Growth and wage inequality in a dual economy*

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Abstract

Who benefits from economic growth? This paper analyses the distributional impact of different types of growth within a two-sector model. The paper first presents necessary and sufficient conditions for unambiguous changes in wage inequality in a dual economy, based on analysis of the entire Lorenz curve. These conditions are then applied to the Harris-Todaro model with an urban non-agricultural sector and rural agriculture. It is shown that capital accumulation or technical progress in agriculture can shift the Lorenz curve inwards and reduce wage inequality, while the effects of development in non-agriculture are typically ambiguous.

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1 Introduction

Who benefits from economic growth? Interest in this question has been revitalized, partly by the anti-globalization backlash, and partly by the increasing availability of relevant data. Based on these new data, there is evidence that the effects of growth on inequality and poverty can vary widely across countries (Ravallion 2001). This variation points to a need to differentiate between alternative types of growth and their distributional consequences. The current paper makes a contribution to this emerging line of research.

The starting point is a two sector model, with rural agriculture as one sector and urban manufacturing and services as the other. Obviously, technical progress or capital accumulation in agriculture may have distributional effects that differ from those in the non-agricultural sector. A naive argument would be that growth in the non-agricultural sector raises living standards in urban areas, and that agricultural growth improves conditions in rural areas. Yet we have known since at least Harris and Todaro (1970) that a general equilibrium analysis is needed. When workers can move between sectors, what is happening in one sector will have consequences for the other. Such interdependence is not simply a theoretical curiosity. For example, Ravallion and Datt (1996) find that rural growth in India seems to have benefited the urban poor as well as the rural poor.

The framework introduced by Todaro (1969) and Harris and Todaro (1970) has long been an attractive way to analyse the interaction of rural and urban sectors. The framework can explain why rural-urban migration may persist in the presence of high urban unemployment, and neatly reveals one form of sectoral interdependence in living standards. For these reasons, the basic structure of the model continues to have some influence within development economics. A large literature has developed that seeks to generalize or extend the framework, or sometimes, to develop alternatives that make use of the same fundamental principles, as in Fields (1989).[1]

An odd feature of the research following Harris and Todaro (1970), however, is that it has rarely examined the implications of dualism for inequality. This omission is surprising, because one of the interesting components of the model is a rural-urban wage differential that is endogenously determined. Kuznets (1955) saw the rural-urban wage differential as an important component of overall inequality in poorer countries. This view has been supported by the empirical work of Bourguignon and Morrisson (1998), who find that an index of labour

[1] The basic ideas are also influential in the regional science literature. See Allen (2001) and Ingene (2001).

market dualism, used as a proxy for the intersectoral wage differential, can explain some of the variation across countries in the extent of inequality. More recently, Eastwood and Lipton (2004) have investigated, for a number of countries, whether convergence between the rural and urban sectors can sometimes offset rising inequality within each sector.

With all this in mind, the current paper aims to shed light on the distributional consequences of different types of growth, using a version of the Harris-Todaro model due to Corden and Findlay (1975). The simplicity of the model allows inequality to be analyzed very easily in terms of movements in Lorenz curves. Compared to much existing work, this is a more general approach, because the findings are not tied to specific summary measures of inequality.

The paper makes two main contributions. Through the use of Lorenz curves, the paper derives necessary and sufficient conditions for unambiguous changes in wage inequality to occur in the Harris-Todaro model. It turns out that these conditions have an interesting and useful property. They depend upon just two variables, the urban unemployment rate and the number of unemployed. If we know the effect of a given change in circumstances - say, productivity growth in agriculture - on the urban unemployment rate and the number of unemployed, then we also know the effect on overall wage inequality. As I will discuss below, these results are potentially of interest beyond poorer countries, because they could also be used to analyse wage inequality in the context of primary and secondary labour markets in developed countries.

The conditions for unambiguous changes in wage inequality lead naturally to the second main contribution of the paper, namely to examine the distributional consequences of various types of economic development, and a few of the policy interventions suggested in the literature.[2] As Fields (2002) points out, since the simple Harris-Todaro model is a special case of more general ones, this can offer some insight into what kind of results can be expected from more complex models of dual economies. The analysis allows us to distinguish between cases where general results may be possible, and cases where theoretical models are likely to yield ambiguous results, because the old and new Lorenz curves intersect.

In the model considered here, capital accumulation and technical progress in agriculture are both found to reduce wage inequality unambiguously. The reason is not simply that rural growth lowers the wage gap between urban and rural workers, because there is also a reinforcing general equilibrium effect. In the long-run migration equilibrium, an improvement in the prospects of agriculture

[2]The conditions I derive have also been used for this purpose in work by Fields (2002), which explicitly builds on an earlier draft of this paper.

lowers the urban unemployment rate and the overall number of unemployed. Therefore, rural growth lowers inequality not only between those in work in the two sectors, but also between the employed and unemployed. The paper shows how these effects combine to yield an inwards shift of the entire Lorenz curve, which is an unusually strong result.

