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Abstract
The departure of a factor in excess supply in the non-traded sector leads to a real appreciation, in a setup that combines the canonical Lewis Model (Lewis, 1954, and Fei and Ranis, 1961, 1964) with a Balassa-Samuelson traded/non-traded dichotomy (Obstfeld and Rogoff, 1996). China is a potential candidate for non-traded factor appreciation, since it has not completed its structural transformation. A transfer of rural labor to urban areas will appreciate the real exchange rate.

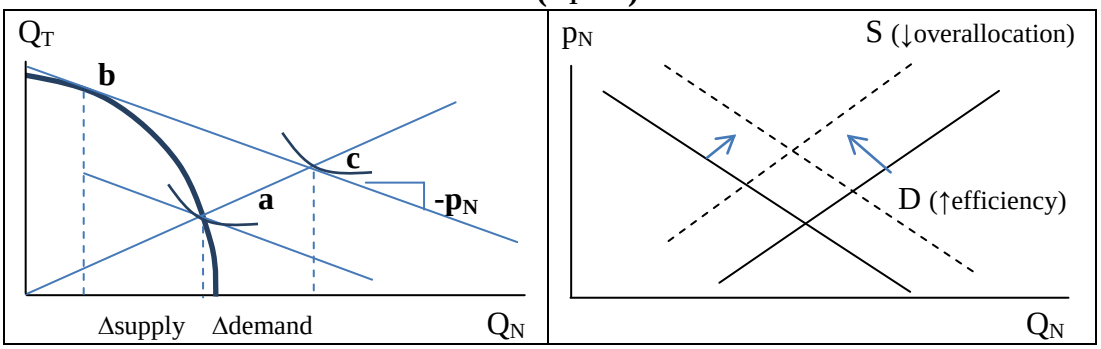
Keywords: Non-traded factor appreciation, Lewis Dual-economy, China
JEL Classification: F21, F31, F41

1. What is Non-traded Factor Appreciation?

This paper is about the exchange rate implication of factors being over-allocated to non-traded production. If an over-allocated factor leaves non-traded production, we argue that there will be a real appreciation. We call this phenomenon non-traded factor appreciation (NTFA).

Figure 1 gives the intuition of NTFA for a two-good economy with a traded good T and non-traded good N. In the left panel North-West movements along the ppf occur as resources leaves N to go to T, and demand exhibits constant expenditure shares for every level of income. The traded price is normalized to unity, so the real exchange rate is the non-traded price in Figure 1.

Figure 1: Real Exchange Rate Appreciation
($P_T \equiv 1$)



At point 'a' on the left panel resources are over-allocated to non-traded goods. Optimality requires that they leave non-traded production and enter traded production. As production moves to point 'b' the budget set expands, and demand for both goods rises to point 'c'. The final P_N (not shown) will rise, responding to a fall in Q_N supply

[1] The authors would like to thank Fiorini, Rabah Amir, Stewart,

and an increase in Q_N demand, relative to 'a', where supply and demand were equal.

The right panel tells the same story in partial equilibrium. The end of over-allocation implies a contraction in supply as factors leave the non-traded sector and an increase in demand as the economy becomes more efficient.

The rest of the paper is structured as follows. In Section 2 we ask if China could be a candidate for NTFA. Section 3 demonstrates NTFA in a stylized two-sector general equilibrium model and Section 4 represents the labour market of this model in a diagram reminiscent of the Specific Factors Model. Section 5 discusses the relationship between NTFA and the Balassa-Samuelson effect (Balassa (1964), Samuelson (1964)) and concludes.

2. Is Chinese Labour Over-allocated to Non-traded Production?

It is widely believed that China has a rural labour surplus (Economist, 2008). Assessing the evidence for this requires that we briefly review the Lewis model (Lewis, 1954, and Fei and Ranis, 1961, 1964) which remains the standard paradigm for discussing labour surpluses in developing countries (see the review by Vines and Zeitlin, 2008, Kirkpatrick and Barrientos, 2004, Fields, 2004, and Temple, 2005).

A Lewis economy has two sectors: a traditional, overpopulated rural subsistence sector characterized by zero or low marginal labor productivity, and, a high-productivity modern urban industrial sector, to which labor from the subsistence sector is gradually transferred. The resultant expansion of modern-sector output (and employment) expansion is assumed to continue until all surplus rural labor is in some sense absorbed in the new industrial sector at *the Lewis Turning Point (LTP).*

The notion of the LTP is plastic. Lewis himself defines it as the exhaustion of surplus labor in the traditional sector (Lewis, 1954). He even mentions a second turning point, which is reached when "the marginal product is the same in the capitalist and non-capitalist sectors, so that we have reached the neoclassical one-sector economy" (Lewis, 1972, pp.83).

