Why isn’t China Exporting Automobiles?
   - A model of technology adoption

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1 Introduction, Motivation & Literature Review

In modern times, the automobile industry has become a relatively labor intensive industry as compared to other industries such as the food processing industry or IT industry. Normally, several people are involved in each process of an automobile production line. However, for a food processing firm such as a bottled water firm, it only takes a few people to control the huge machine in the factory. Under the Heckscher-Ohlin theorem’s assumption, a country will operate an industry that is intensive in its abundant resource. That means a labor abundant country will produce labor intensive goods and a capital abundant country will produce capital intensive goods. Then, why is China, a labor abundant country, not producing automobiles and exporting cars?

One explanation for this situation is that a high technology difference exists between countries, which creates comparative advantages based on more than just factor abundance. Even though the automobile industry is a labor intensive industry, the capital abundant countries will still produce automobiles because they have higher technology and the U.S can produce more with the same labor quantities. Thus, to make the world production more efficient, China will have incentive to promote its own technology level and increase the production in the labor intensive industry’s production back to itself. Given this incentive of technology adoption, what is the tradeoff that China faces for the technology adoption? Also, what are the industrial policies that China can pursue to promote its technology level?

Industrial policy is an official strategic effort to encourage the development of the
manufacturing industry. In the *Report on subject of Manufactures* by Alexander Hamilton (1791), the idea of the industrial policy was first introduced. Hamilton mainly discussed that to promote early American industry, the U.S. needed to protect the infant manufacturing industry and encourage the development of the industry by promoting its technology level. He specifically discussed that using the tariff revenue to support local firm’s innovations and technology development. His idea was expanded by Tilman Altenburg (2011) in *Industrial policy in Developing Country: Overview and Lessons from Seven Country Cases*. Altenburg divided industrial policy into two main categories including functional policies and selective policies. Functional policies encourage support on industry’s framework such as power supply and infrastructure construction. Selective policy is direct subsidy from the government to target area such as technology development. In this paper, we will mainly focus on selective policy and industry outcomes if the government supports the technology development. Also, in *The 8th order of National Development and Reform Commission of The People’s Republic of China*, we can find direct support evidence that China is using industrial policies to develop its technology level.

In this paper, we are mainly interested in the role of how technology differences matters in a Heckscher-Ohlin model framework and what are the industrial policies’ effect on the technology differences. We construct a model which allows us to study this technology adoption problem. This model is a combination trade model of the Heckscher-Ohlin model and Ricardo’s idea of technology differences. In this model, there are two countries (U.S. and China), two factors (labor and capital) and two industries (a capital intensive industry and a
labor intensive industry.) We will study the technology adoption problem by putting different technology levels in the industries from the two countries in this model and examine how technology level changes in China affect the two Countries’ utility and production. For simplicity reasons, we will use a simple Cobb-Douglas function for production and utility in this model.

There are three major results in this paper. The first one is that when China increases its technology level, the U.S. welfare may decreases. This result comes because of clearing terms of trade at the beginning stage of adoption technology and the effect this has on the trade direction. The second result incorporates a cost for technology adoption. We study the optimal technology level given the cost function and two different payment methods. Also, we generate the results for interesting when the original technology level in China is not zero. The last result will give us policy outcome. I will show that under some condition, U.S. will pay China to discourage them from adopting more technology in an attempt to prevent welfare loss for them.

I will introduce the set up for the model and solve the model in the second section of the paper. In the third section, I will explain the major results in the detail by using graphs and mathematical tools. Finally, in section 3 I will conclude.

