26th Asian Economic Symposium-2016: 1-22

Trade Openness, Foreign Direct Investment and Job Reallocation of Chinese Industrial Sectors

Risheng Mao[1,*] and John Whalley[2]

[1]*Institute of World Economics & Politics, Chinese Academy of Social Sciences, China*
[2]*Department of Economic, Social Science Center, University of Western Ontario, Canada*

Abstract: Both trade expansion and inflow of Foreign Direct Investment (FDI) potentially play important roles in shaping the Chinese labor market, but most studies of the effects of trade and FDI on the labor market focus only on the net employment change. In this study, we describe the pattern of job flows both within and across sectors and investigate the links between trade expansion and FDI inflow with gross job flows in Chinese industrial sectors. The study yields three main results. First, gross job flows mainly occur between firms and within industrial sectors and there is relatively small employment change across sectors over the past 10 years. Second, trade openness overall has limited effects on job flows occurring within sectors but has substantial effects on the net change in employment across sectors. Third, in contrast to trade openness, FDI inflows have small effects on changes in employment across sectors after controlling for trade expansion effects but can generate substantial effects on job flows within industrial sectors.

Keywords: *Trade openness, Foreign Direct Investment, Employment, China*

INTRODUCTION

As emphasized by Melitz (2003), trade openness can be one of the important forces that drive resources to reallocate from less productive to more productive firms (or plants) and thus promote welfare and aggregate productivity. Over the past two decades, rapid trade expansion and FDI inflows have been important engines that have driven the Chinese economy as one of the fastest growing. The Chinese job market has also been reshaped by this rapid trade expansion and accumulation of FDI stock, especially in the industrial sectors which account for over 90% of bilateral trade and over 70% of total FDI inflows.

There is a substantial prior literature on the effects of trade openness and FDI inflow on job markets (Revenga, 1992; Milnerand Wright, 1998; Hine and Wright, 1998; Greenaway, *et al.*, 1999; Fu and Balasubramanyam, 2005), but most studies focus on investigating the effects of trade expansion and FDI change on net employment change. In contrast to the previous research, we investigate the linkage of trade openness and FDI inflows with gross job flows both within and across Chinese industrial sectors; existing studies on the response of changes in employment to trade expansion and FDI inflows substantially understate the full magnitude of labor reallocation.

Most existing research on the impacts on gross job flows of international competition factors focus on the interactive effects of real exchange rate movements and trade openness on gross job flows (Klein *et al.*, 2003; Moser *et al.*, 2010; Nucci and Pozzolo, 2010), In contrast, we highlight the different effects of export openness, import penetration and FDI inflow on gross job flows. Our results show that impacts of export openness on job creation and job destruction are symmetric, but also have a reverse effect, that is, export growth contributes substantially to net employment growth but have small effects on job flows

**Corresponding Author's Email: maorsh@cass.org.cn, gilbertmao@163.com*

within sectors. An increase in import penetration only has significant and negative impacts on the job creation rate but has no significant impact on the job destruction rate for industrial sectors. The overall impacts of trade openness on job flows within the industrial sector are limited. These results support earlier findings by Davis and Haltiwanger (1996), and Wacziarg and Wallack (2003) but are opposite to results by Klein, *et al.* (2003) and Christiv *et al.* (2008). Because over 50% of exports by Chinese industrial sectors are from foreign invested firms Foreign Invested Enterprises (FIEs) have significant and positive impacts on the job creation rate through the export channel. On the other hand, FIEs can also generate significant and positive effects on the job destruction rate through the market competition channel. We find FDI inflows actually have minimal effects on employment change across sectors but substantial effects on job reallocation within sectors after controlling for trade expansion effects.

This study also documents the pattern of gross job flows across Chinese industrial sectors. To our best knowledge, only one study describes the general pattern of gross job flows for China (Deng, *et al.*, 2007). We use a more representative panel dataset covering all above average scale firms for Chinese industrial sectors (total revenue over 5 million RMB) over the period 1998 to 2009. We measure gross job flows categorized by the firm's age, employment size, ownership structure and geographic regions as in the related studies (Davis and Haltiwanger, 1992; Albaek and Sorensen, 1998; Haltiwanger and Vodopivec, 2002; Brown and Earle, 2002). Our results show that there is small net employment change but substantial job flows within sectors over the past 10 years for Chinese industrial sectors. The persistence of job creation and destruction rates is lower for Chinese industrial sectors than for developed and transitional economies. The estimated job creation and job destruction rates are asymmetric for firms with different ownership structure. The rapid growth of private firms and FIEs contributes substantially to the positive change of net employment, while the restructuring and reform of State Owned Enterprise (SOEs) are a cause of negative change in employment for Chinese industrial sectors. The variation in gross job flows across industrial sectors with different trade openness and FDI penetration rate is also statistically described.

The remainder of this paper is organized as follows. In section 2, we introduce the firm level panel dataset for Chinese industrial sectors, sample selection process and describe the pattern of gross job flows categorized by different groups. In section 3, based on the related studies and the theoretical background on the linkage of trade openness and FDI inflows with gross job flows; we investigate the impacts using a dynamic estimation strategy. In section 4, we report results and provide possible explanations for them. Concluding remarks are presented in section 5.

PATTERN OF JOB FLOWS ACROSS AND WITHIN CHINESE INDUSTRIAL SECTORS

Data and sample selection

This study uses a large panel survey dataset of Chinese industrial sectors collected every year by the National Bureau of Statistics, China. This panel started in 1998 with over 165,000 firms and ended in 2009 with over 305,000 firms. The maximum number of firms reached over 411,000 in 2008. This firm level panel dataset includes firms only above a certain size (those with average sales revenue over 5 million RMB). All the firms belong to

over 660 four digit narrowly defined industrial sectors[1]. The analysis based on firm level data cannot take into account job flows between different establishments within a firm. This is not a serious problem for our study if firms belong to a single 4 digit industrial sector, and if the regional area and ownership structure for firms do not change in the period. We thus describe the pattern of gross job flows for more aggregated categories and investigate the association of trade openness and FDI with job reallocation within the 4 digit narrowly defined industries. Hence, firms that have multiple business activities in several 4 digit sectors are dropped. Firms that experienced merge, acquisition and ownership structure change or transferred to a different business activity in the alternative sectors are also dropped from our analysis[2]. Following previous research methodology, we keep those firms that have at least 5 employees. Due to the complicated definition of entry and exit of firms in this panel dataset, we only keep firms that have at least two successive years of observations and investigate the pattern of gross job flows for continuous firms. After taking into account the above, our final selected sample includes over 111,000 firms in1998 and the maximum number of firms is over 328,000 in 2008.The total observations are 2,378,180 from the year 1998 to 2009 and around 25% observations are dropped from the original panel dataset of Chinese industrial sectors. The summary statistics of the related variables for firms in the selected sample are reported in Table 1.

Gross Job Flow Measurement

We use the sample selected panel dataset to measure the gross job flows by different categories. Following earlier methods (Davis *et al.*, 1992; 1996), we calculate gross job creation by summing employment gains at expanding firms within a sector, region or other categories. Gross job destruction is calculated by summing employment losses at shrinking firms within a category. To illustrate our method of gross job calculation, we define L_{fct} as the level of employment in a particular firm, which belongs to a member of sector, region or a certain category and the change of employment as ΔL_{fct}. We define job creation of firm *f as* ΔL_{fct} if ΔL_{fct} is positive and job destruction of the firm is absolute value of ΔL_{fct} if ΔL_{fct} is negative. Aggregating across all firms within a sector or other categories provides the amount of job creation and job destruction in a certain category. The job creation rate *JC* and the job destruction rate (*JD*) in category c in the period of t are,

$$JC_{ct} = \sum_{\substack{f \in C \\ \Delta L_{fct} > 0}} \left(\frac{\Delta L_{fct}}{\bar{L}_{ct}}\right) JD_{ct} = \sum_{\substack{f \in C \\ \Delta L_{fct} < 0}} \left(\frac{|\Delta L_{fct}|}{\bar{L}_{ct}}\right) \quad (1)$$

where$\bar{L}_{ct}$ is the average employment level between period of *t-1* and *t* in category *c*, i.e., $\bar{L}_{ct} = 0.5 * (L_{ct-1} + L_{ct})$ while the job reallocation rate is the sum of job creation and job

[1] The 4 digit codes of Chinese industrial sectors were revised and adjusted in 2003. We use the concordance from National Bureau of Statistics (NBS), China between the 4digit codes published in 1994 and new version of 4digit codes published in 2002 to reclassify all industrial codes before 2003 into the new version codes published in 2002.