This is nuanced further by Ranis and Fei (1961) who define three phases of transition. In the first phase, the marginal product is zero, so that the transfer of labor from the traditional sector to the modern sector does not lead to any reduction in the traditional sector's total output. The second phase, which they call the 'shortage point', is ushered in when the marginal product of labour in the traditional sector becomes positive. All the while, in phases one and two, the wage rate in the traditional sector is an 'institutional wage' equal to the average product of labour.

The third and final phase begins when marginal product catches up with the wage rate in the traditional sector, and thereafter the wage becomes the marginal product of labor. Ranis and Fei refer to this point as the 'commercialization point' since the traditional sector can be said to have become commercialized.

In this paper we define the LTP as the moment when the average revenue product of labour (the 'institutional wage') rises to the urban wage. Thereafter we assume rural workers are offered their marginal revenue product.[2]

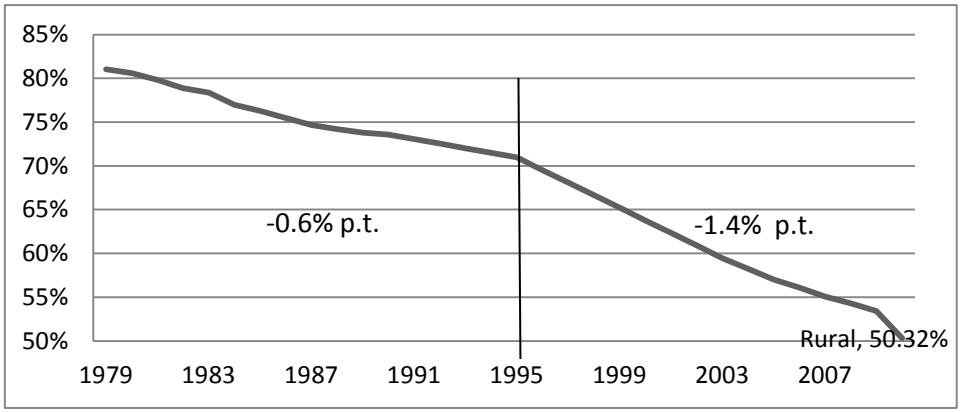
[2] For Cobb-Douglas production, Ranis and Fei's commercialization point would never happen, since the average

As we shall see in Section 3 the main result of this paper applies across all of Ranis and Fei's phases. That is, the real exchange rate appreciates continually as over-allocated labour leaves the traditional sector, whether it is paid its average or marginal product. It ceases, however, when the labour emigration stops. So it is important for us to ask if China's rural-to-urban labour flow is completed.

Empirical applications to China have sometimes claimed that it has (Cai and Wang, 2008, Cai and Du, 2011)[3] but this is contested by Ge and Yang (2011), and, Golley and Meng (2011). The latter argue that despite some recent evidence of rising nominal urban unskilled wages, there is little to suggest that this wage increase has been caused by unskilled labor shortages. Furthermore, Islam and Yokota (2008) estimate province-level rural production functions and find that the marginal product of labor is below the wage in the agricultural sector, which speaks of not-yet-completed transition.

Although the empirical evidence is mixed, there is an important political-economy consideration which leads us to doubt that China has completed its transition. The Chinese government has both a strong incentive to understand the development process, and the power to shape the economy in significant ways. It has used its power to create the so-called household registration (*hukou*) system, which has been a central instrument of the command economy since its inception in 1958 to prevent 'undesirable' rural-to-urban migratory flows (Chan, 2010). The regulation decreed that all internal migrating be subject to approval by the relevant local government. Each person has a *hukou*, classified as "rural" or "urban", in a specific administrative unit. The *hukou* system limited the rural-urban labor mobility and also excluded rural population from access to state-provided goods, welfare, and entitlements.

Figure 2: China's Rural Population Proportion, 1979-2010



Data source: China Statistical Yearbook 2010 and the Sixth National Population Census

Since 1978, China has begun to relax the *hukou* system. In the 1980s, a small

product is always above the marginal product.

[3] Zhang, Yang and Wang (2010) examines the evolving patterns of wage rate in harvest and slack seasons over a long period based on primary survey in Gansu Province, one of the poorest regions in China. The result of the paper shows that there is an acceleration of real wage rate and a shortage of labor in China's poor rural area, which, they argue, indicates that the era of surplus labor is over and China has reached LTP.

number of rural workers were allowed to get *hukou* in towns if they could afford their own food[4] and also had fixed residences, stable jobs or ran their own business there. But this reform had a limited impact on labor mobility because it only focused on towns which didn't provide many job opportunities for rural labor.

