Exchange Rate and International Outsourcing: Would Chinese Yuan Appreciate Against U.S. Dollar?

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Abstract  We apply a simplified version of Antra’s (2005) model to show that when the South has a large amount of redundant labor exists in either the agriculture sector or in state-owned business, it tends to resists currency appreciation in order to attract more international outsourcing activities from the North to accommodate its redundant labor. Consequently, the South as a whole benefits with a larger share of world income and with more employment while binding itself tighter into the global value-chain, even though its real wage might be depressed in consequence. This argument finds support from the case of China, the factory of the world that suffers with substantial social inequality.

Keywords: Exchange rate, international outsourcing, China, Yuan.

JEL Classification: F16, F31, F42

1. Introduction

We live in a world of both specialization and globalization. Encouraged by innovation in computer, communication and transportation technology, firms tend to specialize in particular stages or components of production, exporting them to other countries for further processing or input. In most cases, the locations of production are globally determined based on the comparative advantage of each region. Consequently, the entire production process becomes more efficient and offers substantial benefits to the world. Grossman and Helpman (2005) noted:

Firms seem to be subcontracting an ever expanding set of activities, ranging from product design to assembly, from research and development to marketing, distribution, and after-sale services. Some firms have gone so far as to become “virtual” manufacturers, owning designs for many products but making almost nothing themselves.

When we look at international outsourcing trade between the North (i.e., developed countries) and the South (i.e., developing countries), the current literature generally take the exchange rate as exogenous. For example, Grossman and Helpman (2005), normalizing the exchange rate as one, argue that the catch-up in productivity by the South shifts outsourcing activities from the North to the South, leading to a higher growth in the real income in the South than that in the North. As implied by the Cagan model (1956), the currency in the South should appreciate when higher growth in real wage rates is experienced.1
However, we argue that the South might undervalue its currency to make itself more attractive for international outsourcing activities (i.e., offshore production) if having abundant “redundant” labor in its economy. The firms in the North carry out international outsourcing activities to take advantage of the lower wage rates in the South, but also lead to a higher relative wage in the South, reducing its low-factor-cost advantage in turn. To compensate its rising relative wage, the South might tend to resist its currency appreciation or even devalue its currency in order to improve its comparative advantage to take up more outsourced sectors. We argue that the motive of the South to resist currency appreciation come from a fact that it has an imminent need to accommodate its enormous redundant labor in the agriculture sector into the industrialized sectors. This type of industrialization process occurred in both Taiwan and South Korea in the 1970s and 1980s. Right now, it is currently occurring in China.

The growing Chinese market is an important determinant of foreign direct investment in China, but China’s low wage rates might be the more important determinant of foreign direct investment. A survey by the Japanese government (Ministry of Economy, Trade and Industry, 2001) shows that cost consideration is the number one motive for Japanese multinationals to locate in China with the growing Chinese market playing the second role (Fung et al., 2002). Meanwhile, many multinationals from Hong Kong and Taiwan are lured by the lower Chinese wages to locate in China for low value-added processed assembly. In addition to the low wage rates, China levies an enterprise income tax of 33 percent on domestic firms, but only 15 percent on FDIs (foreign direct investment) in order to encourage foreign firms to substantially participate in its external sector. This favorable tax exemption for FDI, along with its low wage rates and a weak currency policy, greatly encourages China’s exports. As a location for low-cost manufacturing, China represents an opportunity for multinationals around the world to cut costs of productions. These advantages make China the factory of the world. During the last two decades, China has been the fastest growing economy in the world. It is widely expected that China will continue this high economic growth rate for the next two decades or so. Moreover, since the 1980s, China’s trade surplus increased steadily, suggesting that the yuan should appreciate due to both the steady trade surplus and flooding inflow of FDI. In stead, as shown in Figure 1, China has repeatedly devalued its currency as a means of promoting trade and FDI in the 1980s and early 1990s. And then China pegs U.S. dollar from year 1994 till now.
The US trade deficit with China hit a record high of US$162 billion in 2004, a figure that constituted one-fourth of the U.S. total deficit for that year. It is expected to widen to $200 billion in 2005. Thus, from U.S. President George W. Bush through Congress and the Senate, there have been repeated calls for the Chinese to appreciate the yuan in order to ease the current imbalance in Sino-U.S. trade. Even having such a high pressure, there is at least one main reason why China will continue to resist U.S. pressure and only thereafter accept a token appreciation.4 China currently has more than 60 million workers in its state-owned enterprises (SOE) and about 100 million farmers and agricultural workers. By comparison, the about 150 million-strong US workforce only includes about 1.5 million farmers. The redundant personnel in China's SOEs and the excessive number of farmers that have to be given new employment number in the hundreds of millions, and this would be a hard task for any government. Naughton (1996) and Fung (1998) show that China's trade is heavily dependent on enterprises from other economies and a substantial amount of China's trade is conducted by foreign-invented enterprises. For example, foreign firms conducted 56.2 percent of China's imports and 54.8 percent of exports in 2003. It is also well known that China's trade has some important features: a high incidence of re-exports through Hong Kong and a high degree of trade related to foreign investment (Fung, 1996). All this trade is related to international outsourcing activities.5 Therefore, China needs rapid economic growth and expanding export markets to create employment opportunities. If the Chinese yuan is allowed to appreciate too much, it could cause economic and export growth to slow. The process of shifting its redundant labor into global value-chain will be deterred, and the consequent enormous numbers of unemployed that would result would plant the seeds of social unrest and could possibly destabilize the government. Therefore, China has an imminent need to
resist its currency appreciation in order to accelerate China’s industrialization process (i.e., transferring redundant labor into productive sectors).

