Employment adjustment in the global crisis

Differences between domestic, foreign and state-owned enterprises

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Abstract

This paper analyzes the employment adjustment of domestic, foreign and state-owned companies before and during the global crisis. Using Hungarian firm-level data for the period between 2006 and 2012 and matching foreign and state-owned firms to domestic enterprises by industry and employment, it finds that the net job creation rate is similar in domestic and state-owned firms while it is larger by 3.5 percent in foreign-owned enterprises before the crisis. Domestic and foreign-owned firms react to the crisis in very similar fashion by dropping net job creation by about 4 percentage points. Contrary to this behaviour, state-owned enterprises do not decrease net job creation in some, and increase it by 3.5-6 percent in other regressions.

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1. Introduction

The divergent response of businesses to fluctuations in product demand has been of interest in the past decades and the great recession that started in 2008 has fostered new research in this area. Papers analyzed the divergent nature of job creation and destruction over the business cycle (Foster et al., 2016), the relationship between net job growth and firm size (Moscarini and Postel-Vinay, 2012), and the combined effects of firm size and age (Fort et al., 2013). The purpose of this paper is to add another important firm characteristic to these analyses and study the effects of the type of owner on the employment adjustment process: does it differ between firms owned by domestic owners, foreign investors and the State? We study Hungary, a country which is particularly suitable for such analysis as both foreigners and the State are among the important owners of commercial enterprises: as a legacy of state socialism, there are still many firms owned by the State, and during the 1990s the large inflow of foreign capital resulted in massive penetration of foreign ownership. The question, however, is of interest for the Central and East-European economies in general, as the large number of state-owned enterprises (SOEs) is typical for the whole region and foreign ownership is also quite widespread. As the Hungarian level of development and its institutions are similar to the other countries from the region (European Bank for Reconstruction and Development (EBRD), 2012), the results of this analysis may also apply to those countries if the grade of development and institutions determine the employment adjustment of firms. Moreover, the results may also apply to SOEs and foreign firms in more developed and developing economies where the question cannot be studied because of the small number of SOEs and comparable domestic firms.

In this paper, I focus on the years before and during the recession – (2006–2012) which hit Hungary at the end of 2008, as Figure 1 shows. The unemployment rate increased by 4 percentage points during 2009 and 2010 and gross domestic product (GDP) fell by 7 percent in the first year of the crisis. The analysis therefore explores how SOEs, domestic companies and foreign enterprises adjust their employment in the presence of a large negative demand shock.

To study the impact of ownership on employment adjustment, I follow the job flow literature (Davis and Haltiwanger, 1999) and compute average job flow rates.

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2 The effects of the business cycle on employment adjustment in Central and Eastern Europe were studied in a symposium published by the *Economics of Transition* (summarized by Haltiwanger et al., 2003). A thorough search of the literature did not result in any papers studying the heterogeneity of employment adjustment by ownership type in the presence of product demand fluctuations.

3 As the analysis of the Organization of Economic Development and Cooperation shows, the State is among the large employers in many countries (OECD 2014).
(net job creation, job creation and destruction) before and during the crisis separately by owner type while controlling for firm characteristics which may be correlated with employment adjustment. Because firms under the three ownership categories are rather different in their characteristics and, despite the control variables, the results may reflect these differences rather than ownership effects, I construct domestic-foreign and domestic-state samples where I match firms by industry and size to compare firms of similar attributes.

The results show that domestic- and foreign-owned firms followed similar adjustment paths and shed labour in the recession: the estimates are situated in a narrow range between $-4.3$ and $-5.4$ percent. SOEs, however, had a very different adjustment pattern. I find no evidence of net employment declines during the crisis. If anything, SOEs increased their employment by a few percentage points both relative to their own pre-crisis levels and to both types of private enterprises during the recession. This result does not change if the sample is split into large and small enterprises; but in the small firm sample, SOEs do not change their employment (and domestic firms decrease it) while large SOEs increase net job creation in the crisis.

A potential mechanism for keeping a firm’s workforce is to trade-off wages for employment and reduce the wages to avoid lay-offs. We find that the average wage

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Figure 1. Macroeconomic indicators

Source: Hungarian Central Statistical Office. GDP growth and the unemployment rate measured in percent.

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4 On wage fluctuations around the business cycle, see, for example, Carnerio et al. (2012) and Elsby et al. (2016).
cost of SOEs decreased more than that of domestic companies, suggesting that politicians controlling SOEs did consider this trade-off in the hard times of the crisis.

The structure of the paper is the following. In the next section, I discuss employment adjustment along the business cycle. Then I present the comprehensive firm-level data and the descriptive statistics, which show the divergent patterns of restructuring employment of private and state-owned enterprises. The methodology section presents the regression framework and the details of the matching. The next section presents the full and matched sample results. The last section concludes.

2. Firm-level employment dynamics and the business cycle

It is natural that on average, firms expand in good times and contract when the business environment is unfavourable. The research into the relationship between firm-level employment dynamics and the business cycle go beyond this simple relationship and analyzes the cyclicity of gross, instead of net, flows and the effects of firm characteristics on gross and net job flows.

