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Who Creates Jobs in Hungary? The Role of Entering, Exiting and Continuing Firms Before and During the Crisis

JOHN SUTHERLAND EARLE - ÁLMOS TELEGDY

INSTITUTE OF ECONOMICS, HUNGARIAN ACADEMY OF SCIENCES
DEPARTMENT OF HUMAN RESOURCES, CORVINUS UNIVERSITY OF BUDAPEST
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Institute of Economics, Hungarian Academy of Sciences
Department of Human Resources, Corvinus University of Budapest

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Authors:

John Sutherland Earle
George Mason University
Central European University
E-mail: earle@gmu.edu

Álmos Telegdy
senior research fellow
Institute of Economics of the Hungarian Academy of Sciences
E-mail: telegdy@econ.core.hu

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John Sutherland Earle - Álmos Telegdy

Abstract

Using a large panel of Hungarian firms, we study the relation between firm size and net job creation. Categorizing firms in size groups with the traditionally used measure of employment size in the base year suggests that small firms create a disproportionally higher number of jobs than large enterprises. This relation declines when average employment size is used instead, and it reverses when firm age is controlled for. The crisis brought about large declines in employment across all types of firms. The analysis reveals that the main reason for this declines is the increased job destruction rates. Whole job creation rates were stable during the crisis, job destruction increased by about 4 percentage points. We find that the net growth of exporting and foreign-owned firms was reduced the most by the crisis, while state-owned firms kept most of the pre-crisis jobs.

Keywords: Small and Medium Enterprises, employment, job creation, growth, Hungary

JEL classification: L11, L25, O17

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A vállalati méret és kor hatásai a munkahelyteremtésre Magyarországon a globális válság előtt és után

John Sutherland Earle - Telegdy Álmos

Összefoglaló

Tanulmányunkban azt elemezzük, hogyan függ össze a nettó munkahelyteremtés és a vállalati méret. Mikor a vállalatokat a kezdő év szerint csoportosítjuk méretkategóriákba, a kis- és közepes méretű vállalatok méretükhöz képest aránytalanul sok munkahelyet teremtenek. Ez a kapcsolat azonban nagymértékben lecsökken, ha a méretcsoportosítást a nettó munkahelyteremtés kezdő és végpontjai közötti átlagos méret szerint végezzük el. Amikor a vállalat korára kontrollálunk regresszióinkban, a méret-munkahelyteremtés reláció megfordul. A globális válság az összes vállalati méretkategóriában nettó munkahelyrombolást indukált, amelynek oka a megnövekedett bruttó munkahelyrombolás. A bruttó munkahelyteremtés nem változott a válság előtti évekhez képest, a rombolás azonban 4 százalékponttal nőtt. A válság a legjobban az exportáló és külföldi vállalatok nettó munkahelyteremtését csökkentette, az állami tulajdonban levő vállalatok azonban megőrizték a válság előtt meglévő munkahelyeiknek nagy részét.

Tárgyszavak: kis és közepes vállalatok, munkahelyteremtés, növekedés, Magyarország

JEL kódok: L11, L25, O17

1. INTRODUCTION

During the last decades a large number of policies have targeted small and medium sized enterprises (SMEs), mostly to increase their chances to grow and survive. In addition to the belief that SMEs sometimes need financial assistance even though they are viable in the long run, many these policies implicitly assumed that the cure for the low employment rate should be sought at the SMEs because they create a disproportionately larger share of jobs than large enterprises. The potential usefulness of such policies notwithstanding, this analysis tests whether the commonly thought idea about SME job creation is true or not: do indeed SMEs create most of the jobs in Hungary? Do small firms grow faster on average than the large ones as commonly thought by labor specialists, so the relation between employment growth and firm size is negative? Or Gibrat's law is valid, which states that the growth of firm is invariant to its size (Gibrat, 1931)? To test this, we use a dataset which includes all double-entry book keeping firms from Hungary between 2000 and 2008, and build on the methodology from two studies (both papers analyze firms incorporated in the United States). One is written by Davis, Haltiwanger and Schuh (1996) and sheds light on the importance of how the categorization of employment size changes the relationship between employment growth and firm size. Net job creation by size depends largely on how size if measured. The traditional measure is the number of employees at the starting time of the period during which growth is measured, while the one proposed in this paper it is the average between starting and ending period employment (the implications of these size measures are discussed below). While the first measure produces a strong inverse relationship between firm size and growth among the American firms (smaller firms grow faster on average) the second measure diminishes this relation to a great extent. The second paper is a recent study written by Haltiwanger et al. (2010), who study the effect of firm age on the analysis of the growth-size relationship. The authors show that the inclusion of firm age diverts the relationship between firm size and growth and the inverse relationship does not hold anymore. Rather, most net job creation is made by the largest firms.

In addition to this methodological issue the paper describes what happened to net job creation during the crisis. We compare job creation and destruction before the crisis and during its first year (the last data wave we possess). We also analyze how net job

creation change during the crisis along two important firm dimensions: exporting status and ownership, the latter including domestic private, state and foreign.

We start our analysis with presenting the data we use. In Section 3 we discuss the potential measurement error which occurs when firms' size is measured by their employment size at the beginning of the period along which growth is measured and show how the implications of an alternative measure on the relation between the number of jobs created (net of jobs destructed) and size. This is followed by the multivariate analysis of firm size and growth when the age of firm is controlled for, which is based on Haltiwanger et al. (2010). We also analyze another form of net job creation when we take into account the persistence of it. Only those jobs contribute to this job creation rate, which exist for at least two years. Section 5 discusses the effects of the crisis on net employment growth. The last section concludes, discusses the policy implications of the findings and future research questions to be addressed.

2. DATA DESCRIPTION AND DESCRIPTIVE STATISTICS

In this analysis we use the data collected by the Hungarian Tax Authority, which contain information on all Hungarian double-entry book keeping companies for each year between 2000 and 2009. As the rules regulating which firms should be engaged in double entry book keeping have changed during the period studied, we have a large number of firms entering the data later than its year of foundation. The comparison of our database with the number of firms in the Hungarian economy by legal form (Hungarian Statistical Office (HSO), 2000-2009), show that limited liability companies are mostly present in the data, but partnerships enter gradually (we compare the sample and the population of firms below.). As it is likely that this is a non-random process, we do the analysis with and without partnerships.

One important difference between the Hungarian and the US data is that the unit of observation of the former is the firm, and the plant for the latter. This implies that acquisitions and spin offs of plants will be considered as job destruction in a given year and job creation in the following, and mergers and split ups will increase the number of job creation and destruction due to new entries and firm shut downs (the implications of these on the results is discussed in the next section in detail).

The data were cleaned extensively by Subproject 17 of the TÁMOP 232 Project. The cleaning procedures included the harmonization of the industry code between 2007 and 2008, the years between Hungary switched from the NACE 1.1 industrial classification to NACE 2.0. The industrial codes were also cleaned thoroughly in the following cases. If a firm had one code for several years but it switched in the middle of the time series to another code for one year, we considered this as a mistake and changed the code with the one present for many years. We also filled up years with missing industrial code when the adjacent years had a code. We also had to decide how to deal with firms switching industry from one year to another as the computation of growth rates require the use of two years and we always control for industrial categorization. To solve this, we compute the median industry for the whole time-series and use that for each industry. This has the disadvantage not to allow switches between industries (which do happen in reality) but this way we keep the same industry for a firm and do not have to deal with changes in the time series.

The second variable we cleaned was the average employment of the firm. Employment is measured as the average in the given year computed from monthly data by the firms themselves, and it includes all workers who have a contract with the firm, including both employment and assignment contracts. Those on assignment contracts are included only if the employee acts as a physical person and not a sole entrepreneur. Full time and part-time workers are both included in the employment measure. If somebody works at two corporations, he will be counted twice as in any firm level data. Thus, total employment computed from the firm level data will be different from that computed from the labor force survey. In order to include the entrepreneurs in the data, we added to each firm's employment 1. This will change the employment of large firms only marginally, but it will include in the employment counts the owner of micro and small enterprises who usually work in their own firm. Sometime the employment variable has incredible changes from one year to another and we cleaned these. Second and more important is that a small firm by a sole entrepreneur had many times zero employment in the data. Moreover, zero employment was not distinguished from the case when the information was missing. We first recoded the data to let zeroes reflect a firm without employees, and missings to be genuine, so those cases when we do not know what the employment size of the firm is. Having done this we added one to the employment of each firm, representing the entrepreneur which run it. This way we take into account the own-account entrepreneurs in the small firms, while the data for

medium and large firms do not change much as adding one employee to a large firm does not alter proportionally the employment size.

The third variable of interest was the age of the firm. This was computed by using the date of foundation, which is included in the data. If the data showed that the firm was state owned (the proportion of state ownership was larger than 0 in any year) we set the date of foundation to 1970.

Table 1 shows the number of firms in each year of the data. The number of firms in the data constantly rises, from 151,261 in 2000 to 362,420 by 2008, the last year before the crisis. In the last year of the data the number of firms declines by about 22 thousand as firm entry and exit patterns change in the global crisis. Total employment in these firms increased much less than the number of firms, from 2.24 to 2.68 million (dropping back again in 2009 by around 70 thousand). These figures suggest that average firm size declined in the studied period as many micro and small enterprises were born. Indeed, it was mostly the micro and small enterprises which increased their number, as Figure 1 documents. The employment share of microfirms (with employment size below 10 employees) was only 17 percent in 2000 and it increased to 33 percent by 2009. Small enterprises (with employment between 11 and 50) kept their employment share roughly constant at 20 percent. Medium sized firms (employment between 51 and 250) decreased their share somewhat, from 23 to 18 percent. The relative importance of large firms, on the contrary, shrank to a large extent: while in 2000 40 percent of the employees worked in such firms, by the end of the period studied their share fell under 30 percent – a large decline given the relatively short period of time during which it took place.

How much of the changes in the time series discussed above are attributed to changes in the sample and what is a genuine effect? We cannot give a complete answer to this question, but to shed some light on it, we present the share of firms present in the sample to the number of firms in the economy by legal form and size categories. The figures of the population are drawn from the Hungarian Statistical Yearbooks (HSO, 2000-2009). Already in 2000 almost all the limited liability companies are present in the data (the share of sample to population ratio is 98.5 percent). These firms are always present in the data: the lowest proportion we measure for them is 89 percent. On the contrary, partnerships are almost missing from the sample at the beginning of the period as only 10.4 percent of them is present. Their share is constantly rising with a big jump in 2004 when 78.5 of them is included in the sample. By the end of the period studied

the proportion of partnerships further increases, reaching 86 percent. As partnerships are mostly small, their lower presence in the sample is also reflected in its size distribution. In 2000 only about 35 percent of firms with maximum 4 employees are included while in 2009 this ratio grows to 64.

The age distribution of firms also changed during the studied period. In Figure 2 we present the share of employment among new born firms, and those which are 1-2, 3-4, 5-9 year old or older for the first and last year of the analysis. The bar chart shows that newborn firms increased their share somewhat, and that older firm gained a larger weight by the end of the period.[1]

To get a picture on how size and age are shaping together job creation and destruction, we show these by size and age categories. Figure 3 presents the share of employment, job creation and destruction rates for small and large firms (with fewer and more than 500 employees, respectively) by three age categories: new born firms, young (between 1 and 10 years of existence) and mature (older than 10 years).[2] The figure reveals that SMEs that are young and mature have the largest employment share, as well as massive job creation and destruction. Firm births are also important actors of job creation, especially relative to their employment share which is relatively small. Large firms are mostly mature and they have much smaller job creation and destruction rates. These patterns will thoroughly be studied in the following sections of the paper.

