Unemployment and Economic Integration for Developing Countries

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Abstract

While financial or trade integration between countries may increase the size of the market and helps the adoption of more advanced technologies, will it also increase the level of urban unemployment for a developing country? In this model, there is unemployment in the urban sector. Manufacturing firms engage in oligopolistic competition and choose increasing returns technologies to maximize profits. Financial firms provide capital to manufacturing firms and they also engage in oligopolistic competition. We show that an increase in the wage rate in the manufacturing sector changes neither the level of technology nor the level of employment in the manufacturing sector. While financial or trade integration between developing countries leads manufacturing firms to adopt more advanced technologies, the level and rate of employment in the manufacturing sector will not deteriorate.

Keywords: Unemployment, economic development, financial integration, international trade, choice of technology

JEL Classification Numbers: F12, O10, D43

1. Introduction

One important feature of the modern manufacturing sector is the existence of significant degrees of increasing returns (Chandler, 1990). Under increasing returns, average costs decrease with the size of the market. For a developing country, the size of the domestic market may be small and increasing returns in the manufacturing sector may not be sufficiently exploited. The size of the market could be increased by the opening up of international trade. However, the opening up of trade with a developed economy may harm the manufacturing sector in a developing country when this developing country imports manufactured goods. Alternatively, developing countries may form custom unions with other developing countries to increase the size of the market so that increasing returns could be better exploited (Nurkse, 1953, Stewart, 1977, McKinnon, 1993). While economic integration with other developing countries can increase the size of the market and helps the adoption of more advanced technologies, it may also have important and undesirable effects such as increasing the level of unemployment of a developing country. One common concern of the impact of the adoptions of advanced technologies in a developing country is that jobs may be eliminated because advanced technologies are capital intensive (Sen, 1960). Will economic integration among developing countries increase the level of urban unemployment in these countries when more advanced technologies are adopted?

In the past thirty years, many developing countries such as China and India have switched from import substitution to an export oriented development strategy. As a result, international trade among developing countries has increased significantly. In the case of China, while quite closed until 1978, now China is one of the largest trading countries in the world. A significant percentage of China's trade is trade with other developing countries. Since 1980s, many developing countries have also adopted policies more friendly to foreign direct investment. As a result, capital inflows to developing countries such as China have increased dramatically. Developing countries have also tried to achieve high levels of economic integration among themselves through the establishment of preferential trading agreements. One example of preferential trading agreements among developing countries is MERCOSUR in Latin America. This increased degree of trade and financial integration among developing countries can lead to huge welfare gains for participating countries. For example, Pearson and Ingram (1980) have found that a potential economic integration between Ghana and the Ivory Coast could lead to gains of 22 percent to 33 percent of gross output for the two countries.

In this paper, we study the impact of financial and trade integration between two developing countries on the level of technology and urban employment in a general equilibrium model with increasing returns in the financial and manufacturing sectors. The model contributes to the literature by demonstrating that a developing country may not need to worry about an exacerbation of unemployment from financial or trade integration even though financial or trade integration leads to the adoption of more advanced technologies.

In this model, consumers derive utilities from the consumption of the agricultural good and manufactured goods. There are three sectors: the agricultural sector, the financial sector, and the manufacturing sector. First, the agricultural sector uses land and labor to produce the agricultural good. Second, the financial sector receives deposits from capital owners and then provides the received capital to manufacturing firms. A financial firm is called a bank. Banks engage in oligopolistic competition. Third, the manufacturing sector employs capital and labor to produce manufactured goods. Capital is the fixed cost and labor is the marginal cost of production in the manufacturing sector. Manufacturing firms engage in Cournot competition and choose their technologies to maximize profits. A more advanced manufacturing technology is associated with a higher fixed cost but a lower marginal cost of production. Following Harris and Todaro (1970), we assume that the wage rate in the manufacturing sector is exogenously given.[1]

One prominent observation on developing countries is that many workers are employed in the informal sector (Rauch, 1993).[2] Wage rigidity in the formal sector contributes to the existence of the informal sector. Wage rigidity could result from government regulations or the existence of unions. Alternatively, the wage rate can be viewed as exogenously given in a Lewis type model in which a large amount of surplus labor exists. Empirical research on the wage rate during China's economic development is provided by Zhang, Yang, and Wang (2011). They argue that the wage rate in China was stagnant until the 1990s and began to rise only in the last decade when the Lewis turning point was reached.

First, we study a closed economy. We show that an increase in the wage rate in the manufacturing sector changes neither the level of technology nor the level of employment in the manufacturing sector. The reason is as follows. The level of technology of a manufacturing firm is affected by the wage rate and the price of manufactured goods. An increase in the wage rate in the manufacturing sector causes the price of manufactured goods to increase. Since this increase in the price cancels out the impact of an increase in the wage rate, the equilibrium level of technology in the manufacturing sector is not affected by a change in the wage rate in the manufacturing sector.

Second, we study financial integration between two developing countries. We show that financial integration leads manufacturing firms to adopt more advanced technologies. The reason is that financial integration leads to an exit of some banks in each country (however the number of banks serving a manufacturing firm increases after financial integration because a manufacturing firm is served by banks in the world instead of by banks in the home country). Since each bank incurs a fixed cost of capital in production, this exit of some banks releases capital from the financial sector and increases the supply of capital to the manufacturing sector. As a result, manufacturing firms choose more advanced technologies.

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[1] In this model, to focus on how unemployment is affected by economic integration, we make the simplifying assumption that the existence of unemployment is a result of exogenously given wage rate. In reality, the existence of unemployment can be a result of various factors, such as the existence of efficiency wages (Shapiro and Stiglitz, 1984) or adverse selection in the labor market (Bencivenga and Smith, 1997).

[2] Frankel (2005) argues that in India only about 10% of workers are employed in the formal sector.

Third, we study trade integration between two developing countries. We show that trade integration leads manufacturing firms to adopt more advanced technologies. The reason is that with trade integration, a higher degree of competition in the market for a manufactured good leads to a lower profit margin for each unit of manufactured output. To break even, a manufacturing firm produces a higher level of output. A higher level of output makes the adoption of more advanced technologies more profitable because the higher fixed cost associated with a more advanced technology can be spread to a higher level of output.

Finally, we study a joint financial and trade integration between two developing countries. Starting from financial integration alone, a further trade integration between the two countries will lead manufacturing firms to adopt more advanced technologies. Starting from trade integration alone, a further financial integration between the two countries will lead manufacturing firms to adopt more advanced technologies.