A typical pattern of the cyclicity of gross flows is that job creation tends to be less volatile than job destruction (Davis and Haltiwanger, 1999), at least this was found in the data before the last recession. In a recent paper, Foster et al. (2016) show that this pattern changed such that job creation was much lower, and job destruction relatively higher than in earlier recessions, which may be caused by the differential reaction of firms of various size and age to the crisis. As Fort et al. (2013) discuss, young and small firms are the most vulnerable to financial shocks, because the credit crunch and the fall of real estate prices affects this category the most. These businesses cannot issue corporate bonds and they mostly rely on personal wealth (such as real estate) to use it as collateral for loans. If the value of such assets declines, small and young firms cannot finance their activity and shed more labour than similarly small but older, or large enterprises.

Employment size can also be correlated with adjustment behaviour through another channel. Moscarini and Postel-Vinay (2012) find that small and large businesses’ net employment growth is dissimilar in periods with high and low unemployment. The reason for this asymmetry lies in the wage differential of small and large firms: large enterprises are usually more productive than small firms, and pay higher wages. When unemployment is low, large firms poach workers from small enterprises as the latter cannot keep up with the high wages offered. On the contrary, when unemployment is high, large firms shed labour (since they built up a stock in good times, they can fire workers more easily than small firms which were employment constrained) and the difference between small and large firms declines. Therefore, at the end of a recession, when unemployment is high, large firms

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5 Given the vast size of this literature, this section discusses only its main findings and many relevant papers are not cited.
destroy proportionally more jobs than small enterprises while at the end of an expansion, when unemployment is low, they create relatively more jobs.

Another feature that may affect the adjustment of firms is international trade. Firms engaged in importing and exporting activities are more vulnerable to exchange rate fluctuations and to shocks affecting international demand (Nucci and Pozzolo, 2010). Finally, the economic activity of firms (mostly defined as manufacturing and services) also affects the adjustment behaviour (see Davis and Haltiwanger, 1999 for a summary).

Is Hungary a typical country in terms of job creation and destruction? Brown and Earle (2008) compute job creation and destruction rates for a large number of transitional countries for a long time period and find that Hungary had very large rates in early transition but later it exhibited rates around 10–12 percent, which is similar to rates found in other countries. Haltiwanger et al. (2014) study a large set of countries with data from the 1990s and also find that the Hungarian job reallocation rate (the sum of job creation and destruction rates) is similar to the rate measured in other countries. Hungary, in this respect, is not an outlier but has typical behaviour.

The purpose of this paper is to study how firms under domestic private, foreign and state ownership react to the great recession. Ownership is indeed a firm characteristic which alters firm behaviour along many dimensions, such as firm efficiency, employment and wages. With respect to employment adjustment over the business cycle, firms controlled by the state may choose a different adjustment path for differences in their costs and rewards of the state bureaucrats who control the firm. First, it is likely that they are less motivated to maximize profits than the owners of private firms; while private owners not only have the residual control rights but also the right to receive the residual cash flow of the company. For SOEs, this is divided between the state bureaucrat and the treasury. The bureaucrats bear all the cost associated with efforts to control the SOE but their remuneration is rarely linked to firm performance. In addition, the State usually cannot commit itself not to subsidize the companies under its management in hard times (Sappington and Stiglitz, 1987), nor to not expropriate the benefits of innovations made by the management (Hart et al., 1997). These commitment problems create lack of incentive among managers to put an optimal level of effort into the operation of the enterprise. There is also some empirical evidence that another scheme of motivation, incentive payments, is also less used in SOEs (Conyon and He, 2011; Firth et al., 2006). Therefore, one can expect that SOEs are more sluggish in responding to the changing business environment than private companies.

6 Estrin et al. (2009) provide a synthesis of the privatization effects in transition economies. Brown et al. (2010) study the employment and wage effects of privatization takeovers by domestic and foreign investors. Arnold and Javorcik (2009) and Hagemejer and Tyrowicz (2012) show the productivity effects of foreign acquisitions while Earle et al. (forthcoming) present evidence of wage differentials between foreign and domestic enterprises.
Another reason for a different adjustment pattern of SOEs relative to privately owned companies is that SOEs may be used by the controlling politicians to enjoy various forms of private benefits. SOEs may be considered a vehicle to maximize votes through higher levels of employment and wages (Boycko et al., 1996; Shleifer and Vishny, 1994). In addition, politicians facing high unemployment levels in the recession probably do not want to further aggravate the already dismal labour market situation by laying off workers from SOEs. The nomination of managers of SOEs can also be motivated by political, rather than economic, reasons. Supporters of election campaigns, for example, may be rewarded by well-paying and prestigious managerial jobs in SOEs but these people are not necessarily capable managers.

