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Job creation and job destruction in China during 1998–2007

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ABSTRACT

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This paper examines the patterns of job flows in China between 1998 and 2007, when restructuring and reform of state-owned enterprises (SOEs), China's acceptance into the World Trade Organization (WTO), and rapid economic growth all took place. Using the firm-level employment data reported in the Annual Survey of Industrial Enterprises, we find that net employment in the Chinese manufacturing sector has been expanding since 2002 at an average rate of 5.4%. The underlying forces of this are the simultaneous job creation and job destruction affected by not only the reforms on SOEs, but also the changes in the foreign trade environment. Increasing China's openness to international trade and engagement in the global economy has affected the rate of job reallocation significantly and extensively. It is clear from parametric analyses at the industry level that trade liberalization has encouraged job creation and generated net job growth and that the depreciation of industry-specific real exchange rates has led to a significant increase in net employment by reducing the rate of job destruction. *Journal of Comparative Economics* **43** (4) (2015) 1085–1100. School of Economics and Management, Tsinghua University, Beijing 100084, China.

1. Introduction

Job reallocation concerns the rate of reallocation of employment positions across firms, which makes important contributions to improved productivity and economic growth. For example, Hsieh and Klenow (2009) point out that China and India would experience substantial gains in productivity if they had the same allocation efficiency in capital and labor as the United States. For China, a developing country with a huge labor pool, job reallocation is particularly important in enhancing efficiency and maintaining growth momentum. There have been increasing concerns of a "jobless boom" in Asia, particularly in labor-abundant China (Rawski, 2001; The Economist, 2006).[1] However, low net job growth does not fully explain the underlying simultaneous creation and destruction of jobs across and within sectors. This paper complements the existing literature by examining the patterns of job reallocation in China.

When studying China's job dynamics, there are two events that deserve particular attention: the restructuring of state-owned enterprises (SOEs) in the late 1990s and the country's accelerated trade liberalization. Both events have affected employment, but through different mechanisms. The government played an important role in the former, regulating the behavior of firms and directly affecting their employment patterns. The effect of trade liberalization has mainly been through market forces, and firms

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[1] A jobless boom means a lower or even declining ratio between employment growth and economic growth.

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play a more active and important role in this. In particular, China entered the World Trade Organization (WTO) in 2001, and from 1998 to 2007 its trade volume grew at an annual rate of 24%, implying unprecedented foreign market expansion and increased competition in the domestic market. To address this, firms may have had to actively adjust their employment decisions.

To capture those employment patterns, we employ firm-level employment data reported in the Annual Survey of Industrial Enterprises (ASIE) between 1998 and 2007. We initially calculate several job flow variables, including job creation, job destruction, gross and excess job reallocation, and net employment growth. We then examine the magnitude and time variation of these variables, the contributions of various firm characteristics to job flows, and the within- and between-group employment shifts. Finally, we investigate how trade liberalization has affected job flows in China.

Our results provide several interesting findings. First, after three years of contraction, the net employment of the manufacturing sector has been expanding since 2002 at an average rate of 5.4%. Underlying this is the simultaneous creation and destruction of jobs: the average job creation and job destruction rates from 2003 to 2007 are 16.1% and 10.7%%, respectively. On average, the gross job reallocation rate is 27%, which is comparable to that of developed countries.

Second, the reforms of SOEs, which began in the late 1990s, had a profound effect on job reallocation, particularly the "Grasp the big and let go of the small" policy that aimed to corporatize large SOEs and privatize (or even bankrupt) small ones (Berkowitz et al., 2014). This kind of drastic action in the restructuring of SOEs led to substantial net job losses, mainly due to the large-scale destruction of jobs. SOEs employed over 50% of the workforce in 1998, but by 2007 this had declined to 13.2%. The net job growth for private firms was, in contrast, substantial, mainly due to the huge number of jobs created. The employment share of private firms increased from around 6% in 1998 to over 40% in 2007.

Third, there is a negative relationship between firm size and job creation. Small firms have higher levels of job creation and contribute disproportionately to net job growth, which is consistent with the findings in other studies, such as Neumark et al. (2011) and Ayyagari et al. (2011). Business startups and younger businesses are also important in job creation (Haltiwanger et al., 2013). Young firms show both higher job creation and lower job destruction than old firms. Interestingly, once firm age is controlled, the negative association between firm size and job growth only exists for young firms, which is also noted by Haltiwanger et al. (2013) for U.S. firms.

Fourth, the average excess job reallocation rate accounts for about 84% of the gross job reallocation. This indicates that there are a substantial number of newly created jobs in China, exceeding the minimum amount required to accommodate the net employment changes. The proportion of excess job reallocation explained by between-group employment shifts is shown to be low. Most of the excess job reallocation is still explained by within-group shifts, generally consistent with the findings for other countries in the literature.

Last but not the least, China's trade liberalization and the engagement in the global economy have affected job reallocation rates significantly and extensively. Net employment gain was only found in major exporters before China joined the WTO in 2001, but after this, all three types of firms (major, minor, and non-exporter) experienced positive net employment growth. Moreover, a set of parametric analyses at the industry level by running regressions of job flows on a trade openness index and industry-specific real effective exchange rate shows that trade liberalization encourages job creation and generates net job growth, and the depreciation of the industry-specific real exchange rate significantly increases net employment by reducing the job destruction rate.

There is a large body of literature devoted to job flow patterns in both developed countries and transition economies, but only a few studies focus on China specifically.[2] Our paper is closely related to Dong and Xu (2009), who study job reallocation in China, using the ASIE dataset, from 1998 to 2002 when the drastic reforms of SOEs took place. They find that the rate of job creation and destruction in China is more synchronized than in most other transition economies and that the earlier expansion of private enterprises makes possible the absorbing of workers who were laid off by SOEs. Our study extends the analysis beyond the period of SOE reforms to examine the effect of trade liberalization, which increased after the joining of the WTO in 2001.

The remainder of this paper is organized as follows. Section 2 presents the methodology used for measuring job flows. Section 3 discusses the data. Section 4 presents the general patterns of job flows in China, including their variations across observable firm characteristics and a comparison of within- and between-effects of excess job reallocation. Section 5 focuses on the effect of trade liberalization on job flow rates. Finally, Section 6 concludes the paper.

2. Job flow measurement

We construct our job flow measures following Davis and Haltiwanger (1992). Let g_{et} denote the job growth rate of an establishment e at time t. Here, job flow is calculated as the ratio of the change in establishment es employment from time $t-1$ to time t to the average employment between time t and $t-1$. More specifically,

$$g_{et} = \begin{cases} 2(e_t - e_{t-1})/(e_t + e_{t-1}) & \text{if } e_{t-1},\ e_t > 0 \\ -2 & \text{if } e_{t-1} > 0,\ e_t = 0 \\ 2 & \text{if } e_{t-1} = 0,\ e_t > 0 \end{cases},$$

[2] See, for example, Davis et al. (1996), Baldwin et al. (1998), Roberts (1996), De Loecker and Konings (2006), Faggio and Konings (2003), Bilsen and Konings (1998), Konings and Walsh (1999), and Brown et al. (2002). In Table A5, we report several country studies and the job flow rates found for these countries.

where the first equation represents the job growth rate for continuing establishments, which is within the range (–2, 2).[3] The subsequent equations represent the job growth rate for exiting firms and entering firms, respectively. Here, $g_{et} = 2$ corresponds to firm entry and $g_{et} = -2$ corresponds to firm death.

