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October 2011 Working Paper 09/2011 Department of Economics The New School for Social Research

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Trade Expansion and Employment Generation: How Mercantilist Does China Have To Be?⁵

Xiao Jiang*

We conduct an input-output analysis of China's employment changes due to changes in trade structure on sectoral level. We find that between 2002 and 2007 China generated about 71 million jobs due to trade expansion. We also estimate the additional amount of trade that would be needed if China were using trade surplus as the main tool to absorb its excess labor. We find that given the enormous magnitude of this estimated amount, this "mercantilist" approach to excess labor absorption is not feasible. Finally, using Spearman rank correlation analysis, we find that the ranking of China's sectors' employment generation capacities is inversely related to the ranking of these sectors' trade performances. This suggests that the "mercantilist" approach to excess labor absorption is not only infeasible but also inefficient. We end the paper by suggesting a more balanced growth path for China.

Keywords: international trade, labor, China, input-output, factor-content, growth, employment multipliers

JEL Classifications: F13, F16, J21

1. Introduction

China's economic transformation since its implementation of open-market reforms in 1978 has received much attention, with most of the focus on China's enormous success in foreign trade. In 1989 China was still an import surplus country. By 2009, China was the largest exporting country in the world in terms of export value¹. Particularly after 2000, China's total foreign trade volume and trade surplus grew at an astonishing annual rate. The theoretical relation between foreign trade and employment has been an issue of concern to economists for centuries. Much trade theory assumes the resources of a country are given and fully employed before it enters into international trade. International trade is presumed therefore to allocate resources more efficiently through changes in relative prices. Another and older strain of literature sees international trade as a "vent-for-surplus." Smith (1776) was the pioneer of this theory and Myint (1958,1977) wrote extensively on this concept. Contrary to conventional trade theories, this line of

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¹ WTO (2011). Note that the European Union as a whole is ranked as number one, but China is ranked number one as a single country.

thought sees a country entering into trade while possessing some surplus productive capacities, including labor. Hence, foreign trade creates additional effective demand for a country to absorb its surpluses. More recently, Blecker (1997) views the "vent-for-surplus" as a mechanism for a country to exploit economies of scale through an expanded increased market resulting from liberalized foreign trade. Elmslie (1996, 2002) argues that "surpluses" are "vented" through foreign trade by deepening the division of labor within a country. Both of these explanations seem, on the surface, consistent with China's experience of the past 20 years.

As Myint points out², "vent-for-surplus" can have both pro-free-trade and antifree-trade implications. On one hand, countries (such as China) with sizable surplus productive capacities -- that are more or less costless when used for export production -would benefit from trade. On the other hand, countries (such as most of the developed countries) whose productive structures are already well developed will have costly switching from domestic to export production due to the need for "re-specialization." For these countries, free trade would not be beneficial.

In light of this discussion of "vent-for-surplus", the effect of trade on labor (which is an important part of surplus productive capacity) is explored empirically in the literatures. Wood (1995) conducted the factor-content calculation of the change in labor demand in developed countries due to trade. According to his calculation, for developed countries, trade drastically reduces demand for unskilled labors but has somewhat positive effects on skilled labor demand, which in turn contributes to the widening of domestic inequality. Kucera and Milberg (2003) use input-output analysis to calculate the effect of trade expansion on manufacturing employment for OECD countries. Their results demonstrate that, contrary to the conventional theoretical view that trade would result a mixture of winners and losers in a country, trade expansion causes job loss to nearly all manufacture sectors in OECO countries. Henceforth, their results reinforce the recent phenomenon of "de-industrialization" of the West.

These empirical works tend to focus on developed countries. But countries that "vent" the surplus – some of the largest developing countries – are not sufficiently studied. Thus, this paper firstly intends to fill this gap by analyzing the employment implications of China's remarkable trade expansion. Using a standard input-output method, we find that the growth in international trade has been responsible for the creation of more than 70 million jobs in China over the period between 2002 and 2007. Despite this impressive trade performance, China continues to have a considerable surplus of labor. China is a country with the highest population in the world, and its economic restructuring has resulted in an enormous migration of labor from rural areas to cities and from agriculture to manufacturing. The result has been a considerable amount of excess labor. By some estimates, this surplus labor reached 226 million by 2009.³

In this paper we also address the hypothetical question of how much additional trade surplus China would need in order to absorb a reasonable portion of its excess

² Myint (1958, p. 322)

³ See section 3.1 of this paper.

labor. The exercise itself begs the question of the merits of a mercantilist⁴ approach to job-creation. But recent history has shown China has used trade and FDI promotion, exchange rates and labor market regulations to serve the goal of surplus labor absorption, so the question is not outside the realm of debate in contemporary Chinese political economy. But the question is admittedly an extreme one, and so we subsequently turn to the question of whether such an approach is feasible. If not, we must ask what else can be done to address the ongoing problem of surplus labor in China.

