A Synthesis of the Lewis Development Model and Neoclassical Trade Models

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Abstract

A simplified Lewis model with evidence-based assumptions treats all rural output as nontraded, and pays rural workers a convex combination of their average and marginal products. Lewis style transition is characterized as an increase in the weight on marginal product in the determination of the rural wage. This integration with standard trade models underscores the importance of trade for development, and predicts a real exchange rate appreciation for economies undergoing a Lewis style transition.

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1 Introduction

The theme of 'dual' economies, conceived of as economies with both an industrial sector and a rural sector, is longstanding. Adam Smith and David Ricardo both focused on the interaction between these sectors during the Industrial Revolution; for Ricardo the outlook for industrial growth was 'dismal' because of diminishing returns in agriculture (see Hicks, 1965; Pasinetti,1974; Clark, 2007). More recently, during the Great Leap Forward in China in the 1950s, Chairman Mao's forced transfer of agricultural goods from the Chinese countryside to the cities led to famine, and to the deaths of approximately 30 million people (Chang 1997). Thus both theorists and policymakers have long recognized that, in an economy with two very different sectors, growth prospects hinge on how these sectors interact.

Theorizing about dual economies received a substantial impetus from W. Arthur Lewis's paper, 'Economic Development with Unlimited Supplies of Labour' (Lewis, 1954). This model won him the (joint) Nobel Prize for Economics in 1979 and, commenting on the award, Ronald Findlay wrote that 'a large part of ... development economics ... can be seen as an extended commentary on the meaning and ramifications [of this article]' (Findlay, 1980, p. 64, and also 2017 for a later assessment).

The literature directly descending from Lewis's work is comprehensively reviewed in Vines and Zeitlin (2008)[1]. Importantly, they decline to bestow the designation 'dual' onto standard 2x2x2 trade models – with two factors, two goods and two countries (Balassa, 1964; Samuelson, 1964 & 1994) – or the 'Specific Factors' version of the Heckscher–Ohlin trade model presented by Jones and Neary (1984). Rather:

> "... [dualism implies] sectoral asymmetries that are not simply technological. For Lewis [1954], and for Ranis and Fei [1961], there were *organizational* differences between sectors ... and *behavioural* differences between sectors" (Vines and Zeitlin, 2008, page 12)

[1]We draw a good deal from them in section 2, and this footnote stands in place of repetitious citations.

Vines and Zeitlin's reluctance to conflate these models is understandable, since the concept of dualism has provided an organizing principle for a whole academic discipline, namely Development Economics, and a helpful language for a whole generation of policymakers. Someone who has straddled both worlds is Joseph Stiglitz, and it is a testimony to Lewis's distinctive contribution that he sees the task of formulating policy for developing countries precisely in Lewis's terms, advocating what he calls 'growth strategies based on duality's elimination' (Stiglitz, 1999, p. 56).

In this paper we decline to emphasize the differences between Lewis's model and standard trade models and instead seek a rapprochement - making them as close as possible. Our conception of 'close' is that we alter an otherwise standard trade model so that all rural output is nontraded, and pays rural workers a convex combination of their average and marginal products. Lewis style transition involves the rural wage progressively shifting away from average-product sharing towards the marginal product commercialization.

In moving the Lewis model in a neoclassical direction, the creative contribution of this paper lies in choosing what elements of the Lewis tradition to discard. A reader straining for echoes of Lewis (1954) will not hear a word about the developmental role of government, foreign aid, or the history of the USSR – the latter being a pre-occupation of economists in the 1950s. Nor will such important figures as Keynes, Malthus or Marx make an appearance, though they are legion in Lewis (1954).

Our motivation comes from the observation of Gollin (2014), and others, that Lewis's model has stood the test of time very well in some areas, but not so well in others. Furthermore, it has always required careful and ingenious modelling because of some of its nonstandard assumptions (see Wang and Piesse 2013). But if some of these assumptions are in fact dubious, then we sense a rare low-hanging fruit in the world of economic analysis – an opportunity to make models both simpler and more realistic.

Sixty years is a long time to test the realism of the Lewis's assumptions – many new datasets and techniques have become available over this time. As we shall see,

what has stood the test of time is a partition between a rural and urban sector, with lower labour productivity in the former. Despite rejecting many of Lewis's original ideas Gollin (2014) steadfastly holds onto these two:

> '... many of the specific assumptions and mechanisms of the Lewis model have not been well supported by contemporary theory and evidence ... [but] ... it correctly identifies a key feature of the growth process – namely, the importance of *within*-country gaps in income and productivity, or dualism.' (Gollin, 2014, page 73, authors italics)

Our paper is structured as follows. In section 2 we review the literature of the Lewis model to outline its central themes, and sift out the aspects of the model which Gollin (2014) says are not well-supported. This sets the stage for our neoclassical rapprochement model in section 3. Section 4 concludes.

2 Literature Review

2.1 Lewis's Model

In his Nobel Prize autobiography, Lewis (1979) writes that his interest was in the fundamental forces determining the rate of economic growth, and that he felt compelled to turn aside from the models of growth that were emerging at the time (Solow 1956; Swan 1956), descending from Roy F. Harrod (1939) and Evsey D. Domar (1945). These frameworks aimed to provide a general theory of growth, without dealing with the interactions between the industrial and rural sectors. Lewis was unpersuaded by this approach, and felt compelled to reject neoclassical explanations because they could not account for what he took to be basic facts about the initial stages of the development process. In particular, be believed that during initial industrialization, real wages remain more or less constant while profits and savings soar. This counted against a neoclassical framework, since a rise in investment and the capital stock should raise wages. Lewis continues:

> "[o]ne day in August, 1952, walking down the road in Bangkok, it came to me suddenly that both problems have the same solution.

> Throw away the neoclassical assumption that the quantity of labour is fixed. An 'unlimited supply of labour' will keep wages down ... The result is a dual (national or world) economy, where one part is a reservoir of cheap labour for the other." (Lewis, 1979, un-numbered page)

This 'Bangkok moment' launched him on the journey towards his famous framework. Unpacking the metaphor of 'unlimited labour' led him to use the term 'dualism' to describe economies in which there are differences between industrial and rural sectors that cannot be fully explained by differences in production technologies or in factor endowments, in the manner normally used by economists. He identified three such differences between industry and agriculture, what are called 'asymmetries' in Kanbur and McIntosh (1987).

First, there are technological differences between the sectors. Labour is used in each sector. In agriculture it is combined with land in production, whereas industrial goods are produced by combining labour with reproducible capital. Moreover, industrial goods can be consumed or invested, whereas agricultural goods can only be consumed.

Second, there are organizational differences between the sectors. The rural agricultural sector functions on traditional lines and is primarily based on subsistence; industrial production happens in a modern, market-oriented sector, located in towns and cities. There is 'an unlimited supply of labour, available at [a] subsistence wage' (Lewis 1954, p. 139) to both sectors. Lewis interprets the word 'subsistence' broadly, which in turn creates a range of meanings for 'unlimited supply of labour'. The level of the wage is determined in some way by conventions in the underdeveloped agricultural sector. Lewis is noncommittal as to whether wages in this sector are set according to actual subsistence needs, or living standards, or workers' average product. The central idea is that workers are paid above their marginal product, which some took this to mean that the marginal product of labour in agriculture is actually zero. In fairness to Lewis, he was not as strong on this point as some of his followers[2]. Labour can be transferred from agricultural

[2]Lewis was understandably accused of not allowing for a non-zero marginal product, since he

sector to the industrial sector by the migration of workers to towns and cities. The overall stock of labour in the economy is normally fixed in supply (though Lewis, like Ricardo, did sometimes allow for Malthusian features).