China began another round of *hukou* reforms aiming to expand small cities and towns around the mid-1990s. In 1997, the Ministry of Public Security of China (MPS) announced the *Pilot Plan on Household Registration System in Small Cities and Towns,* which permitted rural population who had stable jobs and fixed residences to have local urban *hukou* in these small cities. In 2001, this reform was expanded nationally and in 2003 China began experimenting with rural land reform and *hukou* deregulation – 'crossing a river by feeling stones' – in Chengdu.[5]

All of the above reforms on the *hukou* system, particularly since the mid-1990s, are consistent with the trends shown in Figure 2. The average declining rate of rural population proportion during 1979-1995 is 0.6% while the declining rate following the mid-90s reforms doubled to 1.4%.

Mai et al. (2009) analyzes the effects of the gradual dismantling of institutional barriers (mainly *hukou* system) to rural-urban labour migration in China, using a dynamic Computable General Equilibrium (CGE) framework. They find continued economic benefits of further migration. With half the population still in rural areas, and an urban-rural income gap that is high for its stage of development (Henderson, 2009), it is hard to avoid the conclusion that the authorities have slowed down labour movements, forestalling the LTP.

Yet to answer the question posed in the title of this section we must ascertain whether the output of the rural sector is primarily *non-traded*. There have been a number of recent studies using the Balassa-Samuelson traded/non-traded dichotomy for China (Lu and Han, 2006, Lu and Liu, 2007, Tang and Qian, 2007, Cheung, et.al, 2008, Wang and Yao, 2009, Guo, 2010, and, Tyers and Zhang, 2011) but most of these have confined the designation 'non-traded' to services as a matter of definition. However, there is evidence that supports the idea that China's rural sector is substantially non-traded. In particular, input-output data exhibits a low tradability ratio[6] and this suggests that China has indeed over-allocated labour to non-traded

[4] In the plan-economy stage of China, urban *hukou* population was provided food by local governments in the forms of quota and subsidies.

[5] Chengdu's reforms cover six areas. First, its urban and rural areas are combined for planning purposes, in contrast to normal practice. Second, Chengdu has begun to identify farmers' property rights for housing and land. Third, Chengdu is establishing a cultivation-land protection fund. This fund buys social insurance for famers who keep the cultivation land, to discourage them from selling it. Fourth, Chengdu provides public services to urban and rural areas equitably. Fifth, Chengdu has created a unified administration for urban and rural areas. Finally, a democratic administration system operates at the village level. By the end of 2012, Chengdu will have dissolved its *hukou* system.

[6] This is the ratio of exports and imports to gross output in this sector. De Gregorio et al.(1994) were the first to use a 10-percent cutoff for non-traded goods, which then became the conventional way of classifying nontraded/traded goods (Guo, 2010, Dumrongrittikul, 2012). Based on STAN OECD

production.

Naturally, the validity of NTFA does not depend on its applicability to a particular country, namely China, or to a particular factor, namely labour. However, we have taken the trouble to examine China's rural transformation because of the importance of the Chinese real exchange rate for the world economy. The attendant current account surpluses influenced the international flow of funds prior to the Great Recession (Bagnai, 2009) and, going forward, any framing of appropriate expenditure switching and expenditure reduction policies in the major world economies (Cordon, 1994) should take account of any prospect of a non-traded factor appreciation of China's real exchange rate.

3. Non-traded Factor Appreciation Holds in General Equilibrium

In this section we show that the intuition of Figure 1 survives in a stylized two-sector general equilibrium framework with mobile international capital. Our key innovation is to assume that the manufacture sector produces traded goods while the rural sector produces non-traded goods. Our model thus maps the Lewis rural/urban dichotomy onto the Balassa-Samuelson traded/non-traded dichotomy.

3.1 Production

Consider a dual (Lewis) economy with two sectors, a traded manufacture sector (T) and a nontraded rural sector (N). Output is Cobb-Douglas in both sectors. Rural land *G* (*Gen di*, in Chinese) is fixed. Total labor is normalized to unity, $L = L_T + L_N \equiv 1$, and the rural labor ratio is $l \equiv \frac{L_N}{L} \equiv L_N$.

$$Y_T = K^{\alpha} L_T^{1-\alpha} = K^{\alpha}(1-l)^{1-\alpha} \tag{1}$$

$$Y_N = G^{\beta} L_N^{1-\beta} = G^{\beta} l^{1-\beta}. \tag{2}$$

In the traded sector, we assume that capital *K* is owned by overseas investors.[7] We normalize the price of traded goods so the real exchange rate $\frac{P_N}{P_T} = P_N$. We assume that both capital and labor are paid their marginal products in the traded sector,

$$\frac{\partial Y_T}{\partial K} = \alpha \cdot (\frac{K}{L_T})^{\alpha-1} = \alpha(\frac{K}{1-l})^{\alpha-1} = \bar{r}\,, \tag{3}$$

$$\frac{\partial Y_T}{\partial L_T} = (1-\alpha)(\frac{K}{L_T})^{\alpha} = (1-\alpha)(\frac{K}{1-l})^{\alpha} = W_T\,. \tag{4}$$