This paper is divided into four sections. In Section two we provide an overview of China's trade performance over 2000-2010. In Section three we introduce the inputoutput model used to calculate employment changes due to trade expansion. In the fourth section we estimate the amount of "excess labor" in China and then invert the algorithm used in section three in order to calculate the additional trade that would be needed if trade were the sole means to employ all the excess labor. The fourth section concludes with some policy discussion based on calculations of sectoral employment multipliers. We argue that trade alone cannot realistically solve China's problem of excess labor, but that other forms of macroeconomic stimulus would be much more effective in attaining full employment in China.

2. Trade Expansions and Job Creation

2.1. China's Foreign Trade Performance, 2002-2007

China's total foreign trade (exports plus imports) increased from 355 million Yuan in 1978 (the year of economic reform) to 166,740.2 million Yuan in 2007, that is from 10% of GDP in 1978 to 66.3% in 2007. Exports grew from 167.6 million Yuan in 1978 to 93,455.6 million Yuan in 2007, and imports rose from 187.4 Yuan in 1978 to 73,284.6 Yuan in 2007 (See figure 1^5 for 1990 to 2007).

⁴ Mercantilism - a historical belief that positive trade balance is the solution for most economic problems.

⁵ Figure 1 and 2 are compiled by the author.



Figure 1: China's Trade Value (Export Plus Import) (10,000's of 2007 Chinese Yuan)

Source: China Statistical Yearbook (Various Years) The exchange ratio of U.S Dollar to Chinese Yuan has been rather stable since 1994, a rough average would be 1:8. (China Statistical Yearbook 2009 17-2)

Figure 1 shows that the trade value took a sharp upward turn since the beginning of 2000 with average annual growth of 30% since the year of 2002. Moreover, with the exception of the year of 1993, China has also been enjoying a considerable trade surplus since 1990. Figure 2 below shows the time-series of China's net export value.

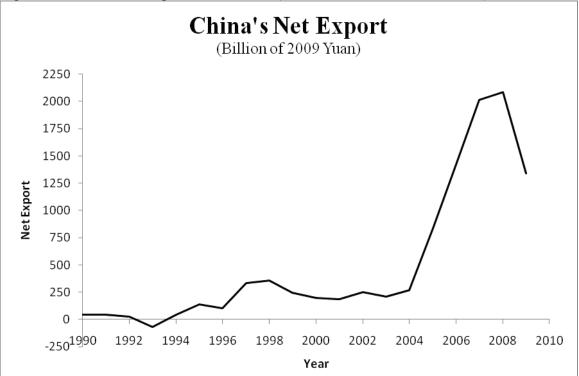


Figure 2: Chinese Net Exports, 1990-2007 (10,000's of 2007 Chinese Yuan)

Source: China Statistical Yearbook (Various Years) The exchange ratio of U.S Dollar to Chinese Yuan has been rather stable since 1994, a rough average would be 1:8. (China Statistical Yearbook 2009 17-2)

Figure 2 shows the expansion of China's net exports for the past 20 years. The trade surplus expanded rapidly after 2003. Especially between 2004 and 2005, China's net exports tripled. Within the next three years, the country's year-to-year growth rates of trade surplus are 69.7%, 41.9% and 88.3% respectively⁶. It is not hard to imagine that the effect of trade on employment during this period of time is large. But the question is how large, and how the employment gains (and losses) are distributed across sectors.

2.2 Factor Content Analysis

In this section we calculate the factor content of trade using the standard input-output algorithm, following Milberg and Kucera (2003). They calculated the labor content embodied in changes in manufacturing output resulting from changing patterns of trade for ten OECD countries from 1978 to 1995. We apply their methodology to China in order to show the effect of China's trade expansion on employment across 42 sectors of the Chinese economy. The algorithm for calculating labor content in trade expansion L is the following:

⁶ Data Source: China Statistical Yearbook 2007, 17-3. Growth rates are calculated by the author.

$$L = \hat{E}[(I - A)^{-1}T] \qquad (1)$$

In equation 1, A is China's input coefficient matrix; I is the identity matrix; and $(I - A)^{-1}$ is therefore the Leontief inverse matrix, in which, where each element a_{ij} indicates input requirement for ith sector if there were a unit increase of the final-use (consumption, foreign trade, or investment) of the output of the jth sector. \hat{E} is the diagonal matrix of labor coefficients (employment per unit of output), and L is the vector of employment changes resulting from the changing structure of foreign trade. T, the trade expansion vector, is defined as follows:

$$T = (X^{2007} - M^{2007}) - (X^{2002} - M^{2002})(D^{2007} / D^{2002})$$
(2)

where X and M are export and import values; and D is the vector of domestic demand which is domestic production plus imports, and superscripts indicate the first and last years of the sample. T is the difference between the net exports at the end of the period and the counterfactual level of net exports that would have resulted by the end of that period had the proportion between net exports and domestic final demand – the propensity of trade relative to final demand – remained constant in each sector. In other words, the trade expansion vector is the net exports resulting from the change in the structure or pattern of trade during the time period being studied.

Vector L is therefore the result of two matrix multiplications. The Leontief inverse matrix multiplied by the trade expansion vector T produces a vector in which each element indicates the additional production required to achieve the amount of trade expansion for each sector. And the \hat{E} matrix multiplied by this vector gives the change in employment in each sector solely due to trade expansion.