Accordingly, the gross *job creation* (JC) rate for sector s at time t is calculated by the sum of the employment gains of expanding and new establishments within the sector, divided by X_{st}, the total employment of the sector. The equation is given by

$$JC_{st} = \sum_{e \in E_{st}, g_{et} > 0} \left(\frac{x_{et}}{X_{st}}\right) g_{et} = \frac{\sum_{e \in E_{st}, g_{et} > 0} (e_t - e_{t-1})}{X_{st}}.$$

Similarly, the gross *job destruction* (JD) rate is the sum of the employment losses (in absolute terms) of shrinking and dying establishments within a sector divided by the total employment of the sector. It is given by

$$JD_{st} = \sum_{e \in E_{st}, g_{et} < 0} \left(\frac{x_{et}}{X_{st}}\right) |g_{et}| = \frac{\sum_{e \in E_{st}, g_{et} < 0} (e_{t-1} - e_t)}{X_{st}}.$$

Furthermore, the sum of JC and JD defines the gross job reallocation rate (SUM) in sector s between time t – 1 and t, and the difference yields the net employment growth rate (NET). They are given by

$$SUM_{st} = JC_{st} + JD_{st},$$
$$NET_{st} = JC_{st} - JD_{st}.$$

Here, SUM_{st} reflects the changes in employment in gross terms and NET_{st} reflects the changes in net terms. We define the excess job reallocation rate ($EXCESS_{st}$) as

$$EXCESS_{st} = SUM_{st} - |NET|_{st}.$$

EXCESS reflects the portion of employment changes in excess of the minimum job reallocation required to accommodate net changes in the employment and is often used as an indicator of job flexibility (Davis et al., 1997).

Note that the *job* reallocation measures are closely related to the measures of *worker* reallocation. Specifically, $X_{st}SUM_{st}$ represents the upper bound of the number of workers who change jobs or switch between employment and non-employment status, and $X_{st} \max\{JC_{st}, JD_{st}\}$ represents the lower bound of the number of worker reallocations. When detailed data on worker reallocation are unavailable, job reallocation measures serve as the best alternative in labor market functioning.

3. Data

The data we use are from the Annual Survey of Industrial Enterprises (ASIE) between 1998 and 2007, conducted by the National Bureau of Statistics of China. This is the most comprehensive survey dataset for Chinese industrial firms in the manufacturing, mining, and public utility sectors. It includes all SOEs and non-SOEs with revenues above RMB5 million (approximately US$ 600,000). Firms included account for over 90% of industrial output, over 70% of industrial employment, and over 97% of exports, when compared to the 2004 industrial census. Importantly, we follow Brandt et al. (2012) to match firms over time using the originally assigned ID and other additional information such as name, industry, addresses, etc. This method can account for the changes in ID due to restructuring, merger and acquisition, or changes in ownership.[4]

We focus on firms in the manufacturing sector. Table 1 provides their descriptive statistics. First, the number of firms is seen to grow over time, from about 148,000 in 1998 to over 312,000 in 2007 [Column (2)].

Second, Column (3) indicates that total employment first declined in the late 1990s and then started to increase from 2002. The decline in manufacturing employment from 1998 to 2001 is a result of labor retrenchment by SOEs. Fig. 1 shows that SOEs employed over 50% of total employment in 1998, declining to 13.2% in 2007. In contrast, the employment share of private firms increased from around 6% to over 40%.

Third, Columns (4), (6), and (8) indicate the total, average, and median value-added respectively, which all increased over time. Columns (5) and (7) show that average and median employment generally declined in the same period—a clear sign of downsizing. Furthermore, the value-added per employee increased drastically, as indicated in Columns (3) and (4) combined. This supports the findings of Brandt et al. (2012), showing a rapid increase in labor productivity. A strong improvement in productivity can be attributed to a productivity increase within ownership type/sector, and/or resource reallocation across ownership type/sector. For example, when workers relocate from low-productivity to high-productivity sectors, or when they move from SOEs to more productive private firms, value-added will increase, whereas employment rate will not. This "jobless growth" phenomenon is also observed by Wang et al. (2007), who attribute it to job reallocations between SOEs and non-SOEs, and across regions, and also to trade liberalization and increasing labor costs.

The ASIE dataset is the most comprehensive for China's manufacturing sector, as it covers 50–70% of the total manufacturing employment (Column 10). However, it also has limitations that may, in some cases, affect the measurement of job flow rates. First, small private firms are underrepresented in the sample, as there is a requirement of RMB5 million sales for non-SOEs. This creates

[3] The average employment between time t – 1 and t rather than the employment for a single period is used, to avoid the case in which either employment is 0.

[4] One-sixth of all firms observed for more than one year experienced a change in their official ID over the sample period (Brandt et al., 2012).

Table 1
Summary statistics on the manufacturing sector.

Year	Number of firms	Employment (million)	Value added (billion RMB)	Mean value		Median value		Reported total manufacturing employment (million)	Employment share
				Employment	Value added (million RMB)	Employment	Value added (million RMB)		
1998	148,554	50.74	1517	342	10.2	133	2.7	83.19	61.0
1999	147,595	47.72	1684	323	11.4	128	3.0	81.09	58.8
2000	149,011	46.21	1975	310	13.3	125	3.3	80.43	57.5
2001	157,367	45.46	2235	289	14.2	120	3.5	80.83	56.2
2002	167,493	46.34	2641	277	15.8	115	3.7	83.07	55.8
2003	178,206	48.84	3408	274	19.1	116	4.5	102.54	47.6
2004	259,823	57.51	4629	221	17.8	94	3.8	106.19	54.2
2005	255,558	59.95	5774	235	22.6	99	5.0	110.59	54.2
2006	280,558	63.83	7223	228	25.7	95	5.9	112.63	56.7
2007	312,903	68.73	9405	220	30.1	90	6.9	97.91	70.2

Data Source: Authors' own calculation based on the Annual Surveys of Industrial Enterprises (NBS, various years). Reported total manufacturing employment is from the NBS China Statistical Yearbook for 1998–2002. For 2003–2007, we follow Banister and Cook (2011) and use the sum of the year-end manufacturing employment by urban enterprises and by township and village employment. As pointed out in Banister and Cook (2011, Table 1), the total manufacturing employment dropped by about 15 million from 2006 to 2007, which is almost completely accounted for by the drop in TVE employment.

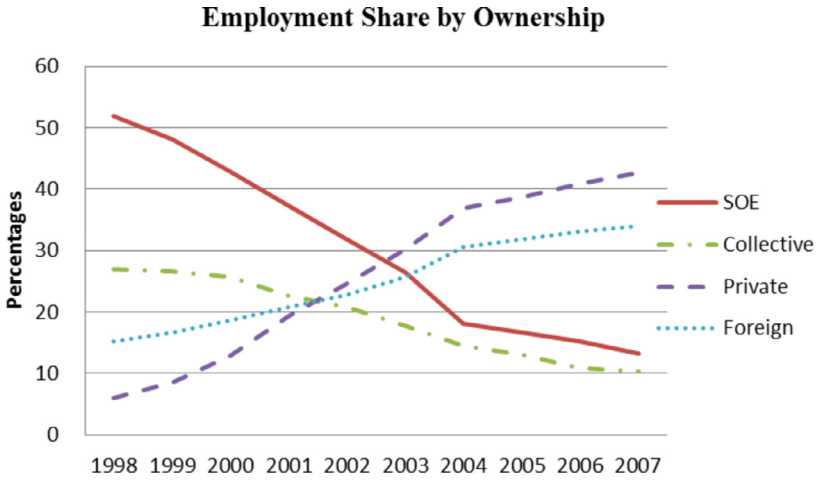

Fig. 1. Employment share by ownership.
Notes: This figure reports the employment share by different types of ownership from 1998 to 2007. We follow Brandt et al. (2011) to utilize firm's registration type information to classify ownership into four basic groups: SOEs, collective, private, and foreign firms. Foreign firms include those from Hong Kong, Macau, and Taiwan (HMT) and those from all other countries. When the registration structure is mixed, we use additional information on firm's major contributor to paid-in-capital to determine firms' ownership. The distribution of ownerships by year is reported in Table A2.

a downward bias in our estimates, as these firms are relatively more dynamic in terms of entry and exit and hiring-and-firing activities.

Second, those newly appearing in the sample cannot be directly identified as "birth" firms. Their IDs may change, so a new ID does not necessarily represent a new firm, and newly appearing non-SOEs could be those whose annual sales increase. sufficiently to reach the RMB5 million sales level.[5] Another problem is that the Industrial Census of 2004 identified many non-SOEs that were not previously surveyed due to inaccuracies in the business registry, which leads to a sharp increase in the number of firms included in the survey between 2003 and 2004. Mis-identifying the aforementioned firms as "birth" could affect job flow measures, particularly job creation rates.

