

The initial thought that international trade is the engine for economic growth is dated back to Adam Smith. However, there is still debate about which countries benefit from these gains more than others and whether trade liberalization leads to the convergence or divergence of growth rates among countries. Incorporation of the human capital into the analysis of the relationship between trade and growth leads to even more complicated results.

The theoretical literature on international trade and growth provides controversial results. The models of Krugman (1987), Lucas (1988), Young (1991), Stokey (1991), Buiter and Kletzer (1991), Nelson (1996) and Easterly and Levine (2000) supports the idea that trade causes uneven development which leads to an ever-increasing divergence between developed and developing countries. Lucas (1988) analyzed the roles of human capital accumulation in international trade with his model of “accidental” learning by doing. Lucas (1993) extends his old model and suggests that according to the comparative advantage theory the country will accumulate only the type human capital specific to the production of the good the country has a comparative advantage at. As a result, different countries specializing in production of different goods will have different growth rates. Lucas also suggests that the countries that produce High-Tech goods will grow faster.<sup>1</sup> Young (1991) demonstrates that under free trade less developed countries always experiences technical progress and growth less than those under autarky while developed country experiences growth more than those under autarky. The fall in the growth rate in the less developed country after trade liberalization is caused by the fact

---

<sup>1</sup> This is valid for the case of CES preferences with the assumption that elasticity of substitution is greater than one.

that it specializes in the sectors where learning by doing opportunities are exhausted.<sup>2</sup> Stokey (1991) and Mochida (2004) similarly show that opening up to trade will depress the wages of the skilled labor (return to private capital investment)<sup>3</sup> which leads to a reduction in human capital investment and subsequently to a fall in the growth rate. Nelson (1996) shows that an increase in the skilled labor wage in the leader country caused by trade induces an increase in the R&D investment leading to higher growth rates.<sup>4</sup> On the other hand, there are the endogenous growth models such as the one of Findlay and Kierzkowski (1983), Romer (1990), Grossman and Helpman (1991), Segerstrom et al. (1990), Rivera-Batiz et al. (1991), Cartiglia (1997) and Eicher (1999), which suggest that trade will lead to a convergence of growth rates across countries. Grossman and Helpman (1991) extend<sup>5</sup> the model of Findlay and Kierzkowski (1983) by endogenizing the schooling into the growth model. They suggest that schooling affects the growth rate positively by increasing the skills and knowledge base in the society. Grossman and Helpman (1991), Cartiglia (1992) and then by using a very similar model of Cartiglia, Eicher (1999) suggest that trade liberalization leads to an increase in the technological change and growth rate in laggard economies and to a decrease in leader economies. Opening up to trade will depress the prices of skilled labor intensive goods in the laggard economy and thus the wage rate of skilled labor will decrease through the Stolper-Samuelson effect. The findings of Ben-David (1993) suggest a strong relationship between trade liberalization and convergence among countries. Grossman

---

<sup>2</sup> In the case of small initial technological gap between less developed and developed countries, the less developed country with a higher population or labor force can catch up and even overtake the developed country,

<sup>3</sup> The opportunity cost of schooling increases in this case due to a decrease in the skilled labor wage.

<sup>4</sup> The reason behind that is that the companies are looking for alternative techniques to replace this high-cost factor by technology.

<sup>5</sup> In their model the source of growth is R&D instead of education.

and Helpman (1991) focus on the effect of a fall in skilled labor wage rate on R&D investment and conclude that R&D sector expands in the laggard country as a result of the fall in the cost of innovation<sup>6</sup>, while Cartiglia (1997) and Eicher (1999) have analyzed effect of trade liberalization on schooling. Since the school fee depends on the wage rate of teachers as skilled labors, a trade-induced decrease in the skilled wage reduces the education cost and hence increases the incentive for more human capital investment.<sup>7</sup>

Feenstra, (1996) provides an overall framework of these models and propose that the convergence result in the endogenous growth models depends on the presence of the international diffusion of knowledge. According to him, if this condition is not satisfied meaning in the absence of international spillovers of knowledge, then in all these endogenous growth models trade in goods will lead to a divergence of growth rates.<sup>8</sup> In the absence of positive technology and knowledge externalities and labor mobility across boundaries the endogenous growth models generally imply that trade in goods intensifies differences in factor endowments, rates of technological change and thus economic growth, which is in harmony with the dynamic HOS model.