Third, and finally, there are differences in the behaviour of the actors in the two sectors. Capitalists in the industrial sector save all their profits, because they are ambitious. Workers save nothing, in either sector, because they are poor (Lewis describes them as not belonging to the 'the saving class' – 1954, p. 157). And landlords in agriculture are assumed to consume all their income, which comes to them to the extent that agricultural workers receive a wage below their average product.

The narrative runs along the following lines: profits in the modern capitalist urban sector create a growing supply of savings. This finances the formation of an increasing stock of capital, which is used to employ more and more labour in the urban workforce.

Although the original Lewis model is a growth model, which he compared to the Swan-Solow model, it takes a particularly simple form – that of a sequence of comparative static results linked together. In the famous diagram on page 152 of Lewis (1954) capital is augmented repeatedly, each time increasing capital's return and sowing the seeds for the next augmentation. In what follows we show comparative static results for augmenting capital and similarly imagining them linked together. We also show a reform of agriculture brought about by a move away from average product remuneration to marginal product remuneration. This, too, can be imagined as a sequence of steps.

In its long history and various incarnations, the analytic challenge of the Lewis model has always been to model the agricultural sector in such a way that it does justice to the realities of developing countries, whilst at the same time allowing the actors respond to economic incentives. Not surprisingly, the versions of his model that came after Lewis took up this challenge.

rules out non-negligible marginal product in his own summary of Lewis (1954), at the end of the paper. However, earlier on (p. 142) he had made the caveat that the existence of zero marginal product is 'not ... of fundamental importance to our analysis'. Ranis (2003, p. 8) agrees with Lewis's self-defence: in a retrospective assessment, he describes the postulation of a 'pure' labour surplus as a red herring. Amartya Sen (1966) helpfully clarifies the debate about this issue.

2.2 Generalizations

The first, and most fundamental, generalization of Lewis's model was made by Ranis and Fei (1961), who demonstrated that the dualistic framework continued to give insight into the process of economic growth even when the condition of pure surplus labour – that is, a zero marginal product of labour in agriculture – does not hold. They initiated a large body work on this question by examining the microeconomic foundations of surplus labour and exploring what occurs when these conditions come to an end. This occurs when a sufficient number of workers have been removed from agriculture for the marginal productivity of the remaining agricultural workers to become positive. As a result, agricultural output declines as further workers leave. Consequently, the marginal agricultural surplus per worker, which accrues to landlords as each worker leaves – and which is traded by landlords for industrial goods – begins to decline, even if the wage per worker (measured in terms of agricultural goods) is exogenous. This is the 'first turning point' identified by Ranis and Fei. It corresponds to the onset of Ricardo's 'dismal' diminishing returns. Ranis and Fei label what happens beyond this point as the 'second phase' of economic development. In that phase the economy is characterized by 'disguised unemployment', as labour in agriculture is still paid more than its marginal product.

Growth becomes more difficult in this second stage of development. Lewis assumes that the real wages per worker, and the level of welfare per worker, do not fall as growth proceeds. But growth is driven by the transfer of labour from agriculture to industry, which, in this second phase, causes agricultural output to fall. As a consequence of this the relative price of agricultural goods rises, and real wages can remain constant only if workers are able to substitute towards industrial goods in such a way as to avoid any damage to their welfare. Mukesh Eswaran and Ashok Kotwal (1993) model this substitution process. We later argue that if industrial goods can be exported, and capital imported, it helps the economy through the difficulty of the economy being 'flooded' by the supply of industrial output, though we do so in a framework without an exogenously fixed wage.

Jorgenson (1961) further develops the study of the dynamics of a dualistic

economy in this second phase of development – when there is a positive marginal product of labour in agriculture and disguised unemployment. He incorporates a Malthusian perspective, by supposing that population growth is increasing in the amount of food consumed per capita, up to a biological ceiling that corresponds to a food-consumption threshold defined by Eswaran and Kotwal[3]. This has the consequence that a too rapid rate of growth of population can cause a Malthusian trap by preventing the emergence of any significant agricultural surplus. Growth of manufacturing activity, such as that analysed by Lewis, can then be sustained only if technological progress in agriculture enables food production to outstrip population growth. Only then can an agricultural surplus emerge, and grow, and so only then can labour progressively move away from agriculture. If this does not happen, then any increases in profits, savings and capital accumulation in industry become self-defeating, since they turn the terms of trade against industry and so bring down profits and capital accumulation[4].

It is natural that these subsequent extensions of the model have focused on the wage and the marginal product of labour in agriculture, and relatedly on the existence or otherwise of pure surplus labour. Even for relatively unsophisticated workers a comparison between what can be earned in agriculture (or consumed, in the case of a subsistence non-monetized economy) versus what can be earned in an urban area comprises a very salient incentive. An economic model does not have to be very sophisticated to predict that a differential return to labour would draw rural workers away from their traditional homes[5]. Furthermore, Lewis-style

[3]They assume workers consume only food until sated. Thereafter, each marginal dollar is spent on industrial goods.

[4]As stressed by Avinash Dixit (1973, p. 346), such a model focuses on 'the constraint on growth imposed by the rate of release of labour from agriculture', whereas in Lewis's model the focus had been on the ability of capital accumulation in industry to soak up the surplus labour force in agriculture. Nevertheless, as Dixit notes, in both models a 'big push' for saving and capital accumulation may be self-defeating (On a 'big push' see Rosenstein-Rodan, 1943 and also Dasgupta and Ray, 1986; Matsuyama, 1991; Murphy, Shleifer and Vishny, 1989; Shapiro and Stiglitz, 1984). This is why Jorgenson thought of increases in savings rates as an outcome of development, rather than a policy tool (Jorgenson, 1961, p. 328).

[5]Harris and Todaro (1970) give this basic incentive centre stage in another strand of Lewis-inspired research. They propose a wage floor in the urban formal sector which prevents the urban market clearing. Workers who choose to leave the rural sector stand to gain a probability weighted combination of the urban wage and whatever is available in unemployment. In the

models do not have to be confined to market economies. For some developing economies it is realistic to model the government as having the power to direct labour irrespective of incentives. This observation greatly expands the applicability of the Lewis model into economies that are partly planned, because a central planner may choose to send low-marginal-product labour to high-marginal-product locations, mimicking market choices of workers who pursue higher wages[6].

2.3 Probing the Assumptions

Gollin (2014) provides an especially valuable review of the assumptions of the Lewis model, and so we follow him in this section[7].