To deal with the first problem, following Brandt et al. (2012), we link firms over time by using information other than ID, such as name, industry, and addresses, among others. To determine the new entry of non-SOEs, we use information on a firm's starting year. If the starting year of a non-SOE that newly appears in year t is $t-1$ or t (i.e., its age is less than two years old), it is identified as a new entry ("birth") in year t and its job growth rate is 2; otherwise, it is treated as a continuing firm. Information on previous employment in these continuing firms is unknown, so we make extra adjustments by taking a conservative approach

[5] This is in fact a common limitation in similar studies that rely on survey data. See Levinsohn (1999) on Chile, De Loecker and Konings (2006) on Slovenia, and Gomez-Salvador et al. (2004) on Belgium.

Table 2
Annual job flow rates 1998–2007.

Year	JC	JC continuing	JD	JD continuing	SUM	NET	EXCESS
		7.3	16.4	12.6			
2000	11.4	7.8	14.8	11.0	26.1	−3.4	22.7
2001	12.4	6.7	15.3	10.3	27.8	−2.8	24.9
2002	12.5	8.9	12.4	9.9	24.9	0.0	24.9
2003	14.4	10.1	11.2	8.9	25.6	3.2	22.4
2004	19.7	10.4	13.9	11.0	33.5	5.8	27.7
2005	17.3	13.9	10.3	8.1	27.5	7.0	20.5
2006	14.5	10.5	9.1	7.8	23.6	5.4	18.2
2007	14.6	10.5	9.0	7.9	23.6	5.6	18.0
Average	14.1	9.6	12.5	9.7	26.6	1.7	22.3
Average (1999–2002)	11.7	7.7	14.7	10.9	26.5	−3.0	23.4
Average (2003–2007)	16.1	11.1	10.7	8.7	26.8	5.4	21.4

Notes: Authors' calculation for different job flow rates. JC (or JD) continuing means job creation (or job destruction) rate for continuing firms only, excluding new entry (or exit). Rates reported are in percentages.

and assigning them a job growth rate of zero.[6] Similarly, a non-SOE that disappears from the sample cannot be directly identified as "death," as a firm may not meet the RMB5 million threshold and is therefore excluded from the sample. To prevent over-estimating the job destruction rate, we use information on a firm's operating status. If the operating status of a non-SOE is not "running" in year t, then it is identified as "death" in year $t + 1$ and its job growth rate is –2.[7] Otherwise, if its operating status is still "running," then it is again treated as a continuing firm and we take the conservative approach of assigning it a job growth rate of zero in the next year.[8]

Our treatment of entry and exit is similar to that of Dong and Xu (2009), as we both rely on firm age to define entry. Newly appearing firms that are at least two years old are regarded as continuing firms that underwent organizational restructuring. Therefore, the net employment change is acquired by subtracting the total employment in year t from that in year t – 1 of firms that disappeared in year t (Dong and Xu, 2009). Our treatment is more conservative than that of Dong and Xu, as their measures tend to give higher job creation rates, particularly in 2004, when a large number of firms entered the sample following the Industrial Census. We discuss this in more detail in the next section and report our results in Tables 2 and A1.[9]

4. Job flow patterns in China

In this section, we first present the magnitude and time variations of job flow rates. We then examine the cross-sectional variations of job flows from aspects such as ownership, size, and age. Finally, we compare the within- and between-effects of excess job reallocation.

4.1. Overall job growth and job reallocation

Table 2 presents annual job flows from 1998 to 2007. A high degree of job turnovers, with simultaneous creation and destruction, is observed in each year. For example, on average, 14.1 of every 100 jobs were newly created, with 12.5 destroyed each year, resulting in job reallocation and net employment growth rates of 26.6 and 1.7%, respectively. Second, the rates of job destruction were greater than those of job creation between 1998 and 2001, when the labor retrenchment program of SOEs was carried out, resulting in net contractions in employment. However, in 2002 job creation and job destruction were on a par, with more jobs created from 2003 to 2007, leading to an average net employment expansion of 5.4%. Third, a large proportion of the labor reallocation reported is due to deep restructuring rather than employment termination, as the average excess job reallocation rate (EXCESS) is around 22%, which accounts for 84% of the gross job reallocation rate.

As emphasized in the data section, we take a conservative measure of a firm's entry and exit. For robustness, we also estimate job flow statistics with alternative definitions. First, we follow Dong and Xu's (2009) definition and treat disappearing firms and newly appearing firms that are at least two years old as continuing firms due to the SOE reformation. Second, we estimate

[6] Among all non-SOEs that first enter the data sample (excluding year 1998), those that are less than two years old ("birth" by our definition) account for 36%; the remaining 64% are either older than two years or have missing information regarding the starting year.

[7] We observe a few cases where firms re-enter the data sample after disappearing from it for just one year. To mitigate the possible disruption, we impute their employment for the missing years by taking the simple average of employment values between t – 1 and $t + 1$. The results with or without imputation are similar.

[8] Among all non-SOEs that disappear from the data sample, those that have a "non-running" status in the last year accounts for 6% ("death" by our definition); the remaining 94% of firms are either "running" or have missing information on operating status.

[9] Firms may hire temporary workers who are not reported in the official data. These workers may be "dispatched" by labor dispatch companies. The incentive to under-report may be stronger after the 2008 Labor Contract Law of China, while our sample covers 1998–2007. Dispatched labor, by its nature, is more mobile than regular employment, and therefore disregarding labor dispatch may bias down our calculated job reallocation measures. We thank a referee for pointing out this potential bias.

Table 3
Average job flow rates by ownership.

Ownership	JC	JD	SUM	NET	EXCESS
Panel a. Job flows by ownership (1998–2007)					
SOEs	9.2	18.8	28.0	−9.6	18.5
Collective	12.2	10.5	22.7	1.7	20.3
Foreign	16.8	8.7	25.6	8.1	17.5
Private	19.4	10.0	29.4	9.4	19.9
Panel b. Continuing SOEs vs. privatized SOEs (1998–2007)					
Continuing SOEs	9.1	20.1	30.2	−12.0	18.2
Privatized SOEs	8.9	11.0	19.9	−2.0	17.9
Panel c. Subsample: sales > 5 million RMB (1998–2007)					
SOEs	8.7	15.4	24.1	−6.7	17.3
Collective	12.3	9.6	21.9	2.8	18.8
Foreign	16.8	8.4	25.1	8.4	16.7
Private	19.3	9.3	28.6	10.0	18.6
Panel d. Subsample: employees >500 (1998–2007)					
SOEs	8.3	16.5	24.8	−8.2	16.5
Collective	12.6	10.1	22.7	2.4	19.9
Foreign	17.1	8.1	25.1	9.0	16.2
Private	16.6	9.3	26.0	7.3	18.7

Notes: Authors' calculation for samples with different types of ownership. Rates are in percentages. Panel *b* distinguishes continuing SOEs and privatized SOEs, where continuing SOEs are firms who remain as state-owned during the whole sample period and privatized SOEs are firms who change from state-owned to private. The numbers of observations are 219,411 for continuing SOEs, and 70,777 for privatized SOEs. Panel *c* calculates job flow rates for firms with annual sales above 5 million RMB only. Panel *d* calculates job flow rates for firms with average number of employees 500 and above.

with no extra adjustments. Both results are reported in Table A1. Our benchmark results are generally similar to the results obtained using Dong and Xu's (2009) definition, though the latter generates much higher job creation in 2004. Without any extra adjustments, both job creation and destruction rates are over-estimated.

Patterns in Table 2 reveal simultaneous high job creation and high job destruction rates. It is then natural to inquire what kinds of firms that have contributed the most to job creation and destruction in China. Therefore, in the following subsections, we attempt to decompose our sample into different groups to determine who creates and who destroys jobs.