T. S. Eicher (1999) examining dynamics gains from trade for laggard and advanced economies assumes that technological change and factor endowment are both endogenous. Interestingly, Eicher (1999) suggests that the interaction of human capital and technology change in terms of cost and benefits of accumulation induced by trade in goods alone will be sufficient to lead to the reduction of technological gap between leader

---

<sup>6</sup> This conclusion is exactly the opposite of the conclusion of Nelson (1996) on the relationship between trade and R&D investment.

<sup>7</sup> This statement is in sharp contrast with the results of Stokey (1991) and Mochida (2004)

<sup>8</sup> Feenstra (2004) finds that trade can slow down the growth rate in the small country in the absence of spillovers of knowledge but whether trade will increase the growth rate of the large country is not determined.

and laggard countries even in the absence of international knowledge spillovers and labor mobility. Moreover trade will have a direct effect on wages. Eicher (1999) examines the effect of trade on the economy by especially focusing on the question of how trade affects the relative demand, supply and wages of skilled and unskilled labors.

The pivotal idea in this article is the fact that the level of the supply of skilled labor and the rate of innovation and growth of a country are deeply linked. Eicher (1999) presents a model with two countries (leader and laggard), three sectors and two goods. The laggard economy is characterized by an endogenously higher supply of unskilled labor, scarcity and high wage rates of skilled labor while the country with relatively more skilled labor endowment is labeled as the leader economy. In each country there are three sectors, namely High Tech, Low Tech and the education sector. High Tech and Low Tech goods which are tradable between these countries are produced in High-Tech and Low-Tech sectors in each country. Furthermore, education sector converts young people to skilled labors through the creation of knowledge, which is immobile across countries. Production of Low Tech goods requires only unskilled labor while production of High Tech goods is skilled labor-intensive where education sector hires only skilled labors as teacher. Skilled labors are perfectly mobile between High-Tech sector and education sector, whereas unskilled labors are perfectly mobile between Low-Tech and High-Tech sectors. As a result, the wages of unskilled workers across Low Tech and High Tech sectors and the wages of skilled labors across High Tech and education sectors are equalized within the country.

High and Low Tech sectors differ in skills-intensity and technological sophistication. Technological change generates a strong skill-biased demand that pushes

up the relative wage rate<sup>9</sup> in the autarky case. The homothetic demand structure limits the return to human capital investment and the relative wages falls in response to higher rates of technological change. This cyclical change of relative wage rates may affect not only the cost and benefit of the investment of human capital but also the allocation of skilled labor between “inventing” and “absorbing” technology, in other terms education and High-Tech sector.

High-Tech goods are more skilled-labor intensive, and the leader country has relatively more skilled-labor endowment compared to the laggard country. Consequently, it can produce the High-Tech goods more efficiently. On the other hand, since the laggard economy is endowed with relatively more unskilled-labor, whose relative wages are lower compared with the ones in leader country the laggard country has comparative advantage in production of Low-Tech goods. As a result of the both Richardian model of comparative advantage and HOS model, on the one hand there will be an expansion of High-Tech sector in the leader economy while a contraction of the same sector occurs in the laggard country if the countries open up their industries to trade. On the other hand, Low-Tech sector expands in the laggard country while it contracts in the leader economy. Opening to trade will lower the prices of High-Tech goods in the laggard country and rise prices of the Low-Tech good, which leads to a contraction of High-Tech goods and an expansion of the Low-Tech goods. As a result, more unskilled labor is demanded by the Low-Tech sector than is being released by the High-Tech sector, which implies there will be an excess demand for unskilled labor and excess supply for skilled labor in the laggard

---

<sup>9</sup> Skilled labor wage rate in terms of unskilled labor wage rate.

economy. To clear the markets, the real wages of unskilled labor should increase while the real wages of skilled labor should decrease.<sup>10</sup>

Trade leads to the contraction of the High-Tech sector in the laggard country and therefore frees skilled labors from the “absorption of technology” in High-Tech sector. Consequently, with the static fall in the relative wage of skilled labors the cost of education (equal to the wage of the teachers<sup>11</sup> multiplied by the teacher-student ratio  $\gamma$ ) will decline. Increase in human capital investment leads to the increased accumulation of human capital, which generates a higher technological change and hence the laggard country attains a higher rate of growth. The new equilibrium under trade is very important as it determines the rate of technological change and thus the dynamic of comparative advantage.