The first concern relates to Lewis's theory of capital driven growth, which Gollin says might have been what Lewis himself considered to be his most important insight. Notwithstanding this, Gollin gives it the title of 'capital fundamentalism'. He quotes Lewis's own admission that the Green Revolution of the post-war period delivered growth arising from the agricultural sector in many countries, contrary to his model, and charges him with ignoring productivity growth. Overall, Gollin describes Lewis's approach as misguided, though he acknowledges he did not have the benefit of subsequent microeconomic studies on savings and investment that have since become available (Gollin 2014, pp 82-83).

On the other hand, drawing on some of his own research, he is solidly with Lewis on the validity of agricultural labour that is in some sense 'surplus' (Gollin

simplest version, equilibrium occurs when labour migration equalizes expected wage across The incorporation of urban unemployment into the model also enables one to begin to discuss the growth of a third sector; the production of services in cities (see Fields, 1975).

[6]As is well-known, the optimal L_1 and L_2 to maximize $p_1Q_1[L_1] + p_2Q_2[L_2]$ is given by $p_1MPL_1 = p_2MPL_2$ which is the same equilibrium as the many-firm solution with clearing labour markets $w_1 = p_1MPL_1 = p_2MPL_2 = w_2$.

[7]Friedman (1953) proposed that so long as a model predicts well the validity of its assumptions are irrelevant. One can imagine using a model which predicts well in spite of poor assumptions, because economists and econometricians are often forced to do this, but that is a different thing to saying that, all other things equal, broadly realistic assumptions don't enhance a theory. In any case, simple neoclassical frameworks, or indeed the Lewis model, don't lend themselves to prediction in a straightforward way. One can also accept that assumptions that are too detailed are also likely to be wrong in any real economic situation, but the assumptions within the Lewis tradition are not like this. They tend to be broad generalizations and approximations, and as such permit minor exceptions.

et al. 2014a and 2014b, and see also Herrendorf and Schoellman 2018). Exciting cross-country testimony to this is found in Adamopoulos and Restuccia (2018), who use high-resolution micro-geography data to predict the gap between actual and potential yields for every 10km x 10km parcel of land in the world. They find that the current ratio of yield in developed countries to yield in developing countries is around three, but that if potential yield could be realized in developing countries the difference would basically vanish.

Evidence for surplus labour is often sought in a unskilled-urban to -rural wage gap, and a favoured country to analyze is China. Gollin (2014) cites Wang and Weaver (2013) and Zhang et al. (2010) who believe surplus labour has been exhausted. However, China has institutional features which have to be taken into account when examining wages, such as changes to minimum wage laws, the use of migrant labour in urban areas and the special role of Town and Village Enterprises (Athukorala and Wei 2018, and Park 2017). Furthermore, we ought to be cautious about the measurement of wages, according to Xue and Gao (2012, abstract) 'China's current official official household survey has failed to effectively cover the rural-to-urban migrants, which overstates the income of urban residents and understates the income of rural residents, and then overstates the urban-rural income gap in China.' Jin and Lee (2017) find a robust and positive impact of rural surplus labor on urban–rural inequality, which is consistent with Lewis's model. Wei et al. (2017) are more inclined to believe that surplus labour is no longer important, and in their comparison to other developing countries conclude that 'China is a low-wage country no more' (2017, pg. 6). However, whatever these authors believe about China's stage of development, they are united in the belief that surplus labour is a meaningful concept.

A more tightly specified component of the Lewis model is that the wage is fixed during the early stages of development, which implies a fall in labours share of output. Gollin (2014) is skeptical of this, based on the constant share observed by Young (2003) in China over 1978-1997 and in four East Asian economics over 1960-1990. Athukorala and Wei (2018) present evidence for a decline in labour's share of GDP in China from 2000 onwards, but this is fully two decades after the

beginning of agricultural reform in China, clouding its relevance for the validity of the Lewis model.

Turning from China to the home of the industrial revolution, even stronger evidence against fixed wages is given by Clark (2007). He has raised a challenge to the orthodoxy within economic history, that wages were constant during the early stages of economic development in the UK. He argues that over 1760 to 1860 real wages in England rose faster than real output per person or, to make the same point another way, labour's share of output rose substantially. On Clark's account the farmland share of GDP was in precipitous decline from 1850, effectively vanishing by around 1900, being cannibalized by physical capital, labour and to a small extent urban land[8]. Allen (2008) defends the fixed real wage view by arguing for the superiority of measuring English GDP over that period on an output basis, rather than on Clark's factor payments basis. Theirs is a highly technical debate revolving around the least bad way of conducting national accounting prior to the existence of national statistical agencies[9]. But they do agree on the invalidity of another assumption taken up by Lewis's followers – that ' ... the marginal productivity of labour is negligible, zero, or even negative' (Lewis 1954, pg 189).

Table 1 (Vollrath, 2009 and Menzies et al. (2016)) is of relevance to debates about fixed wages and a zero marginal product of labour. It illustrates a gradual alignment of rural and urban marginal products of labour at different stages of development. The table is ordered from highest (top left) to lowest (bottom right) and the OECD countries (bold) tend to have a lower ratio of urban to rural marginal products, as is evident by their relative preponderance on the right side of the table. Crucially, Vollrath (2009) collected any available data on the ratio of industrial wages to rural wages, and found a correlation of $0.81 (P < 0.01)$ with

[8]See chapter 14 of Clark (2007) and in particular figure 14.4. Footnote 4 provides references to the controversy of the measurement of wages, to which we now turn.

[9]Allen (2008) catalogues some of the difficulties. Compiling an output measure of GDP runs up against uncertainty of the breadth of growth beyond textiles, incomplete coverage of industries and ambiguity about the appropriate weights for aggregation. Compiling an income measure of GDP runs up against unknown stocks of factors, limited information on profits (most severely for unincorporated enterprises about which little is known), uncertain employment rates or the distribution of earnings across wage categories and unknown acreages of arable, meadow, and pasture that need to be valued.

Country	$\frac{MPL_I}{MPL_R}$	Country	$\frac{MPL_I}{MPL_R}$	Country	$\frac{MPL_I}{MPL_R}$
Kenya	16.84	Venezuela	3.86	**Sth. Korea**	2.65
Malawi	13.72	Guatemala	3.78	China	2.57
Zimbabwe	11.91	Iran	3.7	**France**	2.41
Sth Africa	9.37	**Norway**	3.37	**Finland**	2.32
Peru	7.44	Indonesia	3.32	**US**	2.26
Honduras	6.26	**Japan**	3.31	**Chile**	2.1
Portugal	5.21	India	3.21	**Netherlands**	2.05
Pakistan	4.7	**Turkey**	3.03	Colombia	2.03
Egypt	4.55	**Greece**	2.91	**Canada**	2
El Salvador	4.53	**Denmark**	2.9	**UK**	1.89
Austria	4.27	Tunisia	2.88	**New Zealand**	1.83
Costa Rica	4.23	Argentina	2.81	Uruguay	1.81
Philippines	3.91	Sri Lanka	2.73	Syria	1.74
Italy	3.89	**Sweden**	2.7	**Australia**	1.67

Table 1: **Non-zero Rural MPL affects Wages (Industrial MPL(MPL_I)/Rural MPL(MPL_R); highest to lowest, OECD bold). Source: Vollrath (2009) pg.330, Table 2 and Menzies et al. (2016) for China.**

the ratios below. This establishes two points for us.