The remainder of this paper is composed of four sections. In Section 2, we introduce the exchange rate into the Antra’s (2005) version of the outsourcing model. In Section 3, we illustrate the role of currency in international outsourcing trade. In Section 4, we conclude.

2. Model

Labor is a unique production factor in a world of North-South. We assume that the labor in the North is skilled, while the labor in the South is relative unskilled. Consumers are assumed to have homogeneous preferences on all differentiated goods. The demand function for a representative final-good \( j \) is given by

\[
y_j = \lambda p_j^{-1/(1-\alpha)}, \quad 0 < \alpha < 1,
\]

where \( p_j \) is the price of the final-good \( j \) and \( \lambda \) is a given parameter. We drop the subscript \( j \) in the first stage for simplicity. Supposed that for each final-good, high-tech inputs are produced by the North exclusively and low-tech inputs that can be produced by either the North or by South. The high-tech inputs are meant to comprise activities such as research and development, marketing, etc (Antra’s, 2005), which can only be produced by the skilled labor in the North. The low-tech inputs are referred to as routine processes, such as assembly, and can be done either by the skilled labor in the North or by the unskilled labor in the South. Good quality of either high-tech or low-tech inputs is guaranteed if the production factor is the skilled labor. Under incomplete contract, the specialized low-tech inputs could be bad or good quality if produced by the unskilled labor in the South. Although the South has the advantage of a lower wage rate, the risk of incomplete contract deters the North from carrying out international outsourcing activities. Firms in the North generate the high-tech inputs but outsource the low-tech inputs domestically or abroad. It guarantees good quality if the low-tech input is produced in the North. Induced by incomplete contract, the low-tech input could be bad or good quality in produced in the South. If the specialized low-tech inputs are bad quality, the output of the final-goods will be zero. Otherwise, the output is given by

\[
y = \eta x_h^{1-z} x_l^z, \quad 0 \leq z \leq 1,
\]

where \( \eta = z^{-\alpha}(1-z)^{-1} \). We can divide the production process for the representative final-good into various stages of production. Assume that the wage rate in the North is \( w_N \), and the wage rate in the South is \( \varepsilon w_S \) in term of the currency of the North. Here the exchange rate \( \varepsilon \) is exogenously determined by the government of the South, because the South usually pegs its currency against the North’s currency (e.g., most of Asian countries peg their currency against U.S. dollar).

If the low-tech inputs are produced in the North, the profit of the final-good producer is
I N _ N _
\[ x = \frac{h}{z} \]  \hspace{1cm} (3)

With respect to each output, the first order conditions lead to an equilibrium

\[ \frac{1-z}{z} = \frac{x_h}{x_l} \]  \hspace{1cm} (4)

Substituting (4) into (3), we get the profits of the final-good producer as

\[ \pi_N = (1 - \alpha) \lambda \left( \frac{w_N}{\alpha} \right)^{-\alpha/(1-\alpha)} \]  \hspace{1cm} (5)

When the low-tech inputs are outsourced to the South in order to take advantage of its lower wage rate, the South could acquire a share of surplus in the bargaining. As in literature (Antra’s and Helpman, 2004, etc), the final-good producers in the North and the low-tech producers in the South bargain over the surplus from the relationship after that the South can provide the good quality low-tech inputs. This ex-post bargaining is a generalized Nash bargaining game in which \( \beta p_y \) is attributed to the South, and the remaining surplus, \( (1 - \beta) p_y \), is attributed to the Northern producer, where \( 0 < \beta < 1 \). The producer in the North is to maximize \( (1 - \beta) p_y - w_N x_h \), and the low-tech inputs producer in the South is to maximize \( \beta p_y - x_s x_I \). The first order conditions of the joint profits yield to an equilibrium as

\[ \frac{(1-z)(1-\beta)}{z\beta} = \frac{w_N x_h}{\epsilon w_S x_I} \]  \hspace{1cm} (6)