2.3. Chinese Input-Output and Employment Data, 2002-2007

Beginning in 1987, China's National Bureau of Statistics (various years) has compiled and published input-output tables every 5 years. But only in 2002 did China's inputoutput tables begin to have 42 sectors that are mostly consistent with international standards for sector specifications. The A matrix used in this paper is adopted directly from China's 2007 direct input coefficients table.

Both the 2002 and 2007 input-output tables contain the "Basic Matrix", which is the flow of funds matrix from which the direct input coefficients table, A, is derived. All the values in this matrix are calculated based on producer's prices in the relevant year. The basic matrix contains the vector of imports, exports, and domestic outputs. Since they are calculated at the relevant year's producer price, 2007 imports, exports and domestic output values have to be deflated to 2002 producer's price. We use the producer price index, published annually in *China's Statistical Yearbook*. This allows the calculation of real 2007 exports, imports, and domestic outputs in 2002 producer prices. Adding the vector of real imports to the real domestic output vector give us D, the demand vector measured in producers' prices. With this information, we can now calculate the trade expansion vector T as well as the Leontief inverse matrix. We turn now to the construction of the diagonal labor coefficients matrix, \hat{E} . The Chinese employment data are not readily available in a format that is consistent with the 42-sector input-output table. The Chinese population is administratively divided into two categories: urban and rural residents. For decades, citizens with rural residency did not participate in any detailed national statistical surveys. Only in recent years has data on rural residents been published, but they are compiled with a different standard. Still today only urban employment data are available in a format useful for the present analysis. In the past 20 years, China has experienced an enormous rural-urban migration due to its market opening and industrialization. Nonetheless, it has been extremely difficult for rural residents to change their official status to "urban". As a consequence, it is likely that a large amount of employees across all sectors are holding "rural" residencies, and thus employment data on urban residents understate actual employment (Chow, 2008).

Despite this data problem, it is still possible to estimate labor coefficients with the available data. First, the basic matrix includes a vector called "total employee compensation." We call this vector E. Second, the China's National Bureau of Human Resources publishes data on average annual wages by sector. From 2000 to 2002 the breakdown is 32 sectors, and after 2002, this is expanded to coverage across 128 sectors. With the use of the sector specification concordance form made available by National Bureau of Statistics (2008), we are able to aggregate the 128 sectors into the 42 sectors that are consistent with sectoral breakdown of the input-output tables. By doing so, we are able to obtain the vector of sectoral average annual wages in 2003, W_{03} . Using this vector, we estimate 2002 sectoral average annual wages, W_{02} by deflating W_{03} by the rate of increase of total average annual wages from 2002 to 2003 (0.129%). This allows us to calculate $E^*W_{02}^{-1}$ as the labor coefficients estimates for 2002 by sector -- consistent with the sectoral breakdown in the input-output table. Note that we are making an assumption here about the homogeneity of rural and urban labor and by implication that there is no wage discrimination between urban workers and rural workers. This assumption is reasonable especially for primary and secondary industries in which labor tends to be relatively homogenous and low-skilled. However, this assumption might result in an underestimation of labor in tertiary industries.

Finally, the labor coefficient vector is defined as follows:

$$EW_{02}^{-1}Q_{02}^{-1}$$
 (3)

where Q_{02}^{-1} is the vector of total output taken from the 2002 basic matrix. Since Q_{02}^{-1} is calculated in producer prices in units of 10,000 Yuan like every vector in the basic matrix, the calculated labor coefficients are essentially the numbers of workers required to produce 10,000 Yuan worth of output for each sector in 2002. The diagonalization of this vector will give us the \hat{E} matrix. With the \hat{E} matrix, we are then able to calculate the employment change vector, L, as defined in (1).

2.4. Employment calculations

Calculations of the employment from trade expansion by sector is presented in Table 1, which lists sectors in descending order of jobs created. According to this calculation, during the period from 2002 to 2007, China's trade expansion has generated about 70.9 million jobs in total. As indicated above, the particular algorithm used here controls the counterfactual level of trade surplus by imposing a constant trade propensity, that is a constant ratio of trade to output. One can imagine that the employment generated by the trade surplus as a whole would be much bigger given the rapid overall economic growth China has experienced since 2000.

- Table 1 about here -

Amongst the 42 sectors, only 9 sectors lost employment as a result of trade, and none of the sectors has lost more than 1.5 million jobs. Total employment losses amount to 4.97 million. On the other hand, 31 sectors have gained employments, and 16 of the sectors have gained at least two million jobs. Total employment gain amounts to 75.9 million. It is rather clear from the results that almost all the manufacturing sectors fall within the employment-gaining category, and most of the high job-gaining sectors are manufacturing sectors. This result corresponds to the findings of manufacture employment losses in developed countries due to deindustrialization (Milberg and Kucera's, 2003). Blecker (1989) discussed the possibility that "countries with competitive advantage and chronic trade surpluses can export unemployment to their deficit-ridden trading partners." (Blecker, 1989, p. 396) China has run a trade surplus for more than 20 years; at the same time, its population structure along with its economic reforms have "freed-up" enormous amount of underutilitized capacity and cheap labor to the market sphere which made Chinese exports extremely competitive in international market (Freeman, 2004). From this perspective, the results, especially on manufacturing sectors, might be viewed as the amount Chinese unemployment has been "exported" to its deficit-ridden trading partners.