2 Model for the two countries

My model is a two country, two good and two factor model with a simple Cobb-Douglas function. There are several assumptions for this model: First, the model has a constant return
to scale production function. Second, the labor and capital resources in both countries are fully hired by the two industries. Household cannot borrow across countries. And for each goods, the sum of production quantities of both countries must equals the sum of consumption quantities of both countries. Based on these assumptions, we have several equations.

\begin{align*}
(1) \quad & L^{CH} = L^{CH,LI} + L^{CH,KI}; \\
(2) \quad & K^{CH} = K^{CH,LI} + K^{CH,KI}; \\
(3) \quad & L^{US} = L^{US,LI} + L^{US,KI}; \\
(4) \quad & K^{US} = K^{US,LI} + K^{US,KI}; \\
(5) \quad & Q^{CH,LI} + Q^{US,LI} = C^{CH,LI} + C^{US,LI}; \\
(6) \quad & Q^{CH,KI} + Q^{US,KI} = C^{CH,LI} + C^{US,KI};
\end{align*}

For simplicity, I use $Q^{CH}$ as productions in China and $Q^{US}$ as productions in U.S. $L^{CH,LI}$ is the labor factor that is used in the labor intensive industry in China and the $L^{US,LI}$ is the labor used in the labor intensive industry in U.S. Similarly, the $L^{CH,KI}$ is the labor used in the capital intensive industry in China and $L^{US,KI}$ is the labor used in the capital intensive industry in U.S. The same holds true for capital $K$s. Correspondingly, the Qs are the quantities of labor intensive goods and capital intensive goods production for China and U.S and Cs are quantity of labor intensive goods and capital intensive goods consumed in China and U.S.

For the labor intensive good, we have the following production functions in China and U.S.,

\begin{align*}
(7) \quad & Q^{CH,LI} = A_{LI} \cdot K_{LI}^{\alpha} L^{CLI-\alpha} \\
(8) \quad & Q^{US,LI} = A_{LI}^{US} \cdot K_{LI}^{\alpha} L^{USLI^{1-\alpha}}
\end{align*}

In these functions, the $Q^{CH,LI}$ and $Q^{US,LI}$ are the productions levels for the labor intensive goods. For China, this industry has a technology level of $A_{LI}$ and for U.S., this industry has a
technology level of $A^{US}_{KI}$. The $\alpha$ is the capital share in this industry. A low $\alpha$ indicates a highly labor intensive industry. An example is the automobile industry.

For the capital intensive good, we have the similar functions with different variables,

\begin{align}
Q^{CH}_{KI} &= A^{CH}_{KI} * K^{CH}_{KI} L^{CH}_{KI}^{1-v} \\
Q^{US}_{KI} &= A^{US}_{KI} * K^{US}_{KI} L^{US}_{KI}^{1-v}
\end{align}

In these functions, the $Q^{CH}_{KI}$ and $Q^{US}_{KI}$ are the production level for the capital intensive industry. For China, this industry has a technology level of $A^{CH}_{KI}$ and for U.S. this industry has a technology level of $A^{US}_{KI}$. The $\nu$ is the capital share of production in this industry. $\nu$ should be greater than $\alpha$ because this is a capital intensive industry. One example of this industry is the food processing industry because it is relatively capital intensive industry.

Solving these equations based on first order conditions will give us the nominal wage and rental rate:

\begin{align}
w &= P^{*}_{LI} MPL_{LI} \\
w &= P^{*}_{KI} MPL_{KI} \\
r &= P^{*}_{LI} MPK_{LI} \\
r &= P^{*}_{KI} MPK_{KI}
\end{align}

Since the two countries are under the free trade, the price for each goods is the same in both countries. The nominal wage in both industries is the same in the equilibrium and equals to marginal production of labor. If the wages are different, labor will shift to the higher wage industry and then bring the wage in that industry to equilibrium again. The rental rate in both industries is the same based on the same ideas as above and it is equal to the marginal production of capital.
In this model, to study the welfare of the countries, I will introduce utility functions for the two countries:

(15) \[ U^{CH} = C_{LI}^{CH} + C_{KI}^{1-\tau} \]  
\[ \text{s.t. } P_{LI}^{CH} * Q_{LI}^{CH} + P_{KI}^{CH} * Q_{KI}^{CH} = P_{LI}^{CH} * C_{LI}^{CH} + P_{KI}^{CH} * Q_{KI}^{CH} \]

(16) \[ U^{US} = C_{LI}^{US} + C_{KI}^{1-\tau} \]  
\[ \text{s.t. } P_{LI}^{US} * Q_{LI}^{US} + P_{KI}^{US} * Q_{KI}^{US} = P_{LI}^{US} * C_{LI}^{US} + P_{KI}^{US} * Q_{KI}^{US} \]

The utility function is a function of consumptions and the maximization is subject to a standard economy – wide one period budget constraint. \( U \) is the total utility for China and \( U^{US} \) is the total utility for U.S.