Turning to foreign-owned firms, these may also behave differently from domestic enterprises; if the management has more expertise, they may adjust employment faster to the new demand conditions. If, on the other hand, they have more funds available to survive in bad times, they may fire fewer workers to save on the fixed costs of firing and subsequent hiring in the future.

In conclusion, it is likely that SOEs react more sluggishly to the economic crisis than domestic private companies, both due to low-powered incentives and political motivations or social sensitivity. The behaviour of foreign-owned firms, on the other hand, is less clear and is inherently an empirical question.

There are no empirical papers which deal with the relationship between the business cycle and the ownership type of enterprise. Several papers, however, study job flows in transition countries and some look at differences across ownership types. Konings (1997) finds that SOEs have lower net job creation rates in Romania, Bulgaria and Hungary than private firms. Brown and Earle (2003) find that new firms have higher growth rates than state-owned and privatized firms in Russia while Konings et al. (2003) establish that Ukrainian state-owned and privatized firms have similar job flow rates but de novo enterprises are associated with higher job flows. Faggio and Konings (2003) study five transition countries and find that relative to domestic private companies, foreign-owned firms have larger, and SOEs lower, gross and net flows.

3. Data and descriptive statistics

The host of the data used in this paper is the National Tax and Customs Administration of Hungary. These data are available annually for all firms engaged in double-entry bookkeeping, comprising almost all limited liability companies and about 80 percent of partnerships. In this paper, I use the waves between 2006 and 2012. The most important variable used is average employment, which equals the average of monthly employment figures in a given year. Monthly employment is computed as the average of daily employment divided by the number of working days in the month. If the firm operates in only a part of the year, months of inactivity should enter the average as zero employment. Other variables used are the wage bill...
(including all the costs associated with employment), the total value of sales and value of sales from exporting activities, the year of foundation, two-digit industry classification, and the share capital owned by domestic entities, foreign entities and the state (including both the ownership of the central government and local administrations).\textsuperscript{7}

These data were cleaned thoroughly. We checked the ownership information for miscoding and dubious changes. To decrease spurious entry and exit, we cleaned the longitudinal linkages: if a firm exited the database but re-registered the next year under a new firm identification number, we linked these two entries in time.\textsuperscript{8} We also cleaned unbelievable data entries for employment.\textsuperscript{9} These procedures affected only a small proportion of all data points.

I use year of foundation to construct an age variable of the firm. If the firm is ever state-owned (so the share capital owned by the state is larger than 0), the foundation date is set to 1989 as there are very few newly established SOEs after the fall of the socialist regime.

We drop from the data the economic sectors of education, health and public administration, as enterprises from these categories tend to be very different across ownership categories.\textsuperscript{10} The resulting data have 235,000 firms in 2006, which gradually increases to 337,000 by the end of the studied period. Figure 2 shows the evolution of the total employment of these enterprises. Before the great recession, total employment was more than 2.2 million, which fell in 2009 by more than 100,000 and it remained quite stable thereafter. In the last year of the analysis, when GDP shrank again, there was another, shallower drop in employment. The figure also shows the evolution of corporate employment (data obtained from the Central Statistical Office website). The official data comprise fewer jobs than our data as the official sample has firms with at least five employees, but the dynamics of the two figures are remarkably similar. When I restrict the our data to firms with at least five employees, the two figures become practically identical.

I classify a firm as private if the state controls only a minority of its share capital; otherwise, it is state-owned. A firm is foreign-owned if it is private and foreigners’ ownership share is larger than the possession of domestic private entities. This definition has the advantage of classifying each firm into exactly one ownership type; its disadvantage is that some firms can be classified into a category with a minority of shares owned by the given owner type. In reality, this almost never happens.

\textsuperscript{7} Note that the data do not include the public sector organizations subordinated to ministries (like hospitals, schools and ministries).
\textsuperscript{8} To complete this procedure, we used the Hungarian Company Court data which provide information on re-registration and boundary changes.
\textsuperscript{9} If the value of the variable increased (decreased) at least eight times and then decreased (increased) back, we set the middle year’s value to the average value of the two adjacent years. If it was the first (last) year of the firm time series, we set the first (last) year to missing.
\textsuperscript{10} For example, many domestic private firms in education are driving schools while the SOEs are firms supporting public education. The exclusion of these activities does not change the results.
Table 1 presents the total number of firms included in the analysis as well as their total and average employment by the three ownership types (the figures pertain to 2006 but all the years included in the analysis have similar descriptive

![Figure 2. Total employment in data and in official statistics](image)

Notes: The figure represents total employment in the data and in the statistics of Central Statistical Office. The data comprise all employees of Hungarian double-entry bookkeeping enterprises. The official figures refer to firms with at least five employees. Employment measured in thousands.