Regarding the 9 job-losing sectors, the "agriculture, forestry, farming of animals and fishing" sector is the one that has lost the most (1.44 million). The Chinese economy has historically been an agricultural economy. Yet throughout modern history, Chinese economic policies have been particularly hostile toward the agriculture sector. For example, China was one of the very few countries in the world to impose a high tax (about 50%) on agriculture production, and for decades, Chinese farmers were burdened with various fees from local governments (Li et al. 1998). The economic boom since the 1990s has favored the Chinese manufacturing sector. As the result, the agriculture sector has suffered the problem of abandoned farmland⁷, and this problem was particularly apparent in the late 1990s and beginning of 2000s. This is also evident from figure 3 below where one can observe the decline of China's primary sector's output as a share of its GDP.

⁷ The phenomenon caused by farmers leaving their farmlands to become manufacture wage-labors in cities.

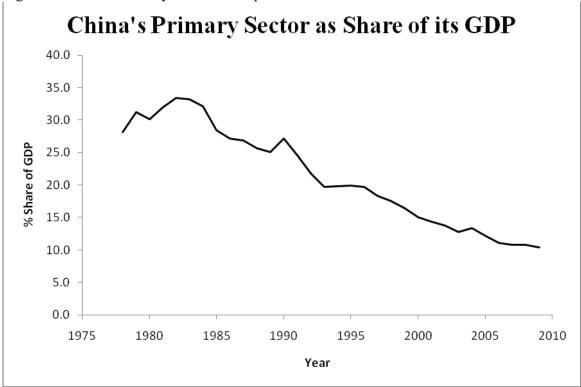


Figure 3. China's Primary Sector's Outputs as Share of Its GDP

Source: China Statistical Yearbook (Various Years)

However, since the agriculture sector is very large in term of total employment, the decline in employment due to trade expansion is only 0.66%. China's agriculture sector will appear again in the concluding section of this paper when we consider alternative paths to employment growth other than international trade.

The sector with the second largest amount of employment losses is "manufacture of clothing, leather, fur, and other product" sector (1.23 Million). Given the apparent prominence of apparel in the Chinese export boom, this is a curious finding and thus deserves some discussion. Notice that this sector is different from the sector called "manufacture of textile", which is the second largest job-gaining sector. This sector is extremely labor-intensive and produces mostly high-end textile commodities, which are extremely competitive internationally, especially in European markets (Milberg, 2000). It is not hard to imagine that the Chinese domestic high-end textile industries are young and less competitive compared to European ones, Moreover, considering the amount of wealth that has been generated by the rapid economic growth in China since 2000, domestic demand for this sector must have expanded more rapidly than the increase of

trade surplus for this sector. Only in this case do we expect to see an employment loss. What we see in Table 1 is the employment loss due to the change in trade structure instead of simply due to a change in net exports. This argument is evident in the input-output data, which shows that, for this sector, the trade surplus has doubled between 2002 and 2007, but total domestic demand for this sector's output in 2007 is 2.5 times 2002⁸.

Our calculations show that China's trade expansion has successfully generated millions of jobs and reduced their burden of unemployment. But what is the size of the labor pool China would need to absorb if it were to attain anything close to full employment? Is it possible to use additional foreign trade to absorb at least a reasonable portion of them? These questions will be addressed in the next section.

3. How Mercantilist Does China Have To Be?

The change of ownership structure as part of China's open market reform has resulted in a serious problem of unemployment and underemployment. (Jefferson and Rawski 1992), This have become a major concern of the central government since the late 1990s. Given the scale of employment that has been created by trade expansion, we can use our inputoutput framework to assess how much additional trade surplus would be needed from the world in order to absorb China's excess labor. Would the world have enough demand to be able to sustain such a "vent-for-surplus"? We address this question by first providing an overview of China's employment in the past 20 years, and then, using the same input-output model used above to estimate the trade surplus vector.

3.1 Unemployment in China: An Alternative Estimate

Unemployment is a tricky concept to define and measure in the case of China. Up until the mid-1990s, the labor market in China was relatively well protected from the turbulence of economic reform. Prior to the mid-1990s, managers of state-ownedenterprises were prohibited from firing employees, and college graduates were placed in state jobs by the government (Chow, 2007). As one can imagine, during that period of time, the problem was not unemployment, but labor market inefficiency. The situation took a radical turn when the government changed the ownership structure of state-ownedenterprises during the 1990s. What immediately followed was a massive wave of layoffs. The workers laid off from the previously fully state-owned enterprises are called "xia gang", and they are not officially counted as unemployed because they are still associated with the enterprises where they were employed. But they have no work to do, and the state provides them only with very limited xia gang benefits. The number of xia gang workers is rather large according to official figures. For example, the number of state workers was 113 million in 1995, and as of 2007, it fell to 64 million. (China Labor Statistical Yearbook, 2008) Furthermore, due to the lack of relevant skills and education, the "xia gang" population tends to be either discouraged from the labor market and retire

⁸ For 2002 and 2007, Net Exports for this sector are 2.3 x 107 Yuan and 4.8 x 107 Yuan, but Domestic Production are 7.1 x 107 Yuan and 1.8 x 108 Yuan, both adjusted to 2002 producer's price.

early, or left to pick up various part-time jobs. Furthermore, the migrant workers from countryside have also over-saturated the urban low-skilled labor market.