Another finding is that the distributional effects of economic development in the urban (modern) sector are often ambiguous, even in a simple model. Again the intuition is relatively simple, and familiar from the well-known Todaro paradox. Given capital accumulation or technical progress in the modern sector, there is a rise in the demand for labour by that sector at any given wage. The change in prospects in the urban area creates migration, potentially increasing the number of unemployed and hence wage inequality. Since this mechanism is also likely to be at work in more general models, the analysis indicates that few general results are likely concerning the distributional effects of productivity growth in non-agriculture.

It is important to clarify, at the outset, the sense in which this exercise sheds light on the distributional consequences of growth, and the sense in which it does not. The analysis assumes a fixed wage in the urban sector, perhaps enforced by minimum wage legislation, for example. This means that we can learn about the distributional consequences of a step increase in total factor productivity in one of the sectors, or in its capital stock, if the wage floor in the urban sector remains unchanged. To give a concrete example, we can identify what the consequences of a productivity shock, such as the Green Revolution in agriculture, would be in the absence of any adjustment to the urban wage.

With this in mind, the term 'growth' in this paper is intended to refer to these step changes in productivity, and does not signify the entire and lengthy transition from poverty to riches.[3] Over the course of such a transition, the assumption of a fixed urban wage would be increasingly untenable. Hence the present analysis will not shed much light on the effects of long-run development on inequality, nor will it shed a great deal of light on the possible existence of a Kuznets curve. Such an analysis would require the urban wage to be endogenously determined. Unfortunately, as pointed out by Svejnar (1989), wage and employment determination in the modern sector of developing countries is one of the least well understood areas in development economics. Until these issues are better understood, it will be hard to develop a full theory of the evolution of inequality to be expected as countries develop over the course of several decades.

[3] In this respect, the paper has far more in common with analyses by trade theorists, notably Corden and Findlay (1975), than with models in the growth theory literature.

This paper's goals are accordingly much less ambitious.

The remainder of the paper is structured as follows. Section 2 uses the Lorenz curve to derive sufficient conditions for unambiguous changes in wage inequality. Section 3 puts these conditions to work, in exploring the distributional effects of capital accumulation and technical progress in agriculture and non-agriculture. The remainder of the analysis examines the distributional implications of various policies (section 4) and the extent to which more general assumptions will modify the results (section 5). Section 6 provides further discussion, with a particular focus on the interpretation of the results. Finally, section 7 concludes.

2 Movements in Lorenz curves

This section derives the conditions under which the Lorenz curve will shift inwards or outwards along its entire length, within a simple version of the Harris-Todaro model. The use of Lorenz curves ensures that the conclusions are not tied to specific inequality measures. The potential strengths of such an approach were demonstrated by Bourguignon (1990) using a more sophisticated model than the one considered here.

The framework in the present paper is standard. Risk-neutral individuals decide between working in rural agriculture or looking for work in urban areas. The agricultural labour market clears, and workers receive a wage w_a. In urban areas, workers will either be employed for a wage (w_m) fixed above the market clearing level, or unemployed with zero income. All those looking for work in urban areas have an equal likelihood of finding work in each period, so that individuals are employed with probability $(1-u)$ and unemployed with probability u, where u is the unemployment rate in the urban sector (the proportion of the urban labour force who are unemployed). I also adopt the standard simplification that the price of agricultural goods relative to non-agricultural goods is exogenously fixed, as in a small open economy in which both goods can be traded internationally.[4] Without loss of generality, units for the two outputs are chosen so that the relative price is equal to one.

Workers migrate between sectors unless the expected wage in the urban sector is equal to the rural wage. Hence in equilibrium, we have the Harris-Todaro migration equilibrium condition:

$$w_a = (1-u)w_m \tag{1}$$

The total number of workers is normalized to one. The proportions employed

[4] Bourguignon (1990) considers a model where the internal terms of trade are endogenous.

in agriculture, employed in the urban (modern) sector, and unemployed are given by L_a, L_m and L_u respectively. For future use, it is helpful to note that

$$L_u = u(1 - L_a) \tag{2}$$
$$L_m = (1 - u)(1 - L_a) \tag{3}$$

Mean wage income μ is given by

$$\mu = w_a L_a + w_m L_m = w_a \tag{4}$$

where the second equality follows from use of (1) and (3).

We are now in a position to analyze the Lorenz curve. Assume that individuals only receive income from wages. The Lorenz curve will clearly be piecewise linear with two kinks, as in figure 1. Segment one is based on the income (zero) of the unemployed, segment two on the income of those in agriculture, and segment three on the income of those working in the modern sector.

