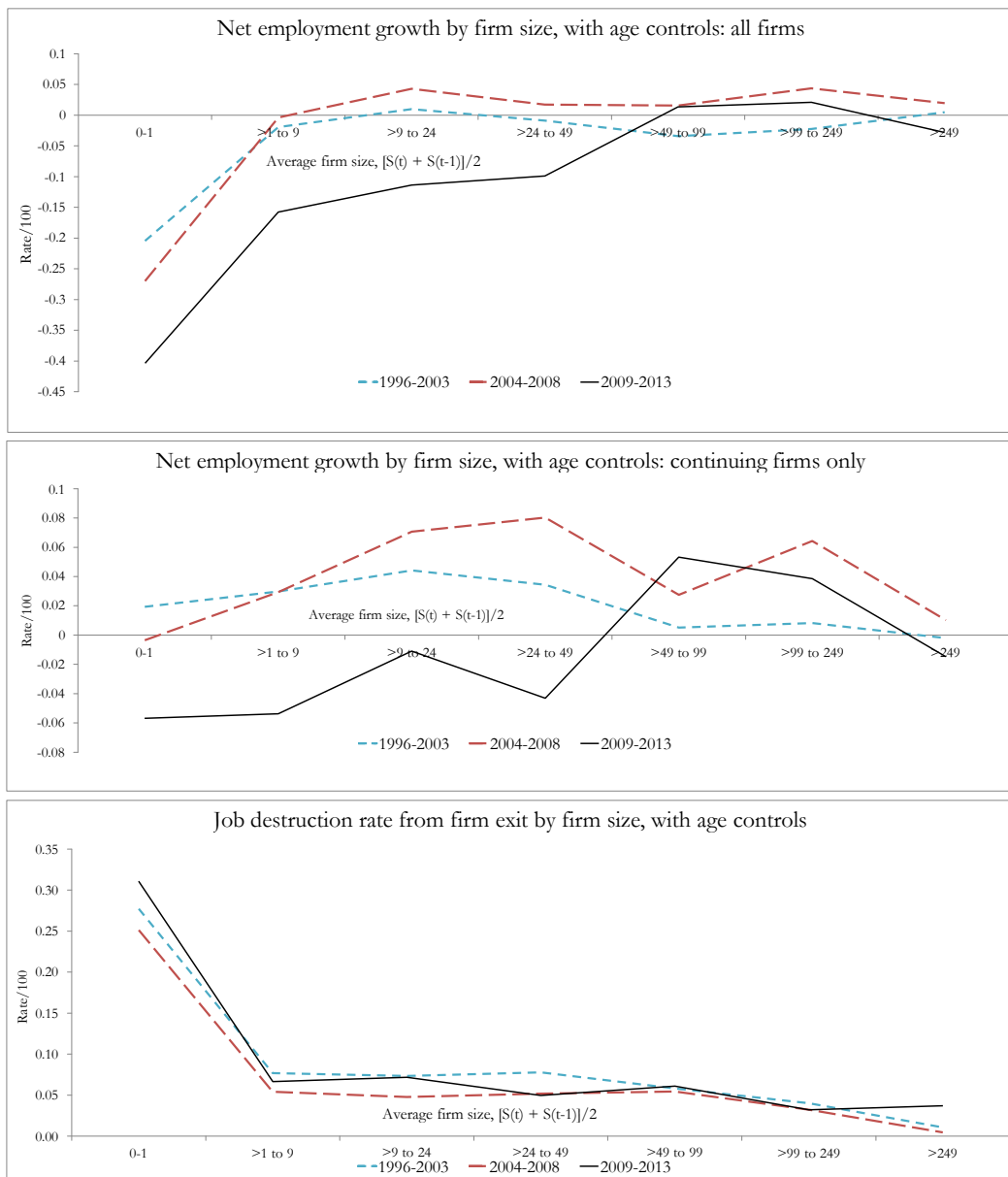
The relationship between net employment growth and firm size during the 2009–2013 recession period is different from the profiles for the pre-EU accession period (1996–2003) and the post-EU accession boom period (2004–2008) which are very similar and in close proximity to each other. During the cyclical downturn, the relationship is positive and has a concave pattern. During the periods prior to the cyclical downturn, net employment growth increases with firm size up to the >9 to 24 employees category, but thereafter the relationship is weak and broadly in line with Gibrat's law (upper panel, Figure 5).