[2] The Chinese names and identity codes for a fraction of firms varies over time periods; we conduct data matching and cleaning through several phases following procedures of research carried out by Brandt, et al. (2012), which uses the dataset from the same source as ours.

destruction rates, $JOBR_{ct}=JOBC_{ct}+JOBD_{ct}$. The net change in employment is the difference between job creation and job destruction rates; $JOBN_{ct}=JOBC_{ct}-JOBD_{ct}$. The excess job reallocation rate is the difference between job reallocation rate and absolute value of net employment change, i.e., $JOBE_{ct}=JOBR_{ct}-|JOBN_{ct}|$. This is the share of the job reallocation rate in excess of the amount required to accommodate the net employment change.

Table 1: Summary Statistics of Firms in Chinese Industrial Sectors

Year	No. of Firms	Mean Value					
		Total Sales	Foreign Sales	No. of Employment	Inventory Value	Total Profits	Wage Paid
1998	111,337	32,762.3	6,920.0	285	7,231.8	662.7	2,071.3
1999	124,773	33,696.9	6,940.9	259	6,907.5	947.2	2,010.7
2000	123,497	38,693.1	8,783.3	248	7,285.7	1,612.6	2,174.7
2001	126,036	41,424.6	9,521.3	228	7,197.8	1,780.6	2,350.8
2002	138,361	44,834.4	10,694.3	220	7,050.8	2,145.7	2,326.8
2003	152,719	54,215.6	13,275.3	220	7,763.8	2,870.0	2,569.2
2004	217,370	52,956.0	14,029.4	186	7,418.1	2,742.7	2,508.8
2005	230,406	65,554.3	16,258.9	194	8,215.0	3,258.2	2,948.5
2006	259,704	75,608.1	18,043.8	190	8,857.1	3,995.3	3,334.7
2007	289,239	88,367.9	19,583.2	186	9,757.5	5,284.7	3,984.5
2008	328,973	89,657.6	18,586.3	174	9,494.2	5,083.4	4,528.2
2009	275,765	10,1285.4	16,961.9	173	9,783.3	6,496.3	--------
Total	2,378,180	67,938.9	14871.1	202	8,445.2	3,669.8	3,088.6

Notes: Unit for statistics of total sales, foreign sales, inventory value, total profits and wage paid is 1000RMB.

Time Variation and Persistence of Gross Job Flows

Table 2 presents data on the time variation of gross job flows for Chinese industrial sectors over the period 1999 to 2009. These data show that job creation and job destruction take place simultaneously. Job creation rates range from 7.2% in 2001 to 12.4% in 2008. Job destruction rates range from 8.1% in 2006 to 14.6% in 1999. The weighted averages of job creation and destruction rates are 10.8% and 9.7% respectively. In contrast to job creation and destruction rates, the net change in employment during the same period is relatively small; and the net growth rate of employment varies from -5.7% in 1999 to 5.7% in 2005, and weighted average net growth rate of employment is only 1% over the period of 1999 to 2009.

The last two columns in Table 2 show also that job reallocation rates range from 17.2% in 2001 to 23.5% in 1999. The excess job reallocation rates vary from 14.3% in 2001 to 22% in 2009; the weighted mean values of job reallocation rates and excess job reallocation rates are 20.5% and 17.7% respectively. These results also imply that over 85% percent of gross job flows occurs within industrial sectors that are not part of net change in employment across sectors.

The Pearson correlation coefficients show that the net growth rate of employment is significantly correlated with job creation and job destruction rates, while the correlation coefficients between net employment change and job reallocation rate are not significant. It appears that the variations in job creation and destruction rates are symmetric. We do not observe countercyclical change in job reallocation rate as in related research on the United States (Davis and Haltiwanger, 1992; Mortensen and Pissarides, 1994; Caballero *et al*., 1997).

Table 2: Gross Job Flows over the Period of 1999 to 2009 (Unit: Fraction)

YEAR	JC	JD	JN	JR	JE
1999	0.089	0.146	-0.057	0.235	0.178
2000	0.086	0.119	-0.033	0.205	0.171
2001	0.072	0.100	-0.028	0.172	0.143
2002	0.101	0.095	0.006	0.196	0.190
2003	0.107	0.085	0.022	0.192	0.170
2004	0.102	0.090	0.012	0.192	0.180
2005	0.140	0.083	0.057	0.222	0.165
2006	0.110	0.081	0.029	0.191	0.162
2007	0.112	0.082	0.031	0.194	0.163
2008	0.124	0.093	0.031	0.217	0.186
2009	0.110	0.115	-0.004	0.225	0.220
Mean	0.108	0.097	0.010	0.205	0.177
Pearson Correlations					
ρ(jc,jn)		*ρ(jd,jn)*		*ρ(jn,jr)*	
=0.863(0.000)		=-0.885(0.000)		=-0.095(0.782)	

Note: The mean values are all weighted by the employment size in different year.

Because newly created jobs can be destroyed and newly destroyed job positions can be recreated simultaneously in the next periods, we now turn to the persistence of job creation and destruction rates. This allows us to assess the magnitude of job creation and job destruction in given periods that can be passed through to later periods. We only measure that the persistence of job creation and job destruction rates for firms that have consecutive observations. We measure the persistence of job creation and job destruction rates as PJC1, the fraction of job newly created in year that continue to be present in year t+1, and PJC2 the fraction of jobs newly created in year t that continue to be present in year t+2. The persistence of job destruction rate is defined analogously.

Table 3 reports the persistence of jobs created and jobs destroyed in the previous one and two years. The key feature in Table 3 is that the persistence of job creation and job destruction rates varies substantially over different periods. The persistence of jobs created in previous year varies from 0.824 and 0.428, and the persistence of jobs created two years earlier drops substantially and ranges from 0.505 to 0.247. The weighted average values of the persistence of jobs created in previous one and two years are only 0.579 and 0.329 respectively. The persistence of job destruction follows the same pattern. The weighted average values of persistence of job destruction drop from 0.587 after one year to 0.349 after two years. Compared with most developed countries and transitional economies, there are relatively low persistence rates for job creation and destruction and suggest that a large fraction of job creation and job destruction are transient in Chinese industrial sectors. This possibly reflects the consistent restructuring of Chinese industrial sectors under SOEs reform over the past decade.

Table 3: Persistence of Gross Job Flows (Unit: rates)

Year	PJC1	PJC2	PJD1	PJD2
2000	0.565	—	0.812	—
2001	0.633	0.372	0.705	0.547
2002	0.428	0.298	0.699	0.490
2003	0.550	0.247	0.644	0.471
2004	0.514	0.273	0.424	0.277
2005	0.445	0.229	0.559	0.273
2006	0.824	0.352	0.607	0.361
2007	0.639	0.505	0.601	0.360
2008	0.511	0.304	0.473	0.283
2009	0.611	0.323	0.510	0.243
Mean	0.579	0.329	0.587	0.349

Notes: The mean values are all weighted by employment size in different year; PJCN (PJDN) is the fraction of job created (destroyed) between year *t-1* and t that persist through year *t+n*.

Variation by Firm's Age, Scale, Ownership and Geographic Regions

Existing research indicates gross job flows are dependent on firms' idiosyncratic demand. Following previous studies, we also calculate the variation of gross job flows by firm age, scale, ownership and geographic regions. Table 4 provides the average value of net growth rate of employment and gross job flows for each category. The statistical results of gross job flows distributed by firm age suggest that young firms are more likely to create new jobs than older firms. The magnitude of job reallocation and job creation both decline substantially with the increase of firm's age, which also corresponds to results of previous research.