**Table 1. Characteristics of the sample, 2006**

|                      | Domestic | Foreign | State   | Total  |
|----------------------|----------|---------|---------|--------|
| **Firms**            |          |         |         |        |
| Number of firms      | 215,709  | 16,567  | 1,328   | 235,005|
| Percent              | 92.4     | 7.1     | 0.6     | 100.0  |
| **Employment**       |          |         |         |        |
| Total employment     | 1,433.7  | 593.0   | 215.8   | 2,242.4|
| Percent              | 64.0     | 26.4    | 9.6     | 100.0  |
| Mean employment      | 6.6      | 35.8    | 162.5   | 9.6    |
|                      | (53.1)   | (267.5) | (1,577.0)| (148.0)|
| Exporting            | 4.6      | 24.1    | 3.9     | 5.9    |
| Wage expenditure     | 2,336.0  | 5,590.9 | 4,244.0 | 3,316.8|
|                      | (2,193.4)| (4,227.3)| (2,310.0)| (3,174.2)|

Notes: ‘Percent’ refers to percent of firms/proportion of employment. Standard deviation for mean employment and wage expenditure in parentheses. Total employment measured in thousands. Exporting shows the proportion of firms engaged in exporting. Wage expenditure is weighted by the firm’s average employment and measured in thousands of 2013 HUF.
Domestic firms are the largest group with almost 216,000 enterprises with almost 1.5 million jobs. As expected, they are also the smallest with an average size of 6.6 employees. The number of foreign-owned firms is 16,600 with 593,000 jobs. The average foreign firm employs 36 workers, showing that not only large, multinational enterprises are present in Hungary but also much smaller foreign firms, many of them probably being established as a consequence of cross-border small investment. SOEs are small in number (1,328), but they are quite large with an average employment of 163. The state, therefore, is still an important owner of Hungarian corporations, providing 216,000 jobs, almost 10 percent of all jobs in the sample.

A firm is classified as an exporter if it exports at least 5 percent of its sales in a given year. According to this definition, 6 percent of firms are engaged in exporting and this proportion varies widely across ownership types. The most active exporters are foreign firms: 24 percent sell their product internationally. Among domestic firms, 4.6 percent export while this figure is 3.9 percent for SOEs. Average wages are defined as the total annual wage bill over the average number of employees, where the wage bill includes all wages and salaries, the payroll tax and in-kind benefits, and it is deflated by GDP deflators. Wages are the highest in foreign enterprises, followed by SOEs, and are the smallest in domestic firms.

The industrial distribution of firms also differs by ownership type, as Table 2 demonstrates. Domestic firms are predominantly in trade, business services, research and development-computers, manufacturing and construction.

|                     | Domestic Firms | Domestic Empl. | Foreign Firms | Foreign Empl. | State Firms | State Empl. |
|---------------------|----------------|----------------|--------------|--------------|-------------|-------------|
| Agriculture, hunting, forestry | 3.5            | 6.2            | 2.8          | 0.9          | 5.4         | 4.7         |
| Mining, energy      | 0.3            | 1.3            | 0.7          | 2.0          | 17.7        | 12.0        |
| Manufacturing       | 13.0           | 25.2           | 15.2         | 51.7         | 3.5         | 4.2         |
| Construction        | 11.9           | 11.0           | 3.2          | 1.8          | 7.7         | 1.3         |
| Trade               | 29.0           | 23.8           | 38.1         | 19.7         | 2.1         | 0.9         |
| Finance, real estate| 7.5            | 5.1            | 17.4         | 8.1          | 11.8        | 4.0         |
| Business services, R&D, computers | 20.3         | 15.0           | 12.7         | 7.9          | 11.1        | 2.9         |
| Culture, sport      | 4.4            | 2.2            | 1.8          | 1.1          | 16.0        | 5.0         |
| Waste management    | 0.3            | 0.4            | 0.3          | 0.2          | 13.1        | 6.4         |
| Transportation      | 4.7            | 4.7            | 3.8          | 4.8          | 7.5         | 57.9        |
| Other services      | 5.4            | 5.0            | 4.2          | 1.9          | 4.3         | 0.8         |
| Total               | 100.0          | 100.0          | 100.0        | 100.0        | 100.0       | 100.0       |
| N                   | 215,709        | 1,433.7        | 16,567       | 593.0        | 1,328       | 215.8       |

Notes: Firms = proportion of firms within ownership category in industry; Employment = proportion of employment within ownership category in industry.
owned companies have a higher share in trade, finance-real estate and a much lower share in construction. SOEs have a high share in culture and sports-related activities, in mining-energy and in waste management.\textsuperscript{11} The table also shows the proportion of employees within ownership category. Domestic and foreign enterprises have a large proportion of their employment in manufacturing, and SOEs are predominantly in transportation. While the main activities of firms are very different by ownership, indeed, there are nevertheless enough firms within the same two-digit industry to allow estimations with industry controls (the distribution of two-digit industries by ownership are available upon request).