Given all these functions, we need to solve this system of equations to eliminate the variables and express them as parameters of the model. Solving the system’s first part which contains the production function, the optimal conditions are:

\[ L_{CH,LI}^{CH} = \frac{B_{F} * L^{CH}_B - K_{CH}}{B_{F} - B_{C}} \]
\[ L_{CH,KI}^{CH} = L^{CH}_B * \frac{B_{F} * L^{CH}_B - K_{CH}}{B_{F} - B_{C}} \]
\[ K_{CH,LI}^{CH} = B_{C} * \frac{B_{F} * L^{CH}_B - K_{CH}}{B_{F} - B_{C}} \]
\[ K_{CH,KI}^{CH} = B_{F} * \frac{K^{CH}_B * L^{CH}_B}{B_{F} - B_{C}} \]
\[ L_{US,LI}^{US} = B_{1F} * L^{US}_B - K_{US} \]
\[ L_{US,KI}^{US} = L^{US}_B * \frac{B_{1F} * L^{US}_B - K_{US}}{B_{1F} - B_{1C}} \]
\[ K_{US,LI}^{US} = B_{1C} * \frac{B_{1F} * L^{US}_B - K_{US}}{B_{1F} - B_{1C}} \]
\[ K_{US,KI}^{US} = B_{1F} * \frac{K^{US}_B * L^{US}_B}{B_{1F} - B_{1C}} \]

Where \( B = [\left( \frac{P_{LI}^{CH} * A_{LI}}{P_{KI}^{CH} * A_{KI}} \right) * \left( \frac{\alpha^*}{\nu^*} * \frac{1 - \alpha^*}{1 - \nu^*} \right)]^{\frac{1}{1 - \nu}} \)

\[ B_{F} = \frac{B_{1F} \nu}{1 - \nu} \]
\[ B_{C} = \frac{B_{1C} \alpha}{1 - \alpha} \]
B1 is the same as B but with different technology $A^{US\_LI}$ and $A^{US\_KI}$.

Solving for the system’s second part with the preference function, the optimal condition becomes:

$$C_{KI} = \frac{(1-\tau)}{\tau} \cdot \frac{P_{LI}}{P_{KI}} \cdot C_{LI}$$

Thus, then combining it with the subjective functions, we have:

$$C^{CH\_LI} = \tau \left( Q^{CH\_LI} + \frac{P_{KI}}{P_{LI}} \cdot Q^{CH\_KI} \right)$$

$$C^{CH\_KI} = (1 - \tau) \left( \frac{P_{LI}}{P_{KI}} \cdot Q^{CH\_LI} + Q^{CH\_KI} \right)$$

Correspondingly, we have the similar format for $C^{US\_LI}$ and $C^{US\_KI}$ but with different corresponding variables for U.S.

Combining the above equations with equation (15), we can come up with an equation between price and productions:

$$\frac{P_{LI}}{P_{KI}} = P = \frac{\tau}{1-\tau} \cdot \frac{(Q^{CH\_KI} + Q^{US\_KI})}{(Q^{CH\_LI} + Q^{US\_LI})}$$

Where we can generate Qs from the equations for Ls and Ks:

$$Q^{CH\_KI} = A_{KI} \cdot B^{\nu}_{F} \cdot L^{CH\_KI}$$

$$Q^{CH\_LI} = A_{LI} \cdot B^{\alpha}_{LI} \cdot L^{CH\_LI}$$

$$Q^{US\_KI} = A^{US\_KI} \cdot B^{\nu}_{1F} \cdot L^{US\_KI}$$

$$Q^{US\_LI} = A^{US\_LI} \cdot B^{\alpha}_{1L} \cdot L^{US\_LI}$$

Solving all these equations, we finally get an equation for the price ratio $P$. $P$ equals to a complicated expression that contains the $A_{KI}$, $A_{LI}$, $K^{US\_KI}$, $K^{US\_LI}$, $\nu$, $\alpha$, $\tau$, $L^{CH}$, $L^{US}$, $K^{CH}$, $K^{US}$.