The cross panel in Table 4 also shows that job creation, destruction and reallocation rates all exhibit an increase with an increase in firm's size of employment, which is opposite to other research. A possible explanation for this is that our sample only includes firms above a certain size (sales revenue over 5 million RMB).The average share of employment for smallest scale firms (employee between 5 and 50) is only about 2% while the average share of employment for largest scale firms (employees over1000) is over 32.8%.

Job flows measured by firm's ownership type show that private firms, foreign FIEs and firms from Hongkong, Taiwan and Macao (HTM) all have higher job creation and reallocation rates than SOEs; while SOEs have higher average job destruction rates than other firms due to the market based reform and restructuring of SOEs during the past decade. The growth rate of net employment for SOEs is -7% while the growth rates of net employment for private, FIEs and HTM range from 2.3% to 4.2%. These are all relatively large given the average employment growth rate in the whole industrial sector is only 1%. The above results indicate that a large fraction of job destruction in Chinese industrial sectors due to restructuring of SOEs has been compensated by the substantial job creation due to the rapid expansion of private firms and FIEs. The employment share of SOEs declines consistently with the rapid increase in the employment share for private firms and FIEs.

The descriptive statistics of net change in employment and job reallocation by geographic regions show that Eastern regions of China both have positive and fast growth in net employment. The employment share in East regions of China is over 61%. Other regions in China show no significant or substantial negative change in net employment. North East and South East of China have the highest job reallocation rates, while North East of China has the highest job destruction rate, probably due to a high concentration of SOEs. Eastern regions of China high job creation rate reflects the rapid trade expansion and FDI inflows that have attracted workers migrating from other regions in the past 10 years.

Figure 1 also reflects the time variation of gross job flows for different regions, which also supports earlier results suggesting that North East and Eastern regions of China have relatively higher job reallocation rates than the other regions. The key feature captured by Figure 1 is that there was a sharp increase in job destruction and reallocation rates, and the growth rate of net employment also dropped substantially in the South West of China in 2004. Job creation and job reallocation rates also increased and net growth in employment jumped to its highest level in the Middle and East regions in 2005. A possible explanation is that industrial sectors relocated from South West to Middle and East regions after 2004 due to the Three Gorge Dam construction in the South West regions of China.

Gross Job Flows by Export Openness, and Import and FDI Penetration across Sectors

Results in the above section predicted that trade openness and FDI inflows can be forces driving gross job flows within and across sectors. We now turn to more details on the links between gross job flows with these factors.

Table 5 presents weighted average values of net employment, gross job flow rates, export openness, and import and FDI penetration across 2 digit industrial sectors. The weighted average values in Table 5 show that there is substantial variation in gross job flow rates across industrial sectors, and gross job flow rates are all significantly correlated with the extent of export openness, import and FDI penetration rates. The annual average values of job creation, net employment change and job reallocation rates are lowest in the tobacco industry and highest in the electronic equipment manufacturing industry. Trade openness and FDI penetration rates in the tobacco industry are relatively small across 26 industrial sectors, while export openness and FDI penetration rates in the electronics industry are both highest.

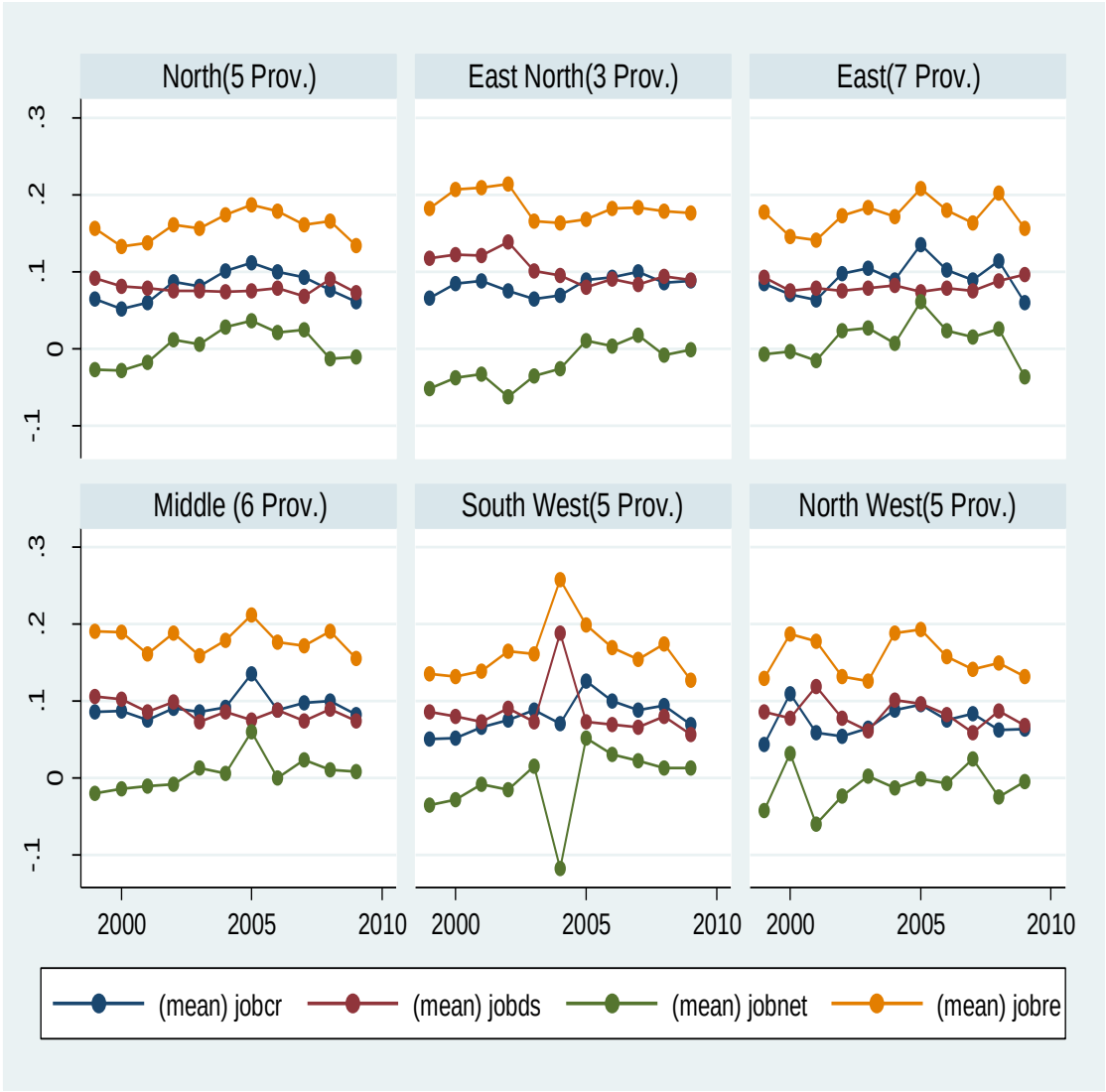

Figure 1: Gross Job Flows across Regions over the Period of 1999 to 2009

Job creation rates vary from 15.7% to 7.3%, net growth rates in employment vary from-2.4% to 5.8%, and job reallocation rates range from 17% to 25.5% across the 26 two digit industrial sectors. Job destruction rates range from 7.8% in the gas and petroleum mining industry to 11.3% in the food processing industry. Industrial sectors with high export openness are concentrated in electronic equipment, instruments, sport products, lumber and apparel manufacturing industries. Industries with highest import penetration rates include iron ore, gas and petroleum mining and instrument manufacturing. The Pearson correlation coefficients of gross job flows with trade openness and FDI penetration rates suggest that job creation, net growth in employment and job reallocation rates all have positive and significant correlations with export openness and FDI penetration rates. Job destruction rates have negative and significant correlations with trade openness and FDI inflows.

