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Impact of Global Value Chains' Participation on Manufacturing Employment in China

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Abstract: The literature on the employment impact of China's GVCs (global value chains) participation has focused on the substitution effects of Chinese inputs imported by developed countries, while few studies have been made on its domestic job creations. To complete this gap, this study proposes GVCs augmented labour demand function, which was applied to panel data of 16 Chinese manufacturing industries over the 2005-2014 period using Arellano and Bond's GMM (Generalised Moment Model) estimator for dynamic panel data model specifications to estimate employment effects of different GVCs participation modes. The obtained positive coefficients of backward linkages show increasing labour intensity processing and assembly increased employment, while the negative coefficients of China's forward linkages and position mean producing more capital intensity intermediate inputs to be embodied in third countries' exports and upgrading along to GVCs provided less job opportunities. Thus, the decrease of processing and assembly exports, the growth of intermediated inputs' exports and the position improvement during the studied period have all diminished the manufacturing employment. These results support the 'mixed-blessing hypotheses of GVC participation in the literature.

JEL Classifications: F14, F16, F66

Keywords: GVCs, manufacturing employment, China

1. INTRODUCTION

The literature on employment effects of global value chains (GVCs) identifies scale, substitution and complementary effects. The use of imported inputs in

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production process boosts output, exports and thus employment. It either substitutes domestically produced intermediate inputs, thus reduces labour demand in production (Hasan et al., 2007; Rodrik, 1997), or complements local intermediate goods, and thus increase labour demand (Davis & Mishra, 2007). The net employment effect of GVCs participation is theoretically uncertain, depending on which effect is higher.

The complementary effect of imported intermediate inputs is more pronounced for developing countries, which import domestically produced sophisticated and higher quality inputs to be processed and assembled with local low-cost labour before re-exporting to the world market. These well-known GVCs backward linkages activities located in the end of global value chains exert positive effects on labour demand. However, along the rise of labour cost, multinationals tend to delocalise labour intensity activities to other low-cost countries, leading to the fall of backward linkages activities and labour demand. To stay competitive internationally, firms in developing countries tend to automatise production processes and improve efficiency, thus decreasing labour demand. They tend to imitate advanced technologies (learning by doing) to produce and to export more capital-intensive intermediate goods via GVC forward linkages. The resulting structural change and moving up to higher value-added industry favour productivity and economic growth, but may need less labour, leading a kind of the 'mixed-blessing hypothesis' of GVC participation (Rodrik, 2018; Pahl & Timmer, 2020), contrary to the objective of economic development in the long term. How to conciliate productivity improvement with job creation is thus a challenge for countries whose manufacturing industries are upgrading inside GVCs.

The empirical literature on the employment impact of GVCs is emerging. It uses backward linkages (i.e., share of foreign value added in exports), forward linkages (share of domestically produced intermediate inputs embodied in third countries' exports), GVCs participation (sum of backward and forward linkages), or GVCs position (i.e., log ratio of supply of intermediates used in other countries' exports to the use of imported intermediates in its own production) proposed by Koopman et al. (2014), etc. to estimate GVCs employment impact.

The obtained empirical results in the literature are ambiguous varying by studied countries, analysed industries and estimated periods. If Banga (2016) and Guha-Khasnobis et al. (2022), Dine & Chalil (2021), Szymczak & Wolszczak-Derlacz (2021) found negative impacts of backward linkages on employment respectively for India, Japan, panel data of 43 countries/56

industries, Dine (2019), Long et al. (2019) and Pan (2020) obtained a positive impact for Turkey, Viet Nam and the US respectively. Banga (2016) did not find a significant effect of forward linkages on Indian employment, while Long et al. (2019), Dine (2019) and Dine & Chalil (2021) showed negative effects in Viet Nam, Turkey and Japan; Szymczak and Wolszczak-Derlacz (2021) and Guha-Khasnobis et al. (2022) found a positive effect for panel data of 43 countries and 56 industries and India. Finally, Long et al. (2019) and Szymczak and Wolszczak-Derlacz (2021) obtained positive effects of GVCs position on employment in Viet Nam, and for 43 countries and 56 industries, while Long et al. (2019) Guha-Khasnobis et al. (2022) found an insignificant effect of GVCs participation in Viet Nam and India respectively.