4.2. Decomposition by ownership

We first examine whether firms with different types of ownership contribute differently to job reallocations. We follow Brandt et al. (2012) and use firms' registration type information to classify ownership into four basic groups: SOEs, collective, non-SOEs, and foreign firms. Foreign firms include those from Hong Kong, Macau, Taiwan, and other countries. When the registration structures are combined, we use additional information on the major contributors of paid-in-capital to determine the ownership of firms.[10]

Table 3 reports the job flow estimates by different types of ownership. Panel *a* shows that SOEs and collective firms have lower job creation rates and higher job destruction rates than foreign and private firms. Indeed, SOEs experience a net employment contraction at an annual rate of 9.6%, whereas private firms have a net employment expansion of 9.4%.[11] Our findings confirm the effect of large-scale labor retrenchment due to the SOE reforms, which began in the late 1990s. Employment expansion at the aggregate level is mainly attributed to growth in private and foreign firms.

One concern is that SOEs may be privatized gradually over time. Since the 15th Communist Party Congress in 1997, the Chinese government has taken a radical approach to the reforming and restructuring of SOEs, with larger SOEs corporatized and smaller ones privatized (as indicated by the slogan "Grasp the big and let go of the small"). Large-scale SOE restructuring has been accompanied by massive layoffs. To understand the effect of the SOE reforms, we further study the job dynamics of two types of firms: those remaining as SOEs and those that have been privatized during the sample period. Panel *b* of Table 3 reports the average job flow rates for these two types. Continuing SOEs appear to have much higher rates of job destruction, but similar job creation rates as privatized SOEs. Therefore, the downsizing of continuing SOEs contributes more substantially to negative job growth during the SOE reform period.

In Panel *c* of Table 3, we compare job flows by ownership for firms with annual sales above RMB5 million. When only focusing on large firms, we can see that SOEs also have substantial net job losses, whereas the job flow statistics for other

[10] In Table A2, we report the distribution of firms by ownership and year. In particular, the share of SOEs declined steadily from 34% in 1998 to 4.2% in 2007, and that of private firms increased from 9.4% to 63.9% in the same period. The share of collective firms also experienced a significant decline, from 39% to 10.6%. The share of foreign firms remained relatively constant at around 20%.

[11] This pattern is even more pronounced if we look at the early period between 1998 and 2002.

Table 4
Average job flow rates by firm size.

Size	JC	JD	SUM	NET	EXCESS
Panel a. Job flows by size (1998–2007)					
(0, 100)	18.4	13.7	32.1	4.7	24.6
[100, 500)	15.6	12.7	28.3	2.9	23.3
[500, 1000)	13.6	13.0	26.6	0.6	22.4
≥1000	11.9	11.9	23.8	−0.1	20.6
Panel b. SOEs (1998–2007)					
(0, 100)	18.8	43.8	62.6	−25.0	36.4
[100, 500)	12.6	32.7	45.3	−20.0	25.2
[500, 1000)	9.3	26.2	35.4	−16.9	18.5
≥1000	7.9	16.7	24.6	−8.8	15.8
Panel c. Private firms (1998–2007)					
(0, 100)	24.7	9.0	33.8	15.7	18.1
[100, 500)	23.7	8.9	32.6	14.8	17.8
[500, 1000)	22.3	8.4	30.7	13.9	16.7
≥1000	21.3	7.6	29.0	13.7	15.2

Notes: Authors' calculation for samples with different sizes. Size is measured as the average number of employees. When conditioning on ownership, we focus on firms that remain a constant ownership during their appearance in the sample.

types of ownership remain similar as before. This confirms the robustness of the general pattern, seen in the benchmark results of Panel *a*. We also restrict the comparable sample to relatively large firms that hire more than 500 workers, to deal with the inflation concern due to the nominal threshold of RMB5 million sales. The results are similar, as presented in Panel *d* of Table 3.

4.3. Decomposition by size

As emphasized in the literature (see Haltiwanger et al., 2013, for example), systematic differences exist in job flow rates across different firm sizes. Table 4 separates firms into different size categories. Panel *a* of Table 4 shows that firms with less than 500 employees experience larger net job gains, whereas those with over 1000 employees suffer from net job losses. In fact, a negative relationship can be found between firm size and net employment growth. The higher job creation rates of small firms result in this negative relationship. Job destruction rates are relatively similar across different sizes.[12]

In Panels *b* and *c*, we calculate job flow rates across sizes for SOEs and private firms separately. Small SOEs still have higher creation rates, but their job destruction rates are also higher. These dominate the creation rates, resulting in higher levels of net employment contractions for these small SOEs. This finding is consistent with the perception of the "Grasp the big and let go of the small" principle for restructuring in the state sector. Small private firms have higher rates of job creation and net employment growth than large ones, which confirms the inverse relationship between net employment growth and size found in Panel *a*. However, the differences are less significant, which may be due to the under-representation of small private firms in the sample.

4.4. Decomposition by age

As small firms are often newly established, they disguise the important role of new firms in creating jobs (Haltiwanger et al., 2013). Table 5 presents the job flow rates across ages.[13] Panel *a* shows that net employment growth is also correlated with age; that is, young firms have higher net employment growth than old firms, with both higher creation and lower destruction rates. For example, newly established firms (age = 0 or 1) have an average job creation rate of over 80% and a job destruction rate of less than 5%. In Panels *b* and *c*, we again separately consider SOEs and private firms. For both, newly established firms have the highest job creation rate and the lowest destruction rate, and therefore exhibit the highest net employment growth. In comparison, firms that have existed for more over 15 years tend to have the lowest net job growth.

In Table 6, we further decompose all firms by their age *and* size combination, following the same categorization as above. Interestingly, after controlling for age, we find that the negative association between firm size and net employment growth only exists for newly established firms (age ≤ 1), whereas for older ones (age ≥ 2), larger firms create more jobs and have higher net job growth. This result highlights the important role of business startups and young businesses in job creation, consistent with the findings by Haltiwanger et al. (2013) on U.S. firms.

[12] A similar pattern holds when we follow Dong and Xu's (2009) definition to define entry and exit. See Table A3 for details.
[13] Age is defined as the difference between year of observation and the reported start year for each firm.

Table 5
Average job flow rates by firm age.

Age	JC	JD	SUM	NET	EXCESS
Panel a. Job flows by age (1998–2007)					
[0,1]	81.5	4.5	86.1	77.0	9.1
[2,5]	14.6	10.3	25.0	4.3	20.6
[6,10]	13.2	10.9	24.1	2.3	21.4
[11,15]	11.7	11.5	23.2	0.2	20.5
>15	7.5	15.1	22.7	−7.6	15.1
Panel b. SOEs (1998–2007)					
[0,1]	70.5	18.8	89.3	51.7	37.6
[2, 5]	23.0	28.8	51.8	−5.7	33.2
[6,10]	15.4	27.1	42.5	−11.6	28.8
[11,15]	14.4	24.4	38.7	−10.0	25.8
>15	6.8	20.2	27.0	−13.4	13.6
Panel c. Private firms (1998–2007)					
[0,1]	90.6	3.4	93.9	87.2	6.8
[2,5]	13.7	8.9	22.6	4.7	17.9
[6,10]	14.8	9.9	24.7	4.9	19.8
[11,15]	13.6	9.4	23.0	4.3	18.4
>15	8.7	9.5	18.2	−0.7	15.2

Notes: Authors' calculation for samples with different ages. Age is defined as the difference between the year of observation and reported start year for each firm. When conditioning on ownership, we focus on firms that remain a constant ownership during their appearance in the sample.

Table 6
Small vs. young, average job flow rates by size-age combination.