Combining the above first order conditions and equation (6), we obtain the optimal price for the final-good producer under international outsourcing as

\[ p_S(z) = \left( \frac{\epsilon w_S}{\beta} \right) \left( \frac{w_N}{\alpha(1-\beta)} \right)^{1-z} \]  \hspace{1cm} (7)

Comparing (7) with (4), the unit price of the final-good will be lower if the final-good producer carries out more international outsourcing activities (i.e., a larger \( z \)). Assuming there is a large number of identical, potential low-tech input producers in the world, perfection competition make them pay an income transfer to the final-good producer, and the amount of the transfer is adjusted so as to make zero profit for the producers in the South. Combining (6), (7), and the necessarily income transfer that leading to zero profit in the South, we obtain the profit of the northern producer as
\[ \pi_S(z) = \lambda \frac{1 - \alpha [z\beta + (1 - z)(1 - \beta)]}{\left( \frac{\omega w_N}{\beta} \right)^{\frac{1}{\alpha}} \left( \frac{w_N}{1 - \beta} \right)^{(1 - \alpha)/(1 - \alpha)}}. \quad (8) \]

For a profit-maximization firm in the North, the strategy of international outsourcing is preferred if \( \pi_N(z) \leq \pi_S(z) \). Comparing (5) to (8), we find that the international outsourcing is carried out only if

\[ A(\varepsilon, z) = \left( \frac{1 - \alpha}{1 - \alpha [z\beta + (1 - z)(1 - \beta)]} \right)^{\frac{1 - \alpha}{\alpha}} \left[ (\beta^{-z}(1 - \beta)^{-1})^z \right]^{\frac{1}{\varepsilon}} \leq \omega, \quad (9) \]

where \( \omega = \frac{w_N}{w_S} \). It is easy to show that \( A(\varepsilon, z) \) is nonincreasing in \( z \) for \( z \in [0,1] \) (see Antra's, 2005) and \( \lim_{z \to 0} A(\varepsilon, 0) \to \infty \). We also have \( \lim_{z \to 1} A(\varepsilon, 1) = \beta^{-1} \left( \frac{1 - \alpha}{1 - \alpha \beta} \right)^{\frac{1 - \alpha}{\alpha}} \varepsilon \). We can illustrate \( A(\varepsilon, z) \) as a downward sloping curve with respect to \( z \) as in Figure 2.

The next, we move to the general equilibrium as derived in Antra's (2004), where world income equals world output on all goods, so that \( E = w_N L_N + w_S L_S \). Note that the full employment condition holds in the North, but not in the South. We assume that the labor demand in the South, \( L_S(z) \), increases with a lower outsourcing threshold \( z \), that is, \( L_S(z) < 0 \). It is because there will then have more stages of productions been shifted to the South, requiring more southern labor. Let \( F(z) \) be the fraction of industries with \( z > z \) and \( f(z) \) be the corresponding probability density function. The relative share of world income can be expressed as:

\[ \frac{\omega L_N}{\omega L_S(z)} = \frac{1 - \alpha \beta \int_{z}^{1} zf(z)dz - Y_g}{\alpha \beta \int_{z}^{1} zf(z)dz + Y_g}. \quad (10) \]

The smaller is the outsourcing threshold \( z \), the larger the share of world income is attributed to the South. Here we denote \( Y_g \) as the output of the South’s homogeneous sector (say agricultural sector) in world income \( E \), wherein there is substantial amount of redundant labor. Therefore, it won’t affect the output \( Y_g \) with the shift of redundant labor from the homogeneous sector to the productive outsourced sectors. We can then rewrite (10) to express the relative wage rate of the North to the South as:

