The Investment Diversion Effect of Regional Integration with Rules of Origin

Masaru Umemoto
Research Assistant Professor, ICSEAD

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Masaru Umemoto
umemoto@icsead.or.jp

Abstract:

In this paper I investigate two enquiries related to the investment diversion effect of regional integration. One of the questions is when the investment diversion occurs. And another question is whether we can control the effect well to promote the desirable foreign direct investment. We provide theoretical analysis to answer these issues. This paper shows that the regional integration that formed by the developing countries like ASEAN Free Trade Area may expect the expansion of direct investment from non-member developed countries by rules of origin. Moreover, when the member countries within the integrated region eager to call investment on the industry with superior technology, which needs foreign capital to promote the sector, the rules of origin could be used as a strategic tool.

I. Introduction

We can predict that the regional economic integration could promote the foreign direct investment from the non-member to the member countries. For example, “in 1984 the EU received only one thirds of the direct investment that the United States did but by 1989 was at the same level.” (MITI (1999)) Although the regional integration provides many incentives to create foreign direct investment foreign producers, all direct investment may not be entirely carried out voluntarily.

Although the foreign subsidiary has already existed within the region, the rules of origin treat the subsidiary discriminately and its cost is not negligible, the subsidiary may increase the ratio of the local components. However, in the case that there is difficulty to obtain necessary components within the region, it might be more efficient to invest for the facilities to produce such components within the region. This defensive import substitute investment is referred as the result of the investment diversion effect. Incidentally, what kinds of conditions make the investment diversion effect? Furthermore, if the member countries of the region want to promote preferable direct investment from non-member countries, what is the optimal level of the rule of origin? This paper provides theoretical analysis to answer for such inquiry.

The concept of the investment diversion is originated by Kindleberger (1966). It defines the investment diversion effect as increased direct investment in certain countries and diminished direct investment in others within the region as rearrangement of the production facilities. However, the recent definition of the invest diversion effect has been changed (See MITI, 1999, Ohno and Okamoto, 1995).

In this paper we define the concept as the effect that the non-member countries of the regional integration increase the direct investment to the member countries within the region due to the trade barrier even though its location for the investment is not best. This type of the investment refers to the defensive import-substituting investment (Yannopoulos, 1990).

Despite of many studies analyze the effects of Regional integration on trade, the research on the investment issues are still not enough. Although some empirical trials exist (USITC, 1993, Ohno and Okamoto, 1995), there is no general theoretical model for this issue. This paper tries to establish the simple theoretical model for the investment diversion effects of the regional integration as the defensive import substitution investment.

The remainder of this paper is organized as follows: In section II we explain the model used in the later sections. In section III we find the condition for the investment diversion effect of the regional integration with rules of origin on the high-tech intermediates industry. Section IV considers the optimal level of rule of origin to accomplish the high-tech investment diversion. Section V summarizes our findings and discusses the policy implications of the results.

II. The Model

We consider three-country (or economies) world. We call each country as A, B, and C. Country A has comparative advantage in the high-tech components production. Country C has comparative advantage in the low-tech components production. We may imagine the country A is a developed country such as Japan and country C is developing country with low wage rate such as Vietnam. Country B has comparative advantage in assembling. We may imagine the country B as Thailand or the other countries called the ASEAN 4.

There is potential to produce the high-tech components domestically in the country B. However, since the cost of producing the high-tech components in country B is higher than the price of the identical imported high-tech components, all high-tech components are initially imported from the country A and not produced domestically. The high-tech components industry in country B can be viewed as an infant industry.

The final good producers employ two types of intermediate inputs. One of the inputs is produced with an inferior technology, while the other is produced with a superior technology. For example, the low-tech components like small parts of electrical machinery are built by simple labor force and low technology machinery, while the high-tech components need experienced labor and high technology. In fact, some of components can be built with the low or high technology. Therefore, we assume that there is a partial substitutability between low-tech and high-tech components.