Table 4: Heterogeneity in Firms and Gross Job Flows (Unit:Rates)

Years of Survive	Age					
	JC	JD	JN	JR	JE	SHARE
0-1	0.172	0.081	0.092	0.251	0.076	0.007
1-4	0.154	0.080	0.070	0.238	0.083	0.069
5-9	0.128	0.087	0.040	0.215	0.082	0.294
10-20	0.109	0.095	0.015	0.203	0.088	0.410
20+	0.061	0.094	-0.040	0.163	0.020	0.220
No. of Employee	Employment Scale					
	JC	JD	JN	JR	JE	SHARE
5—50	0.065	0.068	-0.002	0.133	0.120	0.022
51-150	0.085	0.082	0.003	0.166	0.150	0.136
151—300	0.105	0.093	0.012	0.198	0.174	0.182
301—500	0.101	0.098	0.003	0.199	0.178	0.148
501—1000	0.104	0.100	0.004	0.204	0.180	0.185
1000+	0.126	0.106	0.020	0.233	0.190	0.328
Ownership	Ownership Type					
	JC	JD	JN	JR	JE	SHARE
SOEs	0.060	0.130	-0.070	0.189	0.117	0.132
Private	0.126	0.092	0.034	0.218	0.184	0.256
FIEs	0.129	0.087	0.042	0.216	0.167	0.152
HTM	0.122	0.099	0.023	0.221	0.185	0.166
Miscellaneous	0.093	0.093	0.000	0.186	0.163	0.293
Regions (No.of Prov.)	Geographic Regions					
	JC	JD	JN	JR	JE	SHARE
North(5)	0.097	0.102	-0.005	0.199	0.177	0.098
North East(3)	0.105	0.122	-0.017	0.227	0.175	0.067
East (4)	0.104	0.090	0.014	0.194	0.162	0.376
Middle (6)	0.100	0.098	0.002	0.198	0.160	0.137
South East(2)	0.130	0.101	0.029	0.231	0.192	0.235
South West （4）	0.096	0.098	-0.002	0.194	0.156	0.054
Norht West（5）	0.074	0.090	-0.016	0.164	0.138	0.030

Notes: The statistic data are size weighted average values from 1999 to 2009; the employment scale is the average number of employment for the firms in the whole periods. SOEs represent the state owned enterprises. Private means the private firms, FIEs is the foreign invested enterprises from foreign countries excluding Hongkong, Taiwan and Macro, and HTM represent the firms from Hongkong ,Taiwan and Macro.

To further assess the impact on gross job flows with of openness and FDI inflow, we also calculate the variation in net change in employment and gross job flows by trade openness and FDI penetration rates for 4 digit industrial sectors. The first panel of Table 6 shows that the weighted average values of job creation, net employment and job excess reallocation rates all rise with an increase in export openness. There seems no clear trend in job destruction and reallocation rates with variations in export openness. We also find no clear trend in net employment and gross job reallocation with variation in import penetration rates in Table 6. In contrast to export openness and import penetration, the job creation, net employment growth, job reallocation and job excess reallocation rates all show an upward trend with the increase in FDI penetration rates. The impact on job destruction rates with variation in FDI penetration rate in industrial sectors is unclear.

Table 5: Gross Job Flows, Trade Openness and FDI Penetration rates across Sectors (Unit: Rates)

Industries (2-digit codes)	JC	JD	JN	JR	EXS	IMS	FDIS
Coal mining(06)	0.096	0.088	0.008	0.184	0.016	0.072	0.007
Gas and Petroleum Mining(07)	0.135	0.078	0.057	0.213	0.128	0.836	0.030
Iron Ore Ming(08)	0.132	0.102	0.030	0.234	0.002	0.617	0.022
Food(14)	0.123	0.113	0.010	0.236	0.108	0.034	0.297
Tobacco(16)	0.073	0.097	-0.024	0.170	0.011	0.072	0.029
Textile(17)	0.090	0.103	-0.013	0.192	0.265	0.119	0.250
Apparel(18)	0.107	0.096	0.011	0.203	0.488	0.019	0.525
Lumber(19)	0.116	0.099	0.017	0.215	0.513	0.047	0.654
Furniture(21)	0.129	0.107	0.023	0.236	0.490	0.013	0.539
Printing(22)	0.097	0.094	0.003	0.190	0.094	0.183	0.233
Sports(24)	0.113	0.108	0.006	0.221	0.647	0.035	0.694
Chemicals(26)	0.094	0.096	-0.002	0.190	0.103	0.284	0.155
Pharmaceuticals(27)	0.102	0.080	0.023	0.182	0.095	0.107	0.197
Fiber(28)	0.089	0.095	-0.006	0.184	0.051	0.117	0.217
Rubber(29)	0.095	0.095	0.000	0.191	0.249	0.117	0.412
Plastics(30)	0.122	0.101	0.021	0.223	0.249	0.116	0.459
Stone,Clay and glass(31)	0.089	0.098	-0.008	0.187	0.092	0.046	0.150
Metal Smelting(33)	0.100	0.079	0.021	0.179	0.098	0.330	0.144
Fabricated Meltals(34)	0.114	0.100	0.015	0.214	0.254	0.085	0.305
Generic Machinery(35)	0.096	0.091	0.005	0.187	0.163	0.242	0.195
Specific Machinery(36)	0.096	0.102	-0.006	0.198	0.127	0.292	0.226
Transportation(37)	0.105	0.085	0.020	0.191	0.134	0.124	0.277
Electrical Equipment(39)	0.124	0.091	0.033	0.216	0.267	0.151	0.435
Electronic Equipment(40)	0.157	0.098	0.058	0.255	0.644	0.302	0.744
Instruments(41)	0.114	0.109	0.005	0.223	0.500	0.594	0.522

Pearson Correlations (calculated based on the values of 4 digit industries):

$\rho(jc,exs)$=0.178(0.000) $\rho(jd,exs)$=-0.028(0.022) $\rho(jn,exs)$ =0.125(0.000) $\rho(jr,exs)$=0.102(0.000)

$\rho(jc,ims)$=-0.083(0.000) $\rho(jd,ims)$=-0.066(0.000) $\rho(jn,ims)$=-0.007(0.652)$\rho(jr,ims)$=-0.114(0.000)

$\rho(jc,fdis)$=0.235(0.000) $\rho(jd,fdis)$=-0.071(0.000) $\rho(jn,fdis)$=0.189(0.000)$\rho(jr,fdis)$=0.106(0.000)

Notes: The descriptive statistics across sectors are weighted average values from 1999 to 2009; EXS denotes the export openness; IMS and FDIs are import penetration and FDI penetration rates respectively.

Table 6: Gross Job Flows Measured by Trade Openness and FDI Penetration Rate

Rate	Export Openness					
	JC	JD	JN	JR	JE	SHARE
Non Export (0)	0.052	0.167	-0.115	0.218	0.058	0.000
0<Rate<=0.2	0.098	0.095	0.003	0.193	0.144	0.553
0.2<Rate<=0.5	0.115	0.101	0.014	0.216	0.164	0.219
0.5<Rate<=1	0.126	0.100	0.026	0.227	0.177	0.228
Rate	Import Penetration					
	JC	JD	JN	JR	JE	SHARE
Non Import (0)	0.110	0.100	0.011	0.210	0.145	0.093
0<Rate<=0.2	0.107	0.098	0.009	0.205	0.160	0.680
0.2<Rate<=0.5	0.107	0.095	0.013	0.202	0.151	0.177
0.5<Rate<=1	0.121	0.098	0.023	0.218	0.143	0.050
Rate	FDI Penetration					
	JC	JD	JN	JR	JE	SHARE
Non FDI (0)	0.054	0.130	-0.076	0.185	0.066	0.003
0<Rate<=0.2	0.092	0.098	-0.006	0.190	0.141	0.414
0.2<Rate<0.5	0.113	0.095	0.017	0.208	0.161	0.331
0.5<Rate<1	0.128	0.099	0.029	0.227	0.175	0.252

Note: The export openness and FDI penetration rates are weighted average values of 4 digit industrial sectors over the period of 1999 to 2009; while the import penetration rate is calculated as weighted average values of 3 digit industrial sectors from 1999 to 2009.

The above results for gross job flows in Chinese industrial sectors are also consistent with related research on heterogeneity in firm dynamics. Gross job flows vary with the firm's attributes, industry characteristics and other aggregate shocks as discussed in the related literature.