3. METHODOLOGY, IMPLICATIONS OF SIZE MEASUREMENT

Studies of firm growth face a number of well-known methodological challenges (e.g., Davis et al., 1996, Haltiwanger et al., 2010; Neumark et al., 2011), which are summarized briefly here. Studies of the relationship between size and growth are plagued by regression to the mean issues. For example, random (not serially correlated) measurement error in size in a particular year leads to measurement error in the same direction for growth from the previous year to that year and in the opposite direction for growth from that year to the next. Studies of firm age and growth suffer from difficulties

[1] This is because we categorize formerly state-owned firms as 30 years old in 2000 and these firms switch their age category during the 7 years.
[2] The measurement of employment shares, as well as job creation and destruction rates will be defined in the next section.

in measuring age, particularly in establishing longitudinal links across years when businesses may simply have re-registered (because of a new name or legal form, for instance). For the same reason, entry and exit are particularly difficult to measure. Analysis of the age profile of growth also requires attention to the fact that the population of firms observed at any age consists only of survivors, and the survival selection mechanism is unlikely to be independent of growth potential and realizations. Concerning ownership and growth, the problem is that ownership itself is likely to be endogenous, selected by potential owners according to their expectations of growth. [3] The differential associated with "cherry-picking" or "cream-skimming" may be more important than any effect of different owners on job creation and employee compensation.

The approach in this paper begins with improving longitudinal linkages by using all available means. The relevant information includes industry, region, size, which we use to match firms that exited the data in a given year with those that entered in the following year.

Our data share a common problem with many other datasets as it has information only on firms and not on establishments. This creates measurement problems when a firm boundary change takes place (the firms acquires or divests an establishment, splits up into two or more pieces or merges with another firm). To start with mergers and spit ups, these involve a re-registration of the new entity after the merger or the new firms after the split up. As we do not have information on establishments, we observe these firms as new entries and exits and treat them accordingly. A split up, for example, shows up as the exit of a firm and the entry of two. A merger will have the opposite structure in the data (the death of two firms and the birth of one). If establishments do not change their employment, these changes will not generate any job creation or destruction, but we will count them as net employment changes. Second, we cannot measure the true age of the newly registered firms but will consider them as newborn. In case of acquisitions and divestments of establishments similar problems arise. To take the example of an acquisition, the acquired establishment may have been an independent one before the acquisition or it belonged to another firm. If it was an independent firm, the situation is similar to a merger: the firm exits the data (which results in job destruction) and the acquiring firm increases its size (so it will have a positive net employment change). If

[3] The inclusion of ownership as a determinant of firm growth is yet present in the paper, but it will be incorporated in the final version.

the acquired establishment was part of another firm, then one firm will lose, the other will gain the same amount of employment (for divestments the same reasoning applies).[4] The boundary changes of firms, therefore, lead to increased job creation and destruction and to mismeasurement of the age of the firms: we classify firms established in the past as new born. In addition, we also consider firms as exiting which actually stay in the data but as parts of another firm.

The magnitude of firm entry is measured as the share of entrants in the total number of firms in a given year, and as the share of total employment of entrants in total employment of all firms. Because entrants tend to be quite dynamic, with much higher exit rates and growth rates (conditional on survival) compared to incumbents, the choice of time horizon can be crucial for evaluating the magnitude of turnover (as well as contributions to job growth). We therefore consider several alternative time horizons for the analysis. This will provide information on the contribution of the *de novo* sector to the growth in the number of firms and employees since transition began.

To handle the problem of spurious correlations between size and growth, the project follows methods proposed by Davis et al. (1996) and Neumark et al. (2011) in their analysis of the size-growth relationship in the US economy. First, rather than taking the base for employment growth as the previous year level of employment, the base may be taken as the average of the base and final year in the calculation. Defining E_{it} as number of employees of firm or sector (any grouping of businesses) i in year t, the base is $B_{it} = 0.5*(E_{it}+ E_{it-1})$. As discussed in Davis et al. (1996) and Haltiwanger et al. (2010), the use of an average base helps to cancel the twin regression-to-the-mean problems created by (classical) measurement error.

Using this base, employment growth e_{it} is defined conventionally:

$e_{it} = (E_{it} - E_{it-1})/B_{it}$.

This measure, referred to by Haltiwanger et al. (2010) as the "DHS [Davis et al.] growth rate" is frequently used in studies of reallocation and industry dynamics. Advantages of the DHS compared to conventional growth rates defined over a base of E_{it-}

[4] This boundary change does not create problems of measurement of net employment changes if the acquiring and divesting firms remain in the same size category.

$_1$ are that the former rate is symmetric, bounded over the range [-2, 2], and includes employment changes associated with entry and exit.[5]

An unfortunate confusion in much of the policy discussion (in many countries) about job creation is whether the relevant concept is gross or net. For instance, in discussions of the "importance" of small firms in job creation, it is frequently unclear whether the reference is to gross job creation or to net growth. In fact, e_{it} can be usefully decomposed:

$e_{it} = c_{it} - d_{it}$,

where c and d refer to the job creation and destruction rates, respectively. c is equal to e_{it} for expanding firms (including new entrants) and zero for contracting and exiting firms. On the contrary, d equals the absolute value of e_{it} for contracting firms (including those which exit) and zero for expanding and entering firms. For any single firm, either or both of c_{it} and d_{it} must be zero, but for an aggregation of firms, they can of course both be positive.

The final flow rates involve decompositions of e_{it}, c_{it} , and d_{it} into components associated with firm entry and exit and with changes in employment at continuing firms. For each of these three variables, $y_{it} = y_{it}^1 + y_{it}^2$, where the superscripts denote changes due to turnover and changes due to expansion and contraction at continuers.

The paper will describe the distributions of all these flow rates and how they vary with size categories (defined on E_{it} or B_{it}), age (A_{it}), and ownership (O_{it}). Because these factors are likely to be correlated, and in order to facilitate the study of economy-wide patterns without confounding time and industry shocks and compositional changes, the main estimation method will be a regression of an employment flow rate against these variables while controlling for a full set of industry and year effects:

$y_{ijt} = \gamma_{jt} + \beta(B_{it}) + \alpha(A_{it}) + \theta(O_{it}) + \varepsilon_{it}$,

where y_{ijt} is an employment flow rate, j indexes industries, γ_{jt} are industry-year effects, the β, α, and θ functions may take different functional forms, and ε_{it} represents residual movements in y_{ijt} not accounted for by the independent variables. For example, β, α, and θ may be linear, representing vectors of coefficients on categories of each of the variables of interest. β and α may be polynomials (or other parametric functions). O_{it} represents the categories state, domestic private, and foreign-owned. A further

[5] The traditional rate which relates employment growth to base year employment ($(E_t-E_{t-1})/E_{t-1}$) is asymmetric, bounded only from below at -1 and it is infinite for entrants. Therefore, entry cannot be treated symmetrically with exit.

alternative is non-parametric locally weighted regression (Chesher, 1979; Neumark et al., 2011). The paper will investigate a variety of functional forms to establish robustness of any relationships found between growth and size, age, and ownership.

4. RESULTS

4.1 NET JOB CREATION BY SIZE AND AGE

Before presenting the regression results, we illustrate the importance of the size categorization and age by computing the net job creation between 2007 and 2008 by firm size and age for base year and current size.[6] For reference, Tables 2 and 3 present the number of firms and their total employment for size-age cells (for two size categories, base year and current) while Table 4 presents the tabulations of net job creation for the size-age cells. Between 2007 and 2008, total employment in the sample was very stable as only 342 jobs were destructed on the net by the sample firms. The small number of net change, however, hides great differences in job creation activity by firm size and age. First, newly established firms (those which appear first in the data in 2008) created more than 100 thousand new jobs on the net and those which were only 1 or 2 years old created an additional 22 thousand. The older firms destructed more jobs than created so their net job creation is negative, and the number of jobs destructed increases by age category: 3 years old firms' total employment in 2008 was smaller than in 2007 by only 4630, while the oldest firms destructed more than 50 thousand jobs. The relation between net job creation and base size categorization of firms shows that small firms create, while the large ones destruct jobs. Only the smallest firms create jobs on net: those having their employment in 2007 between 1 and 4 employees created 67.5 thousand jobs while firms in the next size category (between 5 and 9 workers) already destroyed 4800 jobs. Firms in the larger size categories all destroyed jobs.

Changing the size categorization from base year to current changes the size – net job creation relationship to some extent. Most important is that firms in the smallest size category create much fewer jobs than when firm size was measured by its base employment. In this case only 23.3 thousand jobs are created. Overall, in all the larger

[6] We chose 2008 rather than the last year available as this year is not contaminated by the effects of the crisis. The results for the other years are presented in the Appendix.

size categories jobs are destroyed and it is hard to depict a relation between size and net job creation.

The number of jobs created, however, does not take into account the size of the firms which created those jobs. The net job creation rates, which are presented in Table 5, take this into account as they show the net job creation rates relative to the employment of the firms. The rates decline sharply in the first 4 years of existence of the firms, and for older firms they do not vary much. By base year size they also decline among the small firms and then they stay quite stable. By current size categorization we find similar patterns but a less radical negative relationship.

We now turn to the multivariate analysis where we run employment-weighted non-parametric regressions with size and age controls, the dependent variable being the net job creation rate at the firm level. The regression coefficients can thus be interpreted as the rate of net job creation relative to the employment size of the given age or employment category. We follow the practice of Haltiwanger et al. (2010) and for illustrational purposes we do not present the regression coefficients in tables but in figures, where the omitted category – instead of having a zero coefficient – is given the unconditional net job creation rate (the regression coefficients are presented in the Appendix).

The relationship between net job creation and firm size are presented in the top panel of Figure 4 in four ways: with base year classification and current size classification, each with and without age controls. When employment size is measured by base year size, a clear pattern emerges: small firms create a disproportionately larger share of jobs than large ones. The net job creation rate is 17 percent larger for the smallest firms than for those with their employment larger than 1,000, and it quickly decreases as size grows. For the firms with their base size between 5-9, 10-19 and 20-49 employees, the regression coefficients are 0.046, 0.030, and 0.020. For smaller size categories they remain positive but under 0.02. The coefficients are statistically different from zero only in the case of firms under 20 employees. Switching to current size classification changes this relationship quite substantially. Net job creation is still size dependent but the effect vanishes very quickly as firm size grows, and the relationship is much less pronounced than with the base year size classification. The smallest firms create 4.7 percent of all jobs, and the effect is between zero and -1 percent for larger size categories.

Controlling for the age of the firm in the regressions changes the relation between net job creation and firm size dramatically. With base year size classification Gibrat's law is almost completely satisfied. All the regression coefficients on size categories but for the smallest firms are statistically insignificant and essentially zero. When size is measured by current size, the results change even more, showing a strong positive relationship between size and net job creation. All the estimated coefficients are negative and almost all of them are statistically significant. The job creation rate associated with the smallest employment category is large, equal to -0.15. The second size group's coefficient more than halves and for larger firms the coefficients further decrease. Therefore, a measure of size that is less prone to the regression to the mean fallacy and controls for age totally reverses the common knowledge according to small firms create the most jobs in Hungary. It should be noted, however, that age is strongly correlated with size as most new firms enter in the small size categories. Therefore, policies targeting small firms still can have a role in job creation.