We assume that the firm in country A is the source country of the foreign direct investment. The country A's firms produce a final good with components with high technology in country A, the low technology components of country C and built up the final goods in country B. This production process is based on the comparative advantage.[1] The produced final good are demanded in the country B and C. I assume that the perfect competitiveness for the final good and its components market.

We employ a neo-classical production function as the technology of the final good assembly plants in country B. In other words, the production function is linearly homogeneous, that is to say, it displays a constant returns to scale technology. We describe the function as $X = F[M_L, M_H + M_H^*]$ where X is the quantity of the final output, M_L is the quantity of the imported low-tech components from country C, M_H is the quantity of the domestic high-tech components in country B, and M_H^* is the quantity of the imported high-tech components from country A. As we can see from the production function, the domestic and imported high-tech components are identical. However, the initial quantity of the domestic high-tech components is zero, that is, $M_H^0 = 0$.

We denote the demand function for the final good in country B as $D^B[P^B]$ and that in country C as $D^C[P^C]$, we can represent the total demand for the final good as $X = D^B[P^B] + D^C[P^C]$. We simply assume that the price of the final good in country C is higher than the price in country B and its difference is provided from the tariff rate of country C. That means $P^C = P^B(1+t^C)$. Each demand function has right-downward shape and satisfies the condition: $D^{i\prime}[P^i] < 0$. We assume that the

[1] Although the absolute advantage is not sufficient condition for the comparative advantage, this model uses the absolute advantage to explain the rational choice for the multinationals.

price for each component is constant[2]. We do not consider the tariff on the components import. The prices of final good, the imported low-tech components from country C and high-tech components from country A, and the high-tech components that produced in country B are denoted by P, p_L, p_H^* and p_H, respectively. Note that we assume $p_H > p_H^*$. In the other words, the high-tech components that produced in country B becomes more expensive than the high-tech components which imported from country A. Therefore, the source firm in country A does not make any subsidiary for producing high-tech components in country B and supply all necessary high-tech components by import from country A in initial stage.

Since we assume constant returns to scale technology, the final good producer is constrained by zero profit condition such that the price of the final good equals to the unit production cost: $P = p_L m_L + p_H m_H + p_H^* m_H^*$

where $m_L \equiv \dfrac{M_L}{X}$, $m_H \equiv \dfrac{M_H}{X}$, $m_H^* \equiv \dfrac{M_H^*}{X}$. (The unit input coefficient of the low-tech components, the local high-tech components, and the imported high-tech components respectively.)

The final good assemblers find the optimal bundle of unit input coefficients from the solution of the cost minimization problem:

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2 As the further research, we can consider the flexible price of components. We analyzed the effects of FTA with a strict assumption such that all components have constant prices. If we relax this assumption and consider the change of price, the effects on the unit input coefficients under the value added constraint would be complicated, since the ratio of the unit input coefficients depends on the input prices. Then, the elasticity of substitution plays an important role for the economic integration analysis.

$$\underset{m_L, m_H, m_H^*}{Min}\ p_L m_L + p_H m_H + p_H^* m_H^* \qquad \text{s.t.}\ \ F[m_L, m_H + m_H^*] = 1.$$

Recall that $p_H > p_H^*$, and the initial optimal unit input coefficient of the local high-tech components is $m_H^0 = 0$.

The first order condition for the above cost minimization problem leads to

$$\frac{F_2}{F_1} = \frac{p_H^*}{p_L},$$

Where $F_1[m_L, m_H + m_H^*] \equiv \dfrac{\partial F[m_L, m_H + m_H^*]}{\partial m_L}$

and $F_2[m_L, m_H + m_H^*] \equiv \dfrac{\partial F[m_L, m_H + m_H^*]}{\partial m_H^*}$.