Since we solved the equations as functions of the parameters, we can then calibrate each
unknown variables by plugging in numbers for them. Our aim is to study the change in the parameter $A_{LI}$ the technology level in China’s labor intensive industry. We choose $K^C = 1$, $L^C = 4$ for China because China has a low capital to labor ratio. We choose $K^U = 1$, $L^U = 2$ for U.S because U.S has a relatively high capital to labor ratio. We set $\alpha$ equals 0.2 because the $\alpha$ is the capital share in production in the labor intensive industry. It should be low. Based on the same idea, we set $\nu$ equals 0.8 since it is the capital share in capital intensive industry. To simplify the model, we set the preference coefficient $\tau$ equals 0.5. This means that the preference is neutral between the two goods and the utility that you will get from each goods is the same for the same amount of quantity. For the capital intensive industry’s technology level in both countries, $A_{KI}$ and $A^U_{KI}$, I set these two equals to each other and have same value of 1 for simplicity reasons. For the value of the technology level in the labor intensive industry in U.S., $A^U_{LI}$, I set it to equals to 1. For the value of the technology level for the labor intensive industry in China, $A_{LI}$, I set a boundary from 0.25 to 1.25 to study the change in this parameter. The numbers for these parameters is showed specifically in table 2.

3 Result and Discussion

(1) The change in variables

As $A_{LI}$ change, the variables in the model change. Graphs 1-4 illustrate these changes. The price ratio $\frac{P_{LI}}{P_{KI}}$ is falling as the technology level in the labor intensive industry in China increases as showed in figure 1. This change in the price ratio makes intuitive sense. When the technology level $A_{LI}$ increases, the production of labor intensive goods increases correspondingly because you can produce more goods with the same labor and capital. As the
quantity of supply increases, the price of the labor intensive goods will go down. Thus the relative price ratio will go down.

In Figure 2, there are four graphs showing the relationship between unknown variables and $A_{LI}$. The first graph is a graph that illustrates the increase in capital ratio $\frac{K^{CH}_{LI}}{K^{CH}_{KI}}$ in China when $A_{LI}$ increases. The growth of the capital ratio makes sense because the marginal produced of capital increases as $A_{LI}$ goes up. As the marginal production of capital increases, more capital will be employed in the labor intensive industry due to its higher efficiency. The total capital in China is a constant in this model so when $K^{CH}_{LI}$ increases, $K^{CH}_{KI}$ must decrease. Thus the capital ratio $\frac{K^{CH}_{LI}}{K^{CH}_{KI}}$ increases in China. Similarly, in second graph, as $A_{LI}$ increases, the MPL in the labor intensive industry increases causing labor to shift from the capital intensive industry from the labor intensive industry in China. Thus the labor ratio $\frac{L^{CH}_{LI}}{L^{CH}_{KI}}$ for China is increasing due to the relative change between each industry’s labor forces. However, for U.S., the capital employment ratio $\frac{K^{US}_{LI}}{K^{US}_{KI}}$ and labor force employment ratio $\frac{L^{US}_{LI}}{L^{US}_{KI}}$ have the exact opposite trend compared to China’s labor employment and capital employment ratio. This opposite trend is based on the relative productivity’s change and the effect of the trade. In U.S., the labor intensive industry is becoming increasingly relatively less productive. Thus, U.S. is going to shift both labor and capital resources to the capital intensive industry from the labor intensive industry. The capital employment ratio and labor employment ratio in both industries are decreasing.