A THEORETICAL FRAMEWORK AND EMPIRICAL ESTIMATION STRATEGY FOR ASSESSING LINKS

Theoretical Framework

In this section, we develop a simple theoretical framework to further investigate the links between job flows with trade openness and FDI penetration in narrowly defined industrial sectors. Our model follow a previous study on exchange rate and gross job flows by Klein, *et al.* (2003).We begin by specifying the labor demand of firm F and its unit cost function C_F in industry *i* as,

$$C_F(W_F, R_F) = W_F^{\alpha} R_F^{1-\alpha} Q_F \tag{2}$$

Where W_F is the wage rate of firm *F* and R_F is the unit price of non-labor input and Q_F is the output. By Sheppard's lemma, the labor demand for firm *F* can be expressed as the derivative of its cost function with respect to its wage rate, that is,

$$L_F^D = \alpha W_F^{\alpha-1} R_F^{1-\alpha} Q_F \tag{3}$$

The total differential of the logarithm of labor demand is,

$$\hat{L}_F^D = -(1-\alpha)\hat{W}_F + (1-\alpha)\hat{R}_F + \hat{Q}_F \tag{4}$$

Where for any variable $\hat{Z}$ above the equation (4) denotes the total differential of the logarithm of variables, that is $\hat{Z} = \Delta LnZ$. The total output of firm *F* can be written as a function of total income and the idiosyncratic demand shock, that is,

$$Q_F = A_F Y^{\beta} \quad (5)$$

Where Y^{β} is the total income for both domestic and foreign market and A_F is the idiosyncratic demand shock faced by firm *F*.

To capture labor mobility between firms and sectors, we introduce a labor supply equation and solve for equilibrium employment in the specific industry. Following previous studies, the labor supply faced by firm F is determined by the wage rate of firm *F* and average wage rates of other firms, that is,

$$L_F^S = \left(\frac{W_F}{W^{*\delta}}\right)^{\theta} \quad (6)$$

Where L_F^S is the labor supply faced by firm *F* and W^* is the average wage rate of other firms; δ is the cross-elasticity of labor supply between firm *F* and other firms, and θ is the elasticity of labor supply with respect to relative wage rates change. The total differential of the logarithm of the labor supply equation faced by the firm is,

$$\hat{L}_F^s = \theta \hat{W}_F - \theta\delta\hat{W}^* \quad (7)$$

Defining φ_F as the fraction of labor employed by firm *F* in industry y_i and assuming each industry has *n* firms, $\sum_{F=1}^{n} \varphi_F = 1$; By summing across employment change for all firms in industry *i*, yields employment change in industry level as,

$$\hat{L}_i = \sum_{F=1}^{n} \varphi_F \hat{L}_F \quad (8)$$

Defining the demand shock and other variables in industry *i* as the weighted average value of corresponding values for firms in the whole industry y_i,

$$\hat{A}_i = \sum_{F=1}^{n} \varphi_F \hat{A}_F \; \hat{W}_i = \sum_{F=1}^{n} \varphi_F \hat{W}_F \quad (9)$$

$$\hat{W^*}_i = \sum_{F=1}^{n} \varphi_F \hat{W^*} \hat{R}_i = \sum_{F=1}^{n} \varphi_F \hat{R}_F \quad (10)$$

and setting the proportional change of labor demand to equal labor supply in the industry, we can solve for the proportional change in the wage rate at industry level, that is,

$$\hat{W}_i = \frac{1}{\theta+1-\alpha}\left\{(1-\alpha)\hat{R}_i + \hat{A}_i + \beta\hat{Y} + \theta\delta\hat{W^*}_i\right\} \quad (11)$$

To simplify things, we assume that proportional change in each firm's wage rate in industry *i* is equal to the proportional change in the weighted average wage rate for the whole industry *i*, i.e, $\hat{W}_i = \hat{W}_F$. In general, the price of non-labor inputs changes with time and is invariant across different industries and firms, and also we assume that $\hat{R}_F = \hat{R}_i = \hat{R}$.

This allows the labor demand change for the firm *F* in industry *i* to be solved for, given the labor market equilibrium achieved at industry level, as,

$$\hat{L}_F^D = \left\{(1-\alpha)(1-\lambda)\hat{R} + \hat{A}_F - \lambda\hat{A}_i + \beta\hat{Y}(1-\lambda) - \theta\delta\lambda\hat{\overline{W}^*}_i\right\} \quad (12)$$

where $\lambda=(1-\alpha)/((\theta+1-\alpha))$. Firm *F* contributes to job creation if $\hat{L}_F^D \geq 0$ while there is job destruction if $\hat{L}_F^D \leq 0$. The above equation indicates that job creation and job destruction for firm *F* not only depends on the idiosyncratic shock at firm level but also on the aggregate demand shocks taking place at industry level.

In our analysis above, trade expansion and FDI inflows create demand shocks at industry level by reallocating resource among sectors and generating productivity spillover effects on domestic industries. Heterogeneous firms along with trade expansion and FDI inflow own shocks on technological progress within industries generate simultaneous job creation and destruction (Mortensen and Pissarides, 1998). The variation of demand shocks for industry wide can thus be expressed as the function of trade openness and FDI penetration,

$$\hat{A}_i = \hat{A}_i(EXS_i, IMS_i, FDIS_i, X_i) \quad (13)$$

where EXS_i represents export openness for industry; IMS_i is import penetration in industry; $FDIS_i$ denotes penetration of FIEs in the industry *i*, and X_i represents other factors that can also affect the variation in demand shocks for the industry.

The job creation rate for the whole industry is measured by the weighted average sum of the positive growth rate in employment of firms in the specific industry. The job destruction rate for the whole industry calculated using the sum of negative growth in employment by firms in the industry. Define the set of firms with positive employment change as S_+, and firms with negative employment change as S_-. Combining the equation (12) and (13), job creation and destruction rates for industry wide can be written as,

$$JC_i = \sum_{F\in S_+} \varphi_F \begin{Bmatrix} k_1\Delta LnR - \lambda\hat{A}_i(EXS_i, IMS_i, FDIS_i, X_i) \\ +k_2\Delta LnY - k_3\Delta Ln\overline{W}_i + \Delta LnA_F \end{Bmatrix}$$

$$= \psi_+ \begin{Bmatrix} \kappa_1\Delta LnR - \lambda\hat{A}_i(EXS_i, IMS_i, FDIS_i, X_i) \\ +k_2\Delta LnY - k_3\Delta Ln\overline{W}_i \end{Bmatrix} + \sum_{F\in S_+}\varphi_F\Delta LnA_F \quad (14)$$

$$JD_i = \sum_{F\in S_-} \varphi_F \begin{Bmatrix} k_1\Delta LnR - \lambda\hat{A}_i(EXS_i, IMS_i, FDIS_i, X_i) \\ +k_2\Delta LnY - k_3\Delta Ln\overline{W}_i + \Delta LnA_F \end{Bmatrix}$$

$$= \psi_- \begin{Bmatrix} k_1\Delta LnR - \lambda\hat{A}_i(EXS_i, IMS_i, FDIS_i, X_i) \\ +k_2\Delta LnY - k_3\Delta Ln\overline{W}_i \end{Bmatrix} + \sum_{F\in S_-}\varphi_F\Delta LnA_F \quad (15)$$

where $\psi_+ = \sum_{F\in S_+}\varphi_F$; $\psi_- = \sum_{F\in S_-}\varphi_F$; $k_1 = (1-\alpha)(1-\lambda)$; $k_2 = \lambda\beta$ and $\kappa_3 = \theta\delta\lambda$; The above equations indicate that trade openness and FDI penetration can have impacts simultaneously on job creation and destruction rates of specific industries by influencing the demand shocks aggregated at industry wide.