First, evidence of connection between wages and marginal products has a decidedly neoclassical aroma, and is to be contrasted with Lewis's (1954, pg 150) explanation for wage differentials based on the psychological costs of lifestyle changes, the need to reward skills accumulated in the urban sector and the ability of workers in cities to bargain for higher wages. It goes without saying, though the saying of it is our second point, that at no stage is the rural marginal product of labour zero, which would imply an infinite ratio in Table 1.

Thinking over notions of capital accumulation, surplus labour and fixed wages our review of Lewis's assumptions lead us to have sympathy with the previously quoted assessment of Gollin (2014). We now build the simplest representation of dualism possible – a Specific Factors model with a distortion in the labour market designed to stop the marginal revenue product equalizing across countries.

3 Rapprochement Model

This section changes one equation in a standard 2x2x2 competitive trade model – with two factors, two goods and two countries – to create a within-country productivity gap. The original model is a variant of the Specific Factors Model (Jones and Neary 1984).

3.1 Technology, Preferences and Endowments

$$B = B[T, L_B] \equiv L_B B[\frac{T}{L_B}, 1] \qquad B_i > 0, B_{ii} < 0, i \in T, L_B \tag{1}$$

$$S = S[K, L_S] \equiv L_S B[\frac{K}{L_S}, 1] \qquad S_i > 0, S_{ii} < 0, i \in K, L_S \quad MPK = \frac{\partial S}{\partial K} \tag{2}$$

$$L_B + L_B = L \tag{3}$$

$$U = U[C_S, C_B] \equiv C_B U[\frac{C_S}{C_B}, 1] \qquad U_i > 0, U_{ii} < 0, i \in C_S, C_B \tag{4}$$

$$w_B = DMPL_B + (1 - D)APL_B \quad MPL_B = \frac{\partial B}{\partial L_B}, APL_B = \frac{B}{L_B} \tag{5}$$

$$w_S = pMPL_S \qquad MPL_S = \frac{\partial S}{\partial L_S} \tag{6}$$

$$w_S = w_B = w \tag{7}$$

Equations (1) and (2) describe production of Bread (B) and Steel (S) using specific factors K and T and mobile labour inputs L_B and L_S. Equation (3) shows the cap of the sum of labour inputs. Production is homogenous of degree one (constant returns to scale) with decreasing but positive marginal products.

Equation (4) shows consumption of Bread (C_B) and Steel (C_S) satisfying preferences U which are homogenous of degree one with decreasing but positive marginal utility for both goods.

Equation (5) describes wages in the B sector as a convex combination of marginal and average revenue products, with D as the weighting parameter. Wages are in units of B or, equivalently, the price of B is normalized to unity. Equation (6) describes wages in the S sector as the marginal revenue product. p is the

relative price of Steel. Equation (7) says workers move freely between sectors to equate wages in units of B.

3.2 If D=1 this is a Specific Factors Model

If $D = 1$, prices are set on world markets, and all goods are tradable, equations (1) to (7) comprise the 'Specific Factors' version of the Heckscher–Ohlin trade model (Jones and Neary 1984). It is straightforward to show a number of standard results. First, at constant product prices the addition of a specific factor increases the output of the good that uses that specific factor and reduces the output of the other good (Rybczinski's theorem). Second, given another country with identical preferences but different labour or specific factor endowments, a country will export the good that is cheap in autarky (Heckscher-Ohlin theorem). Finally, an increase in the price of a good on world markets will increase the real return to the specific factor for that good and reduce the real return of the other specific factor (Stolper-Samuelson theorem)[10].

The value of laying out the Specific Factors model is simply to make the point that it is already a 'dual' model. Unlike the Solow-Swan or Harrod-Domar models (Solow 1956; Swan 1956; Harrod 1939; Domar 1946) the Specific Factors model does recognize two sectors with different types of capital in locked up in each. Thus the interrogation of Lewis in Gollin (2014, pp 82-83) is an implied interrogation of the Specific Factors Model. Gollin bemoans the fact that Lewis didn't allow for capital in the surplus labour sector, but this is partly a complaint about a lack of capital mobility across sectors, which is also a feature of the Specific Factors model.

3.3 Agents in the Rapprochement Model

If capital immobility were the only remaining distinctive of the Lewis model after other dubious assumptions were dropped, then we would be compelled to overturn

[10]The Heckscher-Ohlin model specifies that factors T and K are amalgamated into a mobile stock of capital, and a parallel set of results are available.

Vines and Zeitlin's (2008) refusal to call the Specific Factors model a dual model. However, what we have taken from Gollin (2014) and others is that the notion of a labour productivity differential in agriculture during development is plausible, and this is an important change to the Specific Factors model, important enough to maintain Vines and Zeitlin's distinction.

The pronumeral D in equation (5) is a key exogenous lever in the model. If $D < 1$ it embodies the distortion that labour is paid a convex combination of its average and marginal products, and with constant returns to scale the former is larger than the latter[11]. As Lewis-style development proceeds the variable D in (5) rises from zero to unity and workers in the rural sector go from being paid their average product to being paid their marginal product. That is, we envisage not so much a 'Lewis turning point' as a 'Lewis continuum'. In a break from what Gollin calls Lewis's 'capital fundamentalism' we do not require that capital accumulation causes the move along the Lewis continuum. In this, we have the support of scholars who believe the Enclosure Movement (Turner 1984, and Armstrong 1981) was an impetus to the industrial revolution. On this account, power to control land first shifts towards profit maximizing agents who subsequently release workers who have hitherto been paid above their marginal product. If workers move to the city, and capital accumulates contemporaneously, we have Lewis's correlation between rural emigration and accumulation but without 'capital fundamentalism'[12].

We now develop a Lewis rapprochement model for a closed and open economy, using the technology, preferences and endowments of (1) to (7). The labelling of goods and specific factors, which is of no significance in the Specific Factors model, now becomes significant. Bread is always nontradable, so that we now make the generalization that rural output is nontradable during economic development in

[11] If $Y = Y(K, L) = L.f(K/L)$, then $MPL = APL - f'(K/L).[K/L] < APL$.

[12] Weitzman (1974) makes a classic profit-maximizing micro-founded case that 'the act of enclosing land must lead to its depopulation' (pg 430) though English historical evidence is complex (Crafts 1978). Marxist accounts (Thompson 1991, Bryer 2006) see enclosure and subsequent profit maximization as expropriating the surplus.

the models that follow[13].

$$C_B = B. \tag{8}$$

The specific factor T is land (Terrain), which cannot be accumulated, while capital K can be accumulated or borrowed from overseas. As in the Specific Factors model, mobile labour is allocated between rural production and urban industrial production, and no one saves anything prior to utility maximization. Any agricultural surplus finding its way to the owners of land is consumed and not invested. The consumption demands of landlords, capitalists, and workers are all derived from (4), a single representative-agent utility function. However, in the case of capitalists the preference for Steel is a derived demand, and in the close economy model, which we are coming to presently, they 'consume' steel by accumulating it. This is then equal to savings by definition.

We consider the process of development for a closed economy in Section 3.4 and then in Section 3.5 we model an open economy that can source global capital for its urban sector and pay for capital with exports.