To get an impression on how these results are driven by entry and exit of firms, in the second panel of Figure 4 we reproduce the results only for continuing firms.[7] As expected, the job creation rates for small size categories become much smaller as entering firms are mostly small. For larger size categories the figures become almost totally flat, except for current size and age controls. Nevertheless, we still find a negative relationship between firm size and net job creation for both base year size and current size classification (the relation being more pronounced in the case of base year size). The relationship vanishes when age is included in the base year size regressions and it reverses when size is measured by the average of current and past year's average employment. The comparison of Panel A and B of Figure 4, therefore, shows that while entry and exit are important in shaping the effect of size on net job creation, the relationship established for the whole sample – albeit attenuated – holds for the population of continuing firms.

Using the same regression output, the next figure investigates the relation between firm age and net growth. We present three lines, one without size and two with size controls (base year and current).[8] To start with the results unconstrained by size, we find that young firms (those which exist for 1 or 2 years) grow faster than older ones and

[7] We keep only those years when the firm exists in both t-1 and t, but we do not require the firm to exist in each year of the analysis.
[8] We do not present in the graphs (but include in the regression) the new born firms as their job creation rate is essentially 2.

for older firms. Up to age = 9 the growth rates are between 1.4 – 2.5 percent with not much relationship with age while for older firms the growth rates are very small. Here the oldest firms are different as their growth rate is 1.7 percent. With either size control we obtain very similar relationships, but for base size the age coefficients are smaller larger and for current size larger than the results without size controls. When only continuing firms are included in the regression (in Panel B of the figure), we obtain similar results. In the interpretation of these results, however, one should keep in mind that our oldest firms are very special as all of them are inherited from the socialism and thus may behave differently from the younger firms.

As firm exit is an extreme way of job destruction (and qualitatively also different from simple downsizing as firms cannot grow back when they exited the economy) we look into exit patterns and test how they relate to firm age (exit pattern's dependence on size is discussed in the next subsection). We run the same regressions as before, but we change the dependent variable to show the contribution of exiting firms to net job creation. The variable takes the value of 2 if the firm exits and 0 otherwise (so the regression coefficients show the absolute value of the job destruction rate). The results presented in Figure 6 reveal that job destruction by exiting firms is the highest in the youngest firms and declines by age. While this pattern is common in each specification, the magnitudes of the coefficients vary by the inclusion of size controls and their measurement. The strongest age dependency can be observed when no size controls are added (but this is very similar to the regression results with base year size controls). In this case the 1 or 2 years old firms exhibit exit-led job destruction rates of 6-7 percent. For older firms this rate is lower, but still quite high. For example, for 4-year old firms it is 4 percent and for 10 year old firms 2 percent. For firms older than 8 years job destruction due to exits is lower than 1 percent. Controlling for current size decreases the age-exit rate relation. For the 1-year old firms the rate is about 3 percent, which is one percentage point lower than the job destruction rate measured for 2 year old firms. The estimated coefficients become zero for age = 7. It is remarkable that the exit rate is quite high – 1.2 percent – for the oldest firms. As these are mostly companies inherited from the socialist system, it is remarkable how different their exit behavior is compared to other old firms.

4.2 JOB CREATION AND DESTRUCTION BY FIRM SIZE AND AGE

Net job creation, as discussed in Section 3, can mask large amounts of movements of jobs across firms. For example, a group of firms may have zero net job creation, but behind this apparent equilibrium state some firms can be established and grow contributing therefore to the total number of jobs while others destroy jobs by shrinking or exiting. To go deeper into these processes, we present job creation and destruction by size and age categories.[9]

Figure 7 shows job creation and destruction rates by firm age. Without controlling for size, there is a strong, monotonically decreasing relationship between job creation and firm age (the entering firms are not presented in the figure as their job creation rate is 2). The youngest firms' job creation rate is 22 percent, which declines abruptly by the 3th year of existence. Those firms which survived for 3 years have a job creation rate equal to 9 percent which continues to slowly decline for older firms, reaching about 1 percent for the oldest firms. The inclusion of current age controls does not change the relationship at all, while controls for base year size decrease the magnitudes but leave the relationship qualitatively unchanged, but it flattens out for the old firms which have job creation rates equal to zero.

Not only job creation is larger in younger firms. Job destruction rates, shown in panel B of Figure 7, have similar patterns. When we do not control for firm size, job destruction is between 5 – 7 percent in the first 6 years and declines for older firms, being zero above age 13. The job destruction rate – age profiles diminish when size controls are added.

Next we investigate how job creation and destruction vary by firm size. The regression coefficients presented in Figure 8 reveal that base year size without age controls has the largest job creation rates and the smallest job destruction rates. When size is measured as the average employment between two consecutive years, we get smaller job creation rates and much larger job destruction rates. For example, for the smallest firms the difference between job creation rates measured at base year and current size is 5 percentage points and the difference between job destruction rates 8 percentage points. The inclusion of age controls flattens the job creation rate and the

[9] We showed in the methodological section that the net employment creation rate equals to the difference between the job creation and destruction rates.

relationship disappears when current size is controlled for. Job destruction rates, however, have a declining pattern by firm size, which is more pronounced when current size is the measurement of employment size. In conclusion, the reason for the negative pattern of net employment growth-size relationship is the flattening of job creation rates and the stronger negative relation between job destruction and size when age is controlled for.

Finally, we study the two extreme forms of job creation and destruction separately: firm entry and exit. In Figure 9 we show how these rates depend on size. To start with job creation of entering firms, this is highly size dependent if age is not taken into account. For the firms with less than 5 employees, the job creation rate of entering firms is over 10 percent for base year size and 14 percent for the current size measure. Job creation from entry declines abruptly. For the second size group it is 2.5 percent regardless of the size measure and it further declines.[10] Job destruction rates associated with exit is larger for current size than for base size. The job destruction rate is 8 percent for the smallest firms, and it declines quickly as already for the second size group is less than 2 percent (with age controls) and it further declines for larger firms.[11]

4.3 FIRM SIZE AND PERSISTENT JOB CREATION

As discussed in the introduction, an important dimension of the quality of employment is job stability. Thus, when examining job creation by firm size and other characteristics, it is useful to inquire whether the jobs created tend to be long- or short-lasting. One possibility, even if some types of firms tend to predominate in (net) job creation, the jobs they create may be short-lived. Perhaps In this subsection, we exploit the panel structure of our data to consider the impact of firm size (and age) on persistent, or stable, job creation. Our operational definition focuses on jobs that survive at least one year.

[10] When we control for age the job creation of entries do not have any size relation as entry is completely correlated with age = 0.

[11] To test the robustness of these results, we ran several specifications. First, as partnerships enter non-randomly to the data, we excluded them and reran the regressions. The results did not change qualitatively. Second, we ran the regressions for the three main economic sectors: agriculture, industry and services. The results hold for each of these sectors.

Formally, defining E_{it} as number of employees of firm i in year t, job creation persisting at least a year is defined as

$C2_{it} = \max\{\min[E_{it} - E_{it-1}, E_{it+1} - E_{it-1}], 0\})$,

and the persistent creation rate is $c2_{it} = C2_{it}/B_{it}$, where $B_{it} = 0.5*(E_{it} + E_{it-1})$, as before. (We also report results with the conventional E_{it-1} in the denominator.)

Job destruction persisting at least a year is analogously defined as

$D2_{it} = \min\{\max[E_{it} - E_{it-1}, E_{it+1} - E_{it-1}], 0\})$,

with persistent destruction rate $d2_{it} = D2_{it}/B_{it}$. Finally, the persistent employment growth rate (net job creation rate) is defined as $e2_{it} = c2_{it} - d2_{it}$. This persistent growth rate has the same properties as the standard DHS growth rate discussed above – symmetric, bounded over the range [-2, 2], and includes employment changes associated with entry and exit. The persistent rates differ in recording employment changes only that persist at least one year beyond the initial change.

Tables 6 shows the descriptive statistics for all these variables, and Figures 10-13 present the regression results using the same specifications for the standard growth rates, above, but with $c2_{it}$, $d2_{it}$, and $e2_{it}$ as the dependent variables. The results reinforce those from the previous analysis: both gross and net job creation rates decline monotonically with size, as they do with age. However, in regressions containing both the size and age characteristics, the size effects are greatly reduced and in those using the base B_{it} in the dependent variable, they are reversed, so that persistent gross job creation is smaller for the smallest size firms, while for net job creation is rises monotonically with firm size category.

5. THE EFFECTS OF THE CRISIS

5.1 JOB FLOWS BETWEEN 2008-2009

The total number of firms between 2008 and 2009 has changed considerably. Table 7 shows changes of net employment for the whole sample and for size and age categories separately. For comparison, we also present the same figures for 2007-2008. In our sample the total number of jobs lost was 124,532, which is about 5 percent of total jobs in 2009 (2,608,288) in the sample. Employment fell in all size categories, but somewhat

surprisingly, small firms contributed to this drop a very small extent as the number of jobs lost in firms with less than 5 employees was only 858. Large firms lost much more jobs: those with at least 500 employees shed almost 34 thousand jobs. Despite its small magnitude, the comparison of this figure with the one from 2008 shows how the crisis hit small firms. Instead of a drop, in the last pre-crisis year small firms increased their total employment by more than 23 thousand. Looking at net employment changes by age distribution, the data show that newly entered firms created 95 thousand jobs on the net, which is smaller by only 10 thousand than the figure in the previous year. Firms born in 2008 also grew, creating in total more than 22 thousand jobs on the net. The older firms all decreased their aggregate employment.

The proportional net employment changes also show in Table 8 that large firms lost more employment relative to their size than small corporations. While smallest firms' net job creation rate was almost zero, in the other size categories this is between 4-8 percent with no apparent relation between size and the magnitude of net employment loss. Net job creation rates by age of the firms reveal that one year old firms grew by 20 percent while all the older firms decreased employment by around 10 percent. The sole exception is the oldest firm category, which lost proportionally fewer job by 3 percentage points.

What is the cause of the job losses across the economy? At least three mechanisms can be suspected behind the employment decline. The first is when job creation declines and job destruction does not change; it is also possible, that job creation has the same magnitude as before, but job destruction increases; and finally the worst-case scenario is when both job creation and destruction change such that employment decline is the greatest. To check what happened in Hungary during the first year of the global crisis, we present in the following not only the job creation rates between 2008 and 2009, but also for the previous pair of years which serve for comparison. To start with job creation, Table 9 reveals that this variable was actually quite stable and did not change much during the first year of the crisis.[12] In 2008 it was 0.132, only one percentage point larger than one year later. Across size categories, job creation rates are 1-2 percentage points lower in 2009 than one year before, with the exception of medium sized firms (between 250-499 employees) which have a higher job creation rate during the crisis and for firms with 500-999 employees which have decreased job creation by 3.5 percentage points. The age distribution of job creation rates shows more radical changes. One-year

[12] The number of jobs created and destructed are shown in Appendix Tables A42 and A43.

old firms increased their job creation rate by 4 percentage points while all the older firms had smaller rates in the crisis than before.