It is very surprising to observe that few studies, to our knowledge, have analysed the impact of China's GVCs participation on her domestic employment, even that China is one of the major GVCs centers in the world, and the high unemployment is a serious challenge for social stability. The existing studies focus on the impact of the import substitutions of Chinese intermediate inputs on the employment in developed countries. Autor et al. (2013), Acemoglu et al. (2016), Pierce & Schott (2016) and Caliendo et al. (2019) have found negative effects of imports from China on the US employment in the industries exposed to Chinese competition, while Wang et al. (2018) have showed that trade with China has led net employment increase in US. While Dauth et al. (2014) and Branstetter et al. (2019) have found negative effect of imports from China on the employment in German and Portugal, Taniguchi (2019) and Choi and Xu (2020) have shown that increases in the imports of intermediate inputs from China had positive effects on Japanese and Korean employment respectively. Kiyota et al. (2021) have shown that the impact of Chinese imports is different for six advanced countries.

The case of China's GVCs participation is however particularly interesting due to her active implication. China's backward linkages passed via low-cost labour-intensive processing and assembly activities for multinationals profiting one of the lowest labour costs in the world at that time (1980s and 1990s). They were the main sector to create jobs and provided about two hundred million workers from countryside (Los et al., 2015). Its employment absorption capacity has been decreasing since 2000s because of the quick rising labour costs. The annual average growth rate of real salaries in manufacturing increased at 14% on average per year, passed from 2247 $/employee in 2005 to 6977 $/employee in 2014. This decreasing job creation capacity coincided with the moving out

of the Chinese firms from low-cost labour-intensive processing and assembly activities via backward linkages and the development of higher technological content industries able to produce intermediate goods to be embodied in third countries' exports via forward linkages, but creates fewer jobs, particularly low-cost ones (Kee & Tang, 2016; Duan et al. 2018; Chor et al., 2021).

The rising labour cost decreases labour demand through delocalising low-cost labour-intensive activities of backward linkages outside China and improving production efficiency inside the existing societies. The decreasing benefits pushed multinationals to close down Chinese processing and assembly firms to delocalise their low-cost labour intensity activities outside China. Consequently, the share of processed and assembly exports in total exports decreased from 55% in 2005 to 36% in 2015. The surviving Chinese manufacturing firms are obligated to make great effort by eliminating excess labour or by introducing labour saving techniques (automatisation of production chains, robots, etc.) to increase efficiency in production. This kind of Schumpeterian "creative destruction" benefits the most performing enterprises, but is bad for employment (Guillaumont Jeanneney & Hua, 2001).

On the other side, after a long period of learning by doing, Chinese firms are now able to domestically produce intermediate goods to substitute imported intermediate inputs to supply Chinese processing exporters or to be embodied in exports of third countries (Kee &Tang, 2016; Duan et al., 2018). These forward linkage activities are more capital intensive and create less jobs.

The objective of this study is to complete the literature gap to estimate the impact of China's different GVCs participation modes on its manufacturing employment. We have limited ourselves to the manufacturing sector to reduce heterogeneous bias. As baseline estimations, we proposed a GVCs augmented labour demand model in function of different GVCs participation modes by controlling labour cost adjustment of hiring and firing (measured by employment lagged one period as in the literature), as well as sector and time fixed effects. The functions were estimated using OECD Trade in Value added (TiVA), World Input-Output (WIOD) and Socio-Economic Accounts (SEA) databases for panel data of 16 manufacturing sectors over the 2005-2014 period. The period ended in 2014 because of the available data of SEA. The obtained results showed positive effects of backward linkages on employment, but negative labour impact of forward linkages and GVCs position, while the impact of GVCs participation was statistically insignificant, probably due to the opposite effects of backward and forward linkages.

We then made several robustness tests to check the stability of the obtained results. We firstly added capital intensity and real value into the model. This addition was justified by Cobb-Douglas production function allowing GVCs impact labour efficiency in production processes (Greenaway et al., 1998; Hasan et al., 2007 and Amiti and Wei, 2005 among others). We also added final domestic demand to capture the employment effects of Chinese reorientation growth model from exports-led to domestic consumption-led ones. This reorientation was reinforced by the recent US China trade conflict and the Covid-19 pandemic. In fact, the high Chinese economic growth during 40 years has allowed 853 million Chinese people out from the poverty, increasing their consumption demand capacity for manufactured goods. The domestic market is potentially very big. Finally, we took off the petrol sector which has special characters and redid the estimations. The obtained results of robustness tests did not modify fundamentally the results of baseline estimation.

This study contributes to the literature in several ways. Few studies have been made on the domestic employment impact of China's GVCs participation; the literature focused on the impact of Chinese import substitution effects on the job creation in developed countries. This study completes this gap by estimating the impact of GVCs on manufacturing employment in China. This study extended the literature on the effects of China's GVC participation, which focused on domestic value added in exports (Koopman et al., 2014, Kee & Tang, 2016; Meng et al., 2017; Yu & Luo, 2018; Taguchi & Li; 2018; Hua, 2022a), or productivity (Lu et al., 2016; Ge et al. 2018; Chor et al., 2021; Hua, 2022b), but also on the impact of real exchange rate on employment in China (Hua, 1997, Chen & Dao, 2011).