3.4 Model setup for closed economy

Technology, preferences and endowments are given by (1) to (7). In a closed economy both goods are nontradable so consumption and production must coincide. Equation (8) states that Bread is always nontradable, but in this closed-economy version so is Steel.

$$C_S = S. \tag{9}$$

It is not possible to borrow capital from overseas, so accumulation must occur domestically. We follow Lewis in spirit at this point, and assume that the urban capitalists are the source of capital for the closed economy. However, as described above, capital is the capitalist's 'consumption' of steel in the previous period.

This is equivalent to exogenous capital accumulation, as in Eswaran and Kotwal (1993). Since preferences in (4) are homogenous of degree one the relative price

[13]Menzies et al. (2016) present input-output table evidence that Chinese rural output can be considered as nontradable, as an approximation.

of steel p is a function $\theta(\cdot)$ of $\frac{C_B}{C_S}$ where $\theta' > 0$. The inverse function also has a positive derivative, so the income expansion path (12) derived from the first order conditions is an upward sloping ray from the origin.

$$L = U + \lambda(income - p \cdot C_S - C_B) \tag{10}$$

$$U_{C_S} - \lambda p = 0$$

$$U_{C_B} - \lambda = 0$$

$$p = \frac{U_{C_S}}{U_{C_B}} = \theta(\frac{C_B}{C_S}) \tag{11}$$

$$C_B = C_S(\theta^{-1}(p)) \tag{12}$$

Substitution of (8) and (9) into (12) determines the relative price p that will clear the goods market.

$$B = S\theta^{-1}(p) \tag{13}$$

Thus, at any point on the Production Possibility Frontier (the ppf), B and S are substituted into (13) and this solves for p.

3.4.1 General Model solution for closed economy

Equations (1) to (3) generate a ppf $B = B(S)$ where $B' < 0$, which expands along the S axis as capital accumulates each period in the urban Steel-producing sector (figure 1). Every position on that ppf generates an autarky market-clearing relative price given by (13). Equations (5) to (7) determine a p that will clear the labour market for any production point. Solving a demand side price equation (based on equations (4), (8), (9), (11)–(13)) with a supply side price equation (based on (1)–(3), (5)–(7)) finds the unique relative price p which both clears the labour market (equating wages in both sectors) and is consistent with zero net demands for either good in autarky.

The pronumeral D in equation (5) rises to unity during a Lewis transition. If D is initially less than unity, labour is over-allocated towards Bread, because rural

workers receive more than their marginal revenue product, and the relative price of Steel is too high for the labour market to be efficient. This is not a 'kissing point' because the slope of the ppf (the marginal rate of transformation $= \frac{MPL_B}{MPL_S}$) is less than the relative price of steel (both in absolute value terms). On a diagram, the product-market-clearing equilibrium price will not be a point of tangency on the ppf. Instead, the budget set cuts the ppf, indicating labour is inefficiently allocated (see figure 2, point A).

In the special case where $D = 1$ in (5), the equating of value of marginal product in the labour market (7) guarantees the equality between the marginal rate of transformation and the relative price p, so that point is a proverbial 'kissing point' where the price ratio equals the marginal rates of transformation and substitution (as in figure 2, point B).

3.4.2 Illustrative Model solution for closed economy

We solve a version of the model, with Cobb-Douglas preferences and production with fixed one-half exponents for the latter. For ease of comparison with previous equations, we use the same equation numberings with asterisks where they specify a functional form for the original general function.

$$B = \sqrt{TL_B} \qquad MPL_B = 0.5\sqrt{\frac{T}{L_B}} \tag{1*}$$

$$S = \sqrt{KL_S} \qquad MPL_S = 0.5\sqrt{\frac{K}{L_S}} \qquad MPK = 0.5\sqrt{\frac{L_S}{K}} \tag{2*}$$

Together, these give a ppf: $B^2 = T(L - \frac{S^2}{K})$. Equations (5) – (7) are solved with the specific marginal products arising from (1*) and (2*).

$$pMPL_S = DMPL_B + (1 - D)APL_B \text{ or } p = \frac{B}{S}\frac{L_S}{L_B}(2 - D) \tag{7*}$$

and Cobb-Douglas preferences then imply (11*):

$$L = C_B^{\delta} C_S^{1-\delta} + \lambda(income - p \cdot C_S - C_B)$$

$$\frac{(1-\delta)U}{C_S} - \lambda p = 0$$

$$\frac{\delta U}{C_B} - \lambda = 0$$

$$p = \frac{(1-\delta}{\delta}\frac{C_B}{C_S} = \frac{(1-\delta}{\delta}\frac{B}{S} \tag{11*}$$

Solving (7*) and (11*) for p we obtain a full model solution:

$$B^2 = T(L - \frac{S^2}{K}) \tag{14}$$

$$L_S = \frac{(1-\delta)}{1+\delta(1-D)} \tag{15}$$

$$p = \sqrt{\frac{T(1-\delta)(2-D)}{K\delta}} \tag{16}$$

3.4.3 Lewis transitions for closed economy

In figures 1 and 2, we show the two types of adjustment that can cause labour to relocate from the rural to urban areas in this closed economy. We describe them without loss of generality, but make reference to our Cobb-Douglas model as a special case. Figure 1 shows the accumulation of capital in the urban sector. In this diagram we assume for simplicity that labour is paid its marginal revenue product in both sectors ($D = 1$ in (5)) at point A. As capital accumulates in the urban sector from time t to $t + 1$, the ppf shifts right as shown. (In our Cobb-Douglas model, the Steel axis intercept ($\sqrt{KL}$) expands rightward, obtained from setting $B = 0$ in (14)).

Whether labour moves out or in of the Bread sector then depends on how substitutable in consumption Bread and Steel are. We show capital accumulation pushing out the ppf and three possible autarky equilibria in figure 1. Equilibrium Bread is written as $B(T, L^{\eta}_{Bj})$ on the vertical axis, where η is the elasticity of substitution of consumption and j is time t or $t+1$. The elasticity of substitution is reflected in the curvature of the indifference curves, and we show $\eta = 0$ and