According to official unemployment data, the unemployment rates from 1995 to 2007 ranged between 2.9% and 4.3% (China Labor Statistical Yearbook, 2007, Table 2-1). In light of the discussion above, we posit that the official data understate the unemployment situation, and perhaps to a very large extent. According to Cai et al. (2008), an individual is only counted as unemployed when he or she registers for unemployment benefits with the state; the bureau of statistics does not conduct representative sample surveys to estimate unemployment. As a result of this way of defining and measuring unemployment, a large amount of xia gang and underemployed workers are not reflected in the statistics, which results in an understatement of the employment problem in China. Cai et al. (2008) develop an alternative measure of Chinese unemployment, defined as the difference between the so-called economically active urban population⁹ (EAUP) and the employed urban population. (Cai et al. 2008) This measure is problematic due to its urban bias, as discussed above. Given the difficulties involved in measuring unemployment, we propose to measure the "excess labor" instead of unemployment. Excess labor is the population that is capable of working but is not. The amount of excess labor will be more than actual unemployment because it includes those who are capable of working but not willing to work; however, this number does not omit rural residents. Our research question now becomes: how much additional trade surplus would China need if it were to absorb the excess labor in the economy?

We estimate excess labor (EL) as follow:

$$EL = P_{+16} - P_{elders} - P_{Students} - TE \qquad (4)$$

EL is the amount of excess labor, which is total population over the age of 16 years, P_{+16} , minus the population over the age of 60 years, P_{elders} , minus the population between 16 and 60 years old who are at school, $P_{students}$, and minus the total amount of people who are employed in the economy (TE) estimated as in section 2.3.

In 2007, the population above 16 years of age was1.04 billion, and the population above 60 was 153 million¹⁰. Population above 16 in school is approximated by the sum of high school, undergraduate and post-graduate students in 2007, that is 52.8 million¹¹. The total employment figure does not need to depend on official (urban-biased) data. It can be estimated using the input-output data and the China Labor Statistical Yearbook dataset, and applying the same algorithm as described in Section 2.3. This gives a sum total of employment for all sectors in 2007 of 603.3 million. The estimated excess labor,

⁹ Urban population that are above 16, willing and able to work.

¹⁰ Downloaded at http://news.163.com/08/0229/14/45SJQDUR000120GU.html.

¹¹ China Statistical Yearbook (2008).

therefore, is 225.965 million. This number is much larger than both official and the Cai et al. (2008) estimation of unemployment.

3.2 Estimation Method and Results

It is tempting to estimate the amount of additional trade surplus that would be needed if China were to absorb all the excess labor by applying the same algorithm, but solving it backwards. However, we suspect that the results will not be very meaningful for two main reasons. First, one can imagine the amount of trade surplus that is needed to absorb 226 million workers is going to be so large as to be completely unsustainable given reasonable levels of world demand. Second, the trade surplus is simply a component of final demand, along with consumption, investment, and government spending. No country, no matter how mercantilist, would use foreign trade to absorb all of its excess labor. Hence, we ask the question differently: how much additional trade surplus would China need to absorb a reasonable portion of its excess labor? We use the proportion of employment that is directly generated by foreign trade in 2007 as this reasonable proportion.

We begin with the inverse of the model in section one:

$$T_s = (I - A) \cdot \hat{E}^{-1} \cdot L_E \qquad (5)$$

 L_E is the vector of excess labor to be absorbed. Again, due to the lack of appropriate sectoral data, the vector L_E must estimated; in other words, the total amount of excess employment has to be distributed among the sectors for them to absorb. There are numerous ways to go about it, but it is most reasonable to distribute the excess labor in accordance to its employment-related trade-performance, as follows: First, compute the amount of employment, Γ , resulting from the change of trade surpluses between 2007 and 2002:

$$\Gamma = \hat{E} \cdot (I - A)^{-1} \cdot (NE^{07} - NE^{02})$$
 (6)

Expression (6) is simply the algorithm that appeared in Section 2.2, but this time the difference in net exports is not the trade expansion vector; instead, it is the actual change in the value of net exports. In other words, Γ simply measures the amount of employment in each sector resulting from the actual growth or decline of the trade surplus. The estimated Γ is a vector of employment, with some values being negative. Since we want to use the job-creating sectors to absorb excess labor, we eliminate all the job-losing sectors and turn Γ into Γ^* . Finally, we compute a vector of percentages, Φ , as follows:

$$\Phi = \Gamma * \cdot (\Gamma * \cdot i)^{-1} \qquad (7)$$

where i is a vector of 1's (the summation vector). Premultiplying by Γ^* produces the vector sum. Each element in Φ is the corresponding sector's share of the total amount of employment generated due to the increase in the trade surplus. A sector with a high share must be a sector that has high employment-related trade performance. In other words,

this sector not only does well with trade surpluses, but also has a high employment multiplier¹². And finally, the excess labor is simply distributed as below:

$$L_{E} = \boldsymbol{v} \cdot EL \cdot \boldsymbol{\Phi}$$
$$\boldsymbol{v} = \frac{i \cdot \Gamma}{TE} \tag{8}$$

where v is the fraction of excess labor that needs to be absorbed by the trade surplus, and is equal to the portion of total employment that is directly generated by trade in the past.