In terms of the choice of technologies, this paper is related to Zhou (2013) who studies a model of rural-urban migration in which firms engage in oligopolistic competition. In Zhou (2013), an increase in the wage rate will not affect a manufacturing firm's choice of technology. Capital accumulation leads firms to choose more advanced technologies, but may not increase employment in the manufacturing sector. Economic integration is not addressed in Zhou (2013).

While there are many studies on financial and trade integration among countries (McKinnon, 1993; Lane and Milesi-Ferretti, 2008; Haufler and Wooton, 2010), this paper is directly related to studies on financial and trade integration in which increasing returns are present. Trade liberalization with increasing returns has been studied by Chao and Yu (1997). One common aspect between Chao and Yu (1997) and this paper is that both models study the impact of trade integration for a developing country. Chao and Yu have shown that trade liberalization may aggravate underemployment and thus lower social welfare in a general equilibrium model. Different from this paper, financial integration and the choice of technology by a manufacturing firm are not studied in Chao and Yu. Trade liberalization with increasing returns has been studied by Gong and Zhou (2014). This paper differs from Gong and Zhou (2014) in some important aspects. In Gong and Zhou, two countries differ in terms of their efficiencies in the financial sector and the wage rate in the manufacturing sector is determined by market forces. The impact of financial integration is not studied in Gong and Zhou. Models of financial integration with increasing returns have been studied by Martin and Rey (2000, 2004). With increasing returns in the financial sector, they show that financial integration will increase asset returns. There are some significant differences between their models and this one. In their models, financial firms engage in monopolistic competition. Trade integration is not their focus and is not addressed in their models. In this model, financial firms engage in oligopolistic competition. The interaction between the financial sector and the manufacturing sector is essential in this study. Joint financial integration and trade integration with increasing returns is studied in Wen and Zhou (2012). There are some significant differences between this paper and Wen and Zhou (2012). In Wen and Zhou, there is no agricultural sector. The wage rate in the manufacturing sector is determined by market forces. In this paper, there is an agricultural sector and the wage rate in the manufacturing sector is exogenously given.

Unemployment may be the result of various factors, such as the existence of minimum wages, labor market search, or efficiency wages. First, Brecher (1974) has studied a model in which unemployment is a result of the existence of minimum wages. Brecher shows that results valid in a model of full employment may not extend to his model incorporating unemployment. Second, Davidson, Martin, and Matusz (1999) have studied a model in which unemployment is of the search type.[3] They show that labor market efficiency is an independent source of a country's comparative advantage. Helpman and Itskhoki (2010) have incorporated firm heterogeneity into labor market search. Third, Brecher and Chen (2010) have studied how international trade, migration, and outsourcing affect unemployment in a model in which unemployment is a result of the existence of efficiency wages as in Shapiro and Stiglitz (1984). Davis and Harrigan (2011) have incorporated firm heterogeneity into efficiency wage models by introducing differences in monitoring intensities of firms. One key difference between this paper and the above papers is that the choice of increasing returns technologies is not incorporated in the above models. The incorporation of the choice of technology in our model is useful in understanding the debate on the relative magnitudes of the impact of the choice of technology and the opening up of international trade on the unemployment rate of a country. Since the opening up of international trade induces firms to choose more advanced technologies, the impact of the opening up of international trade on unemployment could be different from that in a model in which the opening up of international trade and the choice of technology are treated separately and independently.

[3] See Davidson and Matusz (2004, 2010) for syntheses of studies of unemployment and international trade.

The plan of the paper is as follows. Section 2 establishes the equilibrium in which each of the two countries is in autarky. The impact of economic integration on the level of manufacturing technology and the level and rate of urban employment is studied in the next three sections: Section 3 studies the impact of financial integration, Section 4 examines the impact of trade integration, and Section 5 addresses the impact of a joint financial and trade integration. Section 6 concludes.

2. Countries in autarky

There are two developing countries: home and foreign. In this section, we study the case that each of the two countries is in autarky. Without loss of generality, we focus on the home country.

Each individual derives utility from the consumption of the agricultural good and a continuum of manufactured goods indexed by a number $\varpi \in [0, 1]$.[4] Land, labor, and capital are the three factors of production. The total amount of land in the home country is T. The size of the population is L. Each individual may supply one unit of labor. The total amount of capital is K.[5] There are three sectors: the agricultural sector, the manufacturing sector, and the financial sector. First, in the agricultural sector, the agricultural good is produced by land and labor with a constant returns to scale technology.[6] The number of individuals employed in the agricultural sector is L_a. For the constant $\gamma \in (0,1)$, agricultural output is specified as $T^{\gamma} L_a^{1-\gamma}$.

Second, manufactured goods are produced by capital and labor and all manufactured goods have the same costs of production. The wage rate in the manufacturing sector is exogenously given at $\overline{w}$. The employment rate in the manufacturing sector is e. Instead of interpreting e as the percentage of workers employed in the manufacturing sector, in this model we interpret e as the percentage of time that an individual in the manufacturing sector is employed.[7] The number of identical manufacturing firms producing manufactured good ϖ is $m(\varpi)$. Firms producing the same manufactured good are assumed to engage in Cournot competition.

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[4] As discussed in Neary (2003), the motivation of this assumption of a continuum of manufactured goods is to eliminate a manufacturing firm's market power in the factor market.

[5] With homothetic preference assumed in this model, the distribution of ownership of capital will not affect the total demand for the agricultural good and manufactured goods.

[6] Similar to Bencivenga and Smith (1997), we assume that the agricultural sector does not use capital as a factor of production.

[7] One advantage of this interpretation is that each individual in the manufacturing sector has a positive income and thus positive consumption.

Third, for each manufactured good, there are multiple banks in the financial sector providing capital for manufacturing firms producing this manufactured good. A bank charges an interest rate of R for each unit of capital provided to a manufacturing firm. Variables associated with a bank usually carry a subscript b. The number of banks serving manufacturing firms producing manufactured good ϖ is $m_b(\varpi)$. Banks engage in Cournot competition. Similar to Salinger (1988), when there are two stages of production and firms in both stages engage in Cournot competition, we assume that firms in each stage take the prices of inputs as given: a bank takes the interest rate paid to depositors as given and a manufacturing firm takes the interest rate charged by the banks as given.