Size	Age [0,1]	[2,5]	[6,10]	[11,15]	>15
Panel a. Net employment growth (NET, 1998–2007)					
(0, 100)	84.5	−0.3	−1.9	−3.9	−10.4
[100, 500)	78.3	3.5	1.1	−1.2	−8.9
[500, 1000)	72.1	5.9	3.5	0.2	−9.5
≥1000	71.1	8.0	4.8	2.8	−6.2
Panel b. Job creation rate (JC, 1998–2007)					
(0, 100)	89.1	11.0	11.2	10.9	10.4
[100, 500)	82.4	13.8	12.6	11.2	7.9
[500, 1000)	77.1	15.9	13.8	11.8	7.0
≥1000	75.9	18.1	14.6	12.3	7.3
Panel c. Job destruction rate (JD, 1998–2007)					
(0, 100)	4.6	11.2	13.1	14.7	20.8
[100, 500)	4.1	10.2	11.5	12.4	16.8
[500, 1000)	5.0	10.0	10.3	11.6	16.5
≥1000	4.9	10.1	9.7	9.6	13.6

Notes: Authors' calculation for samples with different size-age combination. Age is defined as the difference between the year of observation and reported start year for each firm. Size is measured by the average number of employees.

4.5. Within and between effects

Excess job reallocation rate (EXCESS) reflects the total job reallocation rates in excess of the minimum job reallocation needed to accommodate net employment changes. Previous results indicate that the average of excess job reallocation is 22.3%, which accounts for about 84% of gross job reallocation. In this subsection, we investigate the fractions of excess job reallocation that can be explained by the redistribution of employment within and between the different groups of ownership, size, and age we categorized above, and export status and industries, which are discussed in the next section.[14]

Following Davis and Haltiwanger (1992), we decompose the excess job reallocation rates into the *within* and *between* components for each type of groups as follows:

[14] We also calculate job flow rates by regions and, similar to Dong and Xu (2009), we divide China into eight regions. We find that on average only the three coastal regions (eastern coastal, northern coastal, and southern coastal) experience employment expansions, with the southern coastal region having the highest net employment growth at 6.2%. All other regions experience employment contractions, due to the high job destruction rate. The northeastern region has the highest job destruction rate of 18%, despite a healthy job creation rate. This was once China's industrial center, with many SOEs, but it experienced large-scale layoffs during the labor retrenchment period. Employment shifts between regions account for an average of 15% of the excess reallocation over 1998–2007. The detailed results are available upon request.

Table 7
Between-group employment shifts as fraction of excess job reallocation.

Group type	Ownership	Size	Age	Export intensity	Industry
No. of groups	4	4	5	3	424
1999	0.107	0.000	0.163	0.052	0.075
2000	0.165	0.000	0.229	0.103	0.125
2001	0.215	0.007	0.305	0.201	0.116
2002	0.313	0.039	0.333	0.234	0.218
2003	0.231	0.000	0.234	0.226	0.159
2004	0.189	0.014	0.305	0.226	0.103
2005	0.101	0.000	0.020	0.220	0.029
2006	0.102	0.000	0.126	0.147	0.052
2007	0.073	0.000	0.102	0.127	0.041
Average	0.166	0.007	0.202	0.171	0.102

Notes: Each number reports the fraction of excess job reallocation explained by between-group employment shifts for the indicated group type.

$$\begin{aligned}\text{EXCESS}_t &= \text{GrossReallocation}_t - |\text{NetGrowth}|_t \\ &= \sum_{g=1}^{G} \text{GrossReallocation}_{gt} - |\text{NetGrowth}|_t \\ &= \underbrace{\sum_{g=1}^{G} \text{GrossReallocation}_{gt} - \sum_{g=1}^{G} |\text{NetGrowth}_{gt}|}_{\text{within}} + \underbrace{\sum_{g=1}^{G} |\text{NetGrowth}_{gt}| - |\text{NetGrowth}_t|}_{\text{between}}\end{aligned}$$

where g refers to the group of the whole set G. The first two terms capture the within effect while the last two terms capture the between effect. Taking the ratio of each component to the total excess reallocation, we obtain the contribution of each component in fractions.

Table 7 shows the proportions of the excess job reallocation that can be explained by employment shifts between groups. Overall, employment shifts between groups account for only a small proportion of excess job reallocation. The lowest amount is between-size employment shifts, which accounts for less than 1% of the excess job reallocation. The highest is between-age shifts, which accounts for more than 20% of the total excess job reallocation. The majority of the excess job reallocation is still explained by within-group shifts. This is generally consistent with previous findings for other countries. Examples include Davis and Haltiwanger (1992) for the U.S., Baldwin et al. (1998) for Canada, Faggio and Konings (2003) for transition economies, and Jurajda and Terrell (2003, 2008) for Czechoslovakia and Estonia, which all show that most excess job reallocation occurs within groups rather than across them.[15]

5. Trade liberalization and job flows

The previous section lays out some general patterns of job flows in China. In particular, we find that the SOE reforms that began in the late 1990s have had a profound effect on job reallocation. In this section, we examine accelerated trade liberalization, another important change in China during the past decades. Trade liberalization has important implications for resource reallocation within and across sectors. On the one hand, exposure to international competition forces inefficient firms to contract or even exit, whereas on the other hand, export-oriented firms may enjoy increased access to foreign markets. Therefore, examining the effect of trade liberalization on job flows can be of benefit to the Chinese economy. Despite a growing literature that highlights the importance of gross job flows, the existing literature on China mainly focuses on the effect of international trade on *net* employment growth (Feenstra and Hong, 2008).

5.1. Job flows by export intensity

We first look at job flow rates across export status. China's export-oriented development is widely perceived to be one of the most important factors in explaining the fast GDP growth for the past decades. The export sector is also the major job provider for thousands of migrant workers. In terms of employment share, exporting firms hire more than half of the total manufacturing employment in our sample. For the purpose of our study, we categorize firms into non-exporters (those that have no exports at all), minor exporters (those with export values that account for less than 50% of total sales), and major exporters (those with export values of at least 50% of total sales) and examine job flows by different levels of export intensity. It should be noted that when China joined the WTO in 2001, a drastic increase in its trade volume followed. Therefore, we study two sub-sample periods separately: the pre-WTO period (1998–2001) and the post-WTO period (2002–2007).

[15] We summarize some of the findings in the literature in Table A5.

Table 8
Average job flow rates by export intensity.

Export intensity	JC	JD	SUM	NET
Panel a. All firms pre-WTO (1998–2001)				
Export = 0	12.2	18.7	30.8	-6.5
0 < export < 0.5	9.5	13.2	22.8	-3.7
Export ≥ 0.5	14.5	11.1	25.6	3.5
After-WTO (2002–2007)				
Export = 0	17.7	12.5	30.2	5.2
0 < export < 0.5	12.7	10.5	23.2	2.2
Export ≥ 0.5	16.5	8.5	25.0	7.9
Panel b. Private firms Pre-WTO (1998–2001)				
Export = 0	20.6	10.3	30.9	10.3
0 < export < 0.5	16.1	9.4	25.5	6.8
Export ≥ 0.5	16.5	9.4	25.9	7.1
After-WTO (2002–2007)				
Export = 0	25.1	8.5	33.6	16.5
0 < export < 0.5	18.4	7.7	26.1	10.7
Export ≥ 0.5	17.9	7.8	25.7	10.1

Notes: Authors' calculation for samples with different export intensity. Export intensity = exports/total sales.

Table 8 reports the results. Panel *a* illustrates that before joining the WTO, only major exporters showed positive net employment gain. Non-exporters and minor exporters both experienced negative net job growth. Non-exporters had relatively high job creation, but their job destruction was even higher, which led to a net employment contraction. After 2001, all three types of firms experience positive net employment growth. Major exporters still have the highest net employment growth. Non-exporters also benefit from trade liberalization and achieve a net employment growth even higher than that of low exporters. The universal increase in the net job growth rate is due to strong job creation and low job destruction after China joined the WTO, for all three types of firms.[16]

It is worth noting that the changing composition of the sample with fewer SOEs may affect the results across export status. In particular, the pre-WTO period (1998–2001) coincides with the large-scale SOE reforms; therefore, the pre- and post-WTO comparison may be due to the effect of SOE restructuring. To deal with this concern, we focus on firms who have always been private in Panel *b* of Table 8. Compared with pre-WTO job flow rates, the performance of all types of firms improved after China's entry to the WTO. The net job growth rates have all increased, regardless of export status. This indicates that the negative net job growth for non-exporters and minor exporters before WTO may be due to SOE restructuring.