In figure 3, we can find out the production ratio $\frac{Q^{CH}_{LI}}{Q^{CH}_{KI}}$ and consumption ratio $\frac{C^{CH}_{LI}}{C^{CH}_{KI}}$ easily from
the equations system. For the first graph, I find that the production ratio in China is increasing and the production ratio in U.S. is decreasing. This result can be deduced from the change in the capital and labor employment ratio. In China, the resources are reallocated into the labor intensive industry so that the production in the labor intensive industry will increase whereas the production in capital intensive industry will fall. The U.S. has exactly the opposite situation. For consumption, we have exactly the same consumption ratio in U.S and China. This is due to the preference function. For the preference function, we can generate a relationship between consumption and price ratio: 

\[
\frac{C_{US,LI}}{C_{US,KI}} = \frac{P_{KI}}{P_{LI}} = \frac{C_{CH,LI}}{C_{CH,KI}}.
\]

Thus for both countries, their consumption ratio on the two goods are the same. The third and fourth graphs shows the trade quantity’s changes in the labor intensive good and capital intensive good separately. The trade quantity is just the difference between the quantity produced and consumed. When the trade quantity is positive, the country is exporting, and the country is importing when the trade quantity is negative. I find that at the beginning, U.S. is exporting the labor intensive goods because of its comparative advantage in the labor intensive industry based on its relatively high technology level while China is exporting capital intensive goods due to its comparative advantage. However, as \( A_{LI} \) goes up in China, U.S. starts losing its comparative advantage in the labor intensive industry. Eventually trade direction changes at a certain level of \( A_{LI} \).

In figure 4, we see the relationship between the real GDP and the \( A_{LI} \), as well as the relationship between total utilities in the two countries and the \( A_{LI} \). For the GDP curves, we find that the real GDP in terms of labor intensive goods are increasing for both countries but
the real GDP in terms of capital intensive goods are increasing for China and decreasing then increasing for the U.S. We will focus more on this result later. I also find that the utility for China is always increasing. This situation makes sense since the welfare of China as a whole is increasing due to the increasing consumptions in both goods. Increasing consumptions are affected by the total GDP increases. However, for U.S., the utility curve has a decreasing then increasing shape. This is an interesting change that relate to the real GDP’s (in terms of capital intensive goods) change. I will discuss the reason for this U –shape curve and dig deeper into this result in the next subsection.

Combining the general cases with the specific cases, we can find out that as the technology level increases in China’s automobile’s industry, there are multiple effects. The price of automobile is lower relative to the price of food due to the change in production. The labor and capital resources will adjust and move into the car industry in China which will create more of automobile and lower the production of food in China. In the U.S., the food industry will gain more capital and labor resources and will have a higher production in this capital intensive good while the production in the labor intensive industry will fall. The increase in the technology level of China’s automobile industry will also change the trade direction and generate a higher utility for China. Also, I find this interesting result that a labor abundant country may not produce labor intensive goods, if the technology level in that country is low.

(2) Why the utility in U.S is decreasing first and then increasing?

We can explore the utility of U.S. by making a chart that contains the data at different values
of the $\frac{A_{LI}}{A_{US_{LI}}}$ ratio to show the effect of $A_{LI}$ increasing in China on the utility and consumption of U.S. As can be seen in the data in the table 1: The Utility of U.S. is decreasing from technology level ratio 0.25 to 0.6594 and is increasing from 0.6594 to 1.25. The utility is at its minimum point of 0.6594. Also, we find that the decrease in utility is due to the sharp decrease in consumption of the capital intensive good and slow increase in consumption of the labor intensive good. The increasing of utility is determined by the sharp increase in consumption of the labor intensive good and slow decrease in consumption of the capital intensive good. From the previous part, we also find that the real GDP for U.S. (in terms of the capital intensive good) is decreasing. Therefore, we can determine that when $A_{LI}$ increases, the consumption of the capital intensive good is decreasing in U.S. What is going on in this situation? The explanation is simple and depends on the direction of trade. At the beginning, the U.S. is exporting labor intensive goods and importing capital intensive goods. As $A_{LI}$ increases, China reallocates its production resources to produce more labor intensive goods and produce less capital intensive goods. $P_{LI}$ falls while $P_{KI}$ is increasing. Thus, the U.S. now gains less from the export and losses on the import. As a result, U.S.’s utility is decreasing due to less welfare gained from trade. However, when $A_{LI}$ keeps increasing, the trade direction will reverse and eventually the U.S. will sell capital intensive goods and gain from the benefit of China’s cheaper labor intensive good exports. This result is showed in the figure 5.