2.1. Utility maximization

A consumer's consumption of the agricultural good is c_a and her consumption of the manufactured good ϖ is $c(\varpi)$. For the constant $\alpha \in (0,1)$, the utility function of this consumer is specified as

$$\alpha \ln c_a + (1-\alpha)\int_0^1 \ln c(\varpi) d\varpi . \quad (1)$$

The price of the agricultural goods is p_a. The price of manufactured good ϖ is $p(\varpi)$. A consumer takes the prices of goods as given and chooses the quantities of consumption of goods to maximize utility. With the specification of the utility function, utility maximization requires that a consumer spends α percent of the income on the agricultural good and $1-\alpha$ percent of the income on manufactured goods.

2.2. Profit maximization

In this subsection, we study profit maximization of a manufacturing firm and a bank.

For a manufacturing firm, capital is the fixed cost and labor is the marginal cost of production. To produce each manufactured good, we assume that there is a continuum of technologies indexed by a positive number n. A higher value of n indicates a more advanced technology. The fixed cost associated with technology n in terms of capital is $f(n)$ and the marginal cost in terms of labor is $\beta(n)$. Similar to Wen and Zhou (2012) and Gong and Zhou (2014), to capture the substitution between fixed and marginal costs of production, we assume that a more advanced technology uses a higher amount of capital. However, the marginal cost of a more advanced technology is lower.[8] That is, $f'(n) > 0$, and $\beta'(n) < 0$. More specifically, for constants $\theta > 0$ and $h > 0$, the fixed and marginal costs in the manufacturing sector are specified as

$$f(n) = n^{\theta}, \tag{2a}$$

$$\beta(n) = n^{-h}. \tag{2b}$$

The motivation of this specification of technologies in equations (2a) and (2b) is to ensure symmetry in the two stages of production. With the specification of the utility function in equation (1), a consumer has a constant elasticity of demand for goods (the agricultural good and manufactured goods). With the specification of technologies in equations (2a) and (2b), a manufacturing firm has a constant elasticity of demand for factors of production (capital and labor). Thus in this model with a two-stage oligopoly in the production of manufactured goods, both stages have constant elasticities of demand. This symmetry between stages makes the model tractable.

For a manufacturing firm with output level x, its revenue is px. With costs of capital $f(n)R$ and costs of labor $\beta(n)x\overline{w}$, its profit is $px - f(n)R - \beta(n)x\overline{w}$. A manufacturing firm takes the interest rate charged by a bank as given and chooses its output and technology optimally to maximize profit. A manufacturing firm's optimal choice of output leads to $p\left(1 - \frac{x}{p}\frac{\partial p}{\partial x}\right) = \beta\overline{w}$. Since each manufactured good is produced by m identical firms, combination of this equation with the result that the absolute value of a consumer's elasticity of demand for a manufactured good is one yields

$$p\left(1 - \frac{1}{m}\right) = \beta\overline{w}. \tag{3}$$

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[8] There are various examples to motivate this assumption on the tradeoff between fixed costs and marginal costs. First, Levinson (2006) discusses the choice of transportation technologies. The loading and unloading of cargos can be achieved by two technologies: the usage of longshoremen, and the adoption of containers. For the usage of longshoremen, if the wage rates were high, marginal costs were high. The adoption of containers led to high levels of fixed costs because specially designed cranes, containerships, and container ports had to be built. However, marginal costs decreased sharply. Second, Prendergast (1990) discusses technology choices in three manufacturing industries: nuts and bolts, iron founding, and machine tools. He shows that there is a tradeoff between marginal costs and fixed costs of production in those industries.

Equation (3) is the familiar condition showing that a manufacturing firm's price p is a markup over the marginal cost of production $\beta \overline{w}$ and the markup factor is affected by the degree of competition m. The derivation of equation (3) is as follows. For a manufactured good, let x_i denote a representative firm i's output and let x_{-i} denote the output produced by all firms other than the representative firm i. So total output for a manufactured good is $x_i + x_{-i}$. The clearance of the market for a manufactured good requires that quantity supplied equals quantity demanded: $x_i + x_{-i} = Lc = mx$. In a Cournot competition, when a firm chooses its output, it takes the output of other firms as given. With this in mind, partial differentiation of $x_i + x_{-i} = Lc$ leads to $\frac{\partial(x_i + x_{-i})}{\partial p_i} = \frac{\partial x_i}{\partial p_i} = L\frac{\partial c}{\partial p_i}$. That is, $\frac{\partial x_i}{\partial p_i} = L(\frac{\partial c}{\partial p_i}\frac{p_i}{c})\frac{c}{p_i} = -\frac{Lc}{p_i} = -\frac{mx}{p_i}$. Since firms are symmetric in equilibrium, $x_i = x$ and $p_i = p$. Plugging the above result $\frac{\partial x}{\partial p} = -\frac{mx}{p}$ into $p\left(1 + \frac{x}{p}\frac{\partial p}{\partial x}\right) = \beta(n)\,\overline{w}$ leads to equation (3).

A manufacturing firm's optimal choice of technology leads to[9]

$$f'(n)R + \beta'(n)x\overline{w} = 0\,. \tag{4}$$

Manufacturing firms will keep on entering until the level of profit is zero. Zero profit for a manufacturing firm requires that[10]

$$p\,x - f\,R - \beta\,x\,\overline{w} = 0\,. \tag{5}$$

The fixed cost for a bank in terms of the amount of capital used is f_b. A bank pays an interest rate of r for each unit of capital deposited. With a revenue of $R\,x_b$, fixed cost of $f_b r$, and cost of attracting deposits $r\,x_b$, the profit of a bank is $R\,x_b - f_b r - r\,x_b$. Banks serving manufacturing firms producing manufactured good ϖ engage in Cournot competition. A bank takes the interest paid to depositors as given and chooses its level of output to maximize its profit. A bank's optimal choice of output requires that $R\,x_b - \frac{\partial R}{\partial x_b}x_b - r = 0$. From a manufacturing firm's

[9] The second order condition for a manufacturing firm's optimal choice of technology is assumed to be satisfied and is used later on to sign comparative statics results.