5.2. Openness, exchange rate movements, and job flows

Analyzing job flow rates by dividing firms into exporters versus non-exporters demonstrates the important differences in different export statuses. After China's acceptance into the WTO, all firms experienced higher job creation and lower job destruction. Nevertheless, this simple decomposition does not take into account other factors that may affect job flow statistics, such as industry characteristics, import competition, and the share of SOEs. In this section, we perform a parametric analysis on the effect of trade liberalization on job flow rates at the industry level, where we are able to control for those factors explicitly.

To set the stage, we first calculate job flow rates for each industry. Table A4 provides an example of the average job flow rates for the two-digit industries from 1998 to 2007. We find that simultaneous and substantial job creation and destruction can be observed across all industries. Furthermore, considerable cross-industry variations exist in job creation, destruction, and net employment growth. For example, the average gross job reallocation rates range from 22% in the ferrous metals pressing industry to 35% in the food processing industry.

We then calculate a measure of the trade openness index, which is defined as the sum of the value of an industry's exports plus imports, as a proportion of the sum of that industry's domestic sales, exports, and imports, as in Klein et al. (2003). We find that there are also considerable variations in openness across industries, ranging from 4.1% in the tobacco industry to over 90% in the instruments industry. Fig. 2 presents a simple scatter plot of job flow rates against the openness index. It is clear that industries with higher openness tend to have higher job creation, lower job destruction, and therefore higher net job growth. [17]

[16] It is true that most empirical work in international trade literature shows that exporters on average perform better than non-exporters. However, exporters do not necessarily have higher job creation rates than non-exporters. One example is Gourinchas (1999), who shows that exporters have lower job creation (but also lower job destruction) than non-tradable firms. Levinsohn (1999) also shows that across different size groups, exporters do not always show the highest net job growth, compared with the nontrade sector. One reason for this is that simply dividing firms into exporters versus non-exporters does not take into account other factors that may affect job flow statistics (such as industry characteristics, import competition, SOE's share, etc.). This also shows the importance of a parametric analysis, discussed in the next subsection.

[17] We also calculate the share of SOE firms for each industry, seen in the last column in Table A4. A simple scatter plot also shows that industries with a higher SOE share tend to have lower job creation, higher job destruction, and therefore lower net job growth.

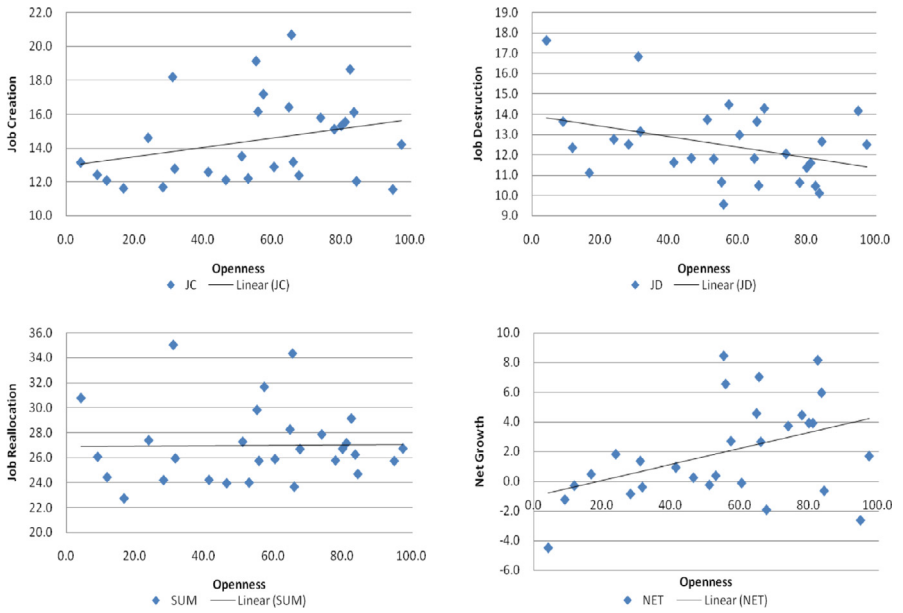

Fig. 2. Trade openness and average job flow rates at 2-digit industry.
Notes: This figure plots the average job flow rates at 2-digit industry against openness for each 2-industry over the period 1998–2007. Openness is defined as (imports + exports)/(imports + exports + domestic sales) following Klein et al. (2003). Numbers are in percentages.

Heterogeneity in job creation and job destruction across industries may reflect, in part, heterogeneity in the exposure of these industries to international competition. We therefore empirically test this by running the following regression:

$$JF_{it} = \alpha_0 + \alpha_1 JC_{it-1} + \alpha_2 JD_{it-1} + \alpha_3 OI_{it} + \alpha_4 OI_{it-1} + \alpha_5 SOE_{it} + \alpha_6' Z_{it} + \lambda_t + \mu_i + \varepsilon_{it},$$

where i indexes industries and t indexes years.[18] The dependent variables are the four job flow rates of job creation (JC), job destruction (JD), net employment growth (NET), and job reallocation (SUM). *OI* is the trade openness index, defined above. We also decompose the openness index into the export intensity index, i.e., exports/total sales, and the import penetration index, i.e., imports/(domestic sales + imports). The results are qualitatively similar. *SOE* represents the share of SOEs in the industry and *Z* represents other industry-specific controls, such as the industry's average wage rate (WAGE), labor productivity (PROD), and the capital to labor ratio (*K*/*L*). To avoid any potential endogeneity problem with these variables, we use lagged one-period data. We also set μ_i as the unobserved industry-level effect. Time dummies (λ_t) and a constant are included in the regression.

Lagged values of job flow measures are included to allow for possible dynamic adjustments. The correlation between the lagged job flows and the unobserved industry effect results in inconsistent ordinary least square estimates and within-estimates. Therefore, we use the generalized method of moments (GMM) estimation advocated in Arellano and Bover (1995) and Blundell and Bond (1998). The estimator includes lagged levels and lagged differences as instruments.

The results are reported in Table 9. Trade openness has significantly positive effects on job creation and net employment growth. Specifically, an increase in trade openness can lead to increases in job creation and net employment growth. The effect on the job destruction rate is significantly negative at the lagged-one period level. The share of SOEs in the industry also affects job flow rates significantly, but mainly through job destruction. A high SOE share leads to a significant increase in job destruction and therefore a significant decrease in net employment growth. As for the effects of other industry-specific controls, we find that industries with higher wage rates, productivity, and capital–labor ratios generally have higher job creation, lower job destruction, and therefore higher net employment growth.[19]

Alongside China's integration into the world economy, from 2005 the Chinese RMB steadily appreciated against the U.S. dollar. To account for different relative price shocks arising from the exchange rate movements over time, we construct an industry-specific real effective exchange rate (REER) and interact it with the trade openness index, following Gourinchas (1998), Klein et al. (2003), and Christev et al. (2008).[20] The industry-specific REER is constructed using a trade-weighted log average of bilateral real exchange rates, where trade weights are constructed from the annual trade data collected from the China Customs General Administration. An increase in REER means a depreciation of RMB. Variations in the industry-specific REER

[18] For more observations and a better control for industry heterogeneity, our regression is run at the four-digit industry level.

[19] The *p*-values of the Sargan tests in Columns 1 and 3 are small, but still acceptable at the 1% level, and the situation improves when we add exchange rates into the regression, so we assume there is no significant problem with the validity of the instruments.

[20] Gourinchas (1998) finds that an appreciation of the cyclical component of real exchange rates simultaneously increases industry-level job creation and destruction, whereas depreciation has a limited effect on reallocation. In comparison, Klein et al. (2003) show that cyclical real exchange rates significantly affect net employment, mainly through job destruction, and that trend real exchange rates significantly affect job reallocation but not net employment.

Table 9
Trade openness and job flows.