\[ \omega = \frac{1 - \alpha \beta \int_{z}^{1} zf(z)dz - Y_g}{\alpha \beta \int_{z}^{1} zf(z)dz + Y_g} \frac{L_N(z)\varepsilon}{L_N}. \quad (11) \]
We have $\lim_{z \to 0} \omega = \frac{1-\alpha \beta - Y_g}{\alpha \beta + Y_g} \frac{L_s(0)}{L_N}$ and $\lim_{z \to 1} \omega = \frac{1-Y_g}{Y_g} \frac{L_s(1)}{L_N}$. Note that the South’s homogeneous sector in world income $E$ (i.e., $Y_g$) is supposed to be very small, so that $\lim_{z \to 0} \omega << \lim_{z \to 1} \omega$.\(^7\) On the other hand, it is feasible to assume the change in $L_s(z)$ is limited. It turns out the $\omega$ curve can be illustrated as an upward sloping curve as in Figure 2, especially when $z$ approaches 1. Comparing to the $A(\varepsilon,z)$ curve with $\lim A(\varepsilon,0) \to \infty$, it is reasonable to argue that $\omega$ curve is relatively flat in Figure 2. It implies that the elasticity of $A(\varepsilon,z)$ is larger than that of the $\omega$ curve with respect to $z \in [0,1]$.

As argued by Antra’s (2005), the condition of $\omega > A(1) > \varepsilon$ holds in a general equilibrium, there exists a unique threshold $z \in (0,1)$ such that the low-tech input is produced in the South if $z > z \equiv A^{-1}(\omega)$, otherwise in the North. Note that a larger $z$ in an industry implies that this industry is relative mature.

**Figure 2. Equilibrium in the Choice of Location**

![Figure 2](image)

3. Redundant Labor and Currency Manipulation

Suppose initially there is full employment in the North, but there are substantial amount of redundant laborers in the South reside in agriculture sector or in state-owned business. International outsourcing activities (i.e., offshore production) from the North to the South
provide jobs for the South’s redundant laborers. Therefore, we argue that the South might tend to encourage international outsourcing activities to accommodate these redundant laborers and to become more industrialized. The argument is illustrated as in Figure 3. Since the \( A(\varepsilon, z) \) is more elasticity than the \( \omega \) curve with respect to \( z \in [0,1] \), it turns out when the South devalues its currency (i.e., a smaller \( \varepsilon \)), both curves shift downward at the same rate to the new equilibrium with a lower threshold \( \tilde{z} \), where \( \tilde{z} < \bar{z} \). It implies that more the low-tech input are ready to be outsourced into the South while \( z > \tilde{z} \). It turns out from this currency devaluation the larger share of world income will be attributed to the South.

Figure 3. The South Manipulatively Undervalues Its Currency

As shown in Figure 3, a smaller \( \varepsilon \) (i.e., depreciation) leads to a lower outsourcing threshold (i.e., \( \tilde{z} < \bar{z} \)), and it turns out the South acquires a larger share of world income as implied in equation (10) (i.e., \( \frac{1-\alpha \beta}{\alpha \beta} \int_{\tilde{z}}^{1} zf(z)dz > \frac{1-\alpha \beta}{\alpha \beta} \int_{\bar{z}}^{1} zf(z)dz \) when \( \tilde{z} < \bar{z} \)). Favorably, the total employment in the South increases with a lower outsourcing threshold (i.e., \( L_s(\tilde{z}) > L(\bar{z}) \)), because more of the South’s redundant labor become productive. On the other hand, the depreciation also leads to a lower \( \omega \) in the new equilibrium as in Figure 3. It is observed in Figure 3 that the equilibrium \( \omega \) changes as the same direction as \( \varepsilon \), implying that the net effect on relative real wage (i.e., \( \frac{\omega}{\varepsilon} \)) is
ambiguous. However, this manipulated depreciation is not necessarily unfavorable to the South’s relative real wage on net.

The undervaluation in currency makes the South more attractive to the international outsourcing activities, consequently binding it tighter into the global value-chain. This not only makes the South as a whole be wealthier, but also turn some of its redundant labor into productive. Unfortunately, this undervaluation policy might reduce the growth of its real income during this industrialized process. Therefore, the government in the South faces a trade-off between higher real income and more employment while maximizing its objective function. The optimal policy varies with its choice of parameter weight placed on the redundant labor (e.g., peasantry in China), which largely determines which party will be favored. However, this issue of political economy is beyond the scope of our paper. Here we only argue that the South might find it is beneficial (at least as a whole) to manipulatively undervalue its currency in order to shift its enormous redundant labor into productive and binding it tighter into the global value-chain. Our argument finds support in the case of China.

In 1979, China had just opened her door to international trade and FDI, and 82.08 percent of the population lived in rural area mostly engaged in agriculture. This percentage drops to 59.47 percent in 2003. It has been widely acknowledged that state-owned businesses in China are full of “redundant” labor in the Western standard. Many state-owned businesses are usually very inefficient in production to survive on their own, and the Chinese government has consistently strived to slim these state-owned business.