[10] For some examples of Cournot competition with zero profits, see Sections 3.7 and 4.5 of Brander (1995) and Zhang (2007).

profit maximization and the specifications of costs in equations (2a) and (2b), we have $\frac{\partial f}{\partial R}\frac{R}{f}=-\frac{\theta}{\theta+h}$. Using $\frac{\partial x_b}{\partial R}\frac{R}{x_b}=\frac{R}{x_b}m\frac{\partial f}{\partial R}=\frac{R}{x_b}m\left(\frac{\partial f}{\partial R}\frac{R}{f}\right)\frac{f}{R}=-\frac{\theta m_b}{\theta+h}$, a bank's optimal choice of output leads to marginal revenue (left-hand side of equation (6)) equals marginal cost (right-hand side of equation (6)):

$$R\left(1-\frac{\theta+h}{\theta m_b}\right)=r\,. \tag{6}$$

Banks will keep on entering the financial sector until the profit of a bank is zero. Zero profit for a bank requires that

$$R\,x_b - f_b r - r\,x_b = 0\,. \tag{7}$$

2.3. Market clearing conditions

In this subsection, we establish markets clearing conditions, including markets for capital, labor, the agricultural good, and manufactured goods.

For manufactured good ϖ, the financial sector's supply of capital to manufacturing firms is $m_b(\varpi)x_b(\varpi)$ and manufacturing firms' demand of capital is $m(\varpi)f(\varpi)$. In equilibrium, the two should be equal:

$$m_b x_b = m f\,. \tag{8}$$

For the market for capital, the demand for capital from the financial sector is $\int_0^1 m_b(\varpi)f_b(\varpi)d\varpi$ and the demand for capital from the manufacturing sector is $\int_0^1 m(\varpi)f(\varpi)d\varpi$. Thus the total demand for capital is $\int_0^1 m_b f_b d\varpi+\int_0^1 m f\,d\varpi$. The total supply of capital in the home country is K. The clearance of the market for capital requires that

$$\int_0^1 m_b f_b d\varpi+\int_0^1 m f\,d\varpi = K\,. \tag{9}$$

The amount of individuals associated with the manufacturing sector is L_m. Since the employment rate in the manufacturing sector is e, the effective supply of labor in the manufacturing sector is eL_m. The total demand for labor in the manufacturing sector is

$\int_0^1 m(\varpi)\beta(\varpi)x(\varpi)d\varpi$. Equilibrium in the market for labor in the manufacturing sector requires that

$$eL_m = \int_0^1 m\beta x\, d\varpi \,. \tag{10}$$

For the labor market of this economy, the amount of individuals employed in the agricultural sector is L_a and the amount of individuals associated with the manufacturing sector is L_m. The supply of labor is L. Labor market equilibrium of this economy requires that

$$L_a + L_m = L \,. \tag{11}$$

With a wage rate of $\overline{w}$ and possibility of employment of e, the expected return for a worker in the manufacturing sector is $e\overline{w}$. The return of a worker in the agricultural sector is $(1-\gamma)p_a T^{\gamma} L_a^{-\gamma}$. Similar to Harris and Todaro (1970) and Zhang (2002), since a worker can move between the manufacturing and agricultural sectors, in equilibrium the expected returns or utility should be equal in the two sectors:

$$e\overline{w} = (1-\gamma)p_a T^{\gamma} L_a^{-\gamma} \,. \tag{12}$$

For the agricultural sector, the return to land q is equal to the value marginal product of land:

$$q = \gamma\, p_a T^{\gamma-1} L_a^{1-\gamma} \,. \tag{13}$$

For the market for the agricultural good, the value of total supply is $p_a T^{\gamma} L_a^{1-\gamma}$. Total income in this economy is the sum of labor income $e\overline{w}L$, capital income rK, and land income qT. Thus total income is $e\overline{w}L + rK + qT$. Because α percent of this total income is spent on the agricultural good, the total demand for the agricultural good is $\alpha(e\overline{w}L + rK + qT)$. The clearance of the market of the agricultural good requires that

$$p_a T^{\gamma} L_a^{1-\gamma} = \alpha\,(e\overline{w}L + rK + qT) \,. \tag{14}$$

For the market for manufactured goods, the value of the supply of manufactured good ϖ is mpx. Integrating over all manufactured goods, the value of total supply of manufactured goods is $\int_0^1 m(\varpi)p(\varpi)x(\varpi)d\varpi$. Since $1-\alpha$ of total income is spent on manufactured goods, the total demand for manufactured goods is $(1-\alpha)(e\overline{w}L + rK + qT)$. The clearance of the market for the manufactured goods requires that

$$\int_0^1 m\, p\, x d\varpi = (1-\alpha)(e\overline{w}L + rK + qT). \tag{15}$$

2.4. Equilibrium in a closed economy

We focus on a symmetric equilibrium in which all manufactured goods have the same levels of output and price. Since all manufactured goods are symmetric, we do not index a manufactured good in a symmetric equilibrium. Since the measure of total manufactured goods is one, for simplicity of presentation, we drop the integration operator in a symmetric equilibrium. In this closed economy, equations (3)-(15) form a system of 13 equations defining 13 endogenous variables e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, and x_b as functions of exogenous parameters. A symmetric equilibrium in this closed economy is a tuple (e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, x_b) satisfying equations (3)-(15). For the rest of the paper, the agricultural good is used as the numeraire: $p_a \equiv 1$.

To conduct comparative statics for this closed economy, we need to reduce this system of 13 equations to a smaller and thus manageable number of equations. To achieve this goal, first, from equations (6)-(9), the interest rate paid to depositors can be expressed as

$$r = R\left(1 - \sqrt{\frac{(\theta+h)f_b}{\theta K}}\right). \tag{16}$$

Second, from equations (6) and (16), the number of banks can be expressed as $m_b = \sqrt{\frac{(\theta+h)K}{\theta f_b}}$. From equations (7) and (16), the level of output of a bank can be expressed as $x_b = f_b\left(\sqrt{\frac{\theta K}{(\theta+h)f_b}} - 1\right)$. Plugging the value of m_b and the value of x_b into equation (8), the number of manufacturing firms is

$$m = \left(K - \sqrt{\frac{(\theta+h)Kf_b}{\theta}}\right) / f. \tag{17}$$

Third, from equations (3) and (17), the price of a manufactured good is

$$p = \beta \bar{w} / \left(1 - f / \left(K - \sqrt{\frac{(\theta + h)Kf_b}{\theta}} \right) \right). \quad (18)$$