(3) **Technology adoption depends on costs**

In the previous study, we assumed the model was no cost on the promotion of the $A_{LI}$ in
China. However, this situation is highly unlikely in the real world. We impose a utility cost on increasing $A_{LI}$. The equation for the utility function in China now becomes:

$$U = C_{LI}^{\tau} C_{KI}^{1-\tau} - \text{COST} \cdot A_{LI}^2$$

This cost is a common convex cost. This cost can be interpreted in another way too. Consider $U(C) = C$ & $C = C_{LI}^{\tau} C_{KI}^{1-\tau}$, now we can think of the cost as a cost on the composite good where the composite goods is produced using a Cobb-Douglas function.

With this new cost, we can construct a new graph for utility with the parameter as technology on the x-axis. In figure 6, we can see that each utility curve has a different maximization point. As a result, when costs changes, the optimal $A_{LI}$ utility maximizing $A_{LI}$ changes for China. Figure 7 plots out the optimal $A_{LI}$ for each cost value. As cost increases, the optimal $A_{LI}$ falls. This makes intuitive sense because when the cost of adopting technology increases, we will lower the quantity of technology in order to maximize the utility function which now also depends on the COST*$A_{LI}^2$.

Figure 7 further plots out two curves for the optimal $A_{LI}$. These two curves represent two different methods of adopting the technology. First, the temporary method is when we invest in technology to bring up $A_{LI}$ for short period (a single period). The effect of adoption here is temporary and the economy will need to invest again in next period if it wants it to keep technology at that new level. For an infinite period economy, the household will have the cost every period and its utility function will be:

$$U = \frac{C_{LI}^{\tau} C_{KI}^{1-\tau} - \text{COST} \cdot A_{LI}^2}{1-\beta}$$
Second, the permanent method is when the household invests in technology adoption in the first period and then acquires the technology permanently. In this case, the utility function is the present value of the sum of the utilities in each single period. The resulting utility function is:

\[ U = \frac{1}{1-\beta} \cdot C^*_{L1}C^*_{K1} - \text{COST} \cdot A^2_{LI} \]

As illustrated by the graph, a household is willing to pay a much higher permanent cost (vs. temporary cost) to acquire the same level of technology. This makes perfect sense because if you buy something permanently, you will be willing to pay more for it.

Combining the two methods together, we can plot a graph of the optimal technology level, \( A_{LI} \), given combination of costs for the two methods. Figure 8 shows this result. In this figure, 0 on the z-axis implies we choose the permanent method and 1 on z-axis implies we choose the temporary method. The graph is in a 3D space because we have two independent costs for the two methods. For most cost combination the economy will choose the permanent method rather than temporary method. The combination of the costs is given by points in the x-y plane. The only situation where the temporary method will be chosen is when we either have an extremely low cost for the temporary method or a relatively high cost on the permanent method.

Figure 9 will expand on the idea developed in the figure 8. Instead of choices on the z-axis, we will plot the optimal technology level \( A_{LI} \) for a combination of the costs. Using this graph, we can find the optimal technology level given a combination of the costs for the two
methods. Similar to figure 8, I find out that most of the time, the permanent method will be used but when the cost of the permanent method is very high or temporary cost is very low, the economy will switch to the temporary method. The discontinuity in the graph illustrates this shift.

(4) **U.S. intervention in technology adoption choices in China**

Combing the idea from result (2) and result (3), I study whether the drop in U.S. utility will lead to the discouraging China from adopting new technology.