Capital supply is infinitely elastically at the world real rate of return $\bar{r}$, which fixes the capital-labour ratio in the traded sector. We use (3) to obtain this capital-labor ratio, K/L_T. Substitution of the ratio into (4) determines the (endogenous) wage in the traded

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Input-output database for China, the tradability ratio for China's agricultural sector is 4%, 2%, 4% for mid-1990s, early 2000s and mid-2000s, respectively.

[7] Since the beginning of the reforms in 1978, and increasingly since the 1990s, Chinese capital, which is primarily located on the Eastern Seaboard, has been increasingly financed by foreigners.

sector.

$$\frac{K}{L_T} = \left(\frac{\alpha}{\bar{r}}\right)^{\frac{1}{1-\alpha}} \tag{5}$$

$$W_T = (1-\alpha)\left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} \tag{6}$$

It is important to understand how the endogenous wage in the traded sector (and, when the Lewis transition is complete, the whole economy) is tied down by (6). From (5), any movement of workers from the rural sector to the traded sector (a rise in L_T) raises capital borrowings from overseas. That this must be so is evident from (3) and (4). Without the extra capital, extra workers arriving in the traded sector will reduce the capital-labour ratio in (3) and (4), lowering the marginal product of labour (see (4)) and raising the marginal product of capital (see (3)).

But profit maximizing firms notice that the last unit of borrowed capital becomes infra-marginal as workers arrive, and so they borrow more capital until the capital-labour ratio returns to its previous level, fixed by the world real rate of return on the right-hand-side of (3). At the conclusion of this process, wages in the traded sector, which had been subject to downward pressure from rural emigrants, are held up by the capital inflow in (4). Thus the model exhibits an internationalized Lewis growth dynamic: emigrant rural labour drains into the urban sector to combine with foreign capital, fuelling economic growth.

In the nontraded sector, we distinguish two stages of Lewis-style transition. At *Stage I*, rural labor is paid its average product and as a consequence there is no output left for land. We define the payments to rural labor in this way because peasants' output has been shared in both traditional societies and in communist collectives, and paying the average product of labor is the simplest form of sharing[8]. As we noted earlier, it is also consistent with the 'institutional wage' of Ranis and Fei (1961). At *Stage II*, both rural labor and land are paid their marginal products.

At both stages, rural output is exhausted by the payments to factors, which allows us to substitute $P_N Y_N$ for the sum of payments to land and labour. We provide a detailed description of Stage I and Stage II presently. For now, we will use the fact that total rural income is always $P_N Y_N$ to derive an expression for non-traded demand.

3.2 Demand

We begin by characterizing demand for the non-traded good. We assume all consumers have taste parameter θ for nontradable goods, C_N. Denote Z as the nominal income of a representative agent. The consumer's budget constraint is,

$$Z = C_T + P_N C_N . \tag{7}$$

Then the optimization problem is as follows,

[8] China espoused egalitarianism in rural areas, with peasants 'eating from the same big pot' during 1952 to 1976 (The Cultural Revolution ended in 1976). In the post-Cultural-Revolution period, peasants still share output among family members.

$$max\ U = \mathrm{C}_N{}^{\theta} C_T^{1-\theta}\ , \tag{8}$$

$$\mathrm{s.t.}: Z = C_T\ + P_N C_N\ .$$

The representative agent maximizes utility subject to the budget constraint[9]. The demand for nontraded goods can be obtained by the first order condition,

$$\mathrm{C}_N = \frac{\theta Z}{P_N}. \tag{9}$$

If (9) is rewritten with P_N as the subject, it becomes a demand curve. It will become clear as we solve for the equilibrium that rural emigration increases *Z*, so it becomes a shift parameter in (9) for the demand schedule in the right panel of Figure 1.