The system of 13 equations is thus reduced to the following system of three equations defining three endogenous variables n, L_m, and e as functions of exogenous parameters:[11]

$$V_1 \equiv f'\beta - \beta' f + \beta' \left(K - \sqrt{\frac{(\theta + h)Kf_b}{\theta}} \right) = 0, \quad (19)$$

$$V_2 \equiv (1-\alpha)\left(1 - f / (K - \sqrt{\frac{(\theta + h)Kf_b}{\theta}}) \right)(L - L_m) - \alpha(1-\gamma)L_m = 0, \quad (20)$$

$$V_3 \equiv e\bar{w} - (1-\gamma)T^{\gamma}(L - L_m)^{-\gamma} = 0. \quad (21)$$

Partial differentiation of equations (19)-(21) with respect to n, L_m, e, $\bar{w}$, and K yields

$$\begin{pmatrix} \frac{\partial V_1}{\partial n} & 0 & 0 \\ \frac{\partial V_2}{\partial n} & \frac{\partial V_2}{\partial L_m} & 0 \\ 0 & \frac{\partial V_3}{\partial L_m} & \frac{\partial V_3}{\partial e} \end{pmatrix} \begin{pmatrix} dn \\ dL_m \\ de \end{pmatrix} = - \begin{pmatrix} 0 \\ 0 \\ \frac{\partial V_3}{\partial \bar{w}} \end{pmatrix} d\bar{w} - \begin{pmatrix} \frac{\partial V_1}{\partial K} \\ \frac{\partial V_2}{\partial K} \\ 0 \end{pmatrix} dK. \quad (22)$$

Let Δ denote the determinant of the coefficient matrix of endogenous variables in system (22): $\Delta \equiv \frac{\partial V_1}{\partial n}\frac{\partial V_2}{\partial L_m}\frac{\partial V_3}{\partial e}$. Partial differentiation of equations (19)-(21) leads to $\frac{\partial V_1}{\partial n} > 0$, $\frac{\partial V_2}{\partial L_m} < 0$, and $\frac{\partial V_3}{\partial e} > 0$. As a result, $\Delta < 0$. With Δ nonsingular, a unique equilibrium exists for the system (22).[12]

The following proposition studies the impact of a change in the wage rate in the manufacturing sector.

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[11] Equations (19)-(21) are derived as follows. First, equation (19) is derived by plugging the value of x from equation (5) into equation (4) and then replacing the value of p with equation (18). Second, equation (20) is derived by dividing equation (14) by equation (15), replacing the value of L_a from equation (11), replacing the value of mx from equation (10), and replacing the value of p from equation (18). Third, equation (21) is derived by plugging the value of L_a from equation (11) into equation (12).

[12] Turnovsky (1977, chap. 2) discusses conditions for the existence of a unique local equilibrium and a unique global equilibrium. He demonstrates that conditions for the existence of a unique global equilibrium are very strict. Thus we focus on the existence of a unique local equilibrium.

Proposition 1: An increase in the wage rate in the manufacturing sector changes neither the level of technology nor the level of employment in the manufacturing sector. The employment rate decreases.

Proof: An application of Cramer's rule on the system (22) leads to

$$\frac{dn}{d\overline{\overline{w}}} = 0\,,$$

$$\frac{dL_m}{d\overline{\overline{w}}} = 0\,,$$

$$\frac{de}{d\overline{\overline{w}}} = -\frac{\partial V_1}{\partial n}\frac{\partial V_2}{\partial L_m}\frac{\partial V_3}{\partial \overline{\overline{w}}} / \Delta < 0\,.$$

From Proposition 1, an increase in the wage rate in the manufacturing sector does not lead manufacturing firms to use a smaller amount of labor in producing each unit of output. The reason is as follows. From equation (3), an increase in the wage rate in the manufacturing sector increases the price of a manufactured good. Since the number of manufacturing firms producing a manufactured good does not change (from equation (17)), an increase in the wage rate in the manufacturing sector leads to the same proportional increase in the price of a manufactured good. Since this price increase absorbs the impact from an increase in the wage rate in the manufacturing sector, the equilibrium level of technology of a manufacturing firm and thus the amount of labor used in producing each unit of output are not affected by an increase in the wage rate in the manufacturing sector.

The following proposition studies the impact of a change in the endowment of capital of this country.

Proposition 2: An increase in the endowment of capital leads manufacturing firms to choose more advanced technologies. The level of employment and the employment rate in the manufacturing sector do not change.

Proof: An application of Cramer's rule on the system (22) leads to

$$\frac{dn}{dK} = -\frac{\partial V_1}{\partial K}\frac{\partial V_2}{\partial L_m}\frac{\partial V_3}{\partial e} / \Delta > 0\,.$$

Plugging equations (2a) and (2b) into equation (19) leads to $f = n^{\theta} = \frac{h}{\theta + h}\left(K - \sqrt{\frac{(\theta + h)Kf_b}{\theta}}\right)$. Plugging this value of f into equation (20), the level of employment in the manufacturing sector is not affected by the amount of capital stock. From equation (21), the employment rate is thus not affected by the amount of capital stock.

When there is an increase in the amount of capital, part of the capital is absorbed in the financial sector and the remaining is absorbed in the manufacturing sector. The intuition behind Proposition 2 is as follows. From equation (17), the number of manufacturing firms increases when the amount of capital increases. From equation (18), an increase in the number of manufacturing firms leads to a decrease in the ratio between the price of a manufactured good and the marginal cost if the level of manufacturing technology does not change. This leads to a decrease in the profit for each unit of output. To break even, a manufacturing firm produces a higher level of output. The higher level of output leads a manufacturing firm to adopt a more advanced technology because the higher fixed cost associated with a more advanced technology can be spread to a higher level of output.

A change in the amount of capital does not affect the level and rate of employment in the manufacturing sector. The reason is as follows. When the amount of capital increases, there are two effects affecting the demand for labor in the manufacturing sector working in opposite directions. First, because manufacturing firms choose more advanced technologies, the demand for labor for each unit of output decreases. Second, because an increase in the amount of capital increases a factor of production and capital is fully employed, this leads to an increase in the level of output and increases the demand for labor in the manufacturing sector. With the specifications of costs in equations (2a) and (2b), the two effects cancel out each other. As a result, the level and rate of employment in the urban sector is not affected by the amount of capital.

In the next three sections, we will study the impact of economic integration. For tractability, we assume that the two countries are identical in all aspects. Variables associated with the foreign country carry an asterisk mark. First, we study financial integration without trade integration between the two countries. Second, we examine trade integration without financial integration between the two countries. Third, we address a joint financial and trade integration between the two countries.