In the leader country the expansion of the High-Tech sector demands more skilled labor. In a way, it absorbs skilled labor from the education sector with higher wages. Accordingly, as a consequence of competition between the High-Tech and the education sector in terms of attracting the skilled labors the education cost will increase and the human capital investment starts to decline. Subsequently, the leader country faces a slowdown in the technological change and thus in the growth rate.

Previous models of endogenous model suggest that trade amplifies the disparity between growth rates of the laggard and leader economies by intensifying the initial position of these countries unless the cross boundary knowledge spillover and labor mobility effects are taken into consideration. However, Eicher (1999) interestingly

---

<sup>10</sup> Stolper-Samuelsen theorem holds that a rise in the relative price of a good leads to a rise in the real return to the factor used intensively in the production of that good and to a fall in the real return to the other factor.

<sup>11</sup> The wage rate of teachers is equal to the wage rate of skilled labors.

concludes that trade liberalization alone sufficiently leads to the convergence of laggard and leader countries in terms of rates of growth and technological change even with the absence of knowledge spillover and labor mobility effects, if both technological change and human capital accumulation and the interaction of their respective costs will be endogenized.

### **Critique**

Eicher (1999) assumes that the agents must be identical between career paths and total borrowing equals savings of unskilled labor by referring to the financial market clearing condition. As a result, the expectation of future wage rate for skilled labor endogenized into the interest rate is cancelled out in derivation of human capital investment. However, the future wage rates the student will receive as skilled labor will affect their decision on schooling in an imperfect financial market or in the case where the agent is not identical between two types of career.<sup>12</sup> As the laggard country opens up to trade which leads to a contraction in skilled labor intensive High-Tech production the relative wages of skilled labor will fall. Subsequently, student enrollment will be negatively affected by the fall in the relative wage of skilled labor, which is actually the return to private human capital investment. In other words, young people respond to trade liberalization by lowering their enrollment rate since they expect a lower future wage rate as skilled wage rate due to trade and the opportunity cost of education increases (working as unskilled labors instead of getting education). This fact can be supported by articles of Stokey (1991) and Mochida (2004) holding that opening up to trade will depress the

---

<sup>12</sup> As an unskilled labor in both time periods and a career as a student in the first period and skilled labor in the second period.

wages of the skilled labor which leads to a reduction in human capital investment and subsequently to a fall in the growth rate.<sup>13</sup> Thus, it should be taken into account both the negative and positive effects of a fall in skilled labor relative wage rate on human capital investment decision. The second negative indirect effect of the decreasing future wage rate of skilled labor on human capital investment can be analyzed through the interest rate. The realization of a decrease in the relative wage rate of skilled labors after opening up to trade in laggard economy may depress the supply of savings available to students for tuition loans assuming that the saving rates are higher among higher income groups. Therefore, if the decline in the savings caused by the fall of relative wage rates of skilled labor is not compensated by the increase in savings due to increasing income of the unskilled labors, the interest rate on these loans will increase which lead to less private human capital investment and schooling.

Eicher (1996) and Eicher (1999) utilize the model of Cartiglia (1992) which assumes that life time is composed of two periods, in which unskilled labors save for the first period and benefit from the interest rates and students get educated for the first period and pay the interests of their tuition loans. It is a very strong and a moderately misleading assumption, which renders the model less applicable to the real world cases. This assumption implies that the tuition loans can only be funded from the savings of unskilled labors since skilled labor do not save according to the model (They pay the interests in the second period). However, in real life the saving accumulation capability of skilled labor is much higher than the unskilled labor due to higher income levels.<sup>14</sup>

---

<sup>13</sup> They ignored the positive effect of a fall in skilled labor relative wage rate on the human capital investment through the reduction of the education cost.

<sup>14</sup> Matsuyama (1988) and Galor (1986) hold that lower income groups tend to have higher impatience rate  $\beta$  and thus lower saving rates.

Therefore, the decrease in the wage rate of skilled labor in the laggard economy may dominate the increase in the relative wage rate of unskilled labor and lowers the overall savings, which in turn increases the interest rates.<sup>15</sup> Which effect will be the dominant one depends on the elasticity of substitution between consumption and savings among both groups.