Empirical Estimation

The above section presents a simple theoretical framework that allows investigation of links between trade openness and FDI inflows with gross job flows. It remains an empirical question as to whether trade openness and FDI inflow have substantial effects on job creation and destruction rates respectively. Based on the theoretical framework above, we specify an estimation equation as,

$$JF_{it} = \sum_{j=0}^{1}\{\beta_0 JC_{i,t-j-1} + \beta_1 JD_{i,t-j-1} + \beta_2 EXS_{it-j} + \beta_3 IMS_{it-j} + \beta_4 FDIS_{it-j} + \beta_5 \Delta LnY_{it-j} + \beta_5 \Delta LnW^*_{it-j} + \beta_5 X_{it-j}\} + \mu_i + \omega_t + \varepsilon_{it} \quad (16)$$

where the subscript *i* denotes 4 digit industries and *t* represents a specific year. The subscript *j* denotes the lagged periods of independent variables. *JF* represents the job flows of industrial sectors, which includes job creation, job destruction, job reallocation rates and net change in employment, i.e., $JF_{it} = [JC_{it}; JD_{it}; JR_{it}; JN_{it}]$. JR_{it} and JN_{it} represent job reallocation rates and net change in employment in the industry *i* and year *t* respectively. Y_{it} is the aggregate sales revenue of the industry *i* and W^* is the average real wage rate for industries other than industry *i*[3]; μ_i is the time invariant fixed effect for industry i, ω_t is a year dummy controlling for the aggregate macroeconomic variables, such as the price of non-labor inputs, and ε_{it} is an error item.

The variable representing export openness (EXS_{it}) is calculated as the ratio of foreign sales to total sales in each 4 digit industrial sector. The import penetration rate (IMS_{it}) is measured as the ratio of import value to total revenue plus import value and minus export revenue in each 3 digit industrial sector[4]. Import values for industrial sectors are indirectly accessed from Comtrade database, U.N. by building a concordance Table between 4 digit codes for trading products and 3 digit industry codes for Chinese industrial sectors. Import penetration rates in our estimation equation are thus disaggregated to 3 digit industrial levels. The FDI penetration rate ($FDIS_{it}$) is calculated as the ratio of capital input by FIEs to total capital inputs by all firm in the industry. FIEs include firms from Hongkong, Taiwan and Macro regions and other foreign countries.

X_{it} denotes other variables controlled at industry level that also have potential effects on job flows. Based on our above analysis and related research on gross job flows, we also control for the following aggregate variables for industry wide, that is,

$$X_{it} = [Age_{it}; Scale_{it}; Invrat_{it}; Pro_{it}; HHI_{it}] \quad (17)$$

[3] The average real wage rate of industries excluding industry *i* is calculated as :$W^*_{it} = \frac{TW - W_{it}}{TL - L_{it}}$, where TW and TL represent total wage and total employment in all industrial sectors in each year; W_{it} and L_{it} denote the total wage and employment in each 4-digit industrial sector in each year.

[4] The classification code for Chinese industrial sectors is based on the version in 2002 published by NBS, China.

Age_{it} is the weighted average age of firms in the specific industry. $Scale_{it}$ is the weighted average employment size of firms in industry i; These two variables controlled for idiosyncratic demand shocks due to firms heterogeneity.

$Invrat_{it}$ denotes the ratio of inventory to total production in each industry, which controls for the effects of business cycles on job flows.

Pro_{it} is the average profit rate of industrial sectors calculated as the ratio of net profits to total revenue, which reflects the performance of the firms in each industry. Job creation and job destruction rates for industry wide also depend on the productivity of the firms and the market structure of different industrial sectors.

HHI_{it} is the Herfindahl-Hirschman Index representing the concentration ratio of firms in the specific industry. We use this index to control for the effects of domestic market competition on job creation and destruction rates.

Empirical Results

The empirical equations specified in empirical estimation sub section define a dynamic panel regression model. Because the empirical equation includes several lagged dependent variables, OLS estimators are inconsistent, because the lagged dependent variables are correlated with the error term. There is also correlation of covariates with the time invariant fixed effects for the industries. The FE estimator can overcome inconsistency due to correlation of covariates with the time invariant fixed effects, but it is still inconsistent when the time dimension is small as indicated by Nickell (1981), and this is because the lagged dependent variables are also potentially correlated with the group mean of the error term. The frequently adopted and consistent dynamic panel estimators include one-step GMM system estimators due to Arellano and Bond (1991) and further developed by Blundell and Bond (1998). The frequently applied two-step GMM robust estimator recommended by Windmeijer (2005) and Roodman（2006）is also applied to identify our above dynamic panel equation model[5]. We report the empirical results identified both by FE-estimator and consistent dynamic GMM estimator to provide for a cross consistency and robustness check of our estimation results.

Tables 7 and 8 report empirical results identified by FE-estimator. Columns 1 to 6 of Table 7 show that the coefficients of lagged dependent variables are all statistically significant at 99% level; an increase in the average age of firms in the industrial sectors has not only negative and significant effects on job creation rates but also has positive and significant effects on job destruction rates. An increase in the average scale of firms can have positive and significant effects on job creation and destruction rates simultaneously.

[5]The robust and two-step GMM system estimators for identifying employment equation are conducted using STATA (version 12.1) command "xtabond2", and the theoretical background and estimation details of system and difference GMM estimators in STATA are referring to Roodman (2009).

Table 7: Job Creation and Job Destruction with Trade Openness and FDI Penetration

	Job Creation Rate			Job Destruction Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
JC	-0.166***	-0.148***	-0.165***	0.184***	0.165***	0.178***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
JD	0.126***	0.126***	0.129***	-0.165***	-0.164***	-0.167***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Age	-0.053***	-0.057***	-0.055***	0.020**	0.024**	0.022**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
$Scale$	0.017***	0.022***	0.017***	0.008**	0.006**	0.009**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$Invrat$	-0.126***	-0.128***	-0.120***	0.101***	0.108***	0.102***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Pro	0.148**	0.138**	0.146**	-0.195***	-0.168***	-0.172***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
HHI	-0.047***	-0.030***	-0.047***	-0.079***	-0.101***	-0.089***
	(0.020)	(0.020)	(0.020)	(0.021)	(0.020)	(0.021)
$\hat{Y}$	0.030***	0.029***	0.030***	-0.015***	-0.015***	-0.015***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\widehat{W^*}$	0.043**	0.041**	0.043**	-0.058***	-0.053***	-0.056***
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)
EXS	0.094***		0.082**	-0.044***		-0.058***
	(0.015)		(0.016)	(0.015)		(0.016)
IMS	-0.025	-0.024	-0.023	0.000	0.006	0.005
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
$FDIS$		0.065***	0.030***		0.018	0.042**
		(0.016)	(0.017)		(0.016)	(0.017)
Observations	3,890	3,890	3,890	3,890	3,890	3,890
R-squared	0.163	0.159	0.166	0.133	0.138	0.142
No. of sectors	643	643	643	643	643	643
F - Value	21.63***	21.01***	20.59***	17.07***	17.74***	17.11***
R-Squared	0.163	0.159	0.166	0.133	0.138	0.142

Notes: All the coefficients for JC (JD) in the table are sum of coefficients for one and two term lagged JC (JD); The coefficients for other variables are sum of coefficients for the level and one term lagged those variables; Time dummies are controlled in all the above FE estimator; Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

All the above empirical results are consistent with the descriptive statistics on gross job flows distributed by firm's age and employment size given in section on Variation by Firm's Age, Scale, Ownership and Geographic regions. The results in Table 7 also show

that the job creation rate will decline and job destruction rate will increase simultaneously with a rise in inventory ratios, which indicates that the variation of gross job flows is significantly correlated with the business cycle. An increase in profit rate of industrial sectors can also have significant and positive effects job creation rate and negative effects on job destruction rates, which implies that the employment size will expand with an increase in profit margins for industrial sectors. The coefficients for Herfindahl-Hirschman Indexes indicate that the job creation and destruction rates will decline with an increase of competition in domestic market.

Columns 1 to 3 of Table 7 report results on the association of trade openness and FDI penetration with job creation rates. In column 1, export openness and import penetration rates are both controlled for. An increase in export openness has significant and positive impacts on job creation rate while the coefficient of import penetration is negative and insignificant. In column 2, import and FDI penetration rates are controlled simultaneously, and the results show that an increase in FDI penetration rate has significant and positive effects on job creation rate in industrial sectors, while the coefficient for the import penetration rate is still negative and insignificant. In column 3, export openness, import and FDI penetration rates are all controlled for, and the results for export openness and import penetration are still consistent with the results in column 1 and 2. The impact of FDI penetration on job creation rates in column 3 declines substantially comparing to the corresponding result in column 2. This is because a large fraction of job creation generated by FDI inflows is actually through the export channel, since over 50% of exports of Chinese industrial sectors are attributed to FIEs.