3. Financial integration between the countries

In this section, we study the impact of financial integration but no trade integration between the two countries. Under financial integration, the markets for capital in the two countries are integrated. As a result, the interest rate paid to depositors and the interest rate charged by banks will be the same in the two countries.

Under financial integration, a bank competes with both domestic and foreign banks. As a result, equation (6) featuring a bank's optimal choice of the level of output is replaced with

$$R\left(1-\frac{\theta+h}{\theta(m_b+m_b*)}\right)=r. \tag{6f}$$

Under financial integration, the total amount of capital used by the manufacturing sector in the two countries is equal to the total supply of capital provided by the financial sector in the two countries. As a result, equation (8) featuring the equilibrium for the market of capital in the manufacturing sector is replaced with

$$\int_0^1 (mf+m*f*)d\varpi=\int_0^1 (m_b x_b+m_b*x_b*)d\varpi. \tag{8f}$$

Under financial integration, the amount of capital employed in the financial and manufacturing sectors is equal to world supply of capital. As a result, equation (9) is replaced with

$$\int_0^1 (m_b f_b+m_b*f_b*)d\varpi+\int_0^1 (mf+m*f*)d\varpi=K+K*. \tag{9f}$$

Since the two countries are identical in all aspects, we focus on a symmetric equilibrium in which the variables in the two countries take the same value. In a symmetric equilibrium with financial integration, equations (3)-(5), (6f), (7), (8f), (9f), and (10)-(15) form a system of 13 equations defining 13 endogenous variables e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, and x_b as functions of exogenous parameters. An equilibrium with financial integration is a tuple (e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, x_b) satisfying equations (3)-(5), (6f), (7), (8f), (9f), and (10)-(15). Similar to the equilibrium in autarky, the system of 13 equations can be reduced to the following system of three equations defining three endogenous variables n, L_m, and e as functions of exogenous parameters:

$$f'\beta-\beta' f+\beta'\left(K-\sqrt{\frac{(\theta+h)Kf_b}{2\theta}}\right)=0, \tag{23}$$

$$(1-\alpha)\left(1-f/(K-\sqrt{\frac{(\theta+h)Kf_b}{2\theta}})\right)(L-L_m)-\alpha(1-\gamma)L_m=0, \tag{24}$$

$$e\overline{w}-(1-\gamma)T^{\gamma}(L-L_m)^{-\gamma}=0. \tag{25}$$

For a comparison between the equilibrium with financial integration and the equilibrium under autarky, we can rewrite equations (23)-(25) as follows:

$$\Gamma_1 \equiv f'\beta-\beta' f+\beta'\left(K-\sqrt{\frac{(\theta+h)Kf_b}{\eta_1\theta}}\right)=0, \tag{26}$$

$$\Gamma_2 \equiv (1-\alpha)\left(1-f/(K-\sqrt{\frac{(\theta+h)Kf_b}{\eta_1\theta}})\right)(L-L_m)-\alpha(1-\gamma)L_m=0, \tag{27}$$

$$\Gamma_3 \equiv e\overline{w}-(1-\gamma)T^{\gamma}(L-L_m)^{-\gamma}=0. \tag{28}$$

For equations (26)-(28), if $\eta_1=2$, then they are the same as equations (23)-(25). A comparison of equations (19)-(21) with equations (26)-(28) reveals that starting from autarky, the impact of financial integration can be captured by a change in the value of η_1 from one to two. With this in mind, partial differentiation of equations (26)-(28) with respect to n, L_m, e, and η_1 leads to

$$\begin{pmatrix} \frac{\partial\Gamma_1}{\partial n} & 0 & 0 \\ \frac{\partial\Gamma_2}{\partial n} & \frac{\partial\Gamma_2}{\partial L_m} & 0 \\ 0 & \frac{\partial\Gamma_3}{\partial L_m} & \frac{\partial\Gamma_3}{\partial e} \end{pmatrix} \begin{pmatrix} dn \\ dL_m \\ de \end{pmatrix} = -\begin{pmatrix} \frac{\partial\Gamma_1}{\partial\eta_1} \\ \frac{\partial\Gamma_2}{\partial\eta_1} \\ 0 \end{pmatrix} d\eta_1. \tag{29}$$

The determinant of the coefficient matrix of endogenous variables in system (29) is Δ_F: $\Delta_F \equiv \frac{\partial\Gamma_1}{\partial n}\frac{\partial\Gamma_2}{\partial L_m}\frac{\partial\Gamma_3}{\partial e}$. Partial differentiation of equations (26)-(28) yields $\frac{\partial\Gamma_1}{\partial n}>0$, $\frac{\partial\Gamma_2}{\partial L_m}<0$, and $\frac{\partial\Gamma_3}{\partial e}>0$. Thus $\Delta_F<0$. With Δ_F nonsingular, a unique equilibrium exists for the system (29).

The following proposition studies the impact of financial integration on the level and rate of employment in the manufacturing sector and the level of manufacturing technology.

Proposition 3: Compared with autarky, financial integration does not change the level and the rate of employment in the manufacturing sector. Manufacturing firms adopt more advanced technologies.

Proof: An application of Cramer's rule on (29) leads to

$$\frac{dL_m}{d\eta_1} = 0,$$

$$\frac{de}{d\eta_1} = 0,$$

$$\frac{dn}{d\eta_1} = -\frac{\partial \Gamma_1}{\partial \eta_1}\frac{\partial \Gamma_2}{\partial L_m}\frac{\partial \Gamma_3}{\partial e} / \Delta_F > 0.$$

From equations (6f), (7), (8f), and (9f), the number of banks in a country with financial integration is $\sqrt{\frac{(\theta + h)K}{2\theta f_b}}$. To understand Proposition 3, with financial integration, even though the total number of banks in the two countries is higher than the number of banks in a country in autarky, in each country some banks will exit after financial integration.[13] Since a bank uses capital as fixed costs of production, this exit of some banks releases capital from the financial sector and thus increases the supply of capital to the manufacturing sector. As a result, manufacturing firms choose more advanced technologies.

Financial integration does not affect the level and rate of employment in the manufacturing sector. With financial integration, there are two effects affecting the demand for labor in the manufacturing sector working in opposite directions. First, for each unit of output, with a more advanced technology, the demand for labor decreases. Second, the level of output increases and the demand for labor increases. With the specification of technologies in equations (2a) and (2b), the two effects cancel out each other and thus financial integration does not change the level and rate of employment in the manufacturing sector in each country.