Table 10 presents the job destruction rates by size and age. The grand mean of job destruction rate in Hungary was 0.132 in 2008 and 0.168 one year later, which is 3.5 percentage points larger. Across all size categories, job destruction is always larger in 2009 than one year before except the largest firms which have the same average job destruction rate as before the crisis. The smallest increase in the job destruction rate is measured for the smallest size category (2 percentage points) and the difference between the two years' job destruction rates increases by size, reaching 6 percentage points (the exception is the largest size category as we mentioned before). Along the age distribution it is harder to trace any regularity. Among the 1 year old firms the job destruction rate increased by 2 percentage points but for the 2 year old firms we measure the largest increase of 7 percentage points. For older firms the job destruction rates growth vary between 2 and 5 percentage points, with no visible relation with age.

An extreme form of job creation is the entry of new firms. The number of firms entered in 2008 was 42,271, which declined by 2009 to 34,341, as Table 11 shows. New firms created 10 thousand fewer jobs during the crisis than one year before. The smallest entrants (with employment size under 5) created 76,673 jobs in 2008 and only 64,421 one year later. In larger size categories the number of jobs created during the crisis is comparable to the pre-crisis numbers.[13]

Table 12 presents the number of firms which exited the economy in 2008 and 2009 and job destruction associated with exit. The number of firms which shut down was larger by 7,000 in the crisis than one year before. As it is typical in any economy, the exiting firms were mostly under 5 employees in both years, but in 2009 their number was larger by 6559. It is interesting that there is practically no age dependence in shut downs as exiting firms are of all ages. The employment effect of shut downs is sizable and it grew in the crisis. The total number of jobs in exiting firms was 123,559 in 2008 and 181,271 in 2009. Out of these 57.7 thousand additional jobs lost, the smallest firms lost 13 thousand. One-year old firms lost 4,000 additional jobs and 2 year old firms lost 3,000.

[13] We trace several large entries to the data and the number of jobs created in these categories is actually larger in 2009. These entries, however, might be data errors. Fortunately, the number of jobs created is small and does not change the overall picture at all.

To summarize, the reason for the employment drop during the crisis was not the sluggish job creation but a significant increase in job destruction. While job creation rates did not change, job destruction increased by almost 4 percentage points. The data suggest that job destruction rates' growth rate in the crisis increases by size, while we cannot trace any regularity by the age of the firm. New firm establishment declined and shut down activity, on the contrary, intensified in all size and age categories. Net entry, therefore resulted in large losses of employment.

5.2 FIRM GROWTH BY EXPORT STATUS AND OWNERSHIP

Which firms are likely to create, and which destroy jobs in the crisis? We study several aspects of this issue: persistence, exporting activity and ownership. Persistence is interesting as it sheds light on the following issue: are good and bad firms in the economy? Did those firms which grew before the crisis, continue to create jobs or the set of growing firms is different in the two time periods? Second, as Hungary is a small open economy which exports a high percent of its output, it is important to know whether exporting firms suffer more or less in the crisis. They may have larger output declines but they may also be more productive and innovative and thus more able to adjust to the new conditions. They may, however, more market oriented than non-exporting firms and thus adjust more rapidly their employment levels to the new conditions. Third, the ownership of the enterprise may also be a factor that affects employment growth (e.g., Brown et al, 2010). Foreign-owned firms may be more exposed to international competition, but they may also have more resources to keep their employment level in expectation of better times. State-owned firms might be more affected by political decision making and keep employment to create less tensions in the society (Boycko et al, 2006).

To study the effect of the crisis on employment growth by exporting status and ownership, we run a regression where the dependent variable is net employment growth, the variable of interest is an exporting dummy or ownership status, an interaction term of these variables with a crisis dummy, and we control for employment size categories and the age of the firm. To take into account the size of the firm, we weight the regression by employment size. The exporting status dummy is defined as equal to 1 if

the firm exports at least 5 percent of its output in both years for continuing firms while for entering (exiting) firms we require that it exports at least 5 percent of its output in its last (first) year of existence. According to this definition, 18,083 or 4.6 percent of the firms are exporters. We define three categories of ownership: domestic private (the reference category) state-owned, and foreign. A firm is foreign-owned if a majority of its shares are owned by foreign investors in 2008; if this condition is not satisfied, a firm is either state-owned or domestic private, depending on which of these two owner-types have a higher proportion of shares. The proportion of foreign owned firms is around 7 percent in both years and the proportion of state-owned firms is half percent.

The regression results for exporting are presented in Table 13. The estimated coefficient of the crisis dummy is negative, significant and as large as -0.025. The regression shows that exporting firms created 6.1 percent more jobs in 2008 than non-exporters. In the crisis, however, this trend reversed and export-oriented firms net job creation rate declined by 11.6 percent. The crisis, therefore, hit the most the exporters as the international demand for their output shrank. Using job creation and destruction rates as dependent variables, the regressions reveal that exporting firms had both a lower job creation rate (by 3.4 percent) and a larger job destruction rate (by 8.2 percent) than non-exporters.

The net job creation and ownership correspondence is presented in Table 14. Before the crisis the growth rate of foreign firms was 4.7 percent more than that of the domestic private ones, while state-owned enterprises grew by 3.6 percent less than the comparison group. The crisis changed the correlations between ownership and growth rates: we estimate a rather small and insignificant, but negative coefficient for foreign owned firms while the additional growth rate of state-owned firms relative to domestic private firms is 10 percent (insignificant). It is interesting to see what leads to differences across owner-types: job creation or destruction. The job creation rates differed before the crisis only for foreign firms, which created 1.5 percent more jobs. This difference disappears in the crisis. Job destruction rates, however, do differ across ownership types: foreign owned enterprises' job destruction rate is 3 percent higher and state-owned firms have a 9 percent lower rate. Therefore, while job creation stopped in each type of firm, job destruction varies to a large extent. One possible explanation to this phenomenon is that foreign firms are more dynamic, reacting faster to changes in product demand, while state-owned firms are either less responsive or they deliberately keep their workforce for political reasons.

One possible caveat of the ownership-net growth analysis is that perhaps firms under different ownership types face different output demand conditions. For example, it is likely that among foreign-owned firms there are relatively more exporters which suffer from the dropping export demand. To test for this possibility, we run the regressions by including both the ownership and export status dummy (not presented but available upon request). When both the exporting status and ownership is added to the regression, results do not change qualitatively, except that net employment growth associated with foreign ownership drops. The estimated coefficient of the foreign ownership dummy is 0.027 (significant) and the crisis dummy interaction turns negative (-0.032, insignificant).

The last question we address in this section is whether employment growth before the crisis is correlated with employment growth thereafter. To study this issue, we run regressions similar to those described above, but we add two dummy variables which show whether the firm's net employment growth was positive or negative between 2007 and 2008 (the comparison group is the set of firms which did not grow). We run the regression only on the data from 2009 from which we exclude new entrants. The estimated coefficients for the firms growing/shrinking before the crisis is -0.074/-0.130. Thus, these results provide some evidence that the highest growth rate is attributed to those firms which had a stable employment. We also run similar regressions with including last year's growth as a continuous variable. The estimated coefficient is negative (insignificant) of the magnitude of -0.05. This indicates that a 10 percent higher growth rate in 2008 induces a 0.5 percent lower growth rate during the crisis.

5.3 THE RELATION BETWEEN FIRM SIZE AND NET JOB CREATION

Did the crisis change the relation between firm size and net job creation? To test whether this relation was not changed in the crisis years, we run similar regressions to those in Section 4 (the results are shown in Figure 14). If size is measured by base size, the relation suggested by Birch (1981) still holds. The smallest firms have a positive net employment growth rate of 21.6 percent, followed by the second size category of 2.5 percent while larger firms' net employment creation is practically zero. If the size categories are measured by current size, the relationship still holds, but it is much

weaker. If in the base size regression age dummies are added, the relationship still weakens. Finally, current size categorization of firms and age dummies reverse the age-net job creation relationship: in this case the smallest firms have a negative job creation rate equal to 0.094, the next three size categories have small, but negative coefficients while staring with firms with employment above 50 the relation is negative, and mostly increasing with size.

6. CONCLUSIONS AND POLICY IMPLICATIONS

For Hungary and many other countries emerging from crisis and recession, job creation is an urgent priority. But where should policy makers look for the types of firms most likely to contribute to job creation? A frequent target group of firms for governments around the world has been small and micro businesses, usually in the form of small or micro business loans or loan guarantees, and sometimes also in the form of technical assistance. Other types of industrial and regional policies may target particular sectors under a similar premise that those are "where the jobs are."

Scholars have also displayed consideration interest in firm growth, and the length of the literature on the topic testifies both to that interest and to the considerable methodological difficulties in locating sources of employment. Those difficulties have resulted in an inconclusive debate about issues such as the advisability of special programs for small businesses, for instance. One particular difficulty that is prominent throughout all the early research stems from a lack of attention to, and measurement of, firm age. Yet it only requires a little reflection to realize that age may be an important confounding factor. To the extent that firms have life cycles and early developmental phases, size is likely to be strongly concave in age, with growth rates monotonically declining for survivors. Moreover, age and size are highly, but not perfectly correlated: most start-ups and young firms are small, but the reverse proposition (that small firms are young) is not true. Thus, policies targeted towards all small firms risks wasting resources that could been better focused and thus had a stronger impact. Indeed, this is the finding in recent research for the U.S., as we have discussed.

Probably because of the absence of data on firm age, this finding has yet to be replicated in other economies, and no automatic extrapolation is possible. The U.S. may

well have sufficiently different institutions, policies, and industrial structures that the patterns of employment growth differ substantially from other countries, including Hungary. Out of concern for job creation in Hungary, therefore, this study has focused on the size- and age-related sources of job creation in Hungary.

To do so, we have analyzed some remarkable data covering the universe of registered tax-paying legal entities (engaged in double-sided book-keeping) for Hungary from 2000 to 2008. These data permit us not only to track the evolution of employment at existing firms that continue from one year to the next but also to assess the importance of firm turnover - entry and exit - in job creation and destruction. Many studies of firm growth, particularly those relying on samples rather than a universe, are unable to take these into account.

The results from the analysis for Hungary in the 21st century bear a close resemblance to those reported for the U.S. While in the raw statistics, firm size is strongly negatively associated with growth, once we include controls for firm age, the size-growth relationship disappears. Rather, the only group that engages in systematic net job creation are the entrants (start-ups) and young firms.

Taken at face value, this analysis suggests one should maintain some skepticism about industrial policies targeted on the basis of firm size. It also suggests that policies particularly relevant for start-ups and young firms - that is policies affecting entry and initial growth - may deserve particular attention.

Although these conclusions should be treated as highly preliminary, it is somewhat reassuring that the pattern of empirical results (and their policy implications) is consistent with the finding from a very different economy. But further analysis is certainly warranted. Moreover, the preliminary analysis opens up the possibility of future research in several directions. A first direction would be to extend the agenda to consider not only size and age, but also ownership of the firm, particularly foreign versus domestic ownership. Estimating ownership effects presents an additional econometric problem because of the potential for reverse causality between growth and ownership, as discussed above. To address this issue, future work can exploit the large sample sizes and long panels in the data to estimate firm fixed effect and random growth regressions within industry-year cells (as in Brown et al., 2006, 2010). When the focus is on the question of job creation by domestic versus foreign-owned firms, the most credible identification strategy is to restrict attention to foreign acquisitions of domestic firms and to match carefully on pre-acquisition characteristics (including the history of the

outcome variable) to select one or more control groups (e.g., Imbens and Wooldridge, 2009). One the matched groups are selected, then panel regression estimates can further use the longitudinal structure of the data to identify causal effects.