In Proposition 1, Eicher (1999) states that an increase in the student-teacher ratio,  $\gamma$ , leads to increases in the stock of students and thus in the human capital investment. However, he does not take into account the quality of skills acquired in this schooling process. The student-teacher ratio and the quality of schooling are negatively correlated whereas the quality of education and the return on human capital investment in terms of higher rate of technology and growth are positively related. Thus, the increase in  $\gamma$  has two opposite effects in the growth rate. On the one hand, since the education fees decreases when cost of the teacher can be distributed among more students, the stock of students increases which affect the rate of technological innovation positively, on the other hand the decreasing quality of education due to a higher teacher-student ratio affects the innovation and growth rate negatively.<sup>16</sup>

Eicher (1999) focuses on education and schooling as the only source of growth, although Barro (1991), Mankiw et al. (1992) and Benhabib and Spiegel (1994) show using cross-country regressions that educational achievement accounts for 5-28 percent

---

<sup>15</sup> However, we should take into consideration that the laggard economy is endowed with more unskilled labor and the effect of an increase in their wage rate may increase the overall savings in the country.

<sup>16</sup> Wong and Kar-yui (1995) support the idea that a decrease in the teacher-student ratio will lower the quality of education and the rate of human capital accumulation. This suggestion contradicts the one of Eicher (1999).

of output growth.<sup>17</sup> Eicher (1999) does not take into account the effects of increasing R&D or on the job training investments of the individual firms or by the government on growth. Ignoring R&D and on the job training investments initiated by the individual firms and the government seems a reasonable assumption in a perfect competitive market setting where firms have no incentive to invest on R&D and human capital, since in a perfect competitive market they are operating with zero profits and the government does not intervene into markets by subsidizing R&D. However, in real life monopolies benefiting from higher market powers and profits can invest on R&D and human capital when their returns from R&D activities are greater than their costs. Subsequently, increase in size of the R&D sector will increase the growth rate of the economy.<sup>18</sup> The firms in the leader country with more market power and more knowledge base will increase their R&D investment and thus increase the innovation and growth rate in the leader country, which they are operating in.

Eicher (1999) contains some typos or logical errors which renders the flow of logic a little bit confusing. After derivation of all these formula two obvious typos can be found in the following equations:

$$(1 + r_t) = w_{t+1}^E / (\beta * (U_i / S_i)) \quad (16) \text{ should be corrected as}$$

$$(1 + r_t) = w_{t+1}^E / (\beta * ((U_i / S_i) w_t^U - z_t))$$

$$S_i = \theta / ((w_t^E / \gamma w_t^E) + 1) \quad (17) \text{ should be corrected as}$$

$$S_i = \theta / ((w_t^E / \gamma w_t^U) + 1)^{19}$$

---

<sup>17</sup> In a case study of Taiwan, Tallman and Wang (1994) represent that the contribution of human capital to growth up to 45 percent, however Taiwan is an outlier compared with other countries in term of the relevant data.

<sup>18</sup> Long and Wong (1997) hold that the “scale effects” of R&D depend on the idea that it is easier to create innovation and knowledge the bigger the knowledge base and the bigger the investment on R&D is.

<sup>19</sup> Please refer to the appendix part for the verification of the right equations.

Moreover, Eicher (1999) claims that the contraction of High-Tech sector reduces the demand for skilled labor in the laggard economy and the relative wage must rise to clear the market for skilled labor. However, the contraction of High-Tech sector will reduce the return of the factor, which is intensively used in this sector, the wage of skilled labor in this case.<sup>20</sup>

### **Incorporation of “brain drain” into the model**

The assumption that there is labor movement across seems not very realistic since the developed countries generate intensive immigration policies. They welcome thousands of relatively more educated immigrants to avoid any possible slowdown in economic growth. After the contraction of the skill-intensive sector in the laggard country depressing the skill labor wage directs more skilled labor emigrate from the laggard economy and thus the laggard economy faces the brain drain problem<sup>21</sup> (people get education at home when young and work abroad when old).<sup>22</sup> The skilled labor will immigrate to the leader country due to the higher wages prevailing in the leader country.<sup>23</sup> This labor mobility will present new dynamics in both countries. The fall in the number of skilled labor in the laggard economy will push up the wage rate for skilled labors leading to higher education cost and thus lower human capital investment. The

---

<sup>20</sup> I emailed Theo S. Eicher about this issue and he admitted that there is an error in this logic in his paper.

<sup>21</sup> Barro and Sala-i-Martin (1995) hold that in poor countries persons with relatively high human capital would be more inclined to migrate, which leads to the problem of brain drain.