It is easy to show that the slope of each segment of a Lorenz curve is given by the ratio of that group's wage to the average wage of the whole population.[5] In this case, the slope of each segment will be given by the ratio of that group's wage to the agricultural wage, by (4) above. In particular, note that whatever the distribution of income, the slope of segment two is fixed at unity, given that the wage in agriculture is equal to the mean wage of the whole population.

We can now derive two necessary conditions for an unambiguous increase in wage inequality, represented by an outward shift of the entire Lorenz curve. First, the number of unemployed should increase or stay the same. Secondly, the slope of segment three should also increase or stay the same. If we use a subscript to discriminate between two time periods, so that for instance w_{at} means the rural wage at period t, the two conditions can be written as:

$$L_{u2} \geq L_{u1} \tag{5}$$
$$\frac{w_{m2}}{w_{a2}} \geq \frac{w_{m1}}{w_{a1}} \tag{6}$$

Furthermore, since the slope of segment two is fixed at unity, it should be clear from figure 1 that if both these inequalities hold and one holds strictly, that will be sufficient for an unambiguous increase in inequality.

Using (1), the inequality (6) can be simplified as follows:

$$\frac{1}{1 - u_2} \geq \frac{1}{1 - u_1}$$
$$\text{or } u_2 \geq u_1$$

[5] Bourguignon (1990) provides a formal derivation of this result.

Hence necessary and sufficient conditions for an unambiguous rise in wage inequality in the Harris-Todaro model are very simply stated. If one of the following statements holds, inequality will rise:

(U1) the urban unemployment rate rises, and the number of unemployed goes up.

(U2) the urban unemployment rate is constant, and the number of unemployed rises. Modern sector employment rises, and agricultural employment falls.

(U3) the urban unemployment rate rises, and the number of unemployed is constant. Modern sector employment falls, and agricultural employment rises.

A symmetric analysis can be used to derive the necessary and sufficient conditions for the Lorenz curve to shift inwards, and hence for inequality to be unambigously reduced. Inequality falls if one of the following statements holds:

(D1) the urban unemployment rate falls and the number of unemployed goes down.

(D2) the urban unemployment rate is constant, and the number of unemployed goes down. Modern sector employment falls, and agricultural employment rises.

(D3) the urban unemployment rate falls, and the number of unemployed is constant. Modern sector employment rises, and agricultural employment falls.

These conditions indicate that, to know what happens to inequality in the Harris-Todaro model, all we need to know is the urban unemployment rate and the number of unemployed. Together, these two variables capture all the information in the Lorenz curve. The conditions also indicate that only knowing the direction of change of employment in the modern sector or agriculture does not allow us to draw conclusions about inequality. In particular, urbanization, which corresponds to a fall in agricultural employment, can potentially be associated with a rise or fall in wage inequality.

The main conclusion, that only the urban unemployment rate and the number of unemployed matter, can be seen more explicitly if we consider a Lorenz-consistent summary measure of inequality. For instance, in this model, the Gini coefficient is given by:

$$G = \frac{L_a L_m (w_m - w_a) + w_a L_u}{w_a}$$

as derived in Gupta (1988). In the present context, this expression can be simplified further using equations (1), (2) and (3). The following are all valid

expressions for the Gini coefficient:

$$\begin{aligned} G &= u(1 - L_a^2) && (7) \\ &= L_u(1 + L_a) && (8) \\ &= L_u(2 - \frac{L_u}{u}) && (9) \end{aligned}$$

Differentiation of (9) confirms that the Gini coefficient is increasing in L_u and u, in line with the conditions derived above. It should be emphasized at this point that expressions like (7) will not be a good indicator of inequality in empirical applications, because they ignore inequality within the rural sector, and under-estimate that within the urban sector. Unsurprisingly, back-of-the-envelope calculations show that the expressions above do not yield Gini coefficients of the magnitude actually observed. This does not preclude them from being useful in the theoretical analysis of inequality, social welfare, and shadow wages.

This framework could also be used to analyse poverty, as in Fields (2002), if we follow that paper and that of Ravallion (2002) in drawing a fixed poverty line z between the initial rural wage and the urban wage (so that $w_m > z > w_a$). In a version of the model where the rural wage is constant, the assumed poverty line implies that all the rural workers and the urban unemployed will always be classed as poor. In turn, this implies that the national incidence of poverty, on a simple head-count measure, always moves inversely with modern sector employment.

In a model where the rural wage can vary, it is possible that an increase in the rural wage could lift more people above the poverty line. Sufficient conditions for poverty to remain constant or decline are that modern sector employment is stable or increasing, and the urban unemployment rate is stable or decreasing. The latter requirement follows directly from the Harris-Todaro condition (1) and a fixed urban wage. For a lower urban unemployment rate, the Harris-Todaro equilibrium condition requires a higher rural wage. Poverty may then decline if the rural wage rises above the poverty line, and will certainly decline if modern sector employment has also increased.