A further extension of the existing literature would be to go beyond analysis of the number of jobs to consider the quality of jobs created. Although there are many aspects of jobs, such as types of working conditions, that are difficult to measure, we propose to focus on two dimensions that are both relatively measureable and represent important components in conventional understanding of "good jobs": compensation and persistence. The degree to which a firm is creating well-paying jobs can be captured by its wages and its total labor costs – as a measure of total compensation, including benefits, from the perspective of firm costs. The degree to which firms are creating secure jobs can be proxied by the extent to which the jobs survive for some period after their creation.

Both of these extensions can be readily incorporated into the regression framework outlined above. Redefining y_{it} as the growth in the wage bill, or in total labor costs, the estimates of β, α, and θ provide information on the extent to which the growth in well-paid jobs is associated with smaller or larger size, younger or older age, or domestic or foreign ownership. Similarly, redefining y_{it} as the number of jobs created in year t that survive until year $t+k$, the estimates of β, α, and θ provide information on the extent to which the growth in stable jobs is associated with smaller or larger size, younger or older age, or domestic or foreign ownership.[14] Of course, both of these dimensions of job quality can be combined into a single index where y_{it} represents, for instance, the growth in the real wage bill in year t that survives until year $t+k$.

As a final extension, we propose to investigate the extent to which the size, age, and ownership patterns in job creation vary with aggregate shocks. For instance, small and young firms may exhibit more volatile employment behavior depending on the state of aggregate or industry demand. Understanding this variation can aid policy design over the business cycle and in response to shocks such as the recent financial crisis.

[14] The length of the period examined can be varied to capture different horizons of job security (perhaps up to 5 years). The basic method of measuring job creation persistence is taken from Davis et al. (1996, p. 191).

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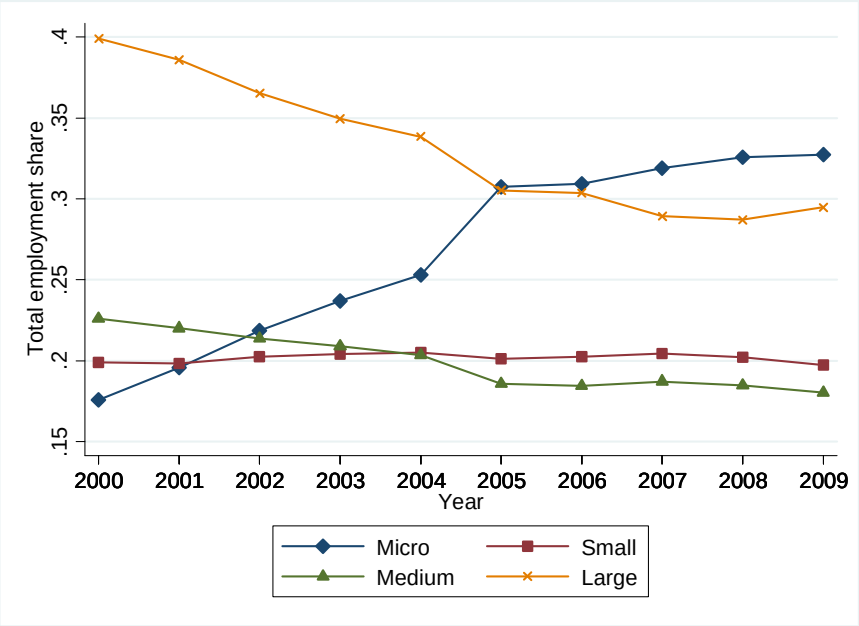
FIGURES AND TABLES

Figure 1

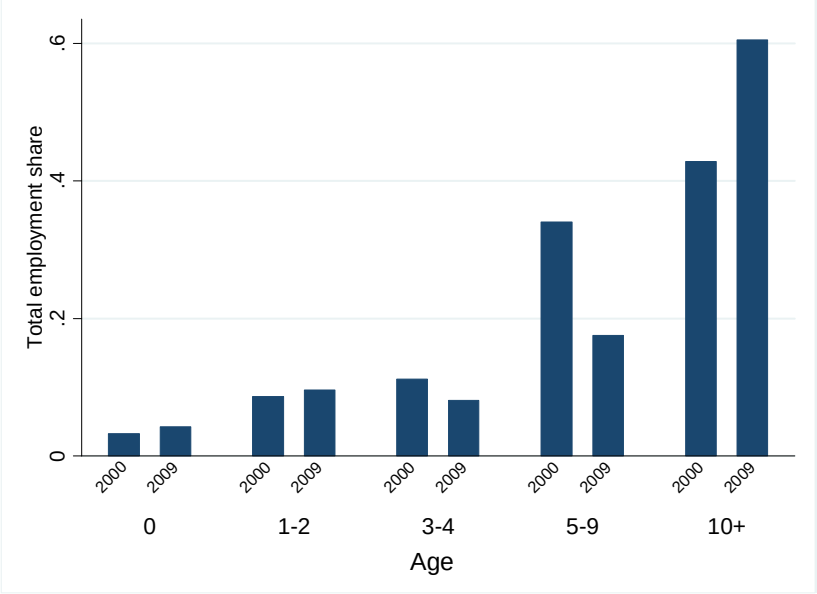
Total Employment Share by Firm Size



Notes: N = 2,902,680, micro: 1-10, small: 11-50, medium: 51-250, large: 251+

Figure 2

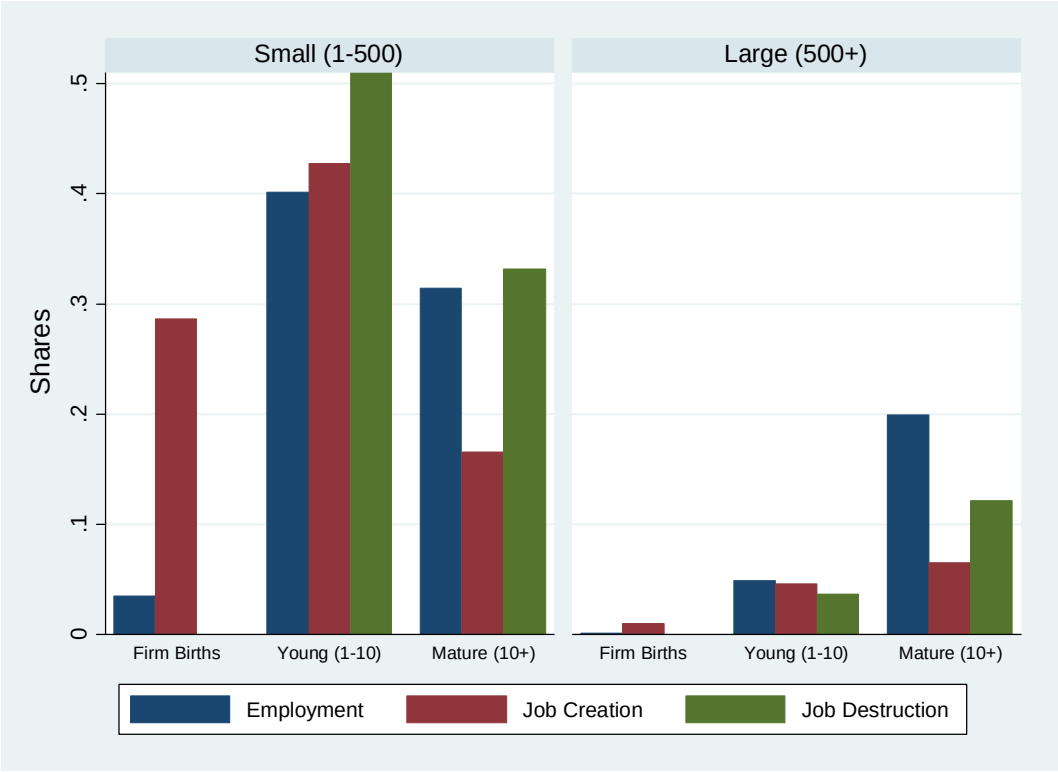
Total Employment Share by Age



Notes: N= 2,902,680

Figure 3

Shares of Employment, Job Creation and Destruction by Broad Firm (Current) Size and Age Classes – Annual Average Rates 2001-2008

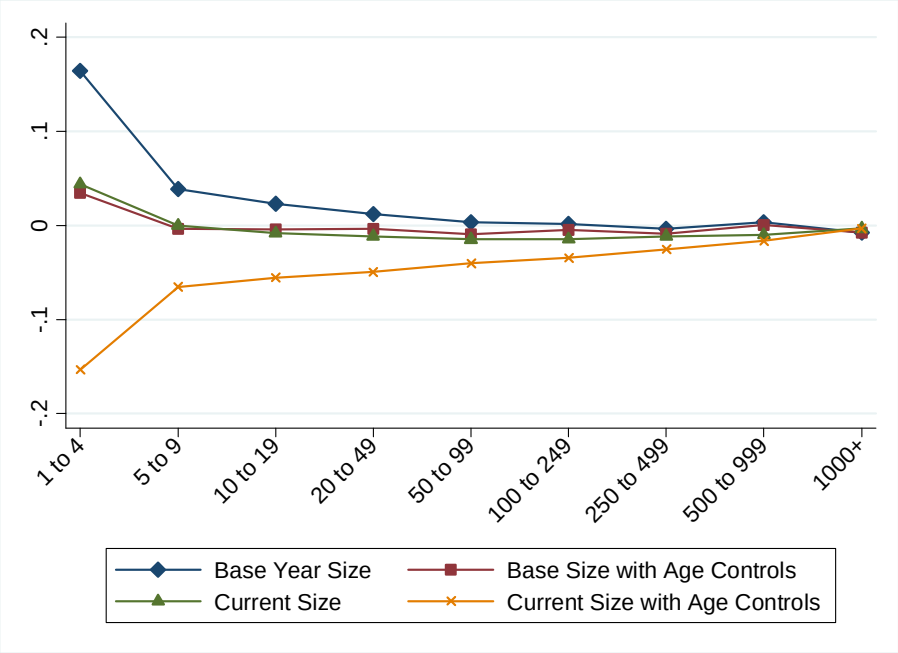


Notes: N= 2,751,419

Figure 4

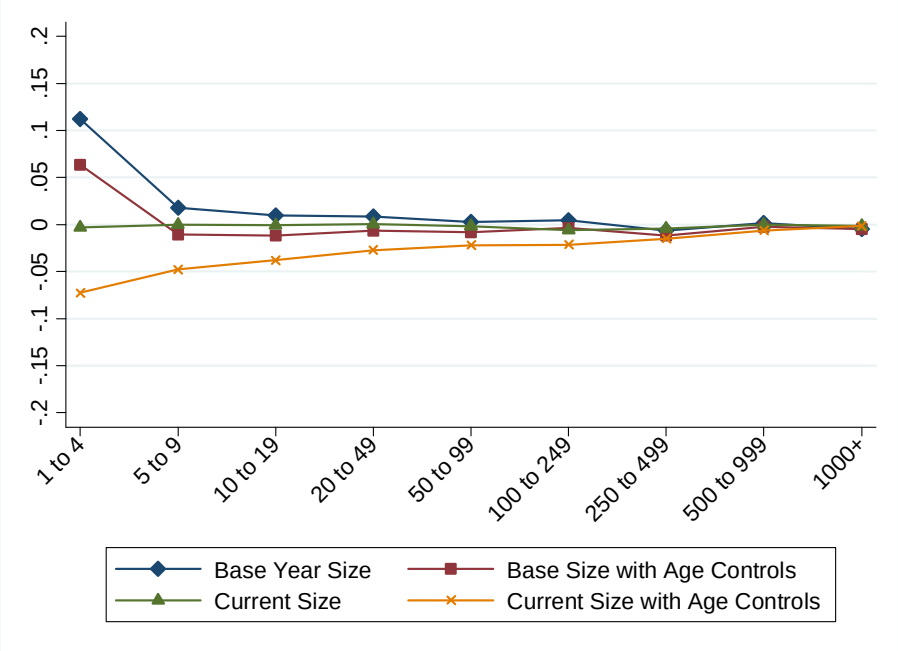
The Relationship between Net Growth and Firm Size