4. Trade integration between the two countries

[13] The exit of banks in this model of oligopoly is similar to the exit of firms in a model of monopolistic competition. Since each firm produces one variety under monopolistic competition, the number of firms is equal to the number of varieties. With the opening up of international trade, the total number of varieties for the world as a whole is larger than the number of varieties in each country before trade. However, after the opening up of international trade, some firms will exit in each country and thus the number of varieties in a given country will decrease.

In this section, we address the impact of trade integration but no financial integration between the two countries. We assume that there is no across the border transportation costs for the agricultural good and manufactured goods. As a result of trade integration, prices of the agricultural good and manufactured goods will be equal in the two countries.

With trade integration between the two countries, a manufacturing firm competes with both domestic and foreign manufacturing firms. As a result, equation (3) featuring a manufacturing firm's optimal choice of output is replaced with

$$p\left(1-\frac{1}{m+m^*}\right)=\beta\overline{w}. \tag{3t}$$

Since markets for the agricultural good in the two countries are integrated under trade integration, equation (14) featuring the clearance of the market for the agricultural good is replaced with

$$p_a(T^\gamma L_a^{1-\gamma}+T^\gamma L_a^{*1-\gamma})=\alpha(e\overline{w}L+e^*\overline{w}L^*+rK+r^*K^*+qT+q^*T^*). \tag{14t}$$

Since markets for manufactured goods in the two countries are integrated under trade integration, equation (15) featuring the clearance of the market for manufactured goods is replaced with

$$\int_0^1 (m\,px+m^*\,px^*)d\varpi=(1-\alpha)(e\overline{w}L+e\overline{w}L^*+rK+r^*K^*+qT+q^*T^*). \tag{15t}$$

We focus on a symmetric equilibrium in which the variables in the two countries take the same value. In a symmetric equilibrium with trade integration, equations (3t), (4)-(13), (14t), and (15t) form a system of 13 equations defining 13 endogenous variables e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, and x_b as functions of exogenous parameters. An equilibrium with trade integration is a tuple (e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, x_b) satisfying equations (3t), (4)-(13), (14t), and (15t).

In a symmetric equilibrium, the system of 13 equations characterizing the equilibrium with trade integration can be reduced to the following system of three equations defining three endogenous variables n, L_m, and e as functions of exogenous parameters:

$$f'\beta-\beta' f+2\beta'\left(K-\sqrt{\frac{(\theta+h)Kf_b}{\theta}}\right)=0, \tag{30}$$

$$(1-\alpha)\left(1-f/[2(K-\sqrt{\frac{(\theta+h)Kf_b}{\theta}})]\right)(L-L_m)-\alpha(1-\gamma)L_m=0\,, \tag{31}$$

$$e\overline{w}-(1-\gamma)T^{\gamma}(L-L_m)^{-\gamma}=0\,. \tag{32}$$

To facilitate the comparison between the equilibrium with trade integration and the equilibrium with autarky, we can rewrite equations (30)-(32) as follows:

$$\Omega_1\equiv f'\beta-\beta' f+\eta_2\beta'\left(K-\sqrt{\frac{(\theta+h)Kf_b}{\theta}}\right)=0\,, \tag{33}$$

$$\Omega_2\equiv(1-\alpha)\left(1-f/[\eta_2(K-\sqrt{\frac{(\theta+h)Kf_b}{\theta}})]\right)(L-L_m)-\alpha(1-\gamma)L_m=0\,, \tag{34}$$

$$\Omega_3\equiv e\overline{w}-(1-\gamma)T^{\gamma}(L-L_m)^{-\gamma}=0\,. \tag{35}$$

For equations (33)-(35), if $\eta_2=2$, then they are the same as equations (30)-(32). A comparison of equations (19)-(21) with equations (33)-(35) reveals that starting from autarky the impact of trade integration can be captured by a change in the value of η_2 from one to two. With this in mind, partial differentiation of equations (33)-(35) with respect to n, L_m, e, and η_2 leads to

$$\begin{pmatrix} \frac{\partial\Omega_1}{\partial n} & 0 & 0 \\ \frac{\partial\Omega_2}{\partial n} & \frac{\partial\Omega_2}{\partial L_m} & 0 \\ 0 & \frac{\partial\Omega_3}{\partial L_m} & \frac{\partial\Omega_3}{\partial e} \end{pmatrix}\begin{pmatrix} dn \\ dL_m \\ de \end{pmatrix}=-\begin{pmatrix} \frac{\partial\Omega_1}{\partial\eta_2} \\ \frac{\partial\Omega_2}{\partial\eta_2} \\ 0 \end{pmatrix}d\eta_2\,. \tag{36}$$

The determinant of the coefficient matrix of endogenous variables in system (36) is Δ_T: $\Delta_T\equiv\frac{\partial\Omega_1}{\partial n}\frac{\partial\Omega_2}{\partial L_m}\frac{\partial\Omega_3}{\partial e}$. Partial differentiation of equations (33)-(35) yields $\frac{\partial\Omega_1}{\partial n}>0$, $\frac{\partial\Omega_2}{\partial L_m}<0$, and $\frac{\partial\Omega_3}{\partial e}>0$. Thus $\Delta_T<0$. With Δ_T nonsingular, a unique equilibrium exists for the system (36).

The following proposition studies the impact of trade integration on the level and rate of employment in the manufacturing sector and the level of manufacturing technology.

Proposition 4: Compared with autarky, trade integration does not change the level or the rate of employment. Manufacturing firms choose more advanced technologies.

Proof: An application of Cramer's rule on the system (36) leads to

$$\frac{dL_m}{d\eta_2} = 0\,,$$

$$\frac{de}{d\eta_2} = 0\,,$$

$$\frac{dn}{d\eta_2} = -\frac{\partial\Omega_1}{\partial\eta_2}\frac{\partial\Omega_2}{\partial L_m}\frac{\partial\Omega_3}{\partial e}/\Delta_T > 0\,.$$

With trade integration, in each country the number of banks and the level of output of a bank will not change. The intuition behind Proposition 4 is as follows. With trade integration, a higher degree of competition in the market for a manufactured good leads to a lower profit margin for each unit of output. To compensate for fixed costs of production, a manufacturing firm produces a higher level of output. A higher level of output makes the adoption of more advanced technologies more profitable.