3 Economic growth and distribution

The results in this section are the second main contribution of the paper. Using the conditions derived above, I analyze the effects of various kinds of growth on wage inequality, now treating the urban unemployment rate and the number of unemployed as endogenous variables.

The analysis considers the effects of productivity gains and capital accumulation in agriculture, and in the urban sector. One of the most striking findings is that rural growth has an unambiguously beneficial impact on wage inequality. In contrast, the effect of growth in the urban sector is typically ambiguous. As noted previously, for the purpose of this analysis, 'growth' should be interpreted as reflecting a step change in productivity or the capital stock, of the kind often studied by trade theorists, rather than the entire and lengthy transition from underdevelopment to industrialization.

I will distinguish between two cases: a model with sector-specific capital, and one with capital that is mobile between the urban and rural sectors. For simplicity, I will ignore the distribution of capital income, and focus on the effects of growth on wage inequality.

3.1 The model with sector-specific capital

It turns out that it is relatively straightforward to use (U1)-(U3) and (D1)-(D3) to study wage inequality in the Harris-Todaro model with sector-specific capital. We can base the analysis around a simple and now well-known diagram introduced by Corden (1974) and Corden and Findlay (1975), shown here as figure 2.

MM' is the marginal product curve in the modern sector, AA' that in agriculture. The ingenious feature of the Corden diagram is the rectangular hyperbola QQ'. The intersection of QQ' with AA' represents an equilibrium in which the Harris-Todaro equilibrium condition (1) is satisfied. To see this, note that the area under the curve at this intersection is equal to $w_a(1 - L_a)$ or alternatively $w_a(L_m + L_u)$. Given that the QQ' curve is a rectangular hyperbola, this area must be equal to the area under the curve at point H, namely $w_m L_m$. It is easy to show that equality between the area $w_m L_m$ and the area $w_a\,(L_m + L_u)$ implies that the Harris-Todaro equilibrium condition (1) is satisfied at the intersection of QQ' with AA'.

This diagram is now used to analyze the effects of growth on wage inequality. Assume that the urban wage rate is fixed, and that returns to labour in agriculture are diminishing, so that AA' slopes downwards. Capital accumulation or technical progress in agriculture will shift AA' upwards and raise the agricultural wage. By (1), the urban unemployment rate must be lower in the new equilibrium. Since modern sector employment is unchanged, while agricultural employment goes up, the number of unemployed must fall. With a fall in both the urban unemployment rate and the number of unemployed, it is clear that growth in the agricultural sector leads to an unambiguous reduction in wage

inequality. The incidence of poverty (as defined in section 2 above) must either decline or remain stable, because modern sector employment is unchanged, while the rural wage has risen.

Now consider the case of capital accumulation or technical progress in the modern sector. The demand for labour at any given wage increases. MM' and QQ' shift upwards, so modern sector employment goes up, rural employment goes down, and the rural wage rises. In the new equilibrium the urban unemployment rate will be lower, again by (1). This means that growth in the modern sector cannot generate an unambiguous rise in wage inequality, given diminishing returns in agriculture. What happens to inequality will depend on whether the number of unemployed goes up or down. If it does not rise, there will be an unambiguous reduction in wage inequality. Otherwise, the old and new Lorenz curves will intersect. In contrast, poverty must decline, because modern sector employment has risen, as has the rural wage.

I now consider the interesting and simpler case where labour is the only input in agriculture and returns to it are constant, so that the AA' line is horizontal. Technical progress in agriculture shifts the AA' line upwards. With unchanged labour demand in the modern sector, employment in the modern sector stays the same, while agricultural employment and wages go up. The number of unemployed must be lower in the new equilibrium, as is the urban unemployment rate. There is again an unambiguous reduction in inequality. Poverty must remain stable (if the rural wage remains below the poverty line) or decline (if the wage rises above the poverty line).

Capital accumulation or technical progress in the modern sector shifts the MM' and QQ' curves upwards. With both the agricultural and modern sector wages constant, the urban unemployment rate must be constant. Modern sector employment will be higher in the new equilibrium, and agricultural employment lower. For the urban unemployment rate to remain constant, the number of unemployed must rise. Using condition (U2) above, this is sufficient for an unambiguous rise in wage inequality. Note, however, that the incidence of poverty declines, because modern sector employment has increased. Conversely, the total number of urban unemployed and rural workers must have decreased.

3.2 The model with mobile capital

I now turn to the case of the Harris-Todaro model with mobile capital, drawing heavily on the classic analysis of Corden and Findlay (1975). They point out that when capital is mobile between sectors, an increase in the aggregate capital stock or a change in the size of the labour force will leave the urban unemployment

rate unchanged. Thus, when factor endowments vary and the economy remains incompletely specialized, it is only movements in the number of unemployed that determine the outcome for wage inequality. Similarly, only movements in modern sector employment determine the incidence of poverty, because the fixed urban unemployment rate implies no changes in the rural wage.