National income is the sum of payments to land and rural labor plus wages in the traded sector (the return to capital is paid overseas). In both Stage I and Stage II payments to land and rural labor sum to $P_N Y_N$, so we obtain,

$$Z = P_N Y_N + W_T \cdot (1 - l). \tag{10}$$

We substitute (10) into (9) to obtain,

$$\mathrm{C}_N = \frac{\theta[P_N Y_N\ + W_T \cdot (1 - l)]}{P_N}. \tag{11}$$

3.3 Equilibrium

The non-traded price clears the market for non-traded goods so that the supply equals with the demand for nontraded goods, i.e.

$$Y_N = \mathrm{C}_N\ . \tag{12}$$

Using (12) in (11) to eliminate C_N, we obtain an expression for nominal income in the non-traded sector in terms of wages in the traded sector which is then substituted into (10), giving,

$$Z = \frac{W_T.(1 - l)}{(1 - \theta)}\ . \tag{13}$$

Thus rural emigration (a fall in *l*) increases nominal income *Z*, shifting out the demand curve (10) as required in the right panel of Figure 1.To find $\mathrm{P_N}$ we substitute (12) into (11), using (2) for Y_N and (6) for W_T. We obtain,

$$P_N(l) = \psi \frac{(1 - l)}{l^{\,1-\beta}},\ \ where\ \psi \equiv\ \frac{\theta(1 - \alpha)}{1 - \theta} \cdot \left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} \cdot \left(\frac{1}{G}\right)^{\beta}, \tag{14}$$

$$\frac{\partial P_N(l)}{\partial l} = -\ \psi \cdot \frac{l + (1 - \beta)(1 - l)}{l^{2-\beta}} < 0 \tag{15}$$

The expressions (14) and (15) give us the real exchange rate and its derivative in terms of the rural labor allocation. It is clear from (15) that a Lewis transition that

[9] There may be heterogeneous agents, but if the utility, U, satisfies the Gorman Form (Varian, 1992), a representative consumer exists.

results in a fall in l will appreciate the real exchange rate, which is the NTFA result.

We now show how different rural labour payment regimes (i.e. being paid the marginal or average product) alter the labor allocation. This, in turn, determines the real exchange rate (15) at each stage of development (Stage I or Stage II).

3.4 Stage I of the Dual Economy

As discussed above, we take up the idea of an 'institutional wage' equal to the average product of labour in Stage I (the pre-LTP stage). Rural labor is paid its average product, while rural land is not paid any return.[10]

$$\frac{W_N}{P_N} \equiv \frac{Y_N}{l}. \tag{16}$$

We now show that (14) and (15) are still valid, because (10) holds in Stage I. We rewrite (16) as,

$$W_N l = P_N Y_N \ . \tag{17}$$

This leads us directly to (10),

$$\begin{aligned} Z &= W_N l \ + W_T L_T, \\ &= \ P_N Y_N + W_T \cdot (1 - l) \ . \end{aligned} \tag{18}$$

Equilibrium is not attained in Stage I until the rural nominal wage (the value of average product of labor) equals the urban wage rate. The rural wage is given by substitution of (14) and (2) into (16),

$$W_N = \ P_N \cdot \frac{Y_N}{l} = \ \frac{\theta(1-\alpha)}{1-\theta}\left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} \cdot \frac{1-l}{l} \tag{19}$$

Since the equilibrium is given by $W_N = \ W_T$, where W_T is obtained from (6), then equilibrium occurs when,

$$\frac{\theta(1-\alpha)}{1-\theta}\left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} \cdot \frac{1-l}{l} = \ (1-\alpha)\ \left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}}.$$

$$\Longrightarrow \quad l \ = \ \theta \ . \tag{20}$$

Equation (20) is also the condition for the economy to reach the LTP. After the LTP, rural labourers are offered their marginal product.[11]

3.5 Stage II of the Dual Economy

At Stage II (the post-LTP stage), it is assumed that both rural labor and land are paid their marginal products. With Cobb-Douglas production, the average revenue product of labour exceeds the marginal revenue product of labour at every labour

[10] This seems reasonable in China in theory because land is owned by 'the people' and in practice because farmers only pay modest rent to the Chinese government.

[11] Equation (20) gives a nice, albeit imprecise, interpretation of what it means for labour to be over-allocated. The condition for this is that the share of non-traded labour – a supply side variable – exceeds the taste parameter for non-traded goods – a demand side variable. It is imprecise because the allocation of (20) is not first-best and more labour needs to leave the rural sector up to the point where workers in both sectors are paid their marginal products (equation (24) below).

allocation, so if rural labour remains at (20) unemployment would emerge as labour demand shrinks. However, downward pressure in wages ensures that the allocation does not remain at (20). Extra workers leave until the allocation sets the marginal revenue products of urban and rural workers equal to each other. We define R_N to be the rental rate of rural land and Euler's theorem gives us,

$$P_N Y_N = P_N \cdot \frac{\partial Y_N}{\partial G} \cdot G + P_N \cdot \frac{\partial Y_N}{\partial L_N} \cdot L_N$$
$$= R_N \cdot G + W_N \cdot L_N. \quad (21)$$