The rest of the paper is structured as the following. The second section proposes a GVCs labour demand function to estimate the employment effect of China's GVCs participation by controlling the cost adjustment of hiring and firing and sector and time fixed effects. The third section checks the stability of baseline estimation results by adding production factors, final domestic consumption and by eliminating the special effect of petrol sector. The economic and political implications are given in the conclusion in section 4.

2. ANALYSIS OF THE EMPLOYMENT EFFECTS OF CHINA'S GVCS PARTICIPATION

The Chinese economy is strongly integrated into the global value chains in particular since its adhesion into the WTO at the end of 2001 and quickly

became one of the most important GVC centers of manufactured goods in the world. This integration began to decline since 2014, which was recently accentuated by US-China trade conflict and Covid-19 Pandemic. It is therefore important to quantify to what extent the Chinese labour force was exposed to these changing external market conditions.

2.1. GVC augmented labour demand function

Our analysis begins to estimate the impact of GVCs on employment in a simple way. Beside our key variable GVCs, we added employment variable lagged one period to take into account the adjustment costs of hiring and firing because the current labour demand generally depends on the employment level in the previous periods. We added industry-fixed and time fixed effects to capture specific factors for each industry and each period as well as error terms. The baseline GVCs labour demand function is written as:

$$lnL_{it} = a_0 + a_1\, lnL_{it-1} + a_2\, lnGVC_{it} + \mu_i + \pi_t + \varepsilon_{it} \quad (1)$$

Where L represents employment. We used respectively backward linkage, forward linkage, participation and position to capture their potential different effects on employment. The waited sign of backward linkage is positive, but negative for forward linkages and position, while GVC participation is uncertain because of opposite effects of backward and forward linkages; its net effect depends which effect is higher.

2.2. Evolution of employment and GVCs

The data on employment of manufacturing sectors comes from WIOD and SEA databases. It is measured by number of personnel employed in production processes. The employment in all sectors increased in 2014 relative to 2005 (Fig. 1a). The labour-intensive textile & apparel sector created the most employment, which increased from 27.6 million persons in 2005 to 32.7 million persons in 2014, but only at an annual average growth rate of 2.2%, the lowest except for coke & petroleum sector (0.8%) and "other manufacturing" sector (0.4%). The employment in textile & apparel sector accounted for 23% of total manufacturing employment in 2005, decreased to 19% in 2014. All labour-intensive sectors created more than a half employments in 2005 (53%), decreased to 48% in 2014. It suggested that labour-intensive sectors became more capital intensive because of the quick rise of labour costs. The machinery sector employed from 7.8 million persons in 2005 to 15.2 million persons in 2014. The employment in ICT & electronic and electronic equipment sectors

increased from 3.4 million in 2005 to 4.9 million jobs. The employment share in medium and high technology sectors increased from 30% in 2005 to 36% in 2014, while in medium sectors passed from 16% to 17% respectively.

GVC backward linkage is measured as share of foreign value added embodied in exports. It captures the value of imported intermediate goods embodied in a domestic sector's exports from foreign industry upstream in the global production chain. A large share indicates that the sector mainly engages in final assembly of imported inputs from other countries and thus strongly depends on the rest of the world. GVC backward participation is considered as an easier gate for developing countries with low labour costs to enter into global value chains, because the countries need not have a whole production line, but only fragmented lines for producing some "tasks" corresponding to their comparative advantages (Baldwin, 2016).

China had used this gate in 1980s to access processing and assembly activities whose share in total exports attainted the highest level in 1997-1998 period (57%) and stayed more than 50% for the 1995-2007 period. China's processing and assembly exports profited GVCs' networks of multinationals to enter world markets. The ICT & electronics sector had the highest share of foreign value added relative to its exports, which decreased from 43% in 2005 to 32% in 2014 (Fig. 1b). The share decreased 8 percentage points for four sectors (electrical equipment, other transport, rubber & plastics, paper & printing), followed by the machinery sector. The textiles and apparel sector's share decreased from 17% in 2005 to 11% in 2014.