Following Davis and Haltiwanger (1999), I define the firm-level net job creation rate ($g$) as the change in employment from one year to the next, divided by the average employment size between the two years:

$$g_{it} = \frac{E_{it} - E_{i,t-1}}{E}.$$

The net job creation rate in year $t$ is equal to the employment-weighted average of $g_{it}$:

$$g_{t} = \sum_{i} w_{it} g_{it},$$

where $w_{it} = E_{it}/\sum E_{it}$. The rates of job creation ($jc$) and destruction ($jd$) are defined identically but only for firms with growing/shrinking employment (and the negative changes associated with job destruction are in absolute values). The job creation (job destruction) rate of shrinking (growing) firms is set to zero.\textsuperscript{12} Figure 3 presents the average yearly rates of net and gross job flows. In 2006, when the unemployment rate was 7.5 percent and GDP grew at a 4 percent rate, the average net job creation rate was over 6 percent. The following two years, when the country was close to a recession with GDP growth close to zero and unemployment was slowly increasing, $g$ deteriorated and was close to nil. In 2009, when the global crisis hit the economy and the unemployment rate jumped to over 10 percent, $g$ reached its lowest value of $-5.6$ percent, but it recovered in the next two years to zero. As GDP shrank again in the last year of the analysis, $g$ fell to $-2.6$ percent. Turning to gross job flows, $jc$ was quite stable at 10–13 percent during the whole period. $jd$ was low in the first year (7 percent), as high as 15.6 percent in 2009 and 11–13 percent in other years.

\textsuperscript{11} To test whether the industrial distribution of firms is statistically different across ownership type, I run regressions with the dependent variable being a dummy representing an owner type and the explanatory variables two-digit NACE codes. The F-test associated with these regressions rejects that null hypothesis (that the industrial structure is not correlated with ownership) at any conventional level.

\textsuperscript{12} Some enterprises are one-person firms and therefore have no employees. To keep these in the sample and to avoid division by zero, we add 1 to all firms’ employment. This data manipulation is innocuous and does not change the regression results.
The purpose of this paper is to document the employment adjustment of firms under various owner types, and in Figure 4 I show $g$, $jc$ and $jd$ separately for domestic, foreign and state-owned enterprises. Domestic firms exhibited negative net creation rates already in 2007–2008, demonstrating that the two years before the great crisis were already quite difficult for Hungarian businesses. In the first year of the recession, $g$ fell to $-4.5$ percent and recovered to 0 in the next two years. In the last year of the analysis when GDP growth was negative again, $g$ promptly fell to almost $-4$ percent. Foreign enterprises had a similar net job creation time pattern with higher values but in the first crisis year they adjusted employment more than domestic enterprises. While the two private ownership types experienced similar adjustment patterns, SOEs behaved very differently. They had negative net job creation in the pre-crisis years which is probably the result of the efforts of the government to decrease the soaring budget deficit. When the crisis hit the economy, SOEs increased $g$ both relative to their previous values and to those measured for private companies. SOEs thus have a counter-cyclical pattern of $g$ in the studied period. The negative growth rates pre-crisis may be explained by the unfavourable economic situation in Hungary when the government introduced an austerity package to balance its budget, which could have forced SOEs to shed labour. The increasing tendency of $g$ during the crisis, however, is hard to reconcile with any simple profit maximizing behaviour and suggests that political factors – such as preserving employment during hard times – could well contribute to this behaviour.

Figure 4 also presents the two gross adjustment rates. Domestic firms’ $jc$ is quite stable at 12.5–14.5 percent. Foreign firms $jc$ is constantly falling in the sample, with a large decline (and partial recovery) in 2009. SOEs create few jobs at the beginning of the period but this variable increases in time, despite the crisis. $jd$ is the highest for
Figure 4. Job flow rates by ownership status

Note: \(N\) (firm-year) = 1,975,315 (domestic); 154,366 (foreign); 10,574 (state).
domestic companies while foreign and state-owned enterprises have quite similar rates of job destruction with the exception of 2009, when SOEs decrease \( jd \) while foreign firms increase it. It is worth contrasting the Hungarian gross job flows with those from the US: as Foster et al. (2016) report, a relatively stable \(jc\) and volatile \(jd\) was typical in recessions, but not in the last one, when \(jc\) declined a lot and did not recover for years. I find this pattern only for foreign-owned firms while domestic enterprises’ gross job flows are typical of earlier recessions in the US.

The unconditional analysis of job flows, therefore, suggests that private companies behaved as expected and shed labour during the crisis by increasing \(jd\) (and foreign companies shrinking \(jc\) as well); SOEs behaved contrary to profit maximizing behaviour and increased their net job creation rate by declining \(jd\) and increasing \(jc\) at the same time. While these unconditional rates are suggestive of different adjustment patterns between SOEs and private enterprises, they may be biased as I do not control for any firm attributes which vary by ownership and are likely to be correlated with job flows. In the following sections, I test whether this difference persists in a multivariate framework.