<sup>22</sup> Wong (1995) defines brain drain as working at home when young and working abroad when old. The occurrence of brain drain depends on two conditions according to him. The wage rate should be higher in the host country and the High-Tech output should be lower compared with the output in the source country. The second condition needs to be modified for two-period life: As an assumption we require that the quality difference between education systems in both countries should not be significant.

<sup>23</sup> Stark (1991) brings up the case that these immigrants may return to their home country. Since its effect would be similar to the emigration process from their new country as the source country only the permanent emigration case is analyzed.

drop in the number of skilled labor in the laggard country who can be employed by the education sector as a teacher and the overall decrease in population affect the growth negatively.<sup>24</sup>

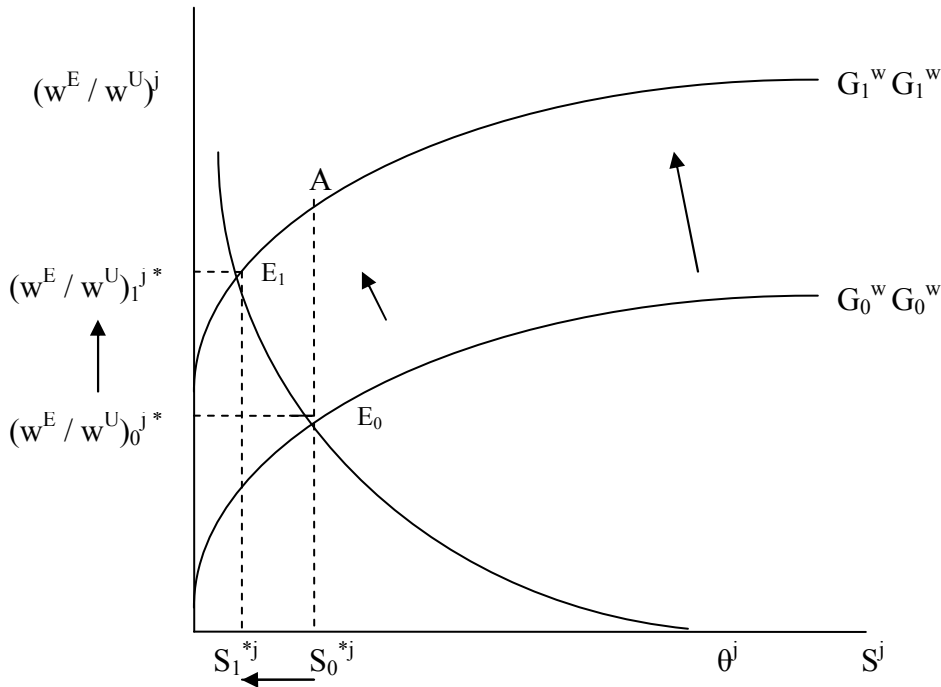


Fig.1 The effect of emigration in the laggard country

In the world economy the relative price  $\pi$  will be determined by a function of total supply and demand. As a consequence of the brain drain, the total supply for the High-Tech goods increases, since the supply increase in the host country (leader country) dominates the decrease in supply of High-Tech goods in the laggard country due to the reduction in the number of skilled labor through the emigration process. The total supply increases because the labor immigrants can produce more in their new host country than they would have produced in their source country, since they are endowed with more capital

<sup>24</sup> Wong and Kip (1997) have argued that brain drain has adverse effects on growth in the source country which is the laggard country in the Eicher (1999) model.

there, which increases their productivity.<sup>25</sup> As a consequence of the increasing total supply the relative price goes down assuming the relative world demand will be constant.

From equation (23)

$$\left(\frac{w_t^E}{w_t^U}\right)^j = \frac{\rho}{1-\rho} \left(\frac{1 + \mu S_{t-1}^j}{\delta \pi (1-\rho)^{-1}}\right)^{\frac{1}{\rho}}, \quad (23)$$

it is obvious that the decreasing relative world price  $\pi$  will increase the relative wage rate  $(w^E / w^U)^j$ , which means that the  $G^wG^w$  should be shifted leftward in Fig 1. The new equilibrium point for  $S^j$  will be lower in the laggard country and thus the growth rate will decrease. Barro and Sala-i-Martin (1995) hold that the migration slows down the convergence speed of the source economies by introducing migration to the Solow-Swan and Ramsey models. Wong and Yip (1997) support the fact that brain drain deteriorates the growth in the source country in their article while focusing more on welfare effects of the brain drain. From equation (24) we see the negative relationship between  $\pi$  and  $S^j$ .