I follow Corden and Findlay in assuming that the modern sector is relatively capital intensive. With this assumption, Corden and Findlay show that capital accumulation will increase the number of unemployed, even though the urban unemployment rate remains constant. By condition (U2) above, this yields a rise in inequality. Modern sector employment must also be higher in the new equilibrium, otherwise the urban unemployment rate would not be constant. The incidence of poverty falls, due to the higher modern sector employment. Hence capital accumulation is associated with greater inequality, increased urbanization and lower poverty.

As pointed out by Corden and Findlay, the effects of capital accumulation may be modified by land scarcity. This is considered in more detail by Yabuuchi (1998). He concludes that, under certain conditions, capital accumulation may decrease the number of unemployed. Hence in a more general model, it may well be difficult to draw firm conclusions about the effect of capital accumulation on inequality.

In the simpler model without land, the effects of technical progress in either the agricultural or the modern sector can also be analyzed. Now, the urban unemployment rate may vary. Corden and Findlay indicate that Hicks-neutral technical progress in agriculture raises rural employment, and lowers modern sector employment, the urban unemployment rate and the number of unemployed. Using condition (D1) above, this is sufficient for an unambiguous reduction in wage inequality. The effect on poverty is ambiguous: fewer people are employed at the modern sector wage, but the rural wage has potentially risen above the poverty line.

Corden and Findlay also show that Hicks-neutral technical progress in the modern sector has the reverse effect. Modern sector employment rises and rural employment falls. The urban unemployment rate and the number of unemployed are higher than before, so inequality must rise.[6] The increase in modern sector employment corresponds to a decline in poverty on a simple head-count measure, although those remaining in agriculture are now worse off than before.

[6] Beladi and Naqvi (1988) show that the conclusions about the rate of unemployment apply to other forms of technical progress in manufacturing or agriculture, not just Hicks-neutral.

3.3 Summary of the results

The main results of this section can be summarised as follows. In all the cases considered, technical progress in agriculture leads to an inwards shift of the entire Lorenz curve. The reason is not simply a reduction in the intersectoral wage gap between those in work in urban and rural areas. There is also a reinforcing general equilibrium effect. In the new migration equilibrium, growth in the agricultural sector implies that the extent of inequality between the employed and unemployed is lower than before.

The effect of technical progress in the modern sector is more complex, and depends on the underlying assumptions. There will be an unambiguous rise in wage inequality if capital is mobile across sectors, or if capital is sector-specific and returns in agriculture are constant. With sector-specific capital and diminishing returns in agriculture, the urban unemployment rate falls. The Lorenz curve will shift inwards, or intersect with the old one, depending on whether the number of unemployed goes up or down. The reason for this complexity is again general equilibrium effects. An improvement in prospects in the urban sector encourages migration from agriculture, and this affects the extent of unemployment, and hence the extent of inequality between the employed and the unemployed.

Other interesting results concern urbanization, defined here as a fall in rural employment, corresponding to an increase in the urban labour force. In most of the cases considered, falling rural employment will occur at the same time as unambiguous increases in wage inequality. The exception is urbanization driven by capital accumulation or technical progress in the modern sector, in the case with diminishing returns to agricultural labour and sector-specific capital. Then reductions in wage inequality may occur at the same time as urbanization.

4 Distributional effects of policy intervention

The model introduced by Harris and Todaro (1970) has often been used to consider various policy interventions. One omission in this literature is that it typically concentrates on aggregate output, and ignores distributional effects. This section will show that policy changes which fall short of achieving the first-best may in fact lead to a rise in wage inequality, suggesting an ambiguous effect on social welfare. For simplicity, I focus on the case of sector-specific capital.

The first observation is that inequality in the model arises only because of unemployment, which in turn arises because of the exogenously fixed wage in the urban sector. One reason the urban wage may be fixed is through minimum

wage legislation, under the control of the government. It is therefore interesting to consider the distributional impact of lowering this wage, and section 4.1 below will study this issue.

The urban wage may, however, be rigid downwards for reasons other than minimum wage legislation. With this in mind, various authors have considered a range of policy interventions that take the wage received by urban workers as exogenously fixed. Policies that can potentially eliminate unemployment altogether include a modern sector wage subsidy (Srinivasan and Bhagwati 1975), an agricultural wage subsidy (Corden and Findlay 1975) and a uniform wage subsidy (Bhagwati and Srinivasan 1974, Corden 1974, Basu 1980). In practice, such policies are likely to be difficult to implement. A wage subsidy could easily lie below the level needed to achieve the first-best outcome, and again it is interesting to explore the distributional impact of such a policy. That will be the task of section 4.2 below.