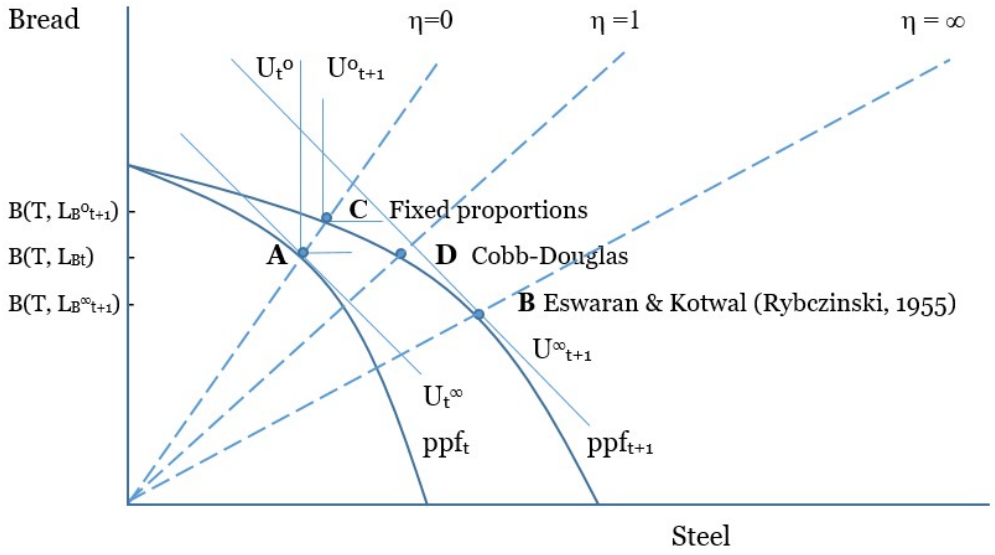

Figure 1: **Capital Accumulation Changes Labour Input for Bread**

∞ ($\eta = 1$ is suppressed) with the corresponding dashed income expansion paths (including $\eta = 1$). If they are infinitely substitutable, the indifference curves U^{∞} converge to straight lines as shown in figure 1, since the relative price change required to clear the goods markets is negligible (vanishingly, zero). For this case an application of Rybczinski's theorem (1955) implies that labour will move into the Steel sector to point B, and Bread output will fall because $B(L_{B^{\infty}_{t+1}}) < B(L_{B_t})$[14]. At the other extreme, if the goods are not substitutable at all, but must be consumed in fixed proportions, the indifference curves U^0 will be corners as shown in figure 1, and the price of Bread rises so much that labour is enticed *out of urban areas* into rural production such that production of both goods increase in equal proportions, at point C. In this case bread output will rise i.e. $B(L_{B^{)}_{t+1}}) > B(L_{B_t})$. Consideration of these polar cases allows us to interpret (15) from our illustrative model solution. The nonappearance of capital in the equation asserts that cap-

[14]With infinite substitutability (straight line indifference curves) the optimum occurs at the same relative price, and Rybczinski's theorem asserts that the tangency occurs with lower output in the sector without accumulation.

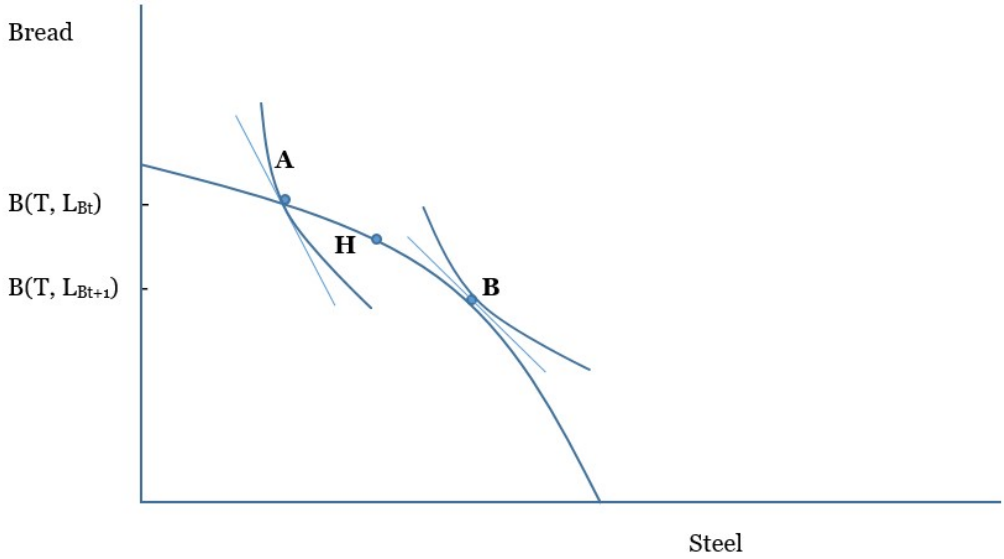

Figure 2: **The End of Overallocation**

ital accumulation does not cause rural emigration. That is, rural output and population is unchanged and the economy comes to rest at point D in figure 1 with no Lewis-style labour emigration to the city. The explanation lies in seeing the unit-elasticity-of-substitution Cobb-Douglas consumption preferences as a midway point between extremely substitutable consumption (point B) and its converse (point C). Generalizing, capital accumulation implies Lewis-style labour emigration only if Steel is fairly substitutable for Bread[15]. This result dovetails with Eswaran and Kotwal (1993) who claim that rural emigration is possible in autarky if consumption is substitutable, but we do not require an exogenous wage as they do. It seems to us that one would need good evidence to postulate a fixed real wage as development proceeds over many decades, and, as we noted earlier, Clark (2007) has questioned this for the industrial revolution in the UK and Gollin (2014) has questioned it more generally.

[15]The elasticity of substitution between factors also has a role to play. If labour is very substitutable for capital in the city, accumulation in the city needs less labour, attenuating the flow of workers from the country.

In figure 2 we isolate the movement of labour to the city caused by an end to an overallocation regime (D rising to unity in (5)) rather than capital accumulation. Both could be drawn on the same diagram, but it would be unreadable. With too much labour in Bread in a closed economy, the price of Bread has to be inefficiently low (equivalently, the price of Steel has to be inefficiently high) to clear the goods markets[16]. Figure 2 shows the relevant indifference curves (here assumed to have non-extreme substitutability) and the associated tangencies which determine the relative price p according to (13), $B = S\theta^{-1}(p)$. As labour makes its way to the urban Steel sector, the increase of Steel output and the fall of Bread output reduces the relative price of Steel.

In our Cobb-Douglas model the movement from A to B is seen in (15) and (16). As D rises to unity in (15) it is clear that L_S rises, and from (3) L_B must fall. From (16) the price of steel falls too.

It is possible to add probabilities of workers being paid nothing in the city such that labour will equilibrate at point H, as in Harris and Todaro (1970)[17]. In their model, rural workers contemplating moving to the city face a gamble over the urban wage and zero. Equilibrium equates the expected, rather than the actual, wage across sectors leaving an urban wage premium in place. As a result, the value of marginal product of labour allocated to Steel production is higher than it is for Bread in equilibrium, as is the case at point H[18]. The similarity between A and H is a feature of a general equilibrium model – the overallocation of rural workers (at A or H) can be sourced institutionally in either rural areas (by overpaying workers relative to the their marginal revenue product) or in urban areas (by offering workers a gamble over wages). In both cases inefficiency results

[16]This labour market inefficiency manifests itself in figure 2 in that for a given price p the choice set is not maximized on the ppf, as is the case when the choice set forms a tangency with the ppf.

[17]One would have to make assumptions about the productive status of the urban unemployed.

[18]Their budget set and indifference curves (not shown) are a less steep version of A. Their model explains an actual wage gap, which is an empirical reality exhibited in Table 1. It would be possible to incorporate Harris and Todaro's insight into our model; in equation (6) one would pre-multiply the RHS by the probability x of obtaining the urban wage and relabel the LHS as the expected urban wage. Setting the rural wage equal to the expected urban wage in the Cobb-Douglas model in (7*) results in $L_S = \frac{(1-\delta)}{1-\delta+\frac{\delta}{x}(2-D)}L$ and L_S is increasing in x, the probability of receiving the urban wage.

from a *relative* difference in the treatment of labour across both sectors.