China’s gain from the adoption of the technology level equals its new utility minus its original utility. If we assume China’s current technology level is $A_{LI} = 0.35$ (for computational ease):

\[
Gain_{CH} = U_{CH} (\text{optimal } A_{LI}) - U_{CH} (0.35)
\]

\[
Gain_{US} = U_{US} (\text{Optimal } A_{LI}) - U_{US} (0.35)
\]

We can now plot how China’s utility changes as the permanent method cost’s change. This is figure 10. In this graph, we see that the gains for China depend on the optimal level of $A_{LI}$ which in turn depends on the cost. The curve is downward sloping because when the cost of technology adoption is too high, China will decrease the technology level and this coupled with higher cost will reduce their gain. Figure 11 illustrates the relationship between optimal $A_{LI}$ and the cost. Notice, the difference between this curve and figure 7 is that when you get to a certain cost level, the technology adoption is no longer optimal and the economy will stay at the current $A_{LI}$. The reason behind is that China no longer gains anything after this cost
level as compared to staying at the current technology level $A_{L1} = 0.35$. For our parameter value the critical cost level for this shift approximately equals to 1.5.

In the figure 12, in addition to China’s gain I also plot out the loss (negative gain) in utility for U.S. As can be seen, as China’s labor intensive industry grows due to the high technology adoption, the utility in U.S. is decreasing because the terms of trade in the U.S. are decreasing. At a high enough cost level, U.S. loss is greater than China’s gain, this switching point is given by the intersection of the two curves.

Going back to the optimal technology adoption graph (Figure 11) and adding in U.S.’s policy action to get figure 13. In order to prevent further loss brought upon by the technology adoption in China, the U.S. may intervene and discourage China from adopting new technology. In general such policy of discouragement will not work, however, if gain for China less than the loss for U.S. a beneficial trade can occur where the U.S. pays China, and China accepts payment to stop its technology adoption policies. This is an interesting result because it implies that it is possible that technology adoption may not be favored by the world, even though it would lead to higher production efficiency (but not necessarily welfare increases).

4 Conclusion
In this paper, I combined Heckscher- Ohlin model with idea from a Ricardian model. The eventual framework is a two country, two factor and two good model that allows me to study the tradeoff of technology adoption faced by China’s government. I solved the model by
solving a system of equilibrium conditions generated by the first order conditions from profit and utility maximization. The equilibrium price is a function of all the parameters. After calibrating the model, I study the effects of changes in $A_{LI}$, the technology level in the labor intensive sector in China.

I got three interesting results from this analysis. The first one is that when $A_{LI}$ increases, the U.S. can actually experience a loss in utility in some cases. After incorporating cost into the model, I find the second set of results which study the optimal level of technology adoption. Finally, combining the ideas from the first and second results, I find an interesting policy implication. I find situations where optimal policy suggests that the U.S. pay China to discourage them from adopting new technology and China will accept such payments.
Table 1

<table>
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<tr>
<th>$\frac{A_{LI}}{A_{US,LI}}$</th>
<th>$U^{US}$</th>
<th>$C^{US,LI}$</th>
<th>$C^{US,KI}$</th>
<th>Trade$^{US,LI}$</th>
<th>Trade$^{US,KI}$</th>
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Table 2

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<th>Name</th>
<th>Value</th>
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<td>$K^{CH}$</td>
<td>1</td>
<td>Total capital in China.</td>
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<tr>
<td>$L^{CH}$</td>
<td>4</td>
<td>Total labor in China.</td>
</tr>
<tr>
<td>$K^{US}$</td>
<td>1</td>
<td>Total capital in U.S.</td>
</tr>
<tr>
<td>$L^{US}$</td>
<td>2</td>
<td>Total labor in U.S.</td>
</tr>
<tr>
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<td>Capital share in production in labor intensive industry.</td>
</tr>
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<td>$\nu$</td>
<td>0.8</td>
<td>Capital share in production in capital intensive industry.</td>
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Figure 1: Technology in Labor Intensive Sector in China Relative to US
Figure 2
Figure 3
Figure 4
Figure 6
Figure 7
Figure 8
Figure 11
Figure 12
References


中华人民共和国发展和改革委员会令。第八号。《汽车产业发展政策》