GVC forward linkage is calculated as domestic value added embodied in intermediate exports that are further re-exported to third countries relative to exports. It measures exports of intermediate goods that are used as inputs for the production of exports of other countries. An increasing ratio suggests that the sector is moving up in the GVCs to start producing intermediate goods for other countries (Wang et al., 2014). Fig 1c shows that the highest share of intermediate goods exported to third country was motor vehicles sector whose share increased from 67% in 2005 to 71% in 2014, followed by transport equipment from 31% to 35% and coke & petroleum from 28% to 33%, food from 13% in 2005 to 21% in 2014. The share was slightly increased for textile & apparel sectors, while that of ICT & electronic decreased slightly. The share decreased for paper & printing from 29% to 20%, followed by machinery equipment, and basic metals.

GVC participation is the sum of sector level forward and backward linkages. It measures the extent to which a sector is involved in the global

production chain. The larger the ratio, the greater the intensity of involvement of a sector in a country in GVCs. GVC position is the log ratio of a sector's supply of intermediates used in other countries' exports to the use of imported intermediates in its own production. This index characterises the relative upstreamness of a sector to gauge whether a sector is likely to be in the upstream or downstream of the global value chain (Koopman et al., 2014). A positive position index means that industries in a sector are relatively upstream by producing inputs for others, thus contributing more value added to other countries' exports than other countries produce and contribute to theirs. A negative position index suggests that sectors are relatively downstream by importing a large portion of intermediates from other countries to produce its final goods. It allows knowing if there is an effect of moving up.

All sectors had positive position indices except for transport, other manufacturing and ICT & electronic in 2005. The GVC position improved for all sectors in 2014 relative to 2005, except for motor vehicles and coke, petroleum sectors whose position indices become negative. The position of ICT & electronics sector was still negative in 2014, meaning that this sector imported more intermediate goods to produce final goods. Even still lightly negative, ICT & electronics sector improved its position among the best just after paper & printing, textiles & apparel (Fig. 1e).

2.3. Econometric tests and estimations

Before performing the econometric regressions, we need to know if the variables are stationary at an absolute level to avoid spurious results. We apply Levin-Lin-Chu panel data unit root tests (Choi, 2001 & Im et al., 2003) in which time trend and panel-specific means (fixed effects) options were used; the variables were lagged by one period. We subtract the mean of the series across panels from the series to mitigate the impact of cross-sectional dependence (Levin et al., 2002). The results, reported in Table A2, allowed us to reject the null hypothesis that all the panels contain unit roots, so we can accept the hypothesis that the variables are stationary at an absolute level. We then applied Hausman specification test and its results showed that fixed effect estimations were preferred to random effect ones.

A potential econometric problem is the endogeneity of explanatory variables. This is a difficulty met in all the estimations on macroeconomic data, due to the possibility of a reverse causal relationship, i.e. an industry with low labour cost is more likely to be engaged in GVCs, due to measurement