Figures 1 and 2 tell a parsimonious story which will, barring extreme non-substitutability between rural and urban consumption, result in a Lewis-style emigration of labour to the cities. Figure 1 adds the notion that under extreme non-substitutability capital accumulation could even see workers drawn away from the city. We suspect the insight that in autarky a lack of substitutability slows down emigration to the city when the economy grows is probably more valuable than the theoretical possibility that workers could actually be drawn into rural production. We are not aware of the latter transpiring in any real economy.

3.5 Model setup for open economy

As for the closed economy, technology, preferences and endowments are given by (1)–(7). However, in an open economy only Bread is always nontradable, so (9) ceases to hold, and any net demand of Steel is traded away with the world at a constant Steel price. Although it would be possible to have domestic- and overseas-sourced capital, for analytic simplicity capital is borrowed from the rest of the world and there are no longer any domestic capitalists. The interest payments on capital are made with Steel exports, so the (negative) net demand for Steel is exported. Capital is supplied infinitely elastically from the world to the urban sector in such a way as to equalize the marginal revenue product of capital to the world required rate of return r^*.

Being able to trade away the Steel surplus is of great consequence for our understanding of development within the Lewis model, because the economy is not flooded with steel as development proceeds, as was the case in autarky. In the previous model, the resultant rise in the relative price of Bread (the flipside of a collapse in the Steel price) holds back workers in the rural sector or even, with extreme non-substitutability in consumption during capital accumulation, recruits urban workers back into rural areas.

3.5.1 General model solution for open economy

We specify the exogenous price of steel explicitly as p_S because we want to create an explicit pronumeral for the price of nontradable Bread p_N – our measure of the real exchange rate. The world rate of return exogenously ties down the capital-labour ratio in the steel sector.

$$r^* = p_S MPK(\frac{K}{L_S}) \quad \Leftrightarrow \frac{K}{L_S} = MPK^{-1}(\frac{r^*}{p_S}) \tag{17}$$

As before, wages in the economy are equalized by the movement of workers. Workers in Steel are paid their value of marginal product and workers in Bread are paid in excess of this (unless $D = 1$). With constant returns to scale both the marginal and average products in (5), now premultiplied by an explicit pronumeral p_N, are functions of the land–labour ratio.

$$\begin{aligned} w_B &= Dp_N MPL_B + (1-D)p_N APL_B \\ &= p_N(D \cdot MPL_B + (1-D) \cdot APL_B) \qquad (18) \\ &= p_N f(\frac{T}{L_B}) \qquad \frac{\partial f}{\partial D} < 0 \qquad (19) \end{aligned}$$

Both MPL_B and APL_B will be increasing functions of the land-labour ratio, and the sign of the partial derivative follows because, as we noted before, constant returns to scale imply that the average product of labour exceeds the marginal product. Therefore putting more weight on the marginal product must *ceteris paribus* reduce the bracketed convex combination in (18). We equate (19) to (6) with the capital-labour ratio from (17) with an explicit p_S substituted into (6), to obtain a supply relation which says that a higher non-traded price will call forth more Bread production (as L_B rises). The numerator of the resultant supply relation will be a constant:

$$p_N f(\frac{T}{L_B}) = p_S MPL_S(\frac{K}{L_S}) = p_S PML_S(MPK_S^{-1}(\frac{r^*}{p_S}))$$
$$p_N = \frac{p_S PML_S(MPK_S^{-1}(\frac{r^*}{p_S}))}{f(\frac{T}{L_B})} \tag{20}$$

This supply relation will shift up as D rises through the Lewis continuum from zero to unity. That is, as the rural sector is commercialized – going from sharing output ($D = 0$) to workers being paid the value of marginal product ($D = 1$) – the curve in p_N x L_B space rises.

The consumption solution is similar to before, except that we write (11) with an explicit price ratio:

$$\frac{p_S}{p_N} = \frac{U_{C_S}}{U_{C_B}} = \theta(\frac{C_B}{C_S}) \tag{21}$$

and the income available for consumption is net of interest payments abroad. Coming as it does from the demand side, and noting that θ is an increasing function, it is no surprise that (21) represents a decreasing relationship between relative prices $\frac{p_S}{p_N}$ and the inverse ratio $\frac{C_S}{C_B}$, namely $\theta((\frac{C_S}{C_B})^{-1})$. In an open economy net demand for Steel is no longer zero, so one can no longer infer (13) from (11). Instead, Bread production in (21) is set equal to consumption from (8) and rearranged to give us (22).

$$p_N = \frac{p_S}{\theta(\frac{B}{C_S})} \tag{22}$$

We cannot set C_S equal to S in an open economy but we can provide an expression for it by considering the income available for consumption. We use Euler's theorem that the payment to factors exhausts output in the case of constant returns to scale, together with the fact that the only part of steel production generating income for domestic factors is what is left after paying return r^* per item of capital.

$$income = (p_S S - r^* K) + p_N B = (p_S S - p_S MPK_S K) + p_N B = (p_S MPL_S L_S) + p_N B$$

So from the budget identity in the Lagrangian (10), and noting (8):

$$income = (p_S MPL_S L_S) + p_N B = p_S C_S + p_N C_B$$

$$C_S = MPL_S L_S = MPL_S(\frac{K}{L_S})(L - L_B) \tag{23}$$

The capital-labour ratio in (23) is determined by the world rate of return and the steel price, from (17), so after making this substitution we further substitute (23) into (22).

$$p_N = \frac{p_S}{\theta(\frac{B[T,L_B]}{MPL_S(MPK_S^{-1}(\frac{r^*}{p_S}))(L-L_B)})} \tag{24}$$

On the RHS an increase in L_B will raise the numerator in the bracketed term and reduce the denominator, causing a rise in the whole bracketed term. Since θ is an increasing function, the rise in L_B creates a negative (relative demand) relation between the price and quantity of the nontraded good. Thus, within this open economy what appears to be a partial equilibrium demand curve (24) is actually consistent with general equilibrium.

3.5.2 Illustrative model solution for open economy

We now solve the model using the illustrative Cobb-Douglas specification. Production and preferences are the same for the closed and open versions, so we use (1*), (2*) and (11*) from section 3.4.2. The marginal product of capital and labour market equilibrium take specific functional representations as follows:

$$\frac{K}{L_S} = MPK^{-1}(\frac{r^*}{p_S}) = (\frac{p_S}{2r^*})^2 \tag{17*}$$

$$w_S = p_S MPL_S = \frac{p_S^2}{4r^*} \tag{6*}$$

$$w_B = Dp_N MPL_B + (1-D)p_N APL_B = p_N\sqrt{\frac{T}{L_B}}(1-\frac{D}{2}) \tag{18*}$$

Setting (6*) and (18*) equal to each other we obtain our supply relation.

$$p_N = \sqrt{\frac{L_B}{T}}\frac{\frac{p_S^2}{4r^*}}{(1-\frac{D}{2})} \tag{20*}$$

This is clearly upward sloping in Bread production, since the RHS is increasing in L_B. Furthermore, as in (20), an increase in D as the rural sector pays workers closer to their marginal product will shift up this curve for every value of L_B. It is also easy to see the downward sloping demand relation in our Cobb-Douglas model equation.