In Table 1, it shows that employment in state-owned businesses decrease over time in China, eliminating more than ten million positions in state-owned enterprises over four years. Some of these “redundant” laborers were transferred into more productive sectors created either by FDI or by export-oriented private-owned business. Considering that there are about hundreds million “redundant” laborers in China waiting to be employed, it is no wonder that China resolutely resists against serious political pressure from the Bush Administration and not to appreciate the yuan. After all, China has an imminent need to maintain an attractive destination for international outsourcing activities to create more jobs for sustaining its political stability.

5. Conclusions

Our model has given a clear illustration of how the supply of redundant labor and manipulated currency affect international outsourcing activities. We argue that if the South has enormous redundant laborers in either the agriculture sector or in state-owned business, it tends to undervalue its currency to attract more international outsourcing activities (i.e., offshore production) from the North to accommodate its redundant laborers. In this industrialization process, the South as a whole benefits with a larger share of world income and with more employment while binding itself tighter into the global value-chain, even though its real wage might be sacrificed. The South generally resists currency appreciation even though its currency is expected to appreciate, especially when the economy is trying hard to cure its social inequality. The argument finds support from the experiences of China (also from other East Asian countries). China, as the factory of the world, engages deeply in international outsourcing activities. Since
1979, China’s GDP has been growing at the fastest rate annually in the world, and this should imply an appreciating yuan. On the contrary, the Chinese yuan depreciated against most main currencies in the world. The puzzle comes from a fact that China has an imminent need to maintain its low cost environment to invite more international outsourcing activities in order to accommodate its huge amount of redundant laborers from either state-owned business or from the agriculture sector. It is crucial for the Chinese government to create enough jobs for sustaining its political stability.

Endnotes

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1. Suppose the monetary policies are exogenous in each country.

2. They recently abandon the tax favor for FDI on August, 2005.

3. Zhang (1996) argues that a key reason for the continuous currency devaluation is to reduce the price distortion and promote exports. Wang (1993) has found that there is a positive relationship between the currency of China and its exports. Brada et al. (1993) also found that devaluation of the Chinese yuan serves to improve its balance of trade.

4. Another reason for China’s resistance on currency appreciation might be its uncompetitive and vulnerable financial system. If the Chinese yuan were allowed to float freely, China’s weak financial system would become a target for international vultures. Therefore, China is speeding up its financial reforms and its four biggest state-owned banks have already been listed on stock markets outside of China, which has attracted investments from international banks. They have also opened up management and board positions in order to become stronger and to help adapt to international demands.

5. It has been mentioned by Feenstra et al. (2002) that an average of 53 percent of Chinese exports was re-exported through Hong Kong over the period 1988-1998. Hong Kong adds a markup and exports these Made-in-China goods elsewhere (mainly to U.S.) without fundamentally changing the goods. Generally, we can view this re-export trade as international outsourcing trade.

6. The $\lim_{z \to 0} A(\varepsilon, 0)$ is equivalent to $\lim_{z \to 0} \left[ \frac{1 - \alpha}{1 - \alpha(1 - \beta)} \right]^{\frac{1}{\alpha}} (1 - \beta)^{\frac{1}{\beta}}$. And $\lim_{z \to 0} A(\varepsilon, 0) \to \infty$ if $\frac{(1 - \alpha(1 - \beta))^{\frac{1}{\alpha}}}{1 - \alpha} (1 - \beta) < 1$. We find out its Taylor expansion is approximated as $1 - \frac{\beta^2}{2(1 - \alpha)} [1 + (1 - 2\alpha)\beta]$, which is smaller than 1.

7. $\frac{1 - \alpha\beta - Y_g}{\alpha\beta + Y_g} - \frac{1 - Y_g}{Y_g} = \frac{-\alpha\beta}{(\alpha\beta + Y_g)Y_g}$, which can be approximated as $-\frac{1}{Y_g} \ll 0$ if $Y_g$ is small enough.
References


Table 1. Labor Supply in China

<table>
<thead>
<tr>
<th>(In Millions)</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2004</th>
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<tbody>
<tr>
<td>Total labor Supply</td>
<td>720.85</td>
<td>730.25</td>
<td>737.4</td>
<td>744.32</td>
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<tr>
<td>Labor Supply in State-owned Enterprise</td>
<td>78.78</td>
<td>74.09</td>
<td>69.24</td>
<td>66.21</td>
</tr>
<tr>
<td>% Of labor Supply of State-Owned Enterprise</td>
<td>10.92%</td>
<td>10.14%</td>
<td>9.39%</td>
<td>8.89%</td>
</tr>
</tbody>
</table>

Source: National Bureau of Statistics of China