4.1 Inequality and minimum wages

Given that the motivation for introducing a minimum wage is often to reduce inequality, it is interesting to note that the origin of inequality in simple versions of the Harris-Todaro model is precisely the setting of a minimum wage above the market clearing level. In this stylized model, abandoning the minimum wage will lead to an unambiguous reduction in wage inequality.[7] It might be thought that lowering the minimum wage, but keeping it above the market-clearing level, would have the same effect. In this section, I show that this is usually true, but not always. The reason is that a reduction in the minimum wage can actually increase the number of unemployed in the sector covered by the minimum wage legislation, as previously demonstrated by Feldman (1989) and Fields (1997).

It can be shown that a reduction in the minimum wage always lowers the urban unemployment rate. In contrast, the effect on the number of unemployed is ambiguous, because the reduced risk of unemployment may lead to migration from rural areas. The urban sector may increase in size sufficiently that the net effect is a rise in the number of people unemployed. To see this more formally, denote the constant wage elasticities of labour demand in the modern sector and agriculture by η and ϵ respectively (both defined to be positive). Feldman (1989) shows that the change in unemployment, in response to a percentage change in

[7] Note that the introduction of a minimum wage may have very different effects in a more complicated model. For instance Rodrik (1996) demonstrates that the introduction of a minimum wage may have beneficial effects on output in a model with multiple equilibria, and that the minimum wage need not bind in equilibrium. Agell and Lommerud (1997) examine the effects of minimum wages on the incentives to acquire skills.

the minimum wage of $\hat{w}_m$, is given by:

$$dL_u = \left[\frac{L_a \epsilon (1-\eta)}{1 + \epsilon (L_a/(1-L_a))} + L_m \eta \right] \hat{w}_m$$

It is clear that if $\eta > 1$, the term in square brackets could possibly be negative, in which case a reduction in the minimum wage will lead to an increase in the number of unemployed, if the minimum wage remains above the market-clearing level. The next question is whether this outcome is ever relevant in practice. Using (3) and simplifying, it can be shown that the critical value of η is given by

$$\eta^* = \frac{\epsilon}{u\epsilon + \left(1 - \frac{1}{La}\right)(1-u)} \tag{10}$$

If the wage elasticity of labour demand in the modern sector is at or below η^* a reduction in the minimum wage leads to an unambiguous reduction in wage inequality. By inspection of (10) it is clear that η^* is decreasing in ϵ, agricultural employment (L_a) and the unemployment rate (u). Even choosing high values for these parameters, to obtain a low threshold, a few simple calculations indicate that $\eta > \eta^*$ is unlikely. For instance, setting $L_a = 0.8$, $u = 0.3$, and $\epsilon = 2$ means that η^* is 4.7. This means that the threshold is unlikely to be reached in practice: the elasticity of labour demand in the urban sector is sometimes assumed to be less than one, as in Agénor (1996, fn. 21). This suggests that for most plausible parameter values, any reduction in the minimum wage will lead to an unambiguous reduction in wage inequality in this simple model. In practice, however, it is essential to emphasize that this effect could be more than offset by a host of others.

4.2 A uniform wage subsidy

This part of the paper considers the distributional effects of a wage subsidy. Recall that in the first best allocation there is no unemployment, and the marginal product of labour in the modern sector is equal to that in agriculture. In an elegant paper Basu (1980) shows that any uniform wage subsidy S greater than or equal to a threshold S^* (to be defined below) will achieve the first-best allocation. Basu also shows that any smaller subsidy $S \in (0, S^*)$ will raise social welfare, where social welfare is measured by total output. This section extends his work by introducing distributional considerations into the welfare analysis.

More specifically, it will be shown that a small uniform subsidy $S \in (0, S^*)$ has an ambiguous effect on the distribution of income. Output in each sector is a function of labour input,

$$
\begin{aligned}
X_a &= f_a(L_a);\ f'_a > 0, f''_a < 0 \\
X_m &= f_m(L_m);\ f'_m > 0, f''_m < 0
\end{aligned}
$$

where as before a denotes agriculture and m denotes the modern sector. Labour is the only variable input, consistent with the presence of fixed sector-specific capital stocks.

If labour is paid its marginal product, and there is a uniform subsidy S, then we have

$$f'_m(L_m) = w_m - S \tag{11}$$

$$f'_a(L_a) + S = (1-u)w_m \tag{12}$$

Note that the optimal subsidy is $S^* = w_m - f'_m(L^*_m)$ where L^*_m is the level of modern sector employment in the first best allocation. The number of unemployed is given by

$$L_u = 1 - L_m - L_a$$

The effect of the subsidy is given by

$$\frac{dL_u}{dS} = -\frac{dL_m}{dS} - \frac{dL_a}{dS}$$

Using results in Basu (1980, p. 194) and equation (11), it can be shown that

$$\frac{dL_u}{dS} = \frac{f'_m - f'_a + (1-L_a)(f''_m + f''_a)}{f''_m\left[(1-L_a)f''_a - f'_a - S\right]} \tag{13}$$

Since $f'_m > f'_a$ outside the first best allocation, the sign of (13) is ambiguous, and so a uniform wage subsidy below S^* will have an ambiguous effect on the number of unemployed and hence on wage inequality. The possibility is open that a uniform subsidy below the optimal level may do more harm than good, although the generality of this result is not clear.