Then, we can obtain the optimal unit input coefficients m_L^0 and m_H^{*0} from the above condition. Figure 1 shows the optimal bundle at point m^0, which is determined on an isoquant curve where Marginal Rate of Technical Substitution equals the price ratio. The zero profit condition for the final good producer requires that $P^0 = p_L m_L^0 + p_H^* m_H^{*0}$. There is a tariff on imported final goods in the country C before forming a regional integration, so the price would be $P^C = P^0(1+t^C)$. Then, the total demand for the final good is $X^0 = D^B[P^0] + D^C[P^0(1+t^C)]$. The demands for the local low-tech and imported high-tech components are $M_L^0 = m_L^0 X^0$ and $M_H^{*0} = m_H^{*0} X^0$, respectively.

III. The Condition for the Investment Diversion Effect

Now we assume that country B and C establish the regional integration with rules of origin excluding the country A. The foreign investors who do not satisfy the rules of origin have three choices after forming regional integration. One of them is just accept to be treated as foreign products even though the final goods are assembled in the member country within the region. Another way is to increase in the ratio of the local inputs to satisfy the rule of origin. Final way is to carry out more direct investment to the member countries to reduce the distortion by input choice from rule of origin. This is because the final good assembler in the member country B may demand the local high-tech components, which are more expensive than the imported ones from non-member country A since the local components are favorably treated by the rules of origin from the imported components. The local high-tech components are demanded only when the usage of the local high-tech components can offset a part of the distortion cost resulting from the rules of origin.

We employ a local content term of origin rule, which requires the share of local inputs in the value of final output to identify as the local originated products. Denote the local content requirement as origin rule $p_L M_L + p_H M_H \geq \gamma p_H^* M_H^*$. where γ is the required local content ratio. Now, the final good producer solves the following cost minimizing problem.

$$\underset{m_L, m_H, m_H^*}{Min} \; p_L m_L + p_H m_H + p_H^* m_H^*$$

s.t. $F[m_L, m_H + m_H^*] = 1$ and $p_L m_L + p_H m_H \geq \gamma p_H^* m_H^*$.

We assume that the final good producers always have positive inputs, that is, $m_L > 0, m_H \geq 0, m_H^* \geq 0$ and $m_H + m_H^* > 0$.

Now we derive a function that determines the input ratio to find the condition for the investment diversion effect. Since the production function is homogeneous of degree one, its first derivatives are homogeneous of degree 0. Then, we obtain

$$\frac{F_2[m_L, m_H + m_H^*]}{F_1[m_L, m_H + m_H^*]} = \frac{F_2[\frac{m_L}{m_H + m_H^*}, 1]}{F_1[\frac{m_L}{m_H + m_H^*}, 1]} \equiv f[\frac{m_L}{m_H + m_H^*}].$$

The Marginal Rate of Technical Substitution (MRTS) can be expressed as the function of the input ratio of the low-tech components to the high-tech components. We assume that the isoquants are strictly convex to the origin and satisfy the sufficient condition for that the MRTS decreases along an isoquant: $\frac{d\left(\frac{F_2}{F_1}\right)}{d\left(m_H + m_H^*\right)}<0$.

Then, its inverse function is an increasing function of the MRTS, $\frac{m_L}{m_H + m_H^*} = f^{-1}[\frac{F_2}{F_1}] \equiv \phi[\frac{F_2}{F_1}]$.

We can derive the ratio of the low-tech components to the total high-tech components from the input ratio function and the cost minimization condition. When $m_H > 0$ after the integration, the cost minimization condition is $\frac{F_1}{F_2} = \frac{p_L}{p_H}$ from the Kuhn-Tucker first order conditions[3]. We obtain $\frac{m_L^0}{m_H^0 + m_H^{*0}} = \phi[\frac{p_H^*}{p_L}]$ prior to the regional integration and $\frac{m_L^1}{m_H^1 + m_H^{*1}} = \phi[\frac{p_H}{p_L}]$ after the integration with the investment diversion effect. If the demand of the local high-tech components is zero (the investment diversion does not occurs), the input ratio is derived from the origin rule constraint, $\dfrac{m_L}{m_H + m_H^*} = \dfrac{p_H^*}{p_L}\gamma$. When this input ratio is greater than the input ratio before integration: $\dfrac{p_H^*}{p_L}\gamma > \phi[\dfrac{p_H^*}{p_L}]$, then the final products would be treated as local originated products. Therefore, the binding condition of the rules of origin is $\gamma > \dfrac{p_L}{p_H^*}\phi[\dfrac{p_H^*}{p_L}]$ to have equality in the required content rule constraint. This is because the Marginal Rate of Technical Substitution must be greater than the price ratio.