$$S_t^j = \frac{\theta^j}{\frac{\rho}{(1-\rho)\gamma} \left(\frac{1 + \mu S_{t-1}^j}{\delta \pi (1-\rho)^{-1}}\right)^{\frac{1}{\rho}} + 1}, \quad (24)$$

The immigration of labors from laggard to leader country leads to an upward jump in the world prices and hence in the relative wage rates in the laggard economy (to point A), then with the decreasing productivity of labor in the leader country due to the increase in the number of labor per capita assuming the capital does not increase, the

---

<sup>25</sup> Bhagwati, Jagdish and Koichi Hamada (1974) support the fact that there is an increase in the productivity of labor in the source country after the emigration.

relative world prices and thus the relative wage starts to decrease until the new equilibrium point  $E_1$ . (Fig. 1)

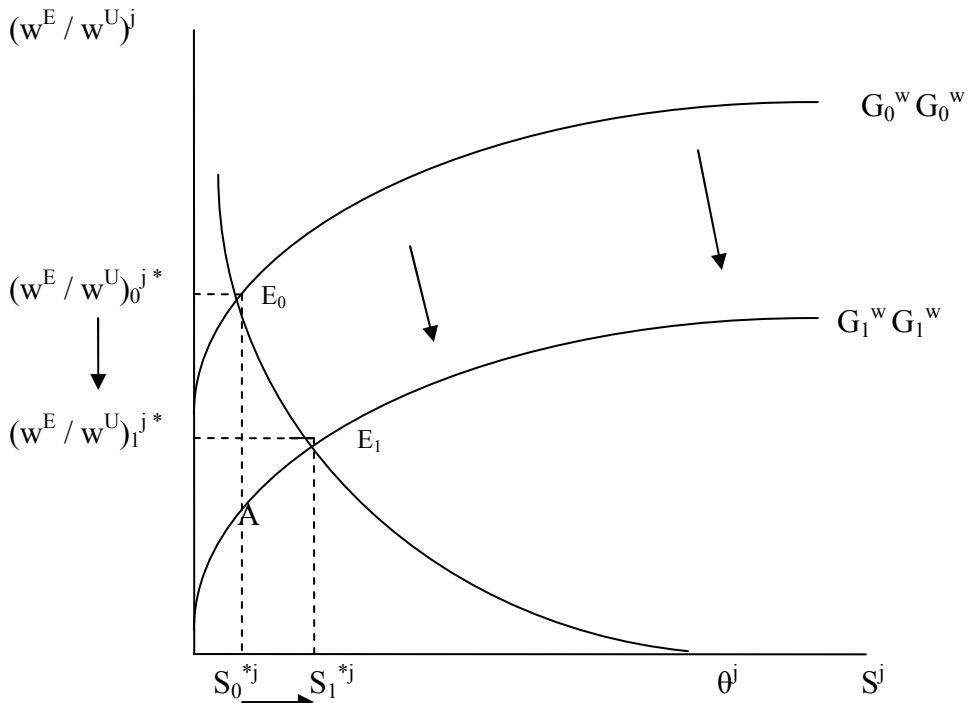


Fig.2 The effect of immigration in the leader country

In the leader country receiving the highly educated immigrants the relative wage rate jump down (represented with the point A in Fig. 2) as a result of an increase in the supply of skilled labor due to immigration.<sup>26</sup> (Skilled labor productivity decreases with the increasing skilled labor/capital ratio assuming that the educated immigrants do not bring their wealth to the host country.)<sup>27</sup> The fall in the skilled labor wage rate leads to the decline in education fees, which increases the incentive to invest in education and thus increase the growth rate in the leader country. The amplified demand for education and

<sup>26</sup> Rybczynski theorem holds that an increase in the factor endowment will increase the output of the industry using it intensively.

<sup>27</sup> It is a reasonable assumption since we are interested here only the effects of labor migration on the growth rate in the leader country not the effect of extra capital accumulation. Barro and Sala-i-Martin (1995) states that migration leads to reduced capital intensity in the host country because migrants bring relatively little capital with them.

thus for skilled labor augments the skilled labor wage rate to the equilibrium level  $(w^E / w^U)_1^{j*}$  while the number of students will increase to  $S_1^{j*}$ .