5 Some extensions

I now consider the effects of extending the simple Harris-Todaro model studied above. First, I consider an unemployment benefit funded by an income tax on urban workers. Secondly, the paper considers how the analysis will be modified by a non-zero wage for the unemployed, reflecting the possibility that they could find work in an informal sector. Unambiguous changes in wage inequality are found to be unlikely in these more general models.

5.1 Unemployment benefits

So far, it has been assumed that the unemployed have no income. I now consider extending the model to incorporate unemployment benefit. The benefit is funded by a proportional income tax paid by urban employees at a fixed rate $0 < t < 1$. The underlying assumption is that it may be easier to tax the incomes of urban workers than the incomes of those working in agriculture.

With the tax in place, the income of each urban worker is $(1-t)w_m$. If the entire tax revenue is used to fund the unemployment benefit, the income of each unemployed person will be $w_u = \left(\frac{1-u}{u}\right) tw_m$. Since the tax just redistributes income within urban areas, it does not affect the expected income of urban living. Under the assumption that workers are risk neutral, and in the absence of labour supply effects of the tax, the allocation of workers between rural and urban areas will be independent of the tax rate.

This can be demonstrated very simply: the new Harris-Todaro equilibrium condition

$$uw_u + (1-u)(1-t)w_m = w_a$$

simplifies to the condition in the absence of a tax,

$$(1-u)w_m = w_a$$

confirming that the tax rate does not affect the intersectoral allocation of workers. Similarly, average income remains w_a. These results require that some workers are employed in each sector, so I assume that

$$w_u < w_a < (1-t)w_m$$

which can be written as:

$$\left(\frac{1-u}{u}\right) tw_m < w_a < (1-t)w_m$$

for which a necessary condition is $t < u$.

The main difference to the earlier analysis is now that the first segment of the Lorenz curve slopes upwards, with slope t/u. Hence this segment gets steeper as the unemployment rate falls, and this makes the necessary and sufficient conditions for an unambiguous change in (after-tax) wage inequality much more complicated. The most interesting finding is that a rise in the number of unemployed is potentially compatible with a decrease in wage inequality, provided the urban unemployment rate falls sufficiently far.

Obviously a rise in the tax rate will lead to an unambiguous reduction in wage inequality. This is because it reduces inequality between the employed and

unemployed, and reduces the extent of inequality in after-tax incomes between urban and rural employees (recalling that the equilibrium urban unemployment rate is independent of the tax rate). The Gini coefficient in this model is given by

$$G = L_u \left(1 - \frac{t}{u}\right)\left(2 - \frac{L_u}{u}\right)$$

which is lower than in (9) unless the tax rate is zero.[8]

5.2 The informal sector

This section considers an alternative and more general assumption about the income of the unemployed. I assume that those not employed in the modern sector can find work in the informal sector, and hence earn a wage $w_u < w_a < w_m$. Once again, mean income will be given by w_a in the Harris-Todaro equilibrium.

The introduction of an informal sector again makes the necessary and sufficient conditions rather more complicated. Perhaps the main point to note is that an unambiguous reduction in inequality now has an additional necessary condition:

$$\frac{w_{u2}}{w_{a2}} \geq \frac{w_{u1}}{w_{a1}}$$

In other words, if the Lorenz curve is to shift inwards, the ratio of the informal sector wage to the agricultural wage must increase. If we assume that the agricultural wage rises with the level of development, as seems likely, then an unambiguous reduction in wage inequality is not possible unless the informal sector wage is also increasing.

That the conditions for changes in inequality are more complicated can also be seen from the Gini coefficient. It is not difficult to show that the Gini coefficient in this model is given by:

$$G = L_u \left(2 - \frac{L_u}{u}\right)\left(1 - \frac{w_u}{w_a}\right)$$

This expression makes clear that knowing what happens to the number of unemployed and the urban unemployment rate is no longer sufficient to tell us what happens to wage inequality. Now, we need to know something about the evolution of the agricultural and informal sector wages as well, and the analysis will require a more complicated model.

[8] See Holmlund and Lundborg (1990) for a far more detailed analysis of unemployment benefits and their distributional consequences, in a version of the Harris-Todaro model with a trade union in one sector.

6 Discussion

This section seeks to place the findings of the paper in context, to highlight some strengths and weaknesses of the present analysis, and to examine the possible implications for future research in this area, including work on the Kuznets curve.