Moreover, When $\phi[\dfrac{p_H}{p_L}] \geq \dfrac{p_H^*}{p_L}\gamma$, there is no demand for the local high-tech components. In other words, the investment diversion effect would not happen. However, if $\phi[\dfrac{p_H}{p_L}] < \dfrac{p_H^*}{p_L}\gamma$, the bundle which satisfies the cost minimization condition, $\dfrac{F_2}{F_1} = \dfrac{p_H}{p_L}$, must reduce the unit production cost of the final good (See Figure 1). Therefore, the condition for the positive demand for the local high-tech components or the condition for the investment diversion effect is $\dfrac{p_H^*}{p_L}\gamma > \phi[\dfrac{p_H}{p_L}]$ or $\gamma > \dfrac{p_L}{p_H^*}\phi[\dfrac{p_H}{p_L}]$.

IV. The Optimal Rule of Origin

In order to promote direct investment from the non-member countries, what is

[3] The derived Kuhn-Tucker conditions are available on Appendix 1.

the best level of the rule of origin for member countries of regional integration? Now, we investigate the optimal level of rule of origin through comparative statics.

First, we begin to find the change of the unit input coefficients when the required content rule ratio changes marginally. By the Kuhn-Tucker first order conditions and Cramer's rule, we can derive $\frac{dm_L^1}{d\gamma} = 0$ and $\frac{d\left(m_H^1 + m_H^{*1}\right)}{d\gamma} = 0$[4]. This result means the change of the rule of origin does not affect the optimal bundle of the low-tech and total high-tech components. This is because they are independent from the level of required content ratio and determined by $\frac{F_2}{F_1} = \frac{p_H}{p_L}$.

The total differential of the content requirement constraint is

$$p_L dm_L^1 + p_H dm_H^1 = \gamma p_H^* dm_H^{*1} + p_H^* m_H^{*1} d\gamma .$$

Then we can derive the following equation:

$$p_L \frac{dm_L^1}{d\gamma} + p_H \frac{d\left(m_H^1 + m_H^{*1}\right)}{d\gamma} = \left(p_H + \gamma p_H^*\right)\frac{dm_H^{*1}}{d\gamma} + p_H^* m_H^{*1} = 0 .$$

Therefore, $\frac{dm_H^{*1}}{d\gamma} = -\frac{p_H^* m_H^{*1}}{p_H + \gamma p_H^*} < 0$ and $\frac{dm_H^1}{d\gamma} = \frac{p_H^* m_H^{*1}}{p_H + \gamma p_H^*} > 0$.

It means that marginal increase in the required content ratio leads the demand for the imported high-tech components per unit of production to decrease and leads the demand for the local high-tech components per unit of production to increase. This result say that when the rule of origin marginally change, the final good producer just substitute the imported high-tech components for the local high-tech components per unit of the final good.

The effect of a rule of origin on the local price and demanded quantity of the final products are

$$\frac{dP}{d\gamma} = p_L \frac{dm_L}{d\gamma} + p_H \frac{dm_H}{d\gamma} + p_H^* \frac{dm_H^*}{d\gamma}.$$

We already obtained $\frac{dm_L^1}{d\gamma} = 0$, $\frac{dm_H^1}{d\gamma} = \frac{p_H^* m_H^{*1}}{p_H + \gamma p_H^*}$, $\frac{dm_H^{*1}}{d\gamma} = -\frac{p_H^* m_H^{*1}}{p_H + \gamma p_H^*}$.