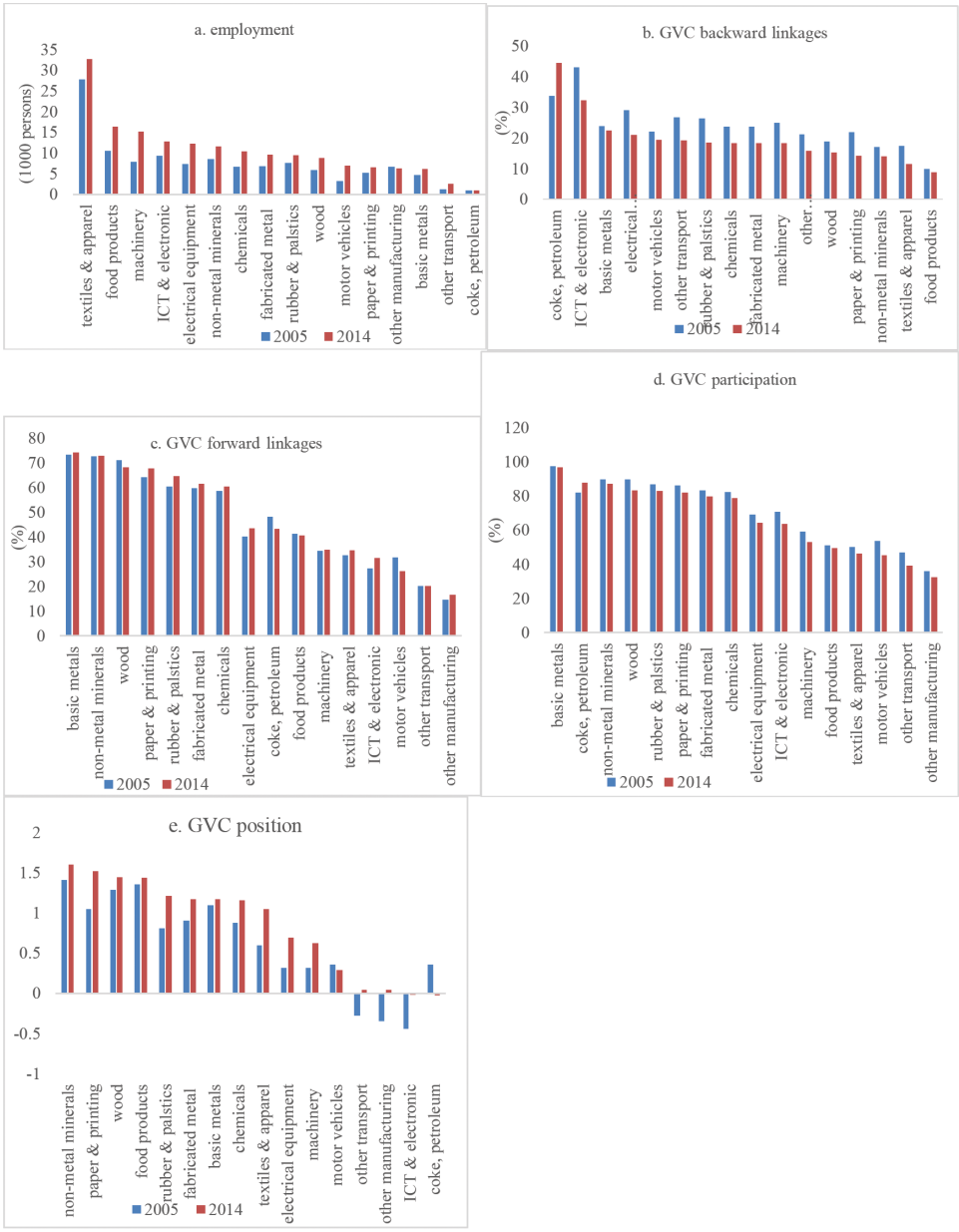

Figure 1: Evolution of employment and four GVC indices in 2014 relative to 2005

error, i.e. GVC indicators are estimated using Leontief decomposition and to the risk of omitted variables. The obtained results of Durbin-Wu-Hausman test do not allow us to accept the null hypothesis of exogeneity of GVCs. As the results of Pagan-Hall test do not allow us to accept the null hypothesis of

homoscedasticity, the system estimator of the one-step Generalised Moment Model (GMM) of Blundel & Bond (1998) which is more efficient than IV/2SLS estimator was chosen.

The GMM system estimation approach combines an equation in levels in which lagged first-difference variables are used as instruments and a first-difference equation in which the instruments are lagged variables in levels[1]. We completed these lagged variables by adding a variable of world average industrial GVC indices to instrument China's GVC participation for the same industries, which is strongly correlated (Babh et al, 2020; Hua, 2022). We had used Arellano-Bond's standard autocorrelation test to ensure no autocorrelation at AR (2). We had tested the validity of the instruments by using the Sargan over-identification test. The results did not allow us to reject the hypothesis on their validity. The instruments were therefore independent of error terms.

The functions were estimated for 16 manufacturing industries over the period from 2005 to 2014 (see table A1 for the list of sectors). The analysis period and the sample size were determined by data availability from the OECD Trade in Value Added (TiVA) and World Input-Output Database (WIOD) databases and Socio-Economic Accounts (SEA). The OECD published data over the period from 2005 to 2015 for 16 manufacturing sectors (2018 edition). The WIOD published Socio Economic Accounts Release 2016 available February 2018 over the period from 2000 to 2014 for 18 manufacturing sector (Timmer et al., 2015). Both databases used an industry list based on the International Standard Industrial Classification (ISIC) Revision 4 and used 2008 System of National Accounts (SNA) concepts allowing for data compatibility. The sectors 17 (manufacture of paper and paper products) and 18 (printing and reproduction of recorded media) in WIOD were regrouped into a sector (paper products and printing) as in TiVA, as well as the sectors 20 (Manufacture of chemicals and chemical products) and 21 (Manufacture of basic pharmaceutical products and pharmaceutical preparations) into a sector (Chemicals and pharmaceutical products). The Socio-economic accounts of WIOD contained industry-level data on employment, capital stocks, gross output and value added at current and constant prices is shown in table A1.