Panel A: All Firms



Notes: N= 2,751,419

Panel B: Continuing Firms

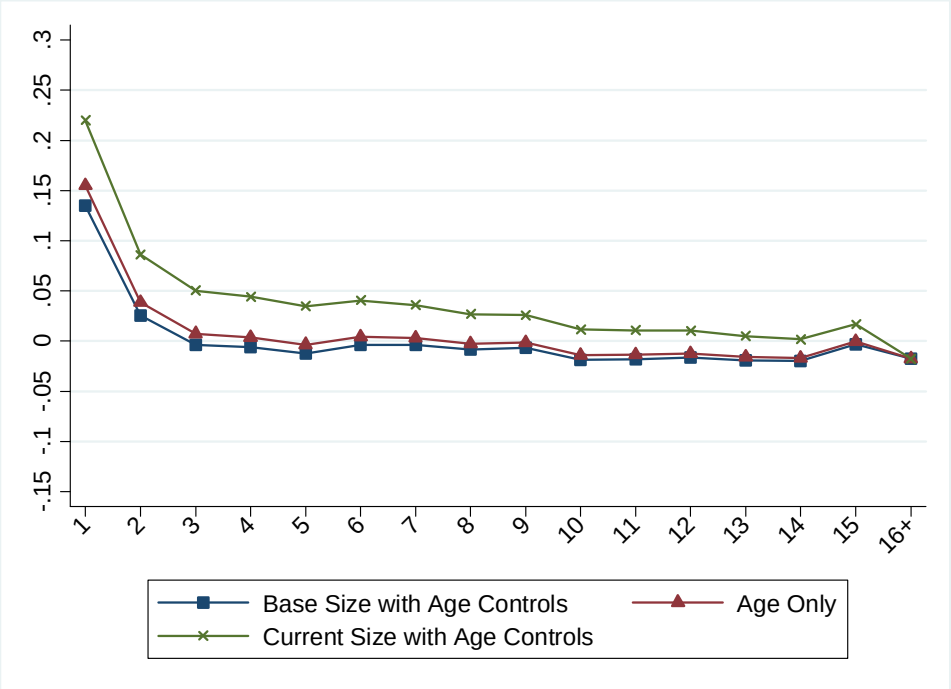


Notes: N= 2,251,430

Figure 5

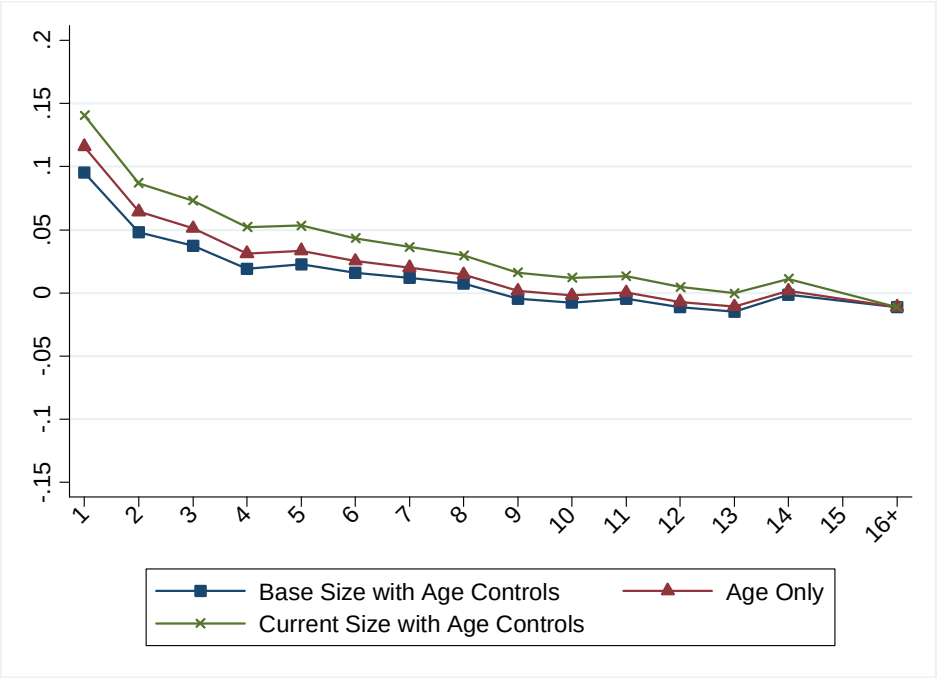
The Relationship between Net Employment Growth and Firm Age