We are depicting a scenario in which a semi-central planning government designates each sector of the economy a share of a given fraction of excess labor to absorb based on that sector's past performance in generating employment through trade. There are certainly many other ways we can go about distributing the excess labor. This distribution makes sense for a trade surplus country like China. Furthermore, since we are interested in seeing the general scale of additional trade surplus that would be needed instead of the specific sectoral results, this way of splitting up the excess labor will produce numbers that are at least informative and meaningful.

At this point, we have all the data needed to make calculations using (6). As one can imagine, the job-creating sectors need to have enormous amounts of additional trade surplus. The total amount of additional trade surplus needed is approximately 265 billion measured in 2007 U.S dollar. Thus to answer our question, if trade were used to absorb the estimated excess labor in China, the trade surplus has to effectively double over its 2007 level.

The result overstates the problem. First, the input-output algorithm estimation does not take overall economic growth into account. The rapid growth of the Chinese economy over time would reduce the burden of excess labor absorption required from the foreign sector. Second, given the fact that each sector has its distinct labor coefficient and output multiplier, a different distribution of excess labor across the sectors would produce potentially very different estimates for the volume of needed additional trade surplus. What we have presented here is an extreme, mercantilist, case. Third, the self-estimated total employment likely has some margin of error -- for example, it does not reflect the underground economy which is known to be rather large in China. By some estimates (Schneider, 2002), it has reached to almost 20% of its GNP by the beginning of 2000s.

Nevertheless, the result seems to suggest that given the extent of the excess labor problem in China, using trade as an instrument to absorb a fraction of that where the fraction is the share of employment from trade in 2007 is not even feasible for that it would require China to almost double its already enormous trade surplus in 2007. Between 2002 and 2007, China indeed has successfully created jobs through foreign

¹² Employment multiplier measures a sector's capability of generating employments given a unit of increase of its final demand. This concept will be discussed in details in section three.

trade expansion. However, if foreign trade were used as an instrument for even a reasonable proportion of excess labor absorption, how mercantilist would China have to be? Our estimation suggests that demand from the rest of the world simply cannot sustain this agenda. Hence, to resolve the problem of excess labors, the government has to look into some alternatives other than foreign trade.

4. Non-mercantilist Job Creation: Multiplier Analysis, Policies and Concluding Remarks

If the world cannot sustain a highly mercantilist approach to excess labor absorption, what alternatives does China have? This is quite an open-ended question, which many industrial policy specialists have been tackling (Cai, 2008; Lin, 2003). In this section, we will provide some insights to this question based on the analytical framework adopted in this paper, the input-output approach.

The foreign trade surplus is of course simply one component of final demand, along with consumption, investment, and government spending. Therefore, in a static model, an increase in any component of final demand would generate employment. Realistically speaking then, trade is not the only solution. But what is the technical relationship between final demand and employment generation? In an input-output framework, with given technical coefficients, the capacity for employment generation for each sector depends on two factors: one, the degree of labor intensity; and two, the extent of the entire economy's dependence on this particular sector¹³. The variable that captures both factors for each sector is the employment multiplier, M,¹⁴ defined as follows:

$$M_e = [(I - A)^{-1}]^T \cdot i \cdot \hat{E} \qquad (9)$$

No new notation is introduced in this algorithm. Again, i is the summation vector; and \tilde{E} is the diagonal matrix of labor coefficients. Here we use end-year (2007) labor coefficients instead of 2002. The logic behind this algorithm is rather simple. $[(I - A)^{-1}]^{T}i$ gives the vector of column sums¹⁵ for the Leontief inverse. Each column sum represents the amount of outputs generated in the entire economy given one unit increase of the corresponding sector's final demand. The computation captures the extent of the entire economy's dependence on the respective sector's output. This vector then multiplied by \hat{E} transforms the column sums into physical employment numbers, giving the amount of employment the entire economy can generate for each unit increase of final demand for each respective sector, that is, the employment multipliers.

The calculated employment multipliers are reported in Table 2 sorted in descending order. If we compare Table 2 with Table 1, we realize that sectors that do

¹³ This is called the degree of indirect effect. See Miller (2009).

¹⁴ For a detailed theoretical discussion of multiplier analysis, please see Miller (2009) Chapter 6.