Table 1 presents the results of baseline estimations. As waited, the employment lagged one period is statistically significant and positive in all estimations. We found that backward linkages increase job creation with the estimated coefficients of 0.22 (columns 1.1, table 1). As the parts of foreign value added in exports embodied in sector relative to gross exports in the same

sector or China decreased of 2.77% per year on average, the decline in processing and assembly activities had diminished the employment of -1.16% ((0.22*(-2.77%)) per year on average. The forward linkages decreased employment with the estimated coefficient of -0.44 (columns 1.2, table 1). As the part of Chinese intermediate goods embodied in third countries increased 0.23% per year on average, it decreased the employment of -0.10% (-0.44*0.23%). The contrasted backward and forward linkage effects have led a statistically insignificant effect on sectoral GVC participation, which is sum of backward and forward linkages (columns 1.3, table 1), while the impacts of GVCs position were negative with the estimated coefficients of -0.21 (columns 1.5, table 1). An improvement in the position along GVCs of 1% led a decrease in employment of 0.21%. As GVCs position improved at 6.37% per year on average, it decreased employment of 1.34% per year on average. These results show that all GVC participation modes have contributed to decrease manufacturing employment.

Table 1: Impact of China's GVCs participation on employment of 16 manufacturing sectors over the 2005-2014 period, baseline GMM estimations

	1.1	*1.2*	*1.3*	*1.4*
$employment_{-1}$	0.88*** (13.94)	0.81*** (17.10)	0.76*** (11.07)	0.85*** (14.55)
backward linkages	0.21** (2.24)			
forward linkages		-0.44** (-2.25)		
GVC participation			-0.24 (-0.54)	
GVC position				-0.21*** (-2.79)
AR(2)	0.32	0.70	0.97	0.39
Sargan test	0.32	0.16	0.05	0.23

Notes: t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

3. ROBUSTNESS TESTS

We made several robustness tests to check the stability of the obtained baseline estimations. We firstly added output and capital intensity to control the employment impact of production factors. We then added domestic final demand to capture the employment impact of the Chinese reorientation growth model from exports-led to domestic consumption-led one. We finally droped down the petrol sector.

The addition of output and capital intensity can be justified by Cobb–Douglas production function. Following Greenaway et al. (1999) who developed a model analysing the employment effect of trade, we wrote a Cobb–Douglas production function in industrial level i in period t as following:

$$Q_{it} = A^{\gamma} K_{it}^{\alpha} L_{it}^{\beta}$$

Where *i* and *t* denote sectors and time respectively. *Q* is real output, *K* is capital stock, *L* is labour inputs used. α and β represent the factor share coefficients. A captures the efficiency of the production and γ allows for factors changing efficiency growth in the use of labour in the production process.

We assumed that economic agents were profit-maximising, and decided labour and capital levels in such a way that the marginal product of labour equaled the wage (w) and the marginal product of capital equaled its user cost c to minimise the total production cost as wL+rK. Solving this system simultaneously to eliminate capital from the output allows us to obtain the following equations:

$$Q_{it} = A_{it}^{\gamma} \left(\frac{\alpha L_{it}}{\beta} * \frac{w_{it}}{c_{it}} \right)^{\alpha} L_{it}^{\beta} \tag{2}$$

Taking logarithms to derive the sector's labour demand function as following:

$$\ln L_{it} = a_0 + a_1 \ln \left(\frac{w_{it}}{c_{it}} \right) + a_2 \ln Q_{it} \tag{3}$$

Where:

$$a_0 = \frac{-(\gamma \ln A + \alpha \ln a - \alpha \ln \beta)}{\alpha + \beta}; a_1 = \frac{-\alpha}{\alpha + \beta}; a_2 = \frac{1}{\alpha + \beta}$$

The substitution possibilities between capital and labour are quite considerable in China (Zhang, 2004; Hua, 2007). To measure the effect of capital/labour intensity on employment, the ratio between the capital user cost and wages in the above equation is replaced by capital/labour intensity as follows:

$$\ln L_{it} = a_0 + a_1 \ln (CI_{it}) + a_2 \ln Q_{it} \tag{4}$$

Where CI measures capital intensity.

We hypothesise that the parameter A in the production function varies with GVC participation such that:

$$A_{it} = e^{\delta_0} GVC_{it}^{\delta_1}$$

Substituting for A_{it} in equation (4), we get GVC labour demand function as:

$$\ln L_{it} = b_0 + b_1 \ln GVC_{it} + b_2 \ln CI_{it} + b_3 \ln Q_{it} \quad (5)$$

$$b_0 = \frac{-\alpha \ln a + \alpha \ln \beta + \delta_0}{\alpha + \beta}, b_1 = -\frac{\gamma \delta_1}{\alpha + \beta}, b_2 = -\frac{\alpha}{\alpha + \beta} \ln CI_{it}, b_3 = \frac{1}{\alpha + \beta}$$

Thus, labour demand is in function of GVCs participation, capital intensity and real output.