Therefore, $\frac{dP^1}{d\gamma} = \frac{p_H^* m_H^{*1}\left(p_H - p_H^*\right)}{p_H + \gamma p_H^*}$ and it is positive. That result means more restrict rule of origin makes the price of the good more expensive.

The increase in price obviously leads the decrease in the total demand of the final good in country B and C.

$$\frac{dX^1}{d\gamma} = \left(D^{B'}[P] + D^{C'}[P]\right)\frac{dP}{d\gamma} = -\frac{\left(\sum_i \eta^i D^i\right) p_H^* m_H^{*1}\left(p_H - p_H^*\right)}{P^1\left(p_H + \gamma p_H^*\right)} < 0$$

where $\eta^i = -\frac{dD^i}{D^i}\bigg/\frac{dP}{P}$, $i \in \{B, C\}$, is the price elasticity of demand.

Therefore, $\frac{dM_L^1}{d\gamma} = m_L^1 \frac{dX^1}{d\gamma} + X^1 \frac{dm_L^1}{d\gamma} < 0$ and $\frac{dM_H^{*1}}{d\gamma} = m_H^{*1} \frac{dX^1}{d\gamma} + X^1 \frac{dm_H^{*1}}{d\gamma} < 0$.

Marginal increase in the required content rule ratio leads the demand for the local low-tech components and imported high-tech components to decrease.

Finally, the effect on the demand for the local high-tech components is

$$\frac{dM_H^1}{d\gamma} = X^1 \frac{dm_H^1}{d\gamma} + m_H^1 \frac{dX^1}{d\gamma} = \frac{p_H^* m_H^{*1} X^1}{p_H + \gamma p_H^*} - \frac{\left(\sum_i \eta^i D^i\right) p_H^* m_H^1 m_H^{*1}\left(p_H - p_H^*\right)}{P^1\left(p_H + \gamma p_H^*\right)}$$

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[4] The detail is available on Appendix 2.

$$= \frac{p_H^* m_H^{*1}}{p_H + \gamma p_H^*} \left(X - \frac{\left(\sum_i \eta^i D^i \right) m_H^1 \left(p_H - p_H^* \right)}{P^1} \right).$$

From this equation, the effect on the demand for the local high-tech components is ambiguous. Then, the following condition is required to have positive effect on the demand for the local high-tech components.

$$\frac{dM_H^1}{d\gamma} > 0 \Leftrightarrow X - \frac{\left(\sum_i \eta^i D^i \right) m_H^1 \left(p_H - p_H^* \right)}{P^1} > 0$$

$$\Leftrightarrow \frac{P}{m_H^1 \left(p_H - p_H^* \right)} > \eta^B \frac{X^B}{X} + \eta^C \frac{X^C}{X}$$

$$\Leftrightarrow \eta^B \frac{X^B}{X} + \eta^C \frac{X^C}{X} < \frac{P^1 F_1}{m_H^1 \left(p_L F_2 - p_H^* F_1 \right)} (>1).$$

Therefore, weighted price elasticity of demand within the region is less than critical value (it is greater than 1), the marginal increase of content requirement promotes more direct investment for local high-tech components industry.

This result suggests that if the demand for the local high-tech components is a concave function of the required content ratio, the member countries of the regional integration can choose the optimal required content ratio at the level where the price elasticity of demand for the final good has exactly the critical value.

V. Concluding Remarks

In this paper we have investigated two enquiries related to the investment diversion effect of the regional integration. One of questions we have is when the investment diversion occurs. And another question is whether we can control the effect well to promote the desirable foreign direct investment. Then, this paper shows that the regional integration that formed by the developing countries like ASEAN Free Trade Area may expect the expansion of direct investment from non-member developed countries by rules of origin. Moreover, when the member countries within the integrated region eager to call investment on the industry with superior technology, which needs foreign capital to promote the sector, the rules of origin could be used strategic tool.