As may be expected, the profile for the 2009-2013 recession period lies below that of the boom period, indicating that firms in all size groups except those in the >49 to 99 employees range had lower net employment growth during the recession. The profile is also steeper. The differential in the net employment growth rates between size groups widened during the recession period, and firms employing less than 50 workers suffered relatively more than larger sized firms. The drop in net employment growth relative to the boom period was biggest for firms in the >9 to 24 employees category.

In line with expectations, net employment growth for continuing firms during the post-EU accession boom period was higher than during the pre-EU accession period (middle panel, Figure 5). The increase in net employment growth was most in the >24 to 49 employees size group and the >99 to 249 employees size group. During the recession, net employment growth for continuing firms dropped most sharply in the smaller size groups. The negative impact of the recession was felt most severely by firms in the >24 to 49 employees range, the group that had grown most rapidly during the boom period. There was no drop in net employment growth for the >49 to 99 employees size group, while the drop for larger firms was relatively small.

The overall pattern for job destruction rate from firm exit by firm size was very similar during all three phases of the cycle. The differences between the three phases in the rates for various size groups were small (bottom panel, Figure 5).

Figure 5. Net employment growth and firm exit by firm size: subsample evidence



Note: The lines in the figures represent partial effects calculated from the regression parameter estimates, as explained in the methodology section.

There are several explanations for the greater employment growth sensitivity of small firms during the recession period. First, small firms in Slovenia are traditionally less export-oriented and more dependent on domestic demand than large firms (Statistical Office of the Republic of Slovenia, 2014). Thus, they were impacted more by the protracted contraction of domestic demand during the recession. Second, banks generally view lending to small enterprises as higher-risk. So, when bank lending slowed down following the onset of the financial crisis, access to bank credit became tighter for small firms relative to large firms and interest rate spreads between small and large firms increased (OECD, 2014). Third, small enterprises that were subcontractors for or



suppliers to large firms experienced liquidity squeeze on account of payment delays by large enterprises also hit by the crisis (European Commission, 2011).

The cyclical variation in the relationship between net employment growth by firm age is somewhat smaller than for the relationship with respect to firm size. Net employment growth dropped in firms of all vintages during the 2009–2013 recession period relative to the earlier periods, but the drop was most for firms that were three years old (upper panel and middle panel, Figure 6). Young firms up to the age of four years also experienced larger increases in the job destruction rate than more mature firms during the recession (lower panel, Figure 6).<sup>10</sup>

#### 4. Conclusions

The findings support the contention of Haltiwanger et al. (2010 and 2013) that researchers may be confusing firm size effects on net employment growth with the effects of firm age. The simple relationship between firm size and net employment growth indicates that net growth rates in Slovenia are higher for smaller firms. However, this negative relationship disappears after controlling for firm age. Net employment growth rises with firm size up to 24 workers and is independent of firm size among larger firms. The evidence underscores that if macroeconomic factors interact with firm size and age differently, the influence of the role of size will be clouded by the role of age if both variables are not taken into account together.