Capital intensity (CI) is the ratio of nominal capital stocks deflated by the price of intermediate goods and divided by number of employees. Data on Capital stocks and number of employees of manufacturing sectors came from World Input-Output (WIOD) and Socio-Economic Accounts (SEA) databases. The capital intensity of all manufacturing sectors increased quickly in 2014 relative to 2005. Only two sectors increased at annual average growth rates less than 10% (8.3% and 9.5% respectively for the coke & petroleum sector and food sector). Others increased from 11% per year at average for chemicals to 17% for fabricated metal sector (17.6%). The capital intensity increased 17% per year at average for ICT & electronic and 15% for textiles & apparel sector and 17.3% for other manufacturing sector. This suggested that the Chinese manufacturing industry became more capital-intensive, and thus needed less employment. As waited, the real output was statistically significant, and exerted a positive effect on employment, while the capital intensity played a negative effect. The addition of these two variables does modify the results of baseline estimations (table 2).

Beside the employment effects of intermediate goods via GVCs participation, the final domestic consumption demand exerted the impact on employment (Los et al. 2015; Foster-Mcgregor, 2019). We add this variable into the equation 5 to obtain

$$\ln L_{it} = b_0 + b_1 \ln GVC_{it} + b_2 \ln CI_{it} + b_3 \ln Q_{it} + b_4 \ln FD_{it} \quad (6)$$

Where FD represents the final domestic demand in real terms. Table 3 reports the estimation results of the above equation. The coefficient of China's final domestic demand is statistically significant and positive, varied from 0.06 to 0.09. As final domestic demand increases 16% per year on average, it increased the employment from 0.96% to 1.44% per year on average.

We finally excluded coke & and petrol sector which suffered special movement. Table 4 presents the results by excluding coke & and petrol sector which suffers special movement. The exclusion of coke & and petrol sector does not modify significantly the coefficients of baseline equations.

Table 2: Impact of China's GVCs participation, output and capital intensity on employment of 16 manufacturing industries over the 2005-2014 period, robustness tests

	2.1	*2.2*	*2.3*	*2.4*
employment$_{-1}$	0.45***	0.45***	0.44***	0.45***
	(6.60)	(6.25)	(6.31)	(6.39)
real output	0.19***	0.15***	0.16***	0.17***
	(6.08)	(4.89)	(4.67)	(5.47)
capital intensity	-0.15**	-0.17***	-0.19**	-0.17***
	(-2.41)	(-2.82)	(-2.94)	(-2.79)
backward linkages	0.27***			
	(3.76)			
forward linkages		-0.36***		
		(-2.66)		
GVC participation			0.24	
			(0.82)	
GVC position				-0.17***
				(-3.21)
AR(2)	0.25	0.76	0.57	0.39
Sargan test	0.12	0.27	0.05	0.23

Notes: t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 3: Impact of China's final domestic consumption on employment of 16 manufacturing sectors over the 2005-2014 period, robustness tests

	3.1	*3.3*	*3.4*	*3.5*
Employment$_{-1}$	0.36***	0.34***	0.37***	0.34***
	(5.21)	(4.79)	(5.08)	(4.59)
Real output	0.14***	0.12***	0.12***	0.12***
	(4.57)	(3.65)	(3539)	(3.74)
Capital intensity	-0.18***	-0.21***	-0.20***	-0.21***
	(-3.19)	(-3.78)	(-3.36)	(-3.71)
Backward linkages	0.31***			
	(4.60)			
Forward linkages		-0.36***		
		(-2.77)		
GVC participation			0.15	
			(0.56)	
GVC position				-0.20***
				(-3.96)
Real final domestic demand	0.09***	0.07***	0.06**	0.09***
	(3.11)	(2.51)	(2.12)	(3.30)
AR(2)	0.34	0.96	0.77	0.54
Sargan test	0.19	0.05	0.05	0.11

Notes: t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 4: Impact of Chinese participation on employment of 15 manufacturing sectors excluding coke & and petrol sector over the 2005 2014 period, robustness tests

	4.1	*4.2*	*4.3*	*4.4*
Employment$_{-1}$	0.36*** (4.58)	0.33*** (4.02)	0.37*** (4.56)	0.34*** (4.21)
Real output	0.24*** (6.45)	0.20*** (5.56)	0.19*** (4.03)	0.23*** (6.33)
Capital intensity	-0.11 (-1.76)	-0.12* (-1.71)	-0.19*** (-2.56)	-0.11* (-1.66)
Backward linkages	0.30*** (4.16)			
Forward linkages		-0.45*** (-3.09)		
GVC participation			0.18 (0.61)	
GVC position				-0.22*** (-3.85)
AR(2)	0.18	0.73	0.48	0.31
Sargan test	0.10	0.21	0.08	0.12