What kinds of the policy implication are included in the findings of our analysis? If the member country of the regional integration eager to have foreign direct investment from the non-member developed countries, that country had better to arranging the environment for the acceptance of the direct investment and deregulate the any barrier related the investment activity. That means it makes the investment cost be reduced. The country where have the most efficient system for direct investment would enjoy the investment diversion effect.

Actually, the intra-bloc distribution of investment is important matter. The place where the desirable foreign direct investment occurs does not necessary to happen in the member country that has the final assembling factory as our model. Actually the competition might happen within the region for obtain the desirable investment from the developed country. Our result suggests that the demand for the local low-tech components would be reduced by marginal increase of the content requirement with investment diversion. Therefore, in the case the location for the diverted investment is different from the place where the low-tech components producers locate, the friction within integrated region might happen.

In order to maximize the foreign direct investment from the non-member developed countries, more restrictive rules of origin (for instance the higher local content requirement) might not be good instruments. The more restrictive rules of origin make the demand of the local high-tech components in the unit production increase. However, the unit cost would be increased and the total demand for the final good would be reduced. Therefore the aggregate demand for the local components might be reduced. The optimal level of the rule of origin is strongly connected with the price elasticity of demand for the final good. Of cause, the cost of the production increase too much due to the rule of origin and exceed the cost under the condition refuse the rules of origin, then the member countries of the regional integration would lose all direct investment from the developed country.

Not like NAFTA, ASEAN Free Trade Area has a plan to have the simple rule of origin such as 40% local content requirement for all products on the negotiated list.[5] From the result of our analysis, the AFTA also could be use rules of origin as the strategic policy for diverse the investment like NAFTA[6]. The member countries of the integration may be able to determine the rules of origin at which the requirement promotes and expands the investment diversion effects. However, as the usual problem of infant industry protection, the investment diversion might not be viable from an economics efficiency point of view because such protection is result from

[5] The listed goods that treated with rules of origin are still limited. Unfortunately the some competitive products are not included in the list such as automobile.

[6] Nafta's rules of origin are further complicate and we can read the strategic purpose from the agreement. See James and Umemoto (1999) and Umemoto and James (1999).

inducing market distortions. Therefore, welfare analysis of the investment diversion effect is an important future subject to research.

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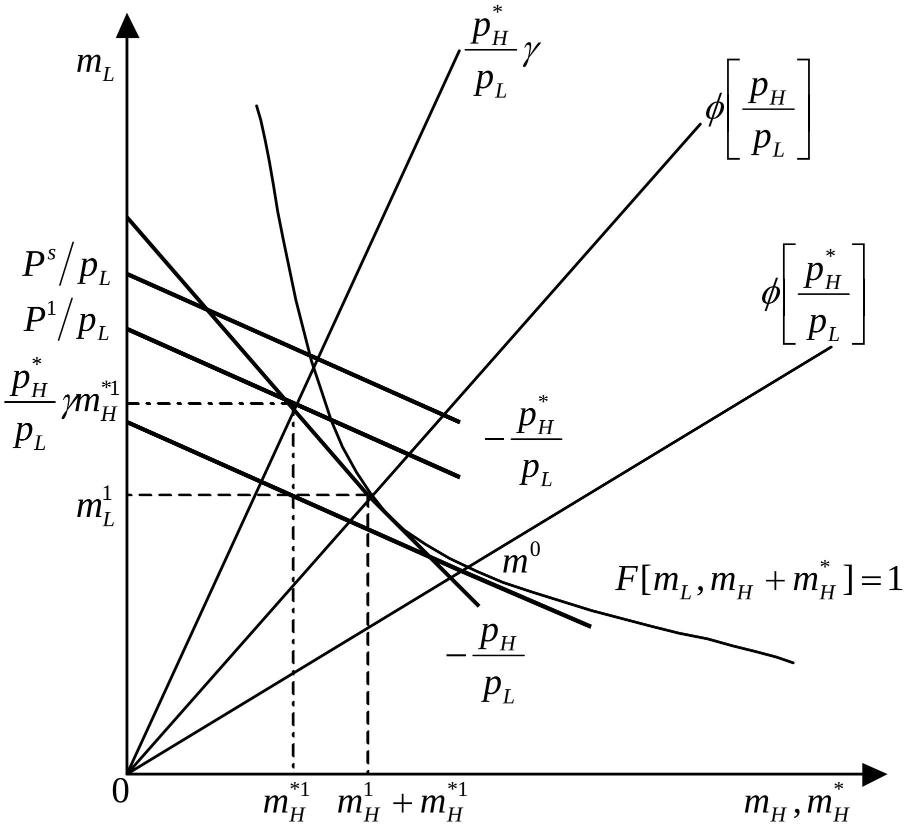