4. Empirical methodology

I follow the methodology developed by Davis and Haltiwanger (1999) and run regressions where the dependent variable is \(g\), \(jc\) and \(jd\) (and also the average wage) and the explanatory variables include a state and a foreign ownership dummy (the omitted category is domestic) and the interaction of all three ownership variables with a crisis dummy (which equals 1 for the period between 2009 and 2012). The regressions control for export status to partial out the effect of international demand shocks, two-digit industry effects, nine employment size controls and 11 age controls as the dependent variables are likely to be correlated with these firm characteristics, as discussed in Section 2.\(^{13}\) The estimation equation is the following:

\[
y_{it} = \alpha_0 + \alpha_F \text{Foreign}_{it} + \alpha_S \text{State}_{it} + \delta_d \text{Domestic}_{it}\text{Crisis}_t + \delta_F \text{Foreign}_{it}\text{Crisis}_t + \delta_S \text{State}_{it}\text{Crisis}_t + \alpha_2 \text{Export}_{it} + \text{Size}_{it} + \text{Industry}_{it} + \text{Age}_{it} + \epsilon_{it}. \tag{1}
\]

In this equation, \(i\) indexes firms, \(t\) indexes time, \(\epsilon_{it}\) is the error term and the regression is weighted by the average employment of two consecutive years. To attenuate the bias of standard errors due to serial correlation, I cluster on firm level. The coefficients \(\alpha_F\) and \(\alpha_S\) measure the difference in the dependent variable relative to domestically owned firms before the crisis, while \(\delta_d\), \(\delta_F\) and \(\delta_S\) measure it during the crisis for the three ownership types within export status, size, industry and firm age.

\(^{13}\) The exporter dummy equals 1 in a year if the firm exports at least 5 percent of its output. The employment categories are the following: 1–4, 5–9, 10–19, 20–49, 50–99, 100–249, 250–499, 500–999, more than 1,000. The age controls are separate dummies for each year between 0–5, and three dummies for ages 6–10, 11–15, more than 15.
Despite the presence of firm-level control variables, these regressions may be biased as firms under the control of state and private entities have very diverse industrial composition, employment size, age and net entry. If there are differences between employment adjustment of firms along these variables, the results may be biased because of the lack of a common support of these variables. To create comparable samples and to estimate the differences in employment adjustment of the three types of owners more precisely, I match SOEs and foreign-owned firms to domestic companies and run the regression on these restricted samples. I use two variables for matching: industry and employment. The large size of the control group (domestic firms) allows matching directly on these two variables rather than using propensity score matching. First I keep only those foreign (state-owned) companies which have at least one domestic pair in the same industry with identical employment. If there is no domestic firm which satisfies the employment condition, I include domestic firms with employment size in a caliper of 10 percent around the foreign (state-owned) company’s size in the same industry. If no domestic firm satisfies these conditions, the foreign (state-owned) firm is dropped from the analysis. An additional matching is done for only the domestic-state matched sample, where I keep only those firms which are more than 10 years old as the SOEs originate from the pre-transition period.

The matching procedure generally results in having few control firms for large foreign (state-owned) firms and many for the small ones. The resulting datasets have 3,900 foreign firms matched to 21,317 domestic companies, and 662 SOEs matched to 2,961 domestic control firms. Since domestic firms are more numerous in this sample than foreign firms (SOEs), I weight in the regression, the domestic firms with the inverse of the number of domestic firms matched to a foreign (state-owned) company (while also weighting the regression by employment). The standardized difference of employment between domestic and foreign firms is 0.014 and between domestic and state-owned firms is 0.03, showing that the two groups of firms have similar mean employment after the matching procedure.

In addition to establishing the average effect of domestic, foreign and state ownership on job creation, I also test whether this behaviour differs by firm size. To do this, I disaggregate the sample into small and large firms based on their average employment (the threshold being 100 employees) and run Equation (1) on these sub-samples. I also test whether firms used an alternative mechanism to decrease their employment costs which is the reduction of average wages. Again, I run the same regression as stated before but with the dependent variable being the logarithm of the average wage of the company.

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14 I use this additional weight to have comparable moments of the foreign (SOE) and domestic distributions. As a robustness check, I run the regressions without this weight and the results do not change qualitatively.

15 Imbens and Wooldridge (2009) suggest using the standardized difference, rather than the t-statistic to decide whether the control and treatment groups are similar in their matched variables as this is not sensitive to sample size. They also suggest that values under 0.25 are acceptable.
5. Results

The regression results for the full sample are shown in the top panel of Table 3. When differences in size, industry, age and exporting status are controlled for, state-owned and domestic private companies had similar net job creation rates before the crisis while foreign companies had a 3.9 percentage points faster employment growth. Both domestic and foreign enterprises start destroying jobs during the crisis at a pace of 4.3 and 5.4 percentage points relative to the pre-crisis period while SOEs