Trade integration does not affect the level and rate of employment in the manufacturing sector. With trade integration, there are two effects affecting the demand for labor in the manufacturing sector. First, the demand for labor for each unit of output decreases because a manufacturing firm chooses a more advanced technology. Second, the level of output of a manufacturing firm increases and the demand for labor increases. With the specification of technologies in equations (2a) and (2b), the two effects cancel out each other and thus trade integration does not change the level and rate of employment in the manufacturing sector in each country.

5. Comprehensive integration between the two countries

In this section, we examine the impact of joint trade and financial integration or comprehensive integration between the two countries. Under comprehensive integration, markets for capital and final goods are integrated in the two countries.[14] We focus on a symmetric

[14] We thank Zhiqi Chen for suggesting the usage of the term comprehensive integration.

equilibrium in which the variables in the two countries take the same value. In a symmetric equilibrium with comprehensive integration, equations (3t), (4)-(5), (6f), (7), (8f), (9f), (10)-(13), (14t), and (15t) form a system of 13 equations defining 13 endogenous variables e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, and x_b as functions of exogenous parameters. An equilibrium with comprehensive integration is a tuple (e, L_a, L_m, p_a, q, r, m, m_b, p, n, R, x, x_b) satisfying equations (3t), (4)-(5), (6f), (7), (8f), (9f), (10)-(13), (14t), and (15t).

The system of 13 equations can be reduced to the following system of three equations defining three endogenous variables n, L_m, and e as functions of exogenous parameters:

$$f'\beta - \beta' f + 2\beta'\left(K - \sqrt{\frac{(\theta+h)Kf_b}{2\theta}}\right) = 0, \tag{37}$$

$$(1-\alpha)\left(1 - f/[2(K - \sqrt{\frac{(\theta+h)Kf_b}{2\theta}})]\right)(L - L_m) - \alpha(1-\gamma)L_m = 0, \tag{38}$$

$$e\overline{w} - (1-\gamma)T^{\gamma}(L - L_m)^{-\gamma} = 0. \tag{39}$$

To facilitate comparison, we can rewrite equations (37)-(39) as follows:

$$\Phi_1 \equiv f'\beta - \beta' f + \eta_2\beta'\left(K - \sqrt{\frac{(\theta+h)Kf_b}{\eta_1\theta}}\right) = 0, \tag{40}$$

$$\Phi_2 \equiv (1-\alpha)\left(1 - f/[\eta_2(K - \sqrt{\frac{(\theta+h)Kf_b}{\eta_1\theta}})]\right)(L - L_m) - \alpha(1-\gamma)L_m = 0, \tag{41}$$

$$\Phi_3 \equiv e\overline{w} - (1-\gamma)T^{\gamma}(L - L_m)^{-\gamma} = 0. \tag{42}$$

For equations (40)-(42), if $\eta_1 = 2$ and $\eta_2 = 2$, then they are the same as equations (37)-(39). With this mind, partial differentiation of equations (40)-(42) with respect to n, L_m, e, η_1, and η_2 leads to

$$\begin{pmatrix} \frac{\partial\Phi_1}{\partial n} & 0 & 0 \\ \frac{\partial\Gamma_2}{\partial n} & \frac{\partial\Phi_2}{\partial L_m} & 0 \\ 0 & \frac{\partial\Phi_3}{\partial L_m} & \frac{\partial\Phi_3}{\partial e} \end{pmatrix} \begin{pmatrix} dn \\ dL_m \\ de \end{pmatrix} = -\begin{pmatrix} \frac{\partial\Phi_1}{\partial\eta_1} \\ \frac{\partial\Phi_2}{\partial\eta_1} \\ 0 \end{pmatrix} d\eta_1 - \begin{pmatrix} \frac{\partial\Phi_1}{\partial\eta_2} \\ \frac{\partial\Phi_2}{\partial\eta_2} \\ 0 \end{pmatrix} d\eta_2. \tag{43}$$

The determinant of the coefficient matrix of endogenous variables in system (43) is Δ_C: $\Delta_C \equiv \frac{\partial \Phi_1}{\partial n}\frac{\partial \Phi_2}{\partial L_m}\frac{\partial \Phi_3}{\partial e}$. Partial differentiation of equations (40)-(42) yields $\frac{\partial \Phi_1}{\partial n} > 0$, $\frac{\partial \Phi_2}{\partial L_m} < 0$, and $\frac{\partial \Phi_3}{\partial e} > 0$. As a result, $\Delta_C < 0$. With Δ_C nonsingular, a unique equilibrium exists for the system (43).

A comparison of equations (26)-(28) with equations (40)-(42) reveals the following. Starting from financial integration alone, the impact of comprehensive integration can be captured by a change in the value of η_2 from one to two. The following proposition studies the impact of trade integration after financial integration between the two countries.

Proposition 5: Starting from financial integration alone, a further trade integration will lead manufacturing firms to adopt more advanced technologies.

Proof: An application of Cramer's rule on (43) leads to

$$\frac{dn}{d\eta_2} = -\frac{\partial \Phi_1}{\partial \eta_2}\frac{\partial \Phi_2}{\partial L_m}\frac{\partial \Phi_3}{\partial e} / \Delta_C > 0 .$$

A comparison of equations (33)-(35) with equations (40)-(42) reveals the following. Starting from trade integration alone, the impact of comprehensive integration can be captured by a change in the value of η_1 from one to two. The following proposition studies the impact of financial integration after trade integration between the two countries.

Proposition 6: Starting from trade integration alone, a further financial integration will lead manufacturing firms to adopt more advanced technologies.

Proof: An application of Cramer's rule on (43) leads to

$$\frac{dn}{d\eta_1} = -\frac{\partial \Phi_1}{\partial \eta_1}\frac{\partial \Phi_2}{\partial L_m}\frac{\partial \Phi_3}{\partial e} / \Delta_C > 0 .$$

While comprehensive integration leads manufacturing firms to adopt more advanced technologies, similar to the case of trade integration or financial integration, it does not change the level and the rate of employment in the manufacturing sector.

6. Conclusion

In this paper, we have studied the impact of financial and trade integration among developing countries on the choice of technology and the level and rate of employment in the manufacturing sector in a general equilibrium model. We have established the following results. First, in a closed economy, an increase in the wage rate in the manufacturing sector changes neither the level of technology nor the level of employment in the manufacturing sector. Second, either financial integration or trade integration between developing countries leads manufacturing firms to choose more advanced technologies. While a more advanced technology uses a lower amount of labor in producing each unit of output, interestingly, the level and rate of employment in the manufacturing sector does not change under financial or trade integration.

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