Figure 1 Effects on the Unit Input Coefficients

Appendix 1:

We can restate that the final good producers will maximize the following.

$$-p_L m_L - p_H m_H - p_H^* m_H^* + \mu_1\left(F[m_L, m_H + m_H^*] - 1\right) + \mu_2\left(p_L m_L + p_H m_H - \gamma p_H^* m_H^*\right).$$

The Kuhn-Tucker first order conditions are the following.

$$-p_L + \mu_1 F_1 + \mu_2 p_L = 0$$
$$m_H\left(-p_H + \mu_1 F_2 + \mu_2 p_H\right) = 0, \quad -p_H + \mu_1 F_2 + \mu_2 p_H \le 0$$
$$m_H^*\left(-p_H^* + \mu_1 F_2 - \mu_2 \gamma p_H^*\right) = 0, \quad -p_H^* + \mu_1 F_2 - \mu_2 \gamma p_H^* \le 0$$
$$F[m_L, m_H + m_H^*] - 1 = 0$$
$$\mu_2\left(p_L m_L + p_H m_H - \gamma p_H^* m_H^*\right) = 0, \quad \mu_2 \ge 0, \quad p_L m_L + p_H m_H - \gamma p_H^* m_H^* \ge 0.$$

Appendix 2:

When the demand for the local high-tech components is positive and the origin rule is just binding, we can derive $\mu_2 = \dfrac{p_H - p_H^*}{p_H + \gamma p_H^*}$ is positive from the first order conditions. Then, we can rewrite the first order conditions.

$$\mu_1 F_1 = \frac{(1+\gamma) p_L p_H^*}{p_H + \gamma p_H^*}, \quad \mu_1 F_2 = \frac{(1+\gamma) p_H p_H^*}{p_H + \gamma p_H^*}$$
$$F[m_L, m_H + m_H^*] = 1, \text{ and } \quad p_L m_L + p_H m_H = \gamma p_H^* m_H^*$$

Take first three of total derivative and write matrix form,

$$\begin{bmatrix} \mu_1 F_{11} & \mu_1 F_{12} & F_1 \\ \mu_1 F_{21} & \mu_1 F_{22} & F_2 \\ F_1 & F_2 & 0 \end{bmatrix} \begin{bmatrix} dm_L \\ d\left(m_H + m_H^*\right) \\ d\mu_1 \end{bmatrix} = \begin{bmatrix} \dfrac{p_1 p_2^*\left(p_2 - p_2^*\right)}{\left(p_2 + \gamma p_2^*\right)^2} d\gamma \\ \dfrac{p_2 p_2^*\left(p_2 - p_2^*\right)}{\left(p_2 + \gamma p_2^*\right)^2} d\gamma \\ 0 \end{bmatrix}$$

By Cramer's rule, we can derive $\dfrac{dm_L^1}{d\gamma} = 0$ and $\dfrac{d\left(m_H^1 + m_H^{*1}\right)}{d\gamma} = 0$.