Notes: t-statistics in parentheses. * p<0.1, ** p<0.05, *** p<0.01

5. CONCLUSION: ECONOMIC AND POLITICAL IMPLICATIONS

How to provide jobs to almost 11 million students who graduated from universities in 2022 in addition of 10 million unemployed is a great challenge for the Chinese government to keep social stability. If the Chinese manufacturing industry had been the main sector to create jobs along to the industrialisation since "open door" policies launched in the end of 1978, its employment absorption capacity had been decreasing recently. This decrease is coincided with the moving out of the Chinese firms from low-cost labour-intensive processing and assembly activities via backward linkages and the development of higher technology industries able to produce intermediate goods to be embodied in third countries' exports via forward linkages but need less labour, in particular non-qualified one.

We estimated GVCs labour demand function by using panel data of 16 Chinese manufacturing industries over the 2005-2014 period from OECD TiVA and WIOD and SEA databases. The estimated coefficients of backward linkages were 0.21. As the part of foreign value added in exports relative to sector and China's gross exports decreased of 2.77% per year on average, the decline in processing and assembly activities diminished the employment of

0.58% per year on average. The estimated coefficient of forward linkage was -0.44. As the part of Chinese intermediate goods embodied in third countries increase 0.23% per year on average, it decreased the employment of 0.10% per year on average. An improvement in position along to GVCs of 1% led a decrease in employment of 0.21%. As GVCs position improved at 6.37% per year on average, it decreased employment of 1.34% per year on average. These results show that backward, forward and position modes have contributed to decrease manufacturing employment during the studied period. These results support the 'mixed-blessing hypothesis' of GVC participation in the literature.

This study completed a literature gap on the impact of GVCs participation on employment in the case of China. Future researches may be done for the more recent period if data become available. They may be extended by including service sectors to know if the last ones created more job opportunities to mitigate the decreasing manufacturing employment.

Note

1. Blundell and Bond (1998) showed that this estimator is more powerful than the first-differences estimators, derived from Arellano and Bond (1991), are, which give biased results in small samples with weak instruments.

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Table A1: 16 Manufacturing Industry Classifications

Labels	*Manufacturing sectors*	*TiVA_Code*	*WIOD code*	*ISTC Rev. 4 codes*
Food	Foods products, beverages & tobacco	D10T12	C10-C12	10-12
Textiles & apparel	Textiles, textile products, leather & footwear	D13T15	C13-C15	13-15
Wood	Wood and products of wood and cork	D16	C16	16
Paper & printing	Paper products and printing	D17T18	C17 C18	17, 18
coke & and petrol	coke & and petrol	D19	C19	19
Chemicals	Chemicals and chemical products	D20T21	C20 C21	20, 21
Rubber & plastics	Rubber and plastics products	D22	C22	22
Non-metal minerals	Other non-metallic mineral products	D23	C23	23
Basic metals	Basic metals	D24	C24	24
Fabricated metals	Fabricated metal products except machinery and equipment	D25	C25	25
ICT & electronics	Computer, electronic and optical products	D26	C26	26
Electrical equipment	Electrical machinery & apparatus n.e.c.	D27	C27	27
Machinery	Machinery and equipment n.e.c.	D28	C28	28
Motor vehicles	Motor vehicles, trailers & semi-trailers	D29	C29	29
Other transport	Other transport equipment	D30	C30	30
Other manufacturing	Other manufacturing	D31T32	C31C32	31, 32

Table A2: Names, calculation methods, sources and unit root tests of variables

Names of variables	*Calculation methods*	*Sources*	*Levin-Lin-Chu unit-root test**
Employment	Number of employment	World Input-Output Database	-7.8438
Backward linkage	share of sector foreign value added relative to its gross exports	OECD TiVA	-6.6287
Forward linkage	Share of domestic value added embodied in intermediate inputs re-exported to third countries relative to gross exports	OECD TiVA	-7.6478
GVC participation	sum of forward and backward linkages	OECD TiVA	-5.8732
GVC position	log ratio of supply of intermediates used in other countries' exports to the use of imported intermediates in its own production	OECD TiVA	-7.0031
Capital intensity	ratio of nominal capital stocks deflated by the price of intermediate goods and divided by number of employees	WIOD	-5.6254
Real final domestic demand	Domestic value added embodied in domestic demand deflated by the price of value added (2012=100)	OECD TiVA	-5.4007

Note: * Levin-Lin-Chu unit-root test (Ho: Panels contain unit roots) is made with time trend and panel-specific means (fixed effects) and subtracted cross sectional means options. The variables are lagged by one period. The results of adjusted t are reported in table corresponding p-value=0.0000 for all variables.