Panel A: All Firms



Notes: N= 2,751,419

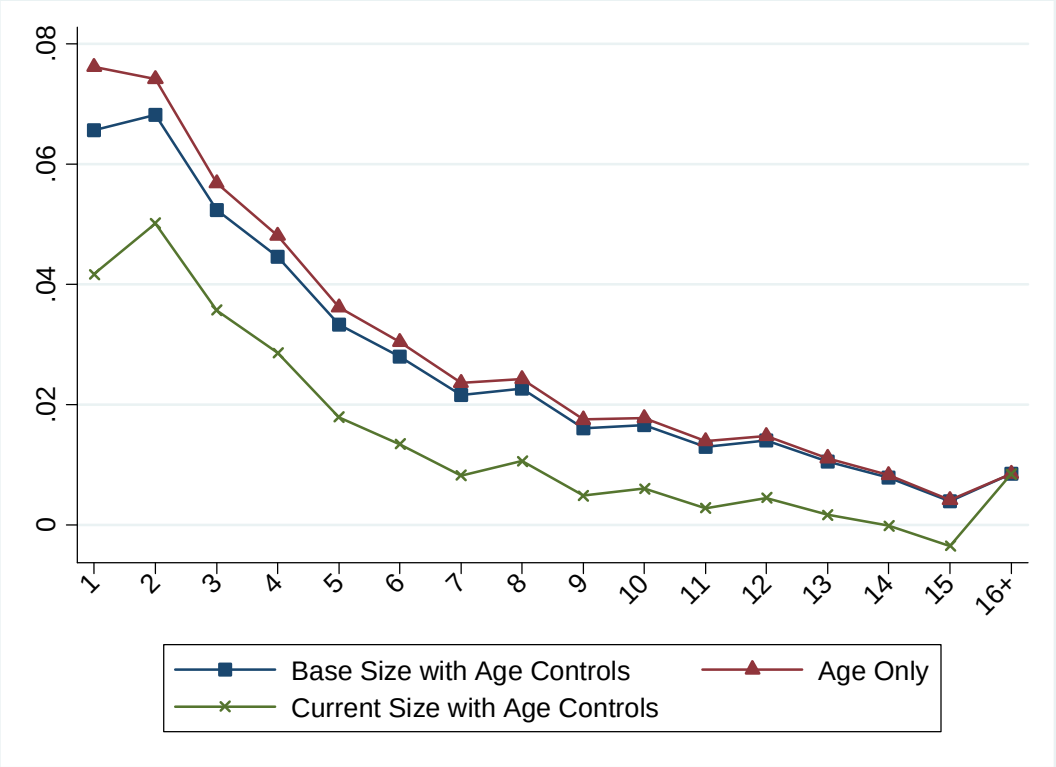
Panel B: Continuing Firms



Notes: N= 2,251,430

Figure 6

Firm Exit by Firm Age

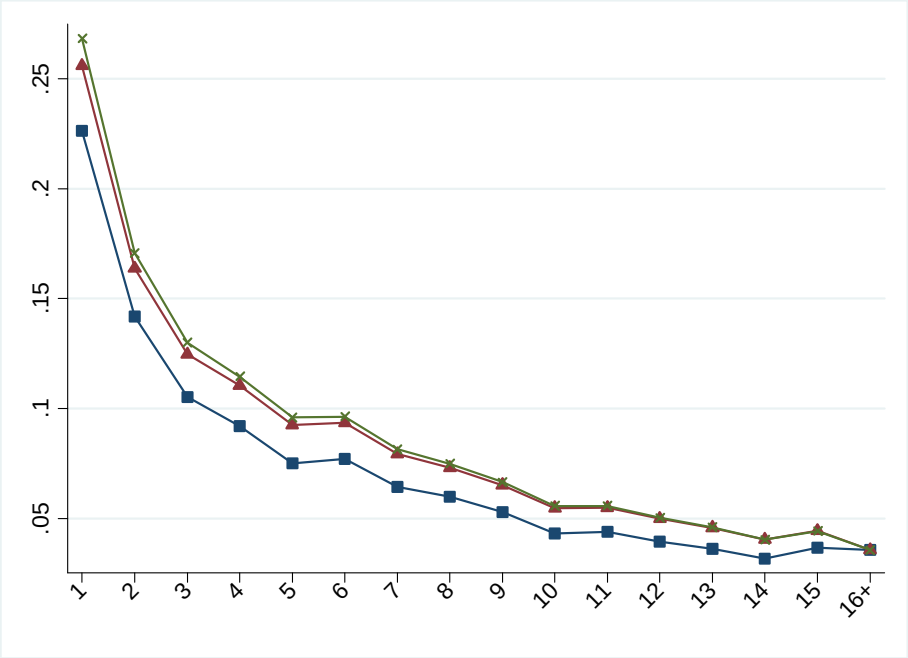


Notes: N= 2,751,419

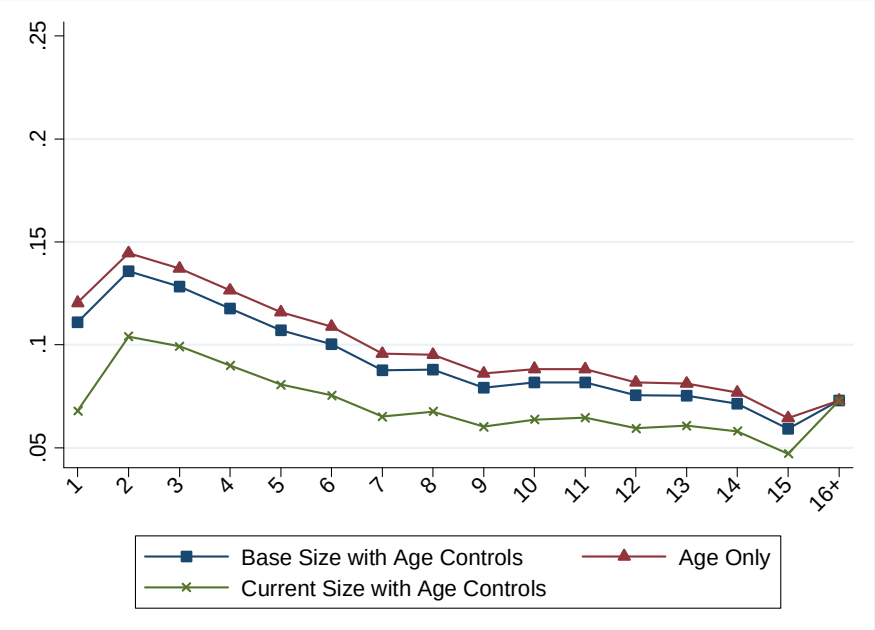
Figure 7

Job Creation and Job Destruction by Firm Age

Panel A: Job Creation



Panel B: Job Destruction

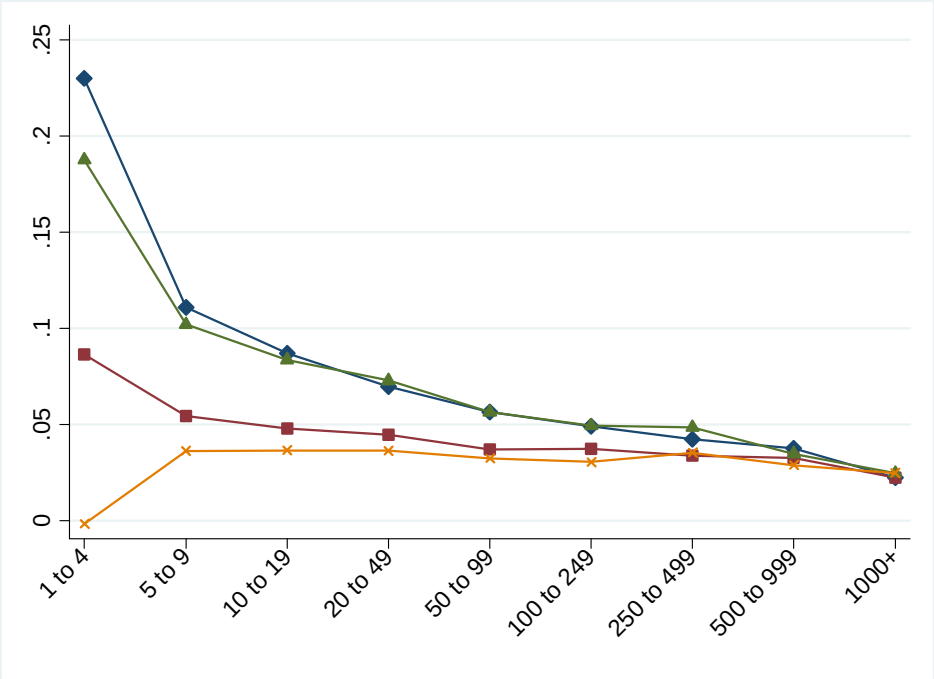


Notes: N= 2,751,419

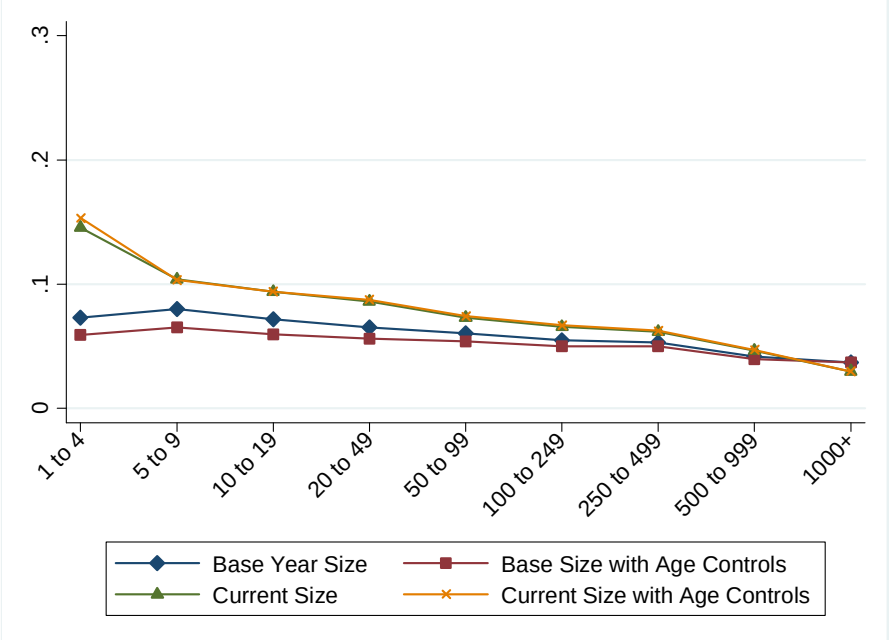
Figure 8

Job Creation and Job Destruction by Firm Size

Panel A: Job Creation



Panel B: Job Destruction

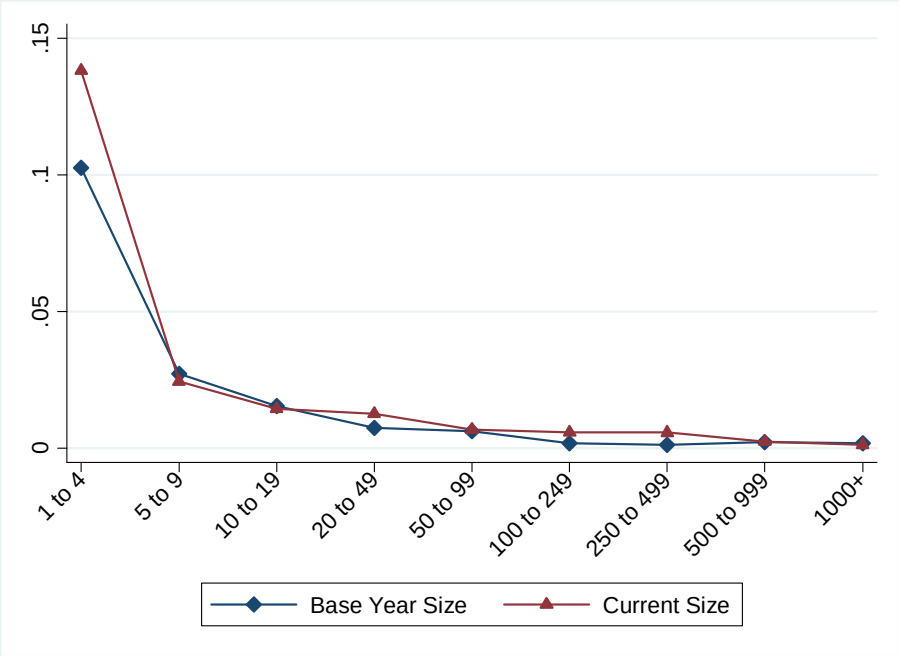


Notes: N= 2,751,419

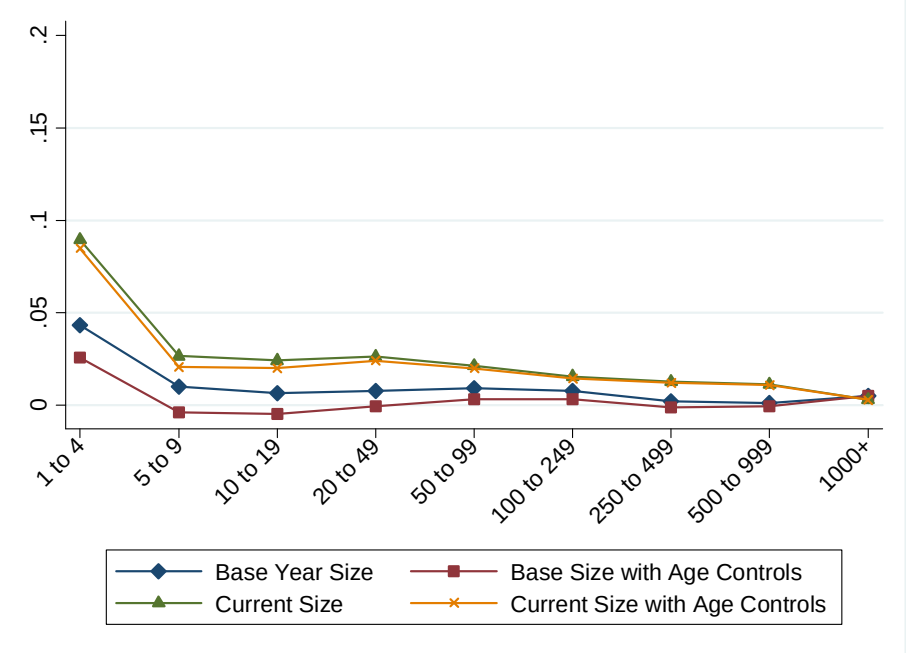
Figure 9

Firm Entry and Exit by Firm Size

Panel A: Job Creation from Firm Entry by Firm Size



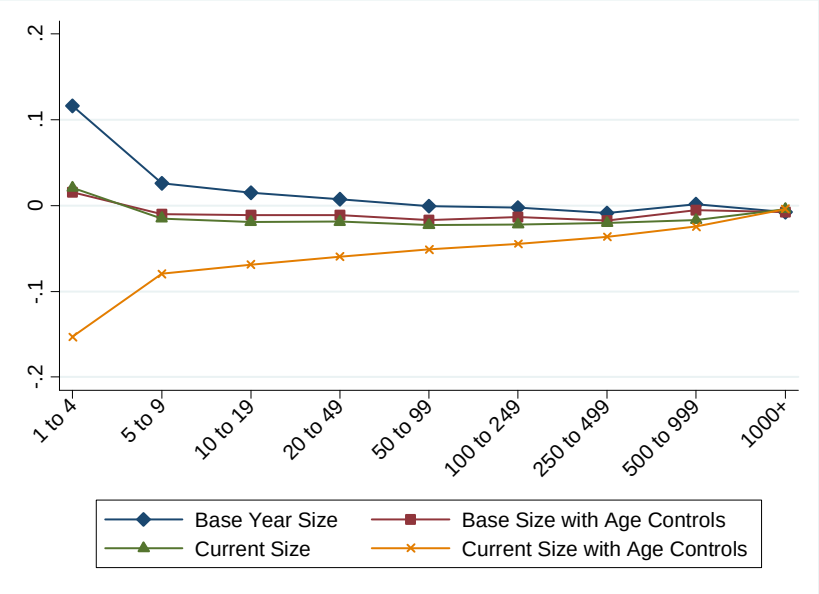
Panel B: Job Destruction from Firm Exit by Firm Size