Total nominal income, Z, should be total wage income from two sectors plus the income from land (the return to capital is paid overseas). Again, we confirm (10) by recognizing (21) in the expression for total nominal income,

$$Z = W_N L_N + W_T L_T + R_N \cdot G = P_N Y_N + W_T \cdot (1 - l). \quad (22)$$

Similarly, equilibrium of Stage II is given by $W_N = W_T$, where W_T is obtained from (6) again, but W_N is now the *marginal* product of labor,

$$W_N = P_N \cdot \frac{\partial Y_N}{\partial L_N},$$
$$= (1 - \beta) \cdot \frac{\theta(1-\alpha)}{1-\theta} \cdot \left(\frac{\alpha}{\bar{r}}\right)^{\frac{\alpha}{1-\alpha}} \cdot \frac{1-l}{l}. \quad (23)$$

By $W_N = W_T$,we obtain the first-best rural labor allocation, l^*[12]

$$l = l^* = \frac{(1-\beta)\theta}{1-\beta\theta}. \quad (24)$$

We have shown that the real exchange rate is decreasing in the rural labour allocation (see (14) and (15)), and, in sections 3.4 and 3.5, that a real appreciation occurs over all the phases of development articulated by Lewis, Ranis and Fei.[13]

4. Non-traded Factor Appreciation in a Labour Market Diagram

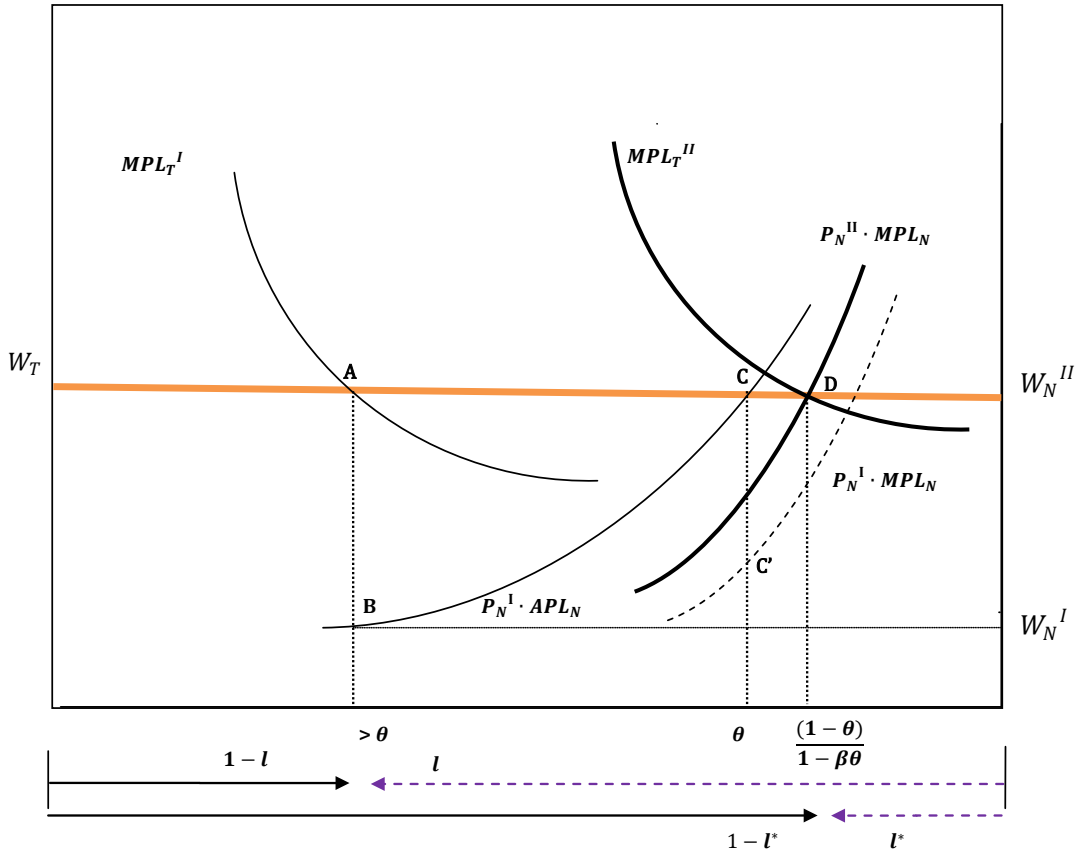
Figure 3 illustrates the Lewis transition in terms of the labour market. As above, we assume that workers are paid their average product to begin with. Rural labour is read from right to left on the bottom axis, and traded labour left to right. From (15), we know that a fall in rural labour appreciates the exchange rate. Insofar as any transition in Figure 3 involves rural labour emigration, it implies a NTFA.