¹⁵ Noticing that the transpose turns row sums into column sums.

well with trade expansion job-generation are not sectors with high employment multipliers. To see this relation more precisely, we compute two Spearman rank correlation coefficients. The first is the rank correlation between the vector of employments generated through trade expansion (which was calculated in Section 2.4) and the corresponding vector of employment multipliers. The result is -0.28, which means the rankings of these two vectors are negatively correlated¹⁶. The second is the rank correlation between the vector of by sector percentage changes of employments and the vector of employment multipliers. This calculation therefore takes into account the relative growth (or reduction) of each sector's initial employment size. This coefficient is again negative and even larger (-0.33). We conclude from the analysis that the sectors that tend create *more* jobs (both in absolute and relative terms) due to trade expansion from 2002 to 2007 mostly tend to be the sectors with *lower* employment multipliers. This analysis suggests that the strategy of letting the sectors with high trade performance to absorb excess labor is highly inefficient for the purpose of job creation.

-Table 2 about here -

Among those sectors with high employment multipliers, the agriculture sector again stands out as the outlier with extremely high employment multiplier relative to other sectors. Chinese agriculture sector is highly labor-intensive due to technological backwardness (Chow, 2007). Recall from above that this is also the sector that has lost the most employment due to changes in the trade structure. The other sectors that are on top of the list in table 3 are all service sectors with high labor intensities, and most of the sectors have either very limited or no foreign trade content due to the characteristics of their outputs. As we move down on the list, we start to see more and more of the export-oriented – and capital intensive – sectors.

It is well documented that China's development strategy has emphasized heavy on capital-intensive industries to sustain steady and rapid GDP growth (Chow, 2007; Kroeber, 2006). For example, enterprises in those industries have favorable tax treatment and easy access to low-interest credit. The rapid development of these sectors allowed them to become internationally competitive very quickly (Cai et al. 2008, Chow, 2007), which explains the high trade performance we observed in Section one above. The other side of the story is that those labor-intensive primary sectors have lagged behind in the process of Chinese economic development. Not only they do these sectors not receive favorable tax and loan treatment, but there also exist many institutional barriers to entry in these sectors. Putting aside the agricultural sector, all of the top ten high employment multiplier sectors are heavily, if not entirely, monopolized by the state. The sector that is most problematic is again the agricultural sector for reasons that have been discussed in section 2.4, and this sector happens to be the sector with the highest employment multiplier. The problem with agriculture caught the central government's attentions in the mid-1990s. In the beginning of 2000s, the government started to experiment by imposing extremely low taxes on agricultural income in several poor and agricultural provinces. In

¹⁶ Spearman rank correlation coefficient is bounded between 1 and -1, where 1 indicates perfect correlation and -1 indicates perfect inverse correlation.

2006, the government completely removed agriculture taxes for the entire country, and started to provide subsidies to farmers. Given its high employment multiplier, we expect those favorable agriculture policies to be effective in generating employment in the future. Lastly, a few words shall be said on China's service sectors. Over the past 30 years, the tertiary sector in China has grown drastically from 23.9% of it GDP in 1978 to 43.4% as of 2009 (China Statistical Yearbook, 2009). Its contribution to the overall employment creation is indeed significantly positive, but such contribution does not come about via the channel of trade due to the fact that many of the tertiary outputs are non-tradable by nature.

To conclude we return to our central research question: What should China do to resolve the problem of excess labor? We saw in Section one that its trade expansion in the 2000s successfully generated millions of jobs domestically, and the counterpart of this story is that millions of jobs have been lost due to de-industrialization for developed countries. However, due to the extent of excess labor, as well as the low employment multipliers associated with those high trade performing sectors, using foreign trade as the main instrument to absorb excess labor may be impossible given the limits of foreign demand. The multiplier analysis suggests that the government should focus on sectors that are highly labor-intensive, especially the agriculture sector. What this entails is a change in the economic policy path China has been following since its reform, namely, from capital-intensive industrial development to a more balanced development path with higher growth in primary sectors and less growth in heavy industry. Regarding the agriculture sector, China has already been moving in this direction. (Lin, 2003) Tax policy should induce agricultural investment demand, which along with the new agricultural subsidies (as government spending) will produce the final demand increase and trigger the employment multiplier effects. Indeed, in the past decade, China has magically achieved the goal of steady and rapid GDP growth, astonishing the rest of the world. The next goal in China's economic transformation should be to achieve more balanced growth and social harmony.¹⁷ Mercantilist trade expansion should have its historical beginning and end.

Acknowledgement

I am grateful to William Milberg and Duncan Foley and participants in the New School-UMass conference and the Western Economics Association conference for discussion of the topic and comments on a previous draft. I am also grateful to Mr. Zhaohui Gu who played an indispensable role in collecting and organizing the Chinese data. All errors are my sole responsibility.

¹⁷ Ironically, Harmonious Society is the political goal the new Chinese administration propagates.