### **Concluding remarks and extensions**

Eicher (1999) shows that trade liberalization leads to the “conditional” convergence<sup>28</sup> between leader and laggard economies even in the absence of international spillovers by analyzing education in an endogenous growth setup allowing for dynamic interactions between human capital and technological innovations. Nonetheless, if the assumption of no international labor movement is relaxed and brain drain is allowed a tendency toward divergence between these economies may be seen. Which effect will dominate depends on the initial economic parameters of both economies and the elasticity of both demand and supply curves for skilled and unskilled labors.

Eicher (1999) assumes that the education sector produce non-rival knowledge (blueprints) beside skills as an embodied knowledge. One possible extension of his model will be to bestow this non-rival knowledge with property rights so that the firms have the pay license fees to the teachers or educational institutions in order to benefit from the knowledge generated in these institutions. This extra profit coming from the knowledge produced by education sector provides the opportunity to lower the tuition fees and hence increase the number of students benefiting from schooling. One other remarkable extension would be analyzing the effects of R&D investment of the individual firms on growth in monopoly and oligopoly market settings by relaxing perfect competitive

---

<sup>28</sup> The conditional convergence was first defined by Barro (1991) and Mankiw et al. (1992) to capture the idea that each country will converge to its own distinct steady state, since their economic parameters such as the impatience rate or the saving rate are different. Ventura (1997) shows that in the global equilibrium there is convergence to steady state that differ across countries.

market assumption. In this case, firms operating in the leader country benefiting from the market power and higher profits will invest more on R&D and on the job training and the leader country will attain higher innovation and growth. As one last extension, the minimum wage requirement and relatively stickiness of wages can be introduced. These regulations or slow adjustment on wages can delay or eliminate the proposed consequences of trade liberalization for both countries in terms of growth and conditional convergence.

## Appendix

$S_t * b_t = U_t * x_t$  Financial market clearing condition requires total borrowing equals saving

$$S_t * \theta (z_t + w_{t+1}^E / \beta^*(1+r_t)) = (U_t / S_t) * \theta * w_t^U$$

$$w_{t+1}^E / \beta^*(1+r_t) = (U_t / S_t) * w_t^U - z_t$$

$$(1+r_t) = w_{t+1}^E / \beta^*((U_t / S_t) * w_t^U - z_t) \quad (16) \quad \text{where } U_t + S_t = 1$$

$$\beta^*((1 - S_t) / S_t) * w_t^U - z_t = w_{t+1}^E / (1+r_t)$$

$$S_t = 1 / (w_{t+1}^E / (\beta^*(1+r_t) * w_t^U) + (z_t / w_t^U) + 1)$$

From (13) we know that  $b_t = \theta * (z_t + w_{t+1}^E / (\beta^*(1+r_t))) \dots w_{t+1}^E / (\beta^*(1+r_t)) = (b_t / \theta) - z_t$

$$S_t = 1 / (b_t / (\theta * w_t^U) - (z_t / w_t^U) + (z_t / w_t^U) + 1)$$

From  $y_t^S = y_t^U$  we have  $b_t = z_t + w_t^U - \theta * w_t^U$

where  $z_t = w_t^E / \gamma$

$$S_t = \theta / ((w_t^E / \gamma w_t^U) + 1) \quad (17)$$

## References

Barro, Robert J. (1991) "Economic Growth in a Cross Section of Countries," *Quarterly Journal of Economics* 106, 407–443.