[12] It can be shown that allocating labour to equate the value of marginal products in both sectors maximizes social welfare, and is equivalent to the centralized solution of a planner who: (1) chooses labour in both sectors; (2) chooses overseas capital level; (3) divides national product among workers; (4) sets the price of non-traded goods to remove any queues or gluts; (5) assumes workers maximize their utility treating prices and income from the government as given. The derivation is available from the authors on request.

[13] As flagged earlier, so long as the output of the rural sector appears as domestic income, so that (10) holds, equations (2), (6) and (11)-(13) ensure (14) and (15) still hold. That is, NTFA is robust to divisions of rural output that depart from those assumed in the narratives of Lewis/Ranis/Fei.

The economy commences with urban workers earning W_T at *A* and rural workers earning W_N^{I} at *B*. Superscripts I and II refer to Stages I and II. Their average revenue product is above their marginal revenue product, with the latter shown by the dashed line. This corresponds to the first two phases of Ranis and Fei (1961), since rural wages are above a low marginal product[14].

Figure 3: Rural-urban Labor Market



As rural workers emigrate to the traded sector, foreign capital meets them, pushing the marginal product of labour schedule rightwards. Rural wages rise along the chord *BC* until the labour allocation is at point *C*, which intersects with the shifted out traded value-of-marginal-product schedule (not shown). At that point there is an equilibrium, but not a utility maximizing one. The rural sector is then reformed (exogenously), perhaps with a desire to maximize utility, so that firms offer workers their marginal product. Unemployment emerges in the sector and workers leave rather than accept wages like *C'*.

As shown in Figure 1, the combination of declining supply of labour to rural output and increased income as the economy approaches the efficient labour allocation pushes up the real exchange rate. In Figure 3 it rises from P_N^{I} to P_N^{II}. The combination of a shift out in the value of marginal product of non-traded labour, due to a rise in P_N, and further capital inflow (pushing the value-of-marginal product of non-traded

[14] Our modeling rules out the first phase of Ranis and Fei, where marginal product is literally zero. Marginal products are always positive for the Cobb-Douglas production function (see (2)), although they could be vanishingly small.

labour right) takes the economy to a final (utility maximizing) equilibrium at *D*, where all workers receive their value of marginal product, and rural workers receive W_N^{II}.

The non-traded labour allocation at *C*, namely θ, is taken from (20) by setting the value of *average* product in the non-traded sector equal to the value of *marginal* product in the traded sector. The allocation at *D*, namely $\frac{(1-\beta)\theta}{1-\beta\theta}$, is taken from (24) by setting both value of *marginal* products equal to each other.

Naturally, the extent, or even the existence, of NTFA in models of China will depend on a number of key modeling assumptions. Contrary to our stylized setup, the Chinese rural sector produces some traded goods and the urban sector has a sizeable share of non-traded services. To the extent that emigrating rural labour ends up in urban non-traded services, depressing their prices, the impact on the overall index of P_N may be muted, or even negative.

Working against this, labour used to produce any *traded* rural output which is transferred to traded urban production may become more productive in its new location. This would amount to an improvement of traded sector productivity leading, in due course, to a Balassa-Samuelson appreciation.

Clearly further research is needed, though Mai et al. (2009) provide some support for NTFA. They consider a departure of 6.3 million workers from rural to urban employment, using a detailed sectoral model of China. Qualitatively, their analysis strikes a chord with ours.[15] As workers arrive in the urban areas, the productivity of capital there goes up. This leads to a boom in both domestic investment (which Section 3 did not account for) and foreign-sourced investment, financed through an open capital account. The boom in the urban industries, which have a production bias towards traded goods, pulls resources out of the non-traded goods sector. The fall in non-traded supply and the increased demand from a strong economy lifts the price of non-traded goods, appreciating the real exchange rate. Thus our prediction survives in a model where the rural and urban sectors are more realistically modeled.[16]

5. Is Non-traded Factor Appreciation a Quasi-Balassa-Samuelson Effect?

A real appreciation coinciding with the expansion of the traded sector is redolent of the famed Balassa-Samuelson effect (Balassa (1964), Samuelson (1964)) where an increase in traded sector productivity appreciates the real exchange rate, and so we conclude by finding a connection between this effect and our stylized model.

Intuitively, the arrival of overseas capital in the urban-traded sector is like an increase in the traded sector productivity of labour. With no increase in land occurring (by assumption) ‘productivity’ in the traded sector is rising faster than ‘productivity’ in the non-traded sector.

[15] We provide more detail on the real exchange rate than the paper does, based on personal communication with Professor Peter B. Dixon.

[16] In Mai et al., (Figure 13, pp. 27) the appreciation of the real exchange rate is around 0.3 per cent.