Table 3. Job flows by ownership before and during the crisis

|                      | Net job creation | Job creation | Job destruction |
|----------------------|------------------|--------------|-----------------|
| **Full sample**      |                  |              |                 |
| State                | -0.032           | -0.022*      | 0.010           |
|                      | (0.029)          | (0.012)      | (0.023)         |
| Foreign              | 0.039***         | 0.021***     | -0.019**        |
|                      | (0.010)          | (0.007)      | (0.008)         |
| Domestic × crisis    | -0.043***        | -0.010***    | 0.032***        |
|                      | (0.004)          | (0.003)      | (0.004)         |
| Foreign × crisis     | -0.054***        | -0.033***    | 0.021***        |
|                      | (0.010)          | (0.007)      | (0.005)         |
| State × crisis       | 0.050            | 0.017        | -0.033          |
|                      | (0.033)          | (0.011)      | (0.029)         |
| **Continuing firms** |                  |              |                 |
| State                | -0.040           | -0.025**     | 0.015           |
|                      | (0.028)          | (0.012)      | (0.025)         |
| Foreign              | 0.038***         | 0.020**      | -0.018***       |
|                      | (0.008)          | (0.008)      | (0.007)         |
| Domestic × crisis    | -0.017***        | -0.007*      | 0.011***        |
|                      | (0.003)          | (0.003)      | (0.003)         |
| Foreign × crisis     | -0.048***        | -0.032***    | 0.016***        |
|                      | (0.010)          | (0.008)      | (0.004)         |
| State × crisis       | 0.063**          | 0.022**      | -0.042          |
|                      | (0.032)          | (0.010)      | (0.030)         |
| **R^2**              | 0.271            | 0.577        | 0.028           |

Notes: N = 2,140,255 (full sample), 1,193,164 (continuing firms). The regressions control for export status, two-digit industries, nine employment size categories and nine age categories and are weighted by average employment. Standard errors (adjusted for clustering of firms) in parentheses. ***Significant at 0.01; **Significant at 0.05; *Significant at 0.10.
increase the bulk of jobs by 5 percentage points (but this coefficient is imprecisely estimated). These results underline the behaviour of SOEs documented with the unconditional rates: relative to domestic private companies, SOEs create over 9 percent more jobs in the crisis.

The table also presents the same specification but with $jc$ and $jd$ as dependent variables. Relative to domestic firms, SOEs have lower $jc$ and similar $jd$ while foreign enterprises have higher $jc$ and lower $jd$ before the crisis. As expected, the burst of the crisis decreases $jc$ in the two types of private firms (by 1 and 3 percentage points) and it also increases $jd$ (by 2–3 percentage points). The coefficients associated with state ownership have opposite signs than the two private firm types (but these coefficients are imprecisely estimated).

Are these results caused by the entry and exit of companies or do they survive in the sample of continuous firms? In the bottom panel I restrict the sample to firms which are in the data for the whole period of analysis. The estimated coefficients hardly change for foreign ownership, but they do for domestic private companies. The effect of the crisis on $g$ is now only $-1.7$ percentage points, suggesting that for this ownership type, net entry is an important adjustment mechanism. The estimated effect of the crisis on SOEs increases to 0.063 and it turns significant at the 5-percent level. Foreign firms’ gross flow effects do not change but for domestic firms $jd$ declines. SOEs $jc$ increases, and $jd$ declines in the crisis.

The regression results for the matched sample are presented in Table 4 and reinforce the full sample results. The domestic-foreign matched sample does not reveal differences in employment adjustment across these two ownership types, and the magnitudes of the estimated coefficients are very similar to those found in the full sample. The domestic-state matched sample results suggest that $g$ associated with domestic companies during the crisis years is very similar to the estimated effect found in the full sample but SOEs increase net job creation by 3.4 percentage points (both estimates are significant at conventional levels). This estimation suggests, therefore, that domestic and state-owned enterprises of similar activities, employment size and age, act just the opposite way in the presence of a large negative product demand shock. Domestic private companies decrease their employment adjustment, but SOEs increase it, both relative to their own pre-crisis levels and to domestic companies. The difference between domestic and state-owned companies is economically large (8 percentage points) and statistically significant. The difference in $g$ is caused by divergent job creation while job destruction is similar across the two ownership types: domestic firms decrease job creation by 2.7 while SOEs increase it by almost 4 percentage points.\textsuperscript{16}

\textsuperscript{16} The results above may be biased if some factor not accounted for in the regression analysis is correlated with ownership. One candidate for such effect may be the unionization of firms. Unfortunately, there are no data on the union coverage of firms by ownership, but the evidence on Hungarian union activity suggests that the unions are weak: Rigo (2012) finds that the regression-adjusted union–non-union wage gap was very small.
Table 5 presents the estimation for the sub-samples of small and large enterprises (I present only the matched samples here). To start with the domestic/foreign comparison, I find no differences in adjustment across small and large firms. Turning to the domestic/state matched sample, small domestic firms decrease by 6 percentage points in the crisis while SOEs of the same size do not change net job creation. In the large firm sample, domestic firms are estimated to have a small and statistically insignificant coefficient, while SOEs increase by 4 percentage points. It seems, therefore, that the crisis hit mostly the small domestic firms, while small SOEs did not change, and large domestic firms did not change much but SOEs increased it among large firms.