Variables	(1) JC_{it}	(2) JD_{it}	(3) NET_{it}	(4) SUM_{it}
JC_{it-1}	0.055***	0.137***	0.035*	0.239***
	(0.019)	(0.031)	(0.021)	(0.023)
JD_{it-1}	0.069***	0.083***	−0.035*	0.239***
	(0.022)	(0.021)	(0.021)	(0.023)
OI_{it}	0.111***	−0.020	0.185***	0.030
	(0.025)	(0.028)	(0.045)	(0.034)
OI_{it-1}	0.038	−0.040*	0.071**	0.018
	(0.026)	(0.021)	(0.035)	(0.037)
SOE_{it}	−0.054	0.106***	−0.106**	0.069*
	(0.038)	(0.022)	(0.046)	(0.041)
$WAGE_{it-1}$	0.016	−0.052***	0.062***	−0.002
	(0.016)	(0.014)	(0.023)	(0.019)
$PROD_{it-1}$	0.026**	−0.014	0.045***	0.004
	(0.011)	(0.009)	(0.015)	(0.015)
K/L_{it-1}	0.032**	−0.040***	0.092***	−0.013
	(0.014)	(0.012)	(0.023)	(0.018)
Constant	−0.252***	0.470***	−0.861***	0.189*
	(0.078)	(0.066)	(0.125)	(0.102)
Time dummies	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	2,856	2,856	2,856	2,856
Sargan test statistic	50.53	36.69	52.59	33.38
p-value	0.026	0.301	0.017	0.449

Notes: (1) GMM-system estimates as in Arellano and Bover (1995) and Blundell and Bond (1998). (2) Robust standard errors in parentheses. (3) Sargan's test is a test of over-identifying restrictions, which is a chi-square under the null hypothesis of instrument validity. (4) OI is the trade openness index, defined as (imports + exports)/(imports + exports + domestic sales); SOE is the share of state firms in the industry; WAGE is industry's average wage rate; PROD is industry's labor productivity, and K/L is industry's capital to labor ratio.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

capture important heterogeneity across industries and indicate the competitiveness of domestic firms relative to their foreign competitors.

The estimation results are reported in Table 10. The industry-specific real exchange rate, interacted with openness, significantly affects net employment growth. A depreciation of RMB leads to a significant increase in net employment growth. This is achieved through a significant decline in job destruction, with no significant change in job creation. This effect is magnified when the industry is more open to trade liberalization. This evidence of destruction-driven adjustment is in accordance with the early findings of Klein et al. (2003) for the U.S. and Colantone (2012) for Belgium. The effects of SOE share and other industry-specific controls on job flow rates remain qualitatively similar to those in Table 9.

6. Conclusion

This paper examines recent job flow patterns in China, including the creation and destruction of jobs, net job growth, and the excess job flow rates, which reflect job flexibility. We first present the magnitude and time variations of job flow rates, then examine the cross-sectional variations of job flows from various aspects, such as ownership, size, and age. Compared with previous studies, we find that China's experience has characteristics of both transitional and mature economies, with simultaneous and substantial job creation and destruction.

Importantly, we extend Dong and Xu's (2009) study on the effect of SOE reforms in the late 1990s and find that the restructuring of SOEs substantially reduces job creation and increases jobs destruction. The job-destroying effect of the reforms has been alleviated after 2002. However, continuing SOEs appear to have much higher job destruction than privatized ones, although they have similar job creation rates. Thus it is the downsizing of continuing SOEs that contributes more substantially to negative job growth.

Our paper also demonstrates the effect of trade liberalization on job flows. Before China's entry into the WTO in 2001, only major exporters demonstrated a net employment gain. After 2001, both exporting and non-exporting firms experience positive net employment growth. A set of parametric analyses at the industry level is obtained by running regressions of job flows on a trade openness index and the industry-specific real effective exchange rate. This shows that trade liberalization encourages job

Table 10
Exchange rate movements, openness and job flows.

Variables	(1) JC_{it}	(2) JD_{it}	(3) NET_{it}	(4) SUM_{it}
JC_{it-1}	0.141***	0.116***	0.006	0.232***
	(0.020)	(0.031)	(0.021)	(0.026)
JD_{it-1}	0.115***	0.086***	−0.006	0.232***
	(0.025)	(0.022)	(0.021)	(0.026)
SOE_{it}	−0.108***	0.115***	−0.162***	0.080*
	(0.040)	(0.023)	(0.045)	(0.042)
$OI_{it} \times REER_{it}$	0.001	−0.031***	0.038**	−0.023
	(0.011)	(0.011)	(0.016)	(0.020)
$OI_{it-1} \times REER_{it-1}$	−0.009	−0.009	−0.007	−0.004
	(0.013)	(0.011)	(0.018)	(0.017)
$WAGE_{it-1}$	0.013	−0.059***	0.084***	−0.021
	(0.019)	(0.016)	(0.029)	(0.023)
$PROD_{it-1}$	0.017	−0.012	0.031**	0.022
	(0.012)	(0.009)	(0.015)	(0.016)
K/L_{it-1}	0.031**	−0.032***	0.078***	−0.000
	(0.015)	(0.011)	(0.026)	(0.019)
Constant	−0.103	0.385***	−0.584***	0.145
	(0.071)	(0.051)	(0.098)	(0.090)
Time dummies	Yes	Yes	Yes	Yes
Industry effects	Yes	Yes	Yes	Yes
Observations	2446	2446	2446	2446
Sargan test statistic	40.15	29.81	57.7	26.56
p-value	0.102	0.475	0.017	0.646

Notes: (1) GMM-system estimates. (2) Robust standard errors in parentheses. (3) Sargan's test is a test of over-identifying restrictions, which is a chi-square under the null hypothesis of instrument validity. (4) OI is the trade openness index, defined as (imports + exports)/(imports + exports + domestic sales); SOE is the share of state firms in the industry; WAGE is industry's average wage rate; PROD is industry's labor productivity, and K/L is industry's capital to labor ratio. REER is industry-specific real effective exchange rate. An increase in REER means a depreciation of RMB.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

creation and generates net job growth, and the depreciation of the industry-specific real exchange rate significantly increases net employment by reducing the job destruction rate.

The changes in job creation and destruction have different welfare implications (Klein et al., 2003), as an increase in job destruction increases worker layoffs and may be detrimental to human capital accumulation, whereas a reduction in job creation only indirectly affects individual employment prospects. Furthermore, if the underlying dynamics of job reallocation are due to downsizing or the death of less productive firms in favor of more productive ones, the sector may turn out to be healthy and promising, in contrast to what is indicated by modest net job growth. A formal welfare analysis is beyond the scope of this study, but we consider it to be an important step toward a better understanding of job reallocations in China.

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Appendix A

See Tables A1–A5.

Table A1
Annual job flow rates 1998–2007 (alternative definitions).

Year	JC	JC continuing	JD	JD continuing	SUM	NET	EXCESS
Panel a. Dong and Xu's (2009) definition							
1999	9.8	7.3	16.0	12.6	25.8	−6.1	19.7
2000	11.0	7.8	14.2	11.0	25.1	−3.2	21.9
2001	11.9	6.7	13.6	10.3	25.5	−1.6	23.9
2002	13.4	8.9	11.5	9.9	24.8	1.9	22.9
2003	15.6	10.1	10.3	8.9	25.9	5.3	20.6
2004	27.9	10.4	11.6	11.0	39.5	16.3	23.2
2005	17.1	13.9	13.0	8.1	30.1	4.2	25.9
2006	15.1	10.5	8.8	7.8	23.9	6.3	17.6
2007	16.0	10.5	8.6	7.9	24.7	7.4	17.3
Average	15.3	9.6	11.9	9.7	27.3	3.4	21.4
Average (1999–2002)	11.5	7.7	13.8	10.9	25.3	−2.3	22.1
Average (2003–2007)	18.3	11.1	10.5	8.7	28.8	7.9	20.9
Panel b. Without extra adjustments using age or status information							
1999	14.4	7.3	20.5	12.6	34.9	−6.1	28.7
2000	15.9	7.8	19.1	11.0	34.9	−3.2	31.7
2001	20.8	6.7	22.5	10.3	43.3	−1.6	41.6
2002	17.7	8.9	15.8	9.9	33.5	1.9	31.6
2003	19.8	10.1	14.5	8.9	34.4	5.3	29.1
2004	35.8	10.4	19.5	11.0	55.3	16.3	39.0
2005	19.9	13.9	15.7	8.1	35.6	4.2	31.5
2006	18.2	10.5	11.9	7.8	30.1	6.3	23.9
2007	19.2	10.5	11.8	7.9	30.9	7.4	23.5
Average	20.2	9.6	16.8	9.7	37.0	3.4	31.2
Average (1999–2002)	17.2	7.7	19.5	10.9	36.6	−2.3	33.4
Average (2003–2007)	22.6	11.1	14.7	8.7	37.3	7.9	29.4

Notes: Authors' calculation based on different treatments of entry and exit. Rates reported are in percentages.