$$p_N = \frac{\delta}{1-\delta}\frac{\frac{p_S^2}{4r^*}(L-L_B)}{\sqrt{TL_B}} \tag{24*}$$

When the model is solved by setting (20*) equal to (24*) we obtain the following:

$$L_B = \frac{2-D}{\frac{2}{\delta}-D}L, \qquad L_S = l - L_B \tag{25}$$

$$p_N = \frac{\frac{p_S^2}{2r^*}\sqrt{\frac{L}{T}}}{\sqrt{(\frac{2}{\delta}-D)(2-D)}} \tag{26}$$

From (25) a move towards paying farmers their marginal product (increasing D) unambiguously motivates labour to leave rural areas. This follows because $\frac{2}{\delta}$

is larger than 2 so a rise in D delivers a greater proportional reduction in the numerator. It might be supposed from (26) that capital accumulation does not cause the price of bread to rise, since K does not appear explicitly, but we recall that capital accumulation is endogenous in this model, and that the capital-labour ratio in urban areas is constant from (17*). Thus, an increase in D sends workers to the city (from (25)) and as they arrive they are equipped with capital borrowed from overseas. It is the modernization of agriculture that causes (global) capital inflow rather than exogenous capital accumulation driving the rural emigration.

3.5.3 Lewis Transition for open economy

Equipped with (20) and (24) we are in a position to track the general equilibrium effects of agricultural reform such that labour is increasingly paid on a marginal- rather than average-product basis. In figure 3 reform of the agricultural sector (a rise in D) raises the supply relation, as shown. Thus reform of the agricultural sector together with labour mobility leads to an appreciation of the real exchange rate (p_N) and labour emigration to the city (a fall in L_B).

With the capital–labour ratio determined by the exogenous required rate of return (see (17)), the labour arriving in the urban areas is equipped with overseas capital, keeping the capital labour ratio constant. It is important that this story from the illustrative model (equations (20*) and (24*)) survives generalization (equations (20) and (24)). The modernization of agriculture that causes (global) capital inflow rather than exogenous capital accumulation driving the rural emigration. Thus the Lewis comovement is maintained – capital accumulation in the city and labour emigration from the country – only in the open economy version of the model it is the labour flow which causes the capital accumulation rather than the other way around.

This is one of the mechanisms in Menzies et al. (2016), who attribute some capital accumulation on Eastern seaboard in China to the dismantling of the Hukou system. Accounts like these, together with the Green Revolution, give plausibility to Gollin's (2014) caution against 'capital fundamentalism'.

The open economy model in this section describes a brighter development sce-

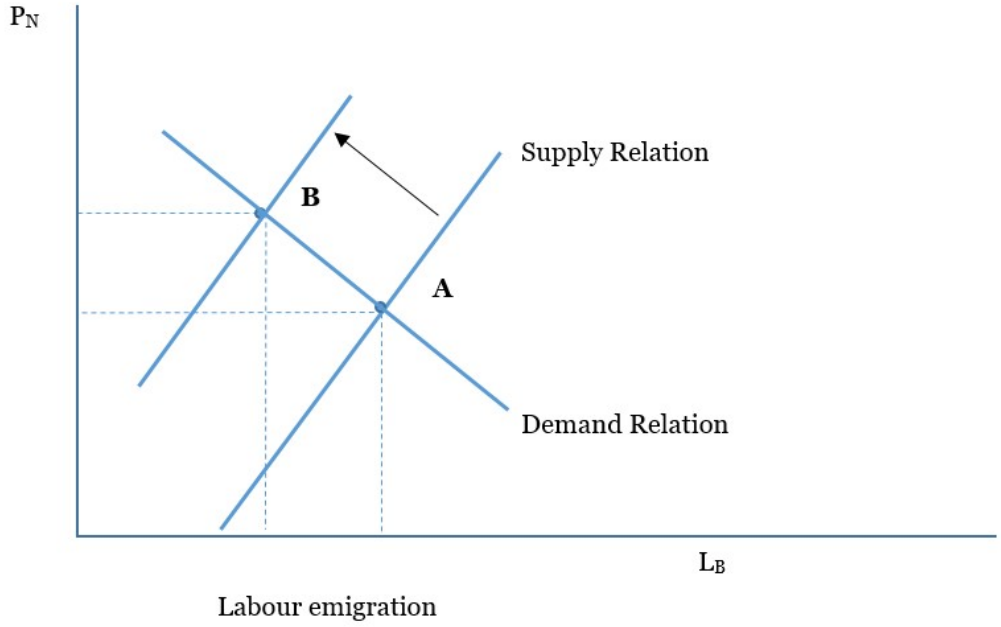

Figure 3: **Labour Emigration to City Causes Capital Inflow**

nario than the autarky model, since development is not held hostage to the consumption elasticity of substitution. Informally, there is the option to export urban goods, avoiding a glut. Lewis himself saw this problem in his original article when he flagged '... the expansion of the capitalist sector may be stopped because the [relative] price of subsistence goods rises...' (Lewis, 1954, page 175) though he stopped short in his original article of advocating overseas capital as one solution.

4 Conclusion

Simple economic models all face the challenge of what might be called *Essentialism*. With each proposed change to the model, which after all is designed to give insights at the level of approximation and generalization, Essentialism dictates that an informal cost benefit analysis be conducted to determine if the proposed change is really essential, given the benefit of extra insight received.

It seems to us that what is essential for the main insights of the Lewis model are the assumptions highlighted by Gollin (2013), and borrowed by us in this paper. These are; a sharing of output in agriculture in the pre-industrial state (modelled here by paying a convex combination of the average and marginal product of labour), and; dualism, such that an increase in capital in the industrial sector, which may cause or be caused by the movement of labour, does not spill over into the agricultural sector. With these essential features, and these alone, we have been able to turn the Lewis model into something recognizable as a neoclassical trade model.

The rapprochement model has given us an interesting picture of a Lewis transition which begins in a faltering way, depending as it does on the elasticity of consumption in a closed economy. In the autarky version we have confirmed the importance of substitutability in consumption as an aid to Lewis transition (Eswaran and Kotwal 1993). As Lewis himself flagged, if the economy is flooded with industrialized goods and their price drops, farming can remain relatively attractive, slowing down rural emigration. But when the economy opens, and overseas capital is involved, economic development gathers pace. The substitutability of consumption can no longer halt the Lewis labour movement since any glut in industrial goods can be exported away. Thus we have been able to add a further phase to the traditional analysis – the point at which the urban output becomes tradable for overseas capital. Relatedly, we have been able to connect the Lewis model to open economy macroeconomics, and predict that Lewis style emigration leads to a real exchange rate appreciation.

Over the long time horizons of economic development, where wages and real exchange rates might be expected to respond to profound changes in the structure of the economy, and where such changes are of profound interest to economists and policymakers, it seems to us that neoclassical analysis has more merit than Lewis allowed. Indeed, development is a long-term business, and although we have followed Lewis by not using the Swan-Solow paradigm, we respect their intuition that it is precisely over such long time horizons that one might expect neo-classical analysis to be at its best. For such time horizons, our rapprochement trade model

makes dual economy models both simpler, and richer.

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