In columns 4 to 6 of Table 7, the impacts of trade openness and FDI inflow on job destruction rate are investigated. In column 4, the results show that job destruction rate drops significantly with an increase in export openness while import penetration rates have no significant effect on job destruction rate. In column 5, the parameters of import and FDI penetration rates are both insignificant. In column 6, we control for export openness, import and penetration rates simultaneously. The results for export openness and import penetration rate show little change compared to the corresponding results in column 4 and 5. However, the parameter for the FDI penetration rate in column 6 is positive and significant. The empirical results show that job destruction rates will also increase significantly with a rise in FDI penetration rates in industrial sectors. This implies that, after controlling for the trade openness impacts on job destruction, FDI inflows into Chinese industrial sectors can also drive domestic firms out of the market.

The results on the effects of trade openness and FDI penetration on net change in employment and job reallocation rate are presented in Table 8. In columns 1 to 3 of Table 8, empirical results show that the variation in export openness can have substantial effects on the net change in employment. This is consistent with the empirical results in Table 7, because an increase in export openness can have positive effects on job creation rates and negative effects on job destruction rates. The parameters for import penetration rates in Table 8 are still negative and insignificant as in the corresponding results in Table 7. In column 2 of Table 8, the parameter of FDI penetration rate shows that FDI can have positive and significant effects on net change in employment if export openness is not controlled for in estimation. However, the parameter for FDI penetration becomes negative and insignificant if export openness is also controlled in column 3. These results consistently show that FDI inflows can have small impacts on net change in employment after controlling for the effects of trade expansion on net employment change. This is because

FDI can have positive and significant effects on job creation and job destruction rates simultaneously as show in Table 7, and a large fraction of FDI inflow effects on net employment is attributed to the export expansion of FIEs.

Table 8. The Impacts of Trade Openness and FDI on Net Employment and Job Reallocation Rate

	Net Employment Growth			Job Reallocation Rate		
	(1)	(2)	(3)	(4)	(5)	(6)
JC	-0.349***	-0.313***	-0.344***	0.018	0.017	0.013
	(0.028)	(0.028)	(0.028)	(0.023)	(0.023)	(0.023)
JD	0.291***	0.289***	0.296***	-0.040**	-0.039**	-0.037**
	(0.026)	(0.026)	(0.026)	(0.021)	(0.021)	(0.021)
Age	-0.073***	-0.079***	-0.077***	-0.033*	-0.033**	-0.031**
	(0.017)	(0.017)	(0.017)	(0.014)	(0.014)	(0.014)
$Scale$	0.009	0.016	0.010	0.026***	0.026***	0.026***
	(0.011)	(0.011)	(0.011)	(0.009)	(0.009)	(0.009)
$Invrat$	-0.226***	-0.236***	-0.222***	-0.024	-0.020	-0.018
	(0.036)	(0.037)	(0.037)	(0.030)	(0.030)	(0.030)
Pro	0.344***	0.306***	0.318***	-0.047	-0.029	-0.026
	(0.065)	(0.066)	(0.065)	(0.054)	(0.054)	(0.054)
HHI	0.032	0.070**	0.043	-0.127***	-0.131***	-0.136***
	(0.031)	(0.031)	(0.031)	(0.026)	(0.025)	(0.025)
$\hat{Y}$	0.044***	0.043***	0.044***	0.015***	0.014***	0.014***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
$\hat{W}^*$	0.101***	0.094***	0.099***	-0.015	-0.015	-0.012
	(0.019)	(0.019)	(0.019)	(0.015)	(0.015)	(0.015)
EXS	0.138***		0.140***	0.049**		0.023
	(0.024)		(0.025)	(0.020)		(0.021)
IMS	-0.035	-0.032	-0.027	-0.025	-0.028	-0.018
	(0.038)	(0.038)	(0.037)	(0.031)	(0.031)	(0.031)
$FDIS$		0.047**	-0.012		0.084***	0.072***
		(0.025)	(0.027)		(0.021)	(0.022)
Observation.	3,890	3,890	3,890	3,890	3,890	3,890
No. of Sectors	643	643	643	643	643	643
F-Value	23.35***	23.10***	22.80***	13.39***	13.82***	13.02***
R-Squared	0.174	0.172	0.180	0.108	0.111	0.111

Notes: The coefficients for JC (JD) in the table are sum of coefficients for one and two term lagged JC (JD); The coefficients for all other variables are sum of coefficients for the level and one term lagged those variables; Time dummies are controlled in all the above FE estimation; Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

The results for the effects of trade openness and FDI penetration on job reallocation are shown in columns 4 to 6 of Table 8. These results show that an increase in export openness can also have positive and significant effects on the job reallocation rates; however, the impact of export expansion on job reallocation rate is smaller than the impact of export expansion on net change in employment. This is also consistent with the empirical results in Table 7. These empirical results also show that an increase in FDI penetration rates can generate substantial, significant and positive effects on job reallocation rates, which also fits well with the result that a rise of FDI penetration rate has significant and positive effects on job creation and job destruction rates simultaneously in Table 7.

To further check robustness of the results in Tables 7 and 8, we use dynamic panel estimator due to Blundell and Bond (1998) to identify our empirical model. Table 9 reports the results identified using robust two-step GMM estimator recommend by Windmeijer (2005) and

Roodman (2009). The results in Table 9 show that an increase in export openness can have positive effects on job creation rates and negative effects on job destruction rates. Hence, export expansion contributes substantially to positive growth in net employment while having no significant and thus minimal effects on job reallocation rates. This is generally consistent with the empirical results identified using FE-estimator. An increase in import penetration rate can also generate negative and significant effects on job creation rates while having no significant effects on job destruction rate. Thus the net change in employment and job reallocation rates will both decline with a rise in the import penetration rate. The above result for import penetration rate is different from the result identified by FE-estimator. All the parameters of import penetration rates are insignificant as identified in Table 7 and Table 8. The results for FDI penetration rate in Table 9 show that, after controlling for trade openness variables, a rise in the FDI penetration rate can cause significant and positive effects on job creation and destruction rates simultaneously. The magnitude of the effects of FDI penetration on job destruction is relative larger than the effects of FDI penetration on job creation. Thus, an increase in FDI penetration rate has insignificant impacts on net change in employment but can cause substantial and positive impacts on job reallocation rates as in Tables 7 and 8.

Table 9: The Impacts of Trade Openness and FDI Penetration on Gross Job Flows (Bludell & Bond, 1998)

	JC.	*JD.*	*JN.*	*JR*
	(1)	(2)	(3)	(4)
$JC_{i,t-1}$	-0.064*	0.202*	-0.253*	0.126
	(0.035)	(0.120)	(0.135)	(0.086)
$JC_{i,t-2}$	-0.100***	-0.044*	-0.059	-0.157***
	(0.033)	(0.026)	(0.053)	(0.033)
$JD_{i,t-1}$	0.120***	-0.021	0.142**	0.080**
	(0.035)	(0.037)	(0.061)	(0.032)
$JD_{i,t-2}$	-0.028	-0.125***	0.099**	-0.156***
	(0.027)	(0.041)	(0.042)	(0.053)
$Age_{i,t-1}$	-0.092***	-0.002	-0.093***	-0.097***
	(0.018)	(0.022)	(0.033)	(0.017)
$Scale_{i,t-1}$	0.027*	-0.011	0.037	0.017
	(0.014)	(0.016)	(0.024)	(0.017)
$Invrate_{i,t-1}$	-0.063	0.114*	-0.188**	0.058
	(0.054)	(0.069)	(0.089)	(0.055)
$Pro_{i,t-1}$	0.085	-0.174*	0.281**	-0.095
	(0.061)	(0.097)	(0.120)	(0.109)
$HHI_{i,t-1}$	-0.067*	0.036	-0.100**	-0.039
	(0.035)	(0.059)	(0.048)	(0.070)
$\hat{Y}_{i,t-1}$	0.002	0.011**	-0.010	0.012*
	(0.006)	(0.004)	(0.007)	(0.006)
$\hat{W}^{*}_{i,t-1}$	0.018	-0.036**	0.060**	-0.016
	(0.021)	(0.014)	(0.030)	(0.013)
$EXS_{i,t}$	0.041	-0.060***	0.102**	-0.012
	(0.038)	(0.022)	(0.050)	(0.040)
$EXS_{i,t-1}$	0.063**	-0.021	0.069	0.045
	(0.030)	(0.025)	(0.043)	(0.034)