Figure 4: Excess Demand for Non-traded Goods in Our Model
($P_T \equiv 1$)

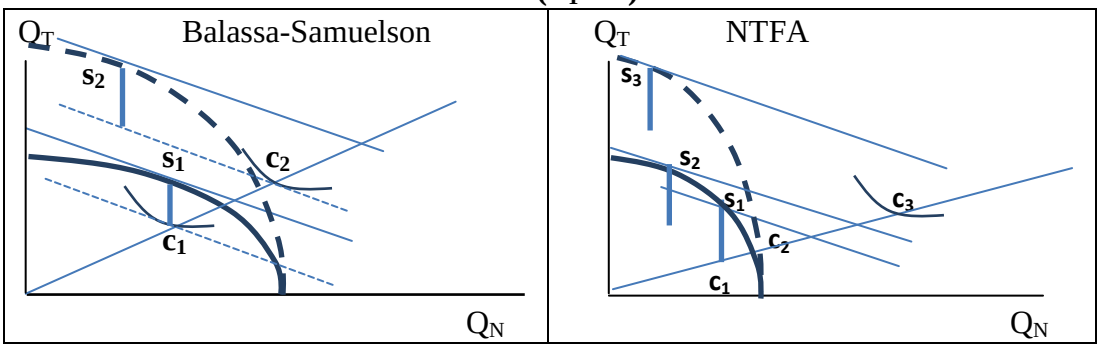


Figure 4 clarifies the issues with respect to our model. Both panels show the excess demand for the non-traded good as the difference along the horizontal axis between consumption demand (c) and non-traded supply (s). They do not show the final equilibrium, after the non-traded price rises to clear the market.

In the left panel, production point s_1 lies above consumption point c_1 because a current account surplus (the line between the two) is required to service borrowed overseas capital.[17] Holding relative prices fixed, an increase in traded sector total-factor-productivity leads, via a Rybcyznski-type result, to a fall in non-traded goods supplied and an increase of traded goods supplied, at point s_2.[18] The current account surplus rises, because more machines are borrowed in response to an increase in the marginal product of capital, and consumption demand for non-traded goods rises along the income consumption curve to c_2. The excess demand for the non-traded good will result in a real appreciation (a rise in P_N) vertically aligning consumption and production in the final equilibrium (not shown).

In the right panel, we start the economy with non-traded equilibrium with s_1 and c_1 vertically aligned. To keep the diagram simple we do not show the budget set lines for utility maximization, though we do show the consumption points and the income consumption curve. At points (c_1, s_1) there is no excess demand for non-traded goods but they have too much labour allocated for their production, implying that the budget constraint is not at a tangency to the ppf. We decompose the transition from points (c_1, s_1) to points (c_3, s_3) into two parts.

First, we conceptually fix capital, and labour moves to the traded sector taking us to production point s_2. This movement on its own is enough to ensure NTFA because excess demand opens up as supply falls to s_2 and demand rises North East along the income consumption curve to c_2. This part of the adjustment is not connected to a 'productivity' explanation, however, and is distinct from the Balassa-Samuelson idea.

However, in the next part of the adjustment, capital is borrowed in response to the higher marginal product of capital (arising from the extra rural workers in the city).

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[17] It is straightforward to confirm from Section 3 that $\bar{r}.K$ equals the current account surplus Q_T-C_T.

[18] In our model, we need a productivity shifter outside of (1). Technically, we would have to have one outside of (2) as well, since Balassa-Samuelson is about traded productivity rising relative to non-traded productivity, but to keep the diagram simple we set the increase in the latter to zero.

This is like a productivity expansion and so the transition from points (c_2, s_2) to points (c_3, s_3) exactly replicates the Balassa-Samuelson pattern in the left panel.

Thus both Balassa-Samuelson and NTFA are a result of excess demand for non-traded goods opening up as factors leave the non-traded sector. However, if we allow for foreign investment there is a second part of the adjustment. The overseas machines that greet the arriving rural workers create a Balassa-Samuelson 'aftershock', which accentuates the gap between non-traded demand and supply. With this foreign borrowing, a Lewis transition implies a quasi-Balassa-Samuelson effect.

Making these connections is possible only because we have mapped the Lewis urban/rural dichotomy onto the Balassa-Samuelson traded/non-traded dichotomy. Although we have focused on China, we suspect this might be a reasonable mapping to make for other economies. India's rural output, for example, is classified as non-traded in Dumrongrittikul (2012).

Both the Balassa-Samuelson and Lewis models have been used in studies of development, but to our knowledge the Balassa-Samuelson implications of a Lewis transition have not been explored. The reason, we suspect, is that the exchange rate implications of factor mobility have remained as isolated results, without being generalized into a principle like NTFA.

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