- Barro, Robert J. and Xavier Sala-i-Martin (1995), *Economic growth*, New York, McGraw-Hill, 383-431.
- Ben-David, Dan (1993), "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics* 108, 653-681.
- Benhabib, Jess and Mark M. Spiegel (1994), "The Role of Human Capital in Economic Development," *Journal of Monetary Economics* 28, 143-173.
- Bhagwati, Jagdish and Koichi Hamada (1974), "Brain Drain, International Integration of Markets for Professionals and Unemployment," *Journal of Development Economics* 1, 19-42
- Buiter, Willem H. and Kenneth M. Kletzer (1991), "Persistent Differences in National Productivity Growth with a Common Technology and Free Capital Mobility," *Journal of the Japanese and International Economy* 5, 325-353.
- Cartiglia, Filippo (1992), "Education, Income Distribution, and Endogenous Growth in an Open Economy," *Mimeo*, Columbia University.
- Eicher, Theo S. (1996), "Interaction between Endogenous Human Capital and Technological Change," *Review of Economic Studies* 63, 127-145.
- Eicher, Theo S. (1999), "Trade, Development and Converging Growth Rates: Dynamic Gains from Trade Reconsidered," *Journal of International Economics* 48, 179-198.
- Easterly, William and Levine Ross (2000), "It is not Factor Accumulation: Stylized Facts and Growth Models" *World Bank and University of Minnesota*, manuscript.
- Feenstra, Robert C. (1996), "Trade and uneven growth," *Journal of Development Economics* 49, 229-256.
- Feenstra, Robert C. (2004), *Advanced International Trade: Theory and Evidence*, Princeton, N.J., Oxford: Princeton University Press, 2004, 338-370.
- Findlay, Ronald and Henryk Kierzkowski (1993), "International Trade and Human Capital," *Journal of Political Economy* 91, 957-978.
- Galor, Oded (1986), "Time Preference and International Labor Migration," *Journal of Economic Theory* 38, 1-20.
- Grossman, Gene M., Elhanan Helpman (1991), *Innovation and Growth in the Global Economy*, Cambridge, MA, MIT Press: 112-172
- Jensen, Bjarne and Kar-yiu Wong, (1997), *Dynamics, Trade, and Growth*, University of Michigan Press.
- Krugman, Paul, (1987), "The Narrow Moving Band, the Dutch Disease, and the Consequences of Mrs. Thatcher," *Journal of Development Economics* 27, 41-55.
- Long, Ngo Van and Kar-yiu Wong (1997), "Endogenous Growth and International Trade: A Survey," *Chapter 2 in Jensen, Bjarne and Kar-yiu Wong, Dynamics, Trade, and Growth*, University of Michigan Press, 11-74.
- Lucas, Robert E. (1988), "On the Mechanics of Economic Development," *Journal of Monetary Economics* 22, 3-42.
- Lucas, Robert E. (1993), "Making a Miracle," *Econometrica* 61, 251-272.

- Mankiw, N.Gregory, Romer, David, and David Weil (1992), "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics* 107, 407-437.
- Matsuyama, Kiminori (1991), "Life-Cycle Saving and Comparative Advantage in the Long Run," *Economic Letters* 28, 375-379.
- Mochida, Megumi (2004), "Educational Loan and Human Capital Accumulation in a Small Open Economy," *Economics Bulletin* 6, 1-10.
- Nelson, Richard R. (1996), *The Sources of Economic Growth*, Cambridge, MA, Harvard University Press, 147-158.
- Romer, Paul M. (1990), "Endogenous Technological Change," *Journal of Political Economy* 98, 71-102.
- Rivera-Batiz, Luis A., and Paul M. Romer (1991), "Economic Integration and Endogenous Growth," *Quarterly Journal of Economics* 106, 530-555.
- Segerstrom, Paul S., Anant T.C.A. and Elias Dinopoulos (1990), "A Schumpeterian Model of the Product Life Cycle," *American Economic Review* 80, 1077-1091.
- Shea, K.-L. and A. E. Woodfield (1996), "Optimal Immigration, Education and Growth in the Long Run," *Journal of International Economics*, 40: 495-506.
- Stark, Oded (1991), *The Migration of Labor*, Cambridge, MA, Basil Blackwell, 322-328.
- Stokey, Nancy L. (1991), "Human Capital, Product Quality, and Growth," *Quarterly Journal of Economics* 106, 587-616.
- Tallman, Ellis W. and Ping Wang (1994), "Human Capital and Endogenous Growth: Evidence from Taiwan," *Journal of Monetary Economics* 34, 101-124.
- Ventura, Jaume (1997), "Growth and Interdependence," *Quarterly Journal of Economics* 107, 57-84.
- Wong, Kar-yui (1995), *International Trade in Goods and Factor Mobility*, Cambridge, MA, MIT Press: 625-664.
- Wong, Kar-yiu (1997), "Endogenous Growth and International Labor Migration: The Case of a Small Emigration Economy," *Chapter 10 in Jensen, Bjarne and Kar-yiu Wong, Dynamics, Trade, and Growth*, University of Michigan Press, 289-336.
- Wong, Kar-yui and Chong K. Yip (1997), "Education, Economic Growth and International Trade," *Mimeo*, University of Hong Kong.
- Young, Alwyn (1991), "Learning by Doing and the Dynamic Effects of International Trade," *Quarterly Journal of Economics* 106, 369-405.