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Table 1. Change i	n Employment Due to	Trade Expansion	(China 2002-2007)
			(

Sector	Employment (10,000)& % Change	Sector	Employment (10,000) & % Change
Manufacture and Processing of Metals	1095.64 99.59%	Professional Technique Services	32.61 11.10%
Manufacture of Textile	861.49	Sanitation, Social Security &	30.95
	58.14%	Welfare	3.02%
Manufacture of Machines for All Purposes	853.85 53.92%	Construction	22.58
Manufacture of Chemical	763.13	Information Transfer, Computer	22.25
Products	41.28%	Services	8.93%
Manufacture of Electronic	638.04	Real Estate	21.55
Equipment	115.62%		3.00%
Manufacture of Metal	341.34	Production and Distribution of	14.16
Products	52.74%	Water	13.96%
Transportation and Storage	311.06 14.67%	Education	6.57 0.27%
Manufacture of Electrical	310.69	Production and Distribution of Gas	4.76
Machinery & Equipment	55.28%		21.85%
Wholesale and Retail Trade	296.31 7.31%	Postal Services	4.14 4.25%
Mining and Washing of Coal	284.80 21.13%	Manufacture of Measuring Instrument and Machinery for Cultural Activity & Office Work	0.20 0.12%
Manufacture of Non-metallic Mineral Products	254.04 20.89%	Recycling and Disposal of Waste	0.00
Timbers Processing, Manufacture of furniture	236.28 37.09%	Management of Water Conservancy, Environment and Public Establishment	0.00
Manufacture of Paper and	228.39	Public Management & Social	-0.78
Paper Products	22.42%	Organization	-0.03%
Manufacture of Transport	214.16	Accommodation and Restaurants	-3.69
Equipment	30.66%		-0.36%
Finance	200.17 26.78%	Culture, Sports and Entertainment	-13.94 -4.68%
Production and Supply of	197.52	Extraction of Petroleum and Natural Gas	-22.05
Electric and Heat Power	40.52%		-10.02%
Mining of Metal Ores	74.93 26.10%	Food and Tobacco Manufacture	-38.14 -3.19%
Mining of Processing	71.82	Research and Experimental	-63.37
Nonmetal and other Ores	14.04%	Development	-51.97%
Processing of Petroleum, Cooking, Processing of Nucleus Fuel	67.63 39.78%	Resident Services and Other Services	-87.44 -6.29%
Manufacture of Artwork,	63.79	Manufacture of Clothing, Leather,	-123.32
Other Manufacture n.e.c	18.43%	Fur and other Products	-13.63%
Tenancy and Business Services	61.36	Agriculture, Forestry, Farming of	-143.84
	12.42%	Animals and Fishing	-0.66%

12.42%Animals and Fishing-0.66%Source: Author's calculation using data from China's Input-output tables and ChinaLabor Statistical Yearbook (Various Years).

Table 2. Employment Multipliers

Sector	Employment Multiplier	Sector	Employment Multiplier	
Agriculture, Forestry, Farming of Animals and Fishing	1.09E-04	Accommodation and Restaurants	1.64E-05	
Public Management & Social Organization	4.00E-05	Manufacture of Paper and Paper Products	1.60E-05	
Education	3.90E-05	Wholesale and Retail Trade	1.46E-05	
Postal Services	3.67E-05	Manufacture of Machines for General and Special Purposes	1.38E-05	
Management of Water Conservancy, Environment and Public Establishment	3.44E-05	Manufacture of Measuring Instrument and Machinery for Cultural Activity & Office Work	1.36E-05	
Mining of Processing Nonmetal and other Ores	2.76E-05	Tenancy and Business Services	1.28E-05	
Research and Experimental Development	2.66E-05	Manufacture of Transport Equipment	1.11E-05	
Sanitation, Social Security & Social Welfare	2.63E-05	Manufacture of Chemical Products	1.09E-05	
Production and Distribution of Water	2.42E-05	Manufacture of Electrical Machinery & Equipment	9.30E-06	
Manufacture of Artwork, Other Manufacture n.e.c	2.26E-05	Production and Distribution of Gas	9.11E-06	
Manufacture of Clothing, Leather, Fur and other Products	2.25E-05	Transportation and Storage	9.03E-06	
Construction	2.23E-05	Manufacture of Electronic Equipment	8.85E-06	
Mining and Washing of Coal	2.15E-05	Food and Tobacco Manufacture	8.36E-06	
Timbers Processing, Manufacture of furniture	2.10E-05	Extraction of Petroleum and Natural Gas	8.22E-06	
Manufacture of Non-metallic Mineral Products	1.98E-05	Finance	7.32E-06	
Manufacture of Textile	1.87E-05	Manufacture and Processing of Metals	6.61E-06	
Mining of Metal Ores	1.82E-05	Production and Supply of Electric and Heat Power	5.91E-06	
Professional Technique Services	1.79E-05	Information Transfer, Computer Services	5.40E-06	
Culture, Sports and Entertainment	1.74E-05	Real Estate	5.17E-06	
Resident Services and Other Services	1.73E-05	Processing of Petroleum, Cooking, Processing of Nucleus Fuel	5.03E-06	
Manufacture of Metal Products 1.66E-05 Recycling and Disposal of Waste 9.38E-07 Source: Author's coloulation using data from China's Input output tables (Verious Verious Verious) Verious Verious Verious Verious Verious				

Source: Author's calculation using data from China's Input-output tables (Various Years).