	JC.	*JD.*	*JN.*	*JR*
	(1)	(2)	(3)	(4)
$IMS_{i,t}$	-0.091***	-0.034	-0.056*	-0.126***
	(0.019)	(0.027)	(0.032)	(0.038)
$IMS_{i,t-1}$	0.039	0.039	-0.007	0.075*
	(0.029)	(0.024)	(0.036)	(0.039)
$FDIS_{i,t}$	0.063	-0.044	0.086	0.017
	(0.054)	(0.049)	(0.091)	(0.046)
$FDIS_{i,t-1}$	-0.028	0.135**	-0.136	0.104**
	(0.034)	(0.068)	(0.095)	(0.053)
Observations	3,249	3,249	3,249	3,249
No. of Sectors	476	476	476	476
AR2	0.165	0.341	0.498	0.119
Hansen	0.997	0.999	0.996	0.995

Notes: The lagged terms for job creation and destruction are set as endogenous variables; all the industry fixed effects and time dummies are controlled in the above two step GMM system estimator, robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

CONCLUSION

This study analyses the pattern of gross job flows in Chinese industrial sectors over the past decade, and focuses on investigating the links between trade openness and FDI inflow with gross job flows. Descriptive statistics of gross job flows show that the average job reallocation rate within sectors is over 20% and the average net change in employment across sectors is only 1% over the period of 1999 to 2009. We find that the persistence of job creation and job destruction rates is relatively lower for Chinese industrial sectors over the past 10 years, and this is probably caused by the reform of SOEs and consistent restructuring of industrial sectors following the accession of WTO since 2001. Job creation and destruction rates vary substantially with firm's age, scale, ownership and also vary across regions and sectors. There also exist significant correlations of trade openness and FDI penetration with gross job flows across industrial sectors. Our results show that the rise of export openness has small effects on job reallocation within sectors, but substantial effects on net change in employment; although net employment and job reallocation rates both decline with the rise of import penetration rate, the magnitude of the effects of import penetration on job reallocation is small, which imply that overall trade openness has limited effects on job flows within Chinese industrial sectors. In contrast to trade openness, results consistently show that the rise of FDI penetration has generated substantial effects on job reallocation rates and the job market of Chinese industrial sectors has been significantly reshaped with the accumulation of FDI during the past decade.

REFERENCES

Aitken, Brian J. and Harrison, Ann E., 1999, "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence fromVenezuela." *American Economic Review*, **89**(3) , 605-18.

Albaek, K. and Sorensen, B.E., 1988, "Worker Flows and Job Flows in Danish Manufacturing,1980-91" *The Economic Journal*, **108**(451),1750-71.

Arellano, M. and Bond, S., 1991, "Some Tests of Specification for Panel Data: MonteCarlo Evidence and an Application to Employment Equations." *Review of Economic Studies*, **58**, 277-97.

Blundell, R., and Bond, S. 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics*, **87**, 115-43.

Brandt, L., Van, B. J., and, Zhang, Y., 2012, "Creative Accounting or Creative Destruction?" Firm-level Productivity Growth in Chinese Manufacturing", *Journal of Development Economics*, **97**(2), 339-51.

Brown, J. D., and Earle, J.S., 2002, Gross Job Flows in Russian Industry Before and After Reforms: Has Destruction Become more Creative?" *Journal of Comparative Economics*, **30**(1), 96 -133.

Caballero, R., Engel, E., and Haltiwanger, J., 1997, "Aggregate Employment Dynamics: Building from Microeconomic Evience." *American Economic Review*, **87**(1),pp.115-37

Christev, A., Kupets, O., and Lehmann, H., 2008, "Trade Liberalization and Employment Effects in Ukraine ", *Comparative Economic Studies*, **50**, 318-40.

Davis, S. J. and Haltiwanger, J. C., 1992, "Gross Job Creation, Gross Job Destruction and Employment Reallocation." *Quarterly Journal of Economics*, **107**(3),819-63.

Davis, S. J. and Haltiwanger, J.C., 1999, "On the Driving Force Behind Cyclical Movements in Employment and Job Reallocation" *American Economic Review*, **89**(5),1234-58.

Davis, S. J. , Haltiwanger, J.C., and Schuh, S., 1996, "Job creation and Job Destruction" Cambridge, MA: MIT Press.

Deng, Haiyan, Haltiwanger, J.C., McGuckin, R., Xu, Jianyi, Liu Yaodong and Liu Yuqi, 2007, "The Contribution of Restructuring and Reallocation to China's Productivity and Growth" The Conference Board and University of Maryland, EPWP# 07-04.

Fu, Xiaolan and Balasubramanyam, V.N., 2005 "Export,Foreign Direct Investment and Employment: The Case of China" *The World Economy*, **28**, 607-25.

Greenaway, D., Hine, R., and Wright P., 1999 "An Empirical Assessment of the Impact of Trade on Employment in the United Kingdom", *European Journal of Political Economy*, **15**,485-500.

Haltiwanger, J.C., and Odopivec, M.V., 2002, Gross Worker and Job Flows in a Transition Economy: *An Analysis of Estonia*, **9**, 601-30.

Helpman, E., Itskhoki, O., and Redding S., 2010, "Inequality and Unemployment in a Global Economy", *Econometrica*, **78**(4), 1239-83.

Hine, R. and Wright, P., 1998, "Trade with Low Wage Economies, Employment and Productivity in UK Manufacturing", *The Economic Journal*, **108** (450), 1500-10.

Kambourov, G., 2009, "Labor Market Regulations and the Sectoral Reallocation of Workers: The case of Trade Reform", *Review of Economic Studies*, **76**, 1321-58.

Klein, M.W., Schuhand, S., and Triest, R.K., 2003, "Job creation, Job destruction and the Real Exchange Rate", *Journal of International Economics*, **59,** 239-65.

Melitz, M.J., 2003, "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica*, **71**(6),1695-1725.

Milner, Chris and Wright, P., 1998, "Modelling Labour Market Adjustment to Trade Liberalisation in an Industrialising Economy" *The Economic Journal*, **108** (447), 509-28.

Mortensen, D.T., and Pissarides, C.A., 1994, "Job Creation and Job Destruction in the Theory of Unemployment" , *Review of Economic Studies*, **61**, 397-415.

Mortensen, D. T. and Pissarides, C.A., 1998, "Technological Progress , Job Creation and Job Destruction" *Review of Economic Dynamics*,**1**, 733-53.

Moser, C., Urban, D. and Mauro, B.D., 2010, "International competitiveness, Job creation and Job destruction- An establishment Level study of Germany Job flows", *Journal of International Economics*, **80** (2),302-17.

Nickell, S., 1981, "Biases in Dynamic Models with Fixed Effects", *Econometrica*, **49**(6),1417-26.

Nucci, F. and Pozzolo, A. F., 2010, "The Exchange Rate, Employment and Hours: What Firm Level Data Say?", *Journal of International Economics*, **82**, 112-23.

Roodman, D., 2009, "How to do xtabond2: An introduction to difference and system GMM in Stata." *The Stata Journal*, **9**(1), 86-136.

Wacziarg, R., and Wallack, J.S., 2004, Trade Liberation and Intersectoral Labor Movements", *Journal of International Economics*, **64**,411-39.

Windmeijer, F., 2005, "A finite sample correction for the variance of linear efficient two-step GMM estimators." *Journal of Econometrics*, **126**, 25-51.