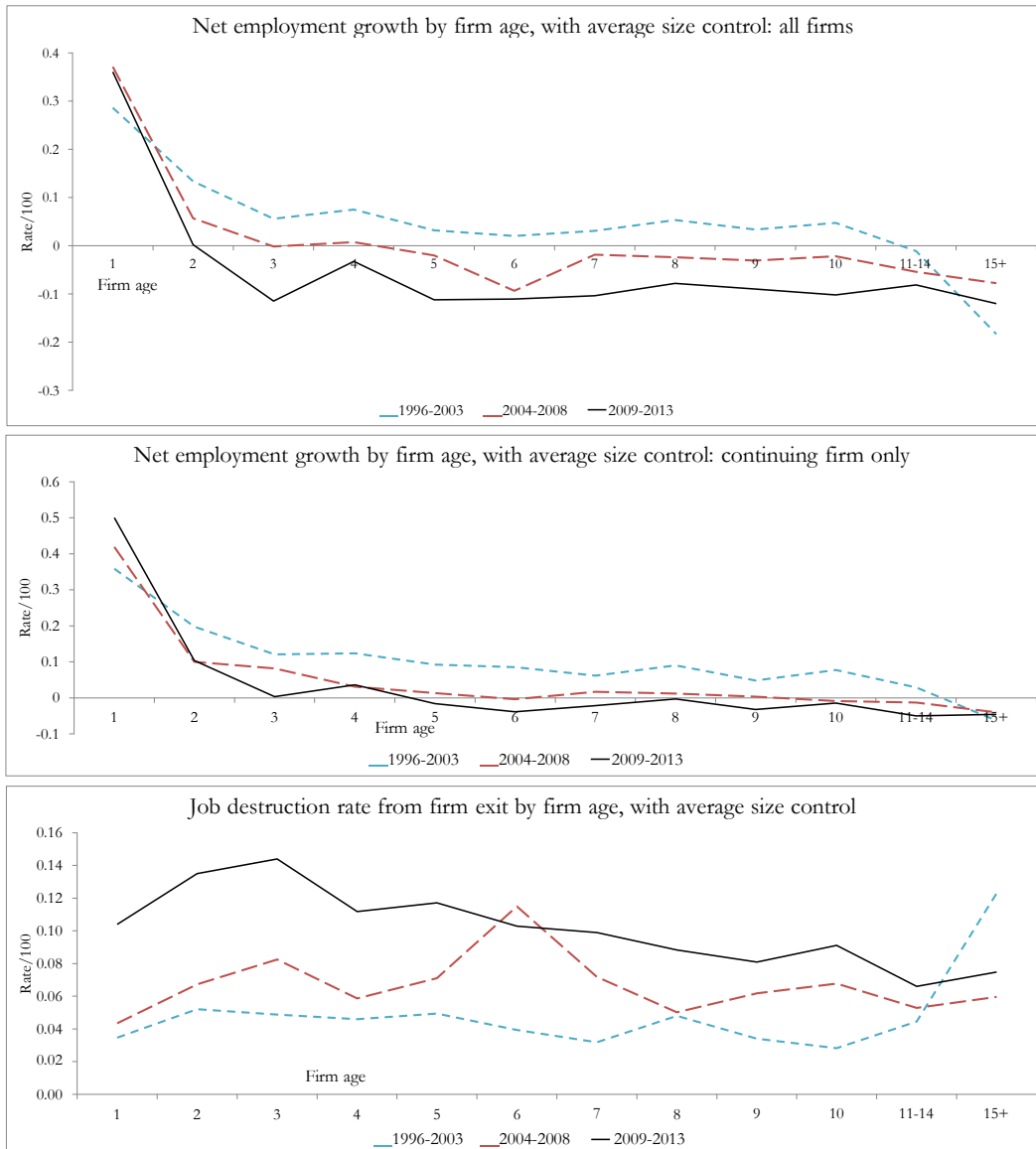
The evidence shows the importance of business start-ups in Slovenia. New entrants account for a little over 2 percent of total private sector employment in any given year, but their share in annual gross job creation is slightly more than one fourth. In general, younger firms exhibit higher job creation and destruction rates as well as higher net employment growth rates than mature firms. Consistent with this pattern, younger firms have a higher job destruction rate from exit. Three years of operation is a critical turning point in the probability of firm exit. These findings suggest that in encouraging private sector job creation, policies targeting firms based on size without taking account of the role of firm age are unlikely to have the desired impact. It also suggests that net employment growth could be facilitated by liberalization of regulations affecting start-up costs and creation of a supporting environment that would improve the chances of a firm's survival.

The evidence shows that small and young firms were more sensitive to the cyclical downturn than large and old firms. However, the variation in cyclical dynamics was stronger for firm size. Small firms and young firms experienced a larger increase in the job destruction rate and, consequently, a larger drop in net employment growth than large firms and older firms during the 2009–2013 recession. This outcome mainly reflects variations in market orientation and credit conditions across firms by both firm size and firm age.

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<sup>10</sup> See footnote 9 for the reason why net employment growth rate for new entrants is not shown in the figure.

Figure 6. Net employment growth and firm exit by firm age: subsample evidence



Note: The lines in the figures represent partial effects calculated from the regression parameter estimates, as explained in the methodology section. Net employment growth of new entrants is not shown in the figure. By construct, using the methodology of Davis et al. (1996), net employment growth for new entrants is equal to 2.