Table A2
Firm distribution by ownership, 1998–2007.

Year	SOEs	Collective	Private	Foreign	Dong and Xu (2009)	
					Private	Public
1998	34.0	39.0	9.4	17.6	27.8	72.2
1999	31.5	37.3	13.0	18.2	30.9	69.1
2000	26.5	35.0	19.4	19.1	36.6	63.4
2001	20.8	29.9	29.3	20.0	44.4	55.6
2002	16.7	26.0	36.8	20.5	50.8	49.2
2003	12.7	21.8	44.2	21.3	56.0	44.0
2004	8.8	15.4	53.9	21.9	62.1	37.9
2005	6.5	14.4	57.0	22.1	64.2	35.8
2006	5.8	11.7	60.9	21.5	66.0	34.0
2007	4.2	10.6	63.9	21.3	66.0	34.0
All	14.0	21.3	44.0	20.7	54.1	45.9

Notes: All numbers are in percentages. The last two columns show the distribution by Dong and Xu's (2009) classification which decomposes firms into private and public.

Table A3
Average job flow rates by ownership and by size (1998–2002). Definition following Dong and Xu (2009).

	JC	JD	SUM	NET	EXCESS
Panel a. By ownership					
Public	8.6	15.1	23.7	−6.5	17.1
Private	20.6	12.8	33.4	7.7	25.7
Panel b. By employment size					
Size < 100	19.0	14.7	33.7	4.3	25.2
100 ≤ size < 500	14.0	14.4	28.4	−0.3	24.7
500 ≤ size < 1000	11.7	15.9	27.7	−4.1	23.5
Size ≥ 1000	9.4	13.6	22.9	−4.2	18.7

Notes: Authors' calculation for samples with different types of ownership or different sizes following Dong and Xu's (2009) definition of entry (and exit) and classification of ownership (and size).

Table A4
Average job flow rates by 2-digit industry.

Industry	JC [1]	JD [2]	SUM [3]	NET [4]	EXCESS [5]	OI [6]	SOE [7]
Food processing (13)	18.2	16.8	35.0	1.4	28.7	30.8	13.7
Food production (14)	17.2	14.5	31.7	2.7	26.3	57.2	17.5
Beverages (15)	12.4	13.6	26.1	−1.2	21.2	8.9	21.7
Tobacco (16)	13.2	17.6	30.8	−4.5	26.3	4.1	79.1
Textile (17)	13.5	13.7	27.3	−0.2	23.6	50.9	9.9
Apparel (18)	16.2	9.6	25.7	6.6	19.2	55.6	2.4
Leather, fur, and feather (19)	16.1	10.1	26.2	6.0	20.1	83.5	2.4
Timber (20)	20.7	13.6	34.3	7.1	27.2	65.3	12.1
Furniture (21)	19.1	10.7	29.8	8.5	21.4	55.1	2.6
Papermaking (22)	12.9	13.0	25.9	−0.1	22.8	60.3	17.5
Printing (23)	11.7	12.5	24.2	−0.8	21.0	28.0	24.1
Stationary and sports products (24)	15.1	10.6	25.8	4.5	21.3	77.8	4.8
Petroleum processing (25)	14.6	12.8	27.4	1.8	22.6	23.7	42.6
Chemicals (26)	12.4	14.3	26.7	−1.9	21.8	67.5	24.1
Pharmaceutical (27)	12.6	11.6	24.2	0.9	21.6	41.2	20.6
Chemical fibers (28)	12.1	12.4	24.4	−0.3	20.5	11.7	40.7
Rubber (29)	12.2	11.8	24.0	0.4	19.2	52.8	12.4
Plastics (30)	16.4	11.8	28.3	4.6	22.7	64.6	4.3
Non-metallic mineral products (31)	12.8	13.2	25.9	−0.4	23.1	31.4	12.2
Pressing of ferrous (32)	11.6	11.1	22.8	0.5	18.0	16.6	42.6
Pressing of nonferrous (33)	13.2	10.5	23.7	2.7	18.6	65.8	38.0
Fabricated metals (34)	15.5	11.6	27.2	3.9	21.4	81.0	5.4
General equipment (35)	12.0	12.7	24.7	−0.6	19.6	84.2	21.1
Special equipment (36)	11.6	14.2	25.7	−2.6	20.2	94.8	25.2
Transport equipment (37)	12.1	11.8	24.0	0.3	20.0	46.3	40.3
Electrical machinery and equipment (39)	15.3	11.4	26.7	3.9	21.3	79.8	9.8
Electronic and telecom (40)	18.7	10.5	29.1	8.2	20.3	82.4	16.9
Instruments (41)	14.2	12.5	26.7	1.7	21.5	97.3	21.7
Handicraft and others (42)	15.8	12.1	27.9	3.7	24.1	73.8	2.3

Notes: Authors' calculation for average job flow rates at 2-digit industries from 1998 to 2007. The last two columns report the trade openness index (OI) and the share of SOE firms (SOE) in each industry. The openness index is defined as (imports + exports)/(imports + exports + domestic sales). Numbers are in percentages.

Table A5
Job flow rates and between-group shifts for other countries in the literature.

Country	JC	JD	SUM	NET	
Panel a. Job flow rates					
U.S.A., 1973–1986[a]	9.2	11.3	20.5	−2.1	
U.S.A, 1973–1992[b]	8.8	10.1	18.9	− 1.4	
Canada, 1973–1992[b]	10.9	11.1	21.9	− 0.2	
Chile, 1979–1986[c]	12.9	13.9	26.8	− 1.0	
Columbia, 1977–1991[c]	12.5	12.2	24.6	0.3	
Morocco, 1984–1989[c]	18.6	12.1	30.7	6.5	
Slovenia, 1994–2000[d]	6.0	7.1	13.1	− 1.1	
Estonia, 1994–1997[e]	7.9	8.1	16.0	− 0.2	
Poland, 1994–1997[e]	3.2	5.4	8.6	− 2.2	
Bulgaria, 1994–1997[e]	2.4	5.7	8.1	− 3.3	
Hungary, 1994[f]	1.3	6.6	7.8	− 5.3	
Ukraine, 1996[g]	2.5	15.3	17.8	−12.8	
Russia, 1991–1999[h]	2.4	10.3	12.7	− 7.9	
Country	Industry	Ownership	Size	Age	Region
Panel b. Between-group shifts					
U.S.A., 1978–1983[a]	0.010	0.000	0.000	0.060	0.000
U.S.A., 1973–1992[b]	0.036	–	–	–	–
Canada, 1973–1992[b]	0.025	–	–	–	–
Poland, 1994–1997[e]	0.052	0.088	0.014	–	0.183
Estonia, 1994–1997[e]	0.277	–	0.213	–	0.149
Slovenia, 1994–1997[e]	0.276	–	0.132	–	0.162
Bulgaria, 1994–1997[e]	0.137	0.024	0.039	–	0.113
Romania, 1994–1997[e]	0.114	0.034	0.002	–	0.102

Notes: These statistics are collected from various sources of literature.
[a] Davis and Haltiwanger (1992).
[b] Baldwin et al. (1998).
[c] Roberts (1996).
[d] De Loecker and Konings (2006).
[e] Faggio and Konings (2003).
[f] Bilsen and Konings (1998).
[g] Konings and Walsh (1999).
[h] Brown et al. (2002).

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