One explanation of the divergent behaviour of enterprises by ownership is that they adjust at different margins, some owners decreasing employment while others adjusting wages. It is possible, therefore, that SOEs also react to the new demand conditions by decreasing wages and keeping their employment stable. To test this hypothesis, we run the same regressions as above but with average wages as the

| Table 4. Job flows by ownership before and during the crisis matched sample results |
|---------------------------------|---------|---------|---------|
|                                | Net job creation | Job creation | Job destruction |
| Domestic/Foreign matched sample |            |          |           |
| Foreign | 0.041***     | 0.006    | −0.035*** |
|         | (0.010)      | (0.007)  | (0.008)   |
| Domestic × crisis                 | −0.044***  | −0.018*  | 0.026**   |
|         | (0.011)      | (0.010)  | (0.010)   |
| Foreign × crisis                    | −0.045***  | −0.018** | 0.027***   |
|         | (0.011)      | (0.008)  | (0.006)   |
| R²                              | 0.066     | 0.149    | 0.028     |
| Domestic/State matched sample     |            |          |           |
| State                             | 0.016     | −0.013   | −0.029    |
|                                  | (0.019)   | (0.008)  | (0.017)   |
| Domestic × crisis                      | −0.045**  | −0.027***| 0.017     |
|                                   | (0.022)   | (0.010)  | (0.023)   |
| State × crisis                      | 0.034***  | 0.038*** | 0.004     |
|                                   | (0.013)   | (0.009)  | (0.010)   |
| R²                               | 0.035     | 0.063    | 0.040     |

Notes: $N = 162,507$ (domestic-foreign matched sample), 23,792 (domestic-state matched sample). The regressions control for export status, two-digit industries, nine employment size categories and nine age categories and are weighted by average employment and with the inverse of the number of control firms associated with a foreign (state) firm. Standard errors (adjusted for clustering of firms) in parentheses. ***Significant at 0.01; **Significant at 0.05; *Significant at 0.10.
The results, presented in Table 6, show that domestic enterprises do not decrease the average wages of workers in any of the matched sample, but foreign and state-owned firms do by 7 percent and 10.6 percent. It seems, therefore, that these owners did consider reducing average wages in the crisis which may have helped them to save jobs.17

17 This result is contingent on changes in working hours. If, for example, SOEs decreased hours of work while private companies rather laid off workers, our measure of average wage will be biased. The data do not have information on total working hours, but another study shows that hours of work per employee did not change much during the crisis, at least not in the first year. Kollo (2011) reports that most of the adjustment took place at the extensive, rather than the intensive margin. While this study does not look at the divergent behaviour of state-owned and private firms, the overall hours effect of the crisis is rather small which suggest that computing wages based on employment, rather than hours, does not induce a large difference.
6. Conclusions

This paper studied the employment adjustment of domestic-, foreign- and state-owned enterprises before and during the global crisis. Both the unconditional and the multivariate analysis reveal that domestic and foreign enterprises reacted in the same way to the eruption of the crisis, and decreased net job creation. Matching firms by industry and employment does not change this result. State-owned enterprises, on the contrary, reacted to the crisis by increasing net job creation in the full sample: relative to domestic enterprises, this behaviour resulted in a larger net job creation by 9 percentage points. In the matched sample, SOEs remained passive and did not change net job creation in the crisis: the difference in the coefficients before and after the crisis is only 1.8 percent and it is not significant. As domestic companies reduced $g$ by 4.3 percent, relative to this group of firms SOEs had a larger $g$ by almost 6 percentage points. The analysis of the average wage cost provides evidence that both foreign-owned firms and SOEs adjusted wages: in the matched sample they decrease this variable by 7 and 10.6 percent while domestic companies have stable wage costs.

The divergent behaviour of SOEs is hard to reconcile with standard profit maximization. Two interpretations were outlined in the introduction of this paper: SOEs were either slow to react to the new economic conditions, or the government fought the mounting unemployment rate through the enterprises it directly controlled:

Table 6. The effect of the crisis on average wage

|                | Domestic/Foreign | Domestic/State |
|----------------|-----------------|---------------|
| State          | 0.275***        | 0.123         |
| Foreign        | 0.526***        | 0.106***      |
| Domestic × crisis | −0.060       | 0.071***      |
| Foreign × crisis | −0.071***     | 0.071***      |
| State × crisis | −0.106***       |               |
| $R^2$          | 0.337           | 0.217         |
| $N$            | 157,365         | 23,149        |

Notes: Matched samples. Dependent variable: log total wage bill/average yearly employment. The regressions control for export status, two-digit industries, nine employment size categories and nine age categories and are weighted by average employment and with the inverse of the number of control firms associated with a foreign (state) firm. Standard errors (adjusted for clustering of firms) in parentheses. ***Significant at 0.01.
unlike private corporations, these firms did not shed labour and thus cushioned the effects of the drop in global demand on employment to some extent. It is hard to distinguish between these two hypotheses, but the increased net job creation in the full sample suggests that concerns about unemployment are likely to have played a role in the employment adjustment of SOEs.

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