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## **Appendix**

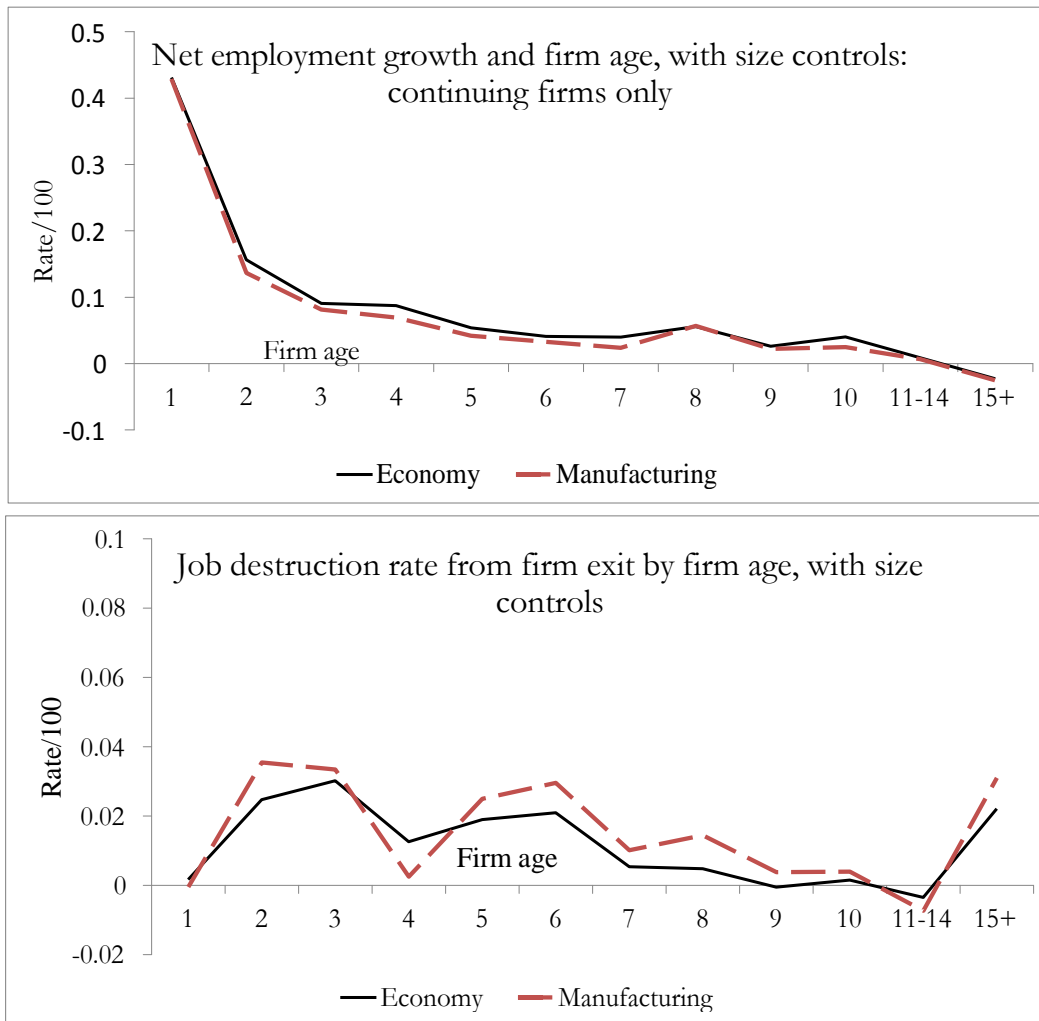
Most studies in the literature on job flows focus on the manufacturing sector, whereas the analysis in the main text of this paper covers the manufacturing and non-manufacturing sectors. If firm-level heterogeneity is different across sectors and shocks have differential sectoral effects, focusing only on manufacturing firms may not provide a representative picture of developments in the economy.

Employment in manufacturing in Slovenia declined at an annual average rate of 1.7 percent during the sample period, compared with an annual average decrease of 0.2 percent for the non-government sector as a whole. Manufacturing employment contracted on account of structural changes during the middle-transition period prior to EU accession, remained virtually unchanged thereafter until the onset of the financial crisis which impacted the sector most severely. On average 6.8 percent new jobs were created each year (POS) in the manufacturing sector and 8.4 percent of existing jobs were destroyed (NEG). In contrast, both job creation and job destruction rates averaged 8.5 percent in the non-government sector as a whole (see Banerjee and Jesenko, 2014).

The role of entry and exit of firms in the job creation and destruction process in the manufacturing sector was broadly similar to that for the non-government sector as a whole. On average, entry accounted for 27–28 percent of job creation and exit accounted for 33–34 percent of job destruction during the entire sample period. Thus, as in many other countries, start-ups in Slovenia are a critical component of the process of creative destruction on an ongoing basis.

Figure 7 shows that the up-or-out pattern of firms in manufacturing was broadly similar to that for the economy as a whole.

**Figure 7. Up-or-out patterns for manufacturing and entire economy**



Note: The lines in the figure with controls represent partial effects calculated from the regression parameter estimates, as explained in the methodology section.