Notes: N= 2,751,419

Figure 10

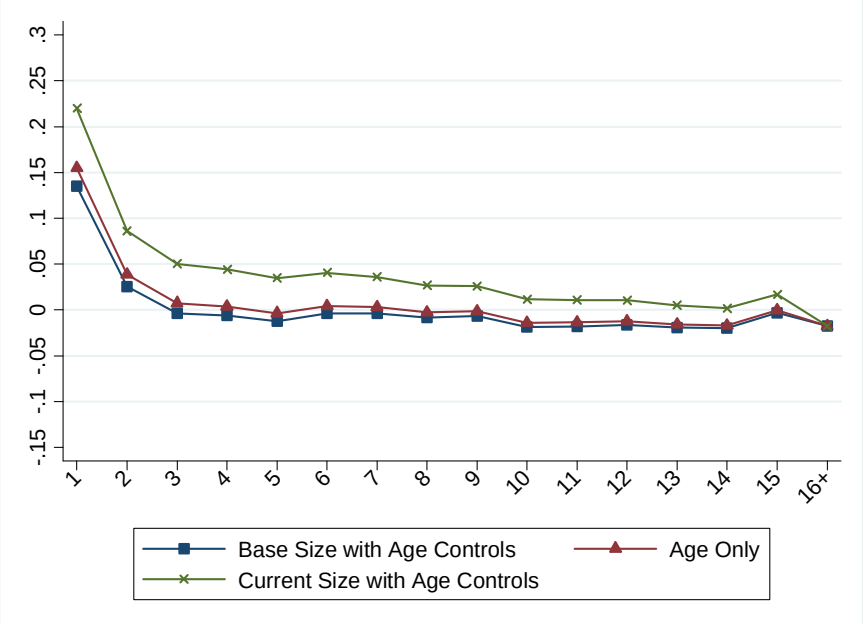
The Relationship between Persistent Net Growth and Firm Size



Notes: N= 2,358,307

Figure 11

The Relationship between Persistent Net Employment Growth and Firm Age

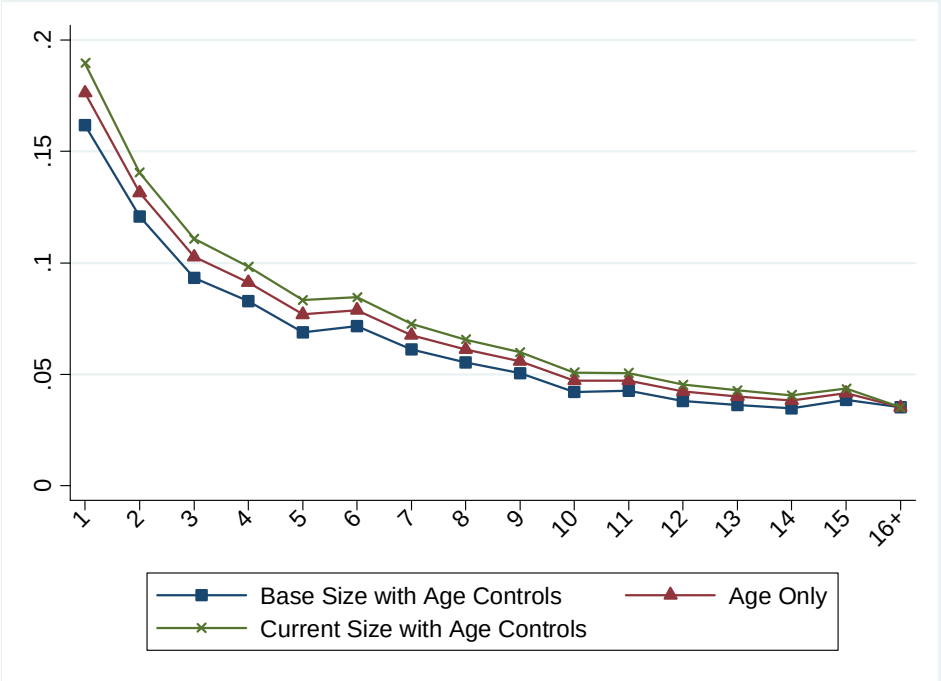


Notes: N= 2,358,307

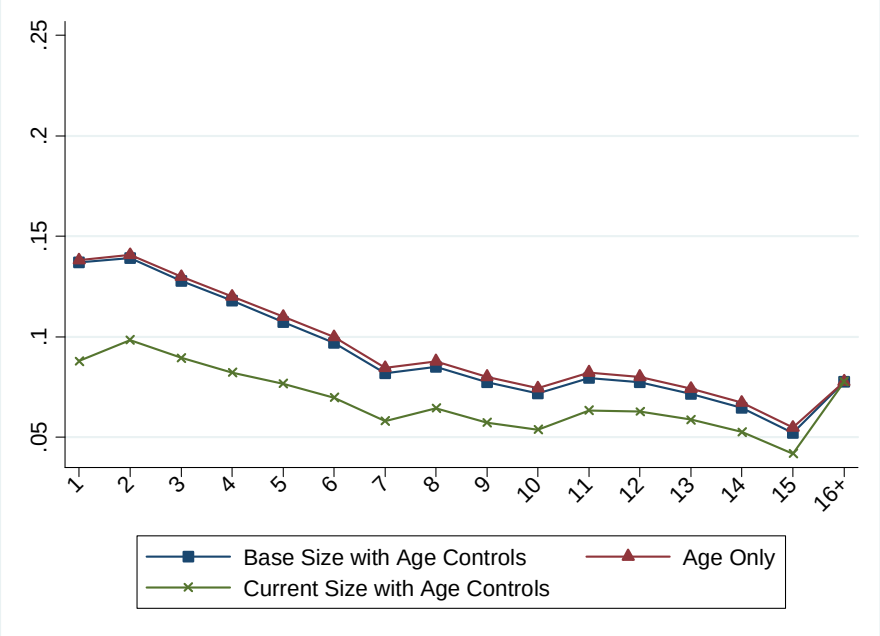
Figure 12

Persistent Job Creation and Job Destruction by Firm Age

Panel A: Job Creation



Panel B: Job Destruction

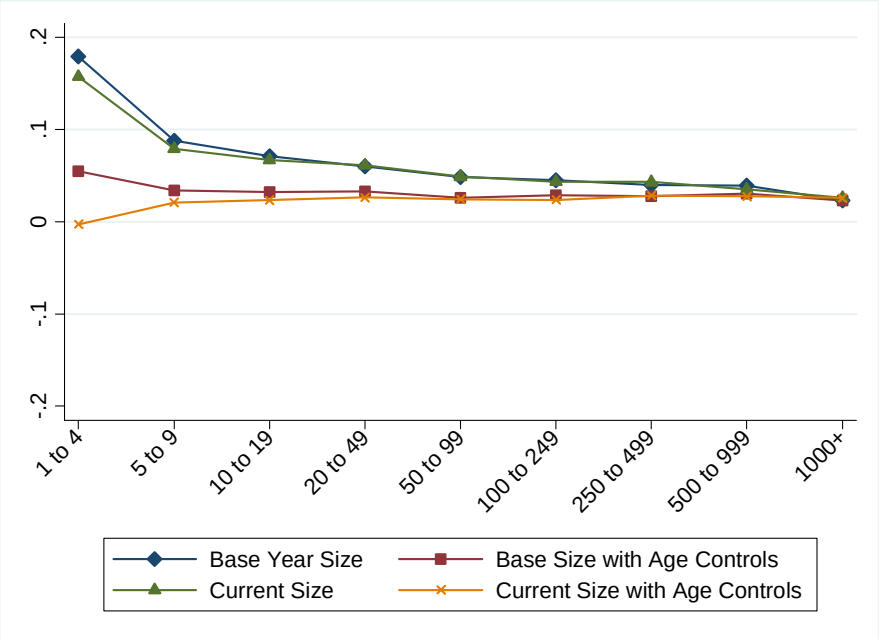


N = 2,358,307

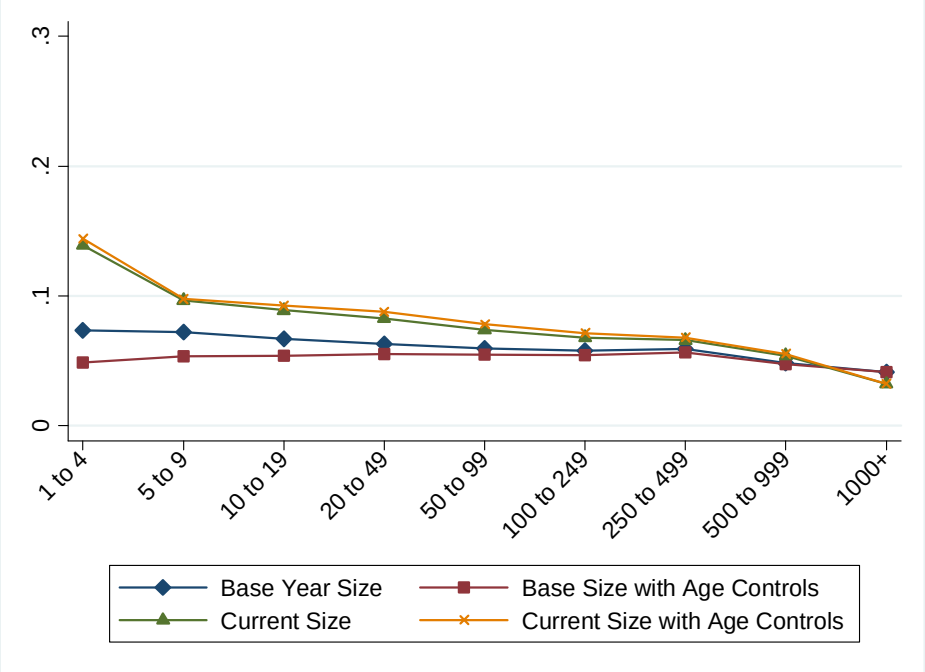
Figure 13

Persistent Job Creation and Job Destruction by Firm Size

Panel A: Job Creation



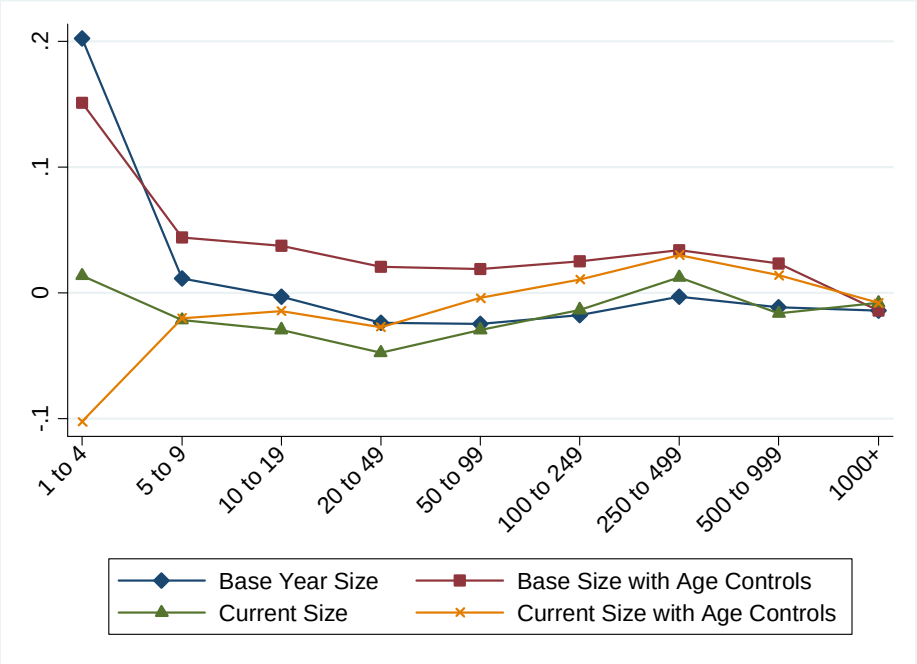
Panel B: Job Destruction



Notes: N= 2,358,307

Figure 14

Relationship between Net Job Creation and Firm Size during the Crisis



Notes: N = 378,754