One of the contributions of the paper has been to follow Fields (1979, 1980) in demonstrating that general statements about growth and wage inequality are difficult to make even in simple models. Often, the movement to a new long-run equilibrium is associated with a new Lorenz curve that intersects the old one. This ambiguity is present even though the paper abstracts from many important aspects of the real world, including remittances, migration decisions made at the household level rather than independently, and heterogeneity within the urban and rural sectors. Stark (1991) has drawn attention to the importance of such considerations. In another influential contribution, Lipton (1980) pointed out that the introduction of heterogeneity can alter the relationship between migration and changes in wage inequality.

Lipton also suggested that "most neoclassical economists would expect voluntary population movements to reduce both inefficiency and inequality" (Lipton 1980, p. 1). As we have seen, Lipton's neoclassical economists would be wrong if there are imperfections in the urban labour market, such as an exogenously fixed wage. Economic development in the urban sector, or a removal of barriers to migration, can generate population movements that sometimes lead to a greater number of unemployed in urban areas.[9] If this is the case, then at best the new Lorenz curve will intersect with the old one, and at worst lie entirely outside it. This suggests that migration policy will sometimes involve an efficiency-equity trade-off.

Overall, the findings demonstrate the potential usefulness of dual economy models when investigating the evolution of inequality and poverty, as in the related contributions of Ravallion and Datt (1999) and Ravallion (2002). The current paper has given especial emphasis to the rural-urban wage gap. As noted earlier, the empirical work of Bourguignon and Morrisson (1998) can be seen as drawing attention to the importance of such differentials. They use average labour productivity in non-agriculture relative to that in agriculture as a proxy for labour market imperfections, and find that this variable can explain some of

[9] Migration can also play a different role if, for example, there are increasing returns to scale in the urban sector. This can imply that migration increases the rural-urban wage gap and thereby encourages further migration. Graham and Temple (2001) calibrate a two sector variable-returns-to-scale model with related properties.

the variation across countries in the extent of inequality. This suggests that the intersectoral wage gap potentially has a sizeable effect on overall inequality, and reinforces the case for studying inequality and poverty within two sector models.

The framework of this paper suggests that, in the cross-country data, summary measures of inequality should be associated more strongly with the urban unemployment rate than one would expect in a model without dualism. This is because in the Harris-Todaro model the degree of inequality between urban workers and rural workers is an increasing function, other things equal, of the urban unemployment rate. In principle, were the relevant data available, the urban unemployment rate could be a better indicator of dualism than the indicator of relative average products of labour used by Bourguignon and Morrisson (1998). This is because the urban unemployment rate is connected to the relative *marginal* products of urban and rural workers, and so could have more to say about wage differentials than a proxy based on relative average products.

In other respects, the current paper supports the findings of Bourguignon and Morrisson. They argue that the observed effect of dualism on inequality could reflect more than simply a difference in average incomes between the rural and urban populations. The current analysis shows why this might be the case. In the model analyzed here, there is no differential between the average income of the rural and urban populations, if we include the unemployed in the urban population. Dualism still gives rise to inequality, because it is associated with greater inequality between the employed and unemployed, and between those in work in urban and in rural areas.

In further work, the obvious priority is to consider more sophisticated dual economy models in which the urban wage is determined endogenously. An innovative analysis along these lines has been carried out by MacLeod and Malcomson (1998). In their model, equilibrium reward schemes vary between the rural (labour-intensive) and urban (capital-intensive) sectors based on differences between the two sectors in the costs of leaving posts unfilled. They show how the generation of jobs in the urban sector has implications for inequality as measured by the Gini coefficient. Again, though, it seems likely that the Lorenz curves will sometimes intersect, ruling out unambiguous statements about movements in wage inequality.

Without a more complex model, it is hard to draw any reliable implications for the evolution of inequality over an entire development path. As previously emphasized, the current framework is not adequate for speculating about the possible existence of a Kuznets curve. The move to a more general framework, however, may only increase the extent of ambiguity about distributional effects.

In principle, one could distinguish between two versions of the Kuznets hypothesis. A model yielding a 'measure-independent' Kuznets curve would be one in which all Lorenz-consistent inequality measures indicated an initial worsening of distribution with economic growth, eventually followed by an improvement as growth proceeds further. This would require the Lorenz curves to shift in and out without ever intersecting, and as we have seen, this is unlikely in all but the simplest models. Hence more usually the Kuznets curve will be 'measure-specific'. The pattern of rising and then falling inequality will only be observed, if at all, for a subset of Lorenz-consistent summary measures.[10]

Kanbur and McIntosh (1988) argue that the Harris-Todaro model can generate a Kuznets curve, but it is not clear that their brief analysis allows for a variable urban unemployment rate. If the migration equilibrium is to be maintained with a fixed urban wage, their analysis will hence be restricted to cases where the agricultural wage is constant. More recently, Rauch (1993) has established some sufficient conditions for a Kuznets curve to exist in a two sector model, but only when using the log variance of income as a measure of inequality.[11]

In any case, it is not clear that we should expect to find a Kuznets curve either as a general phenomenon in the data, or as a prediction of theoretical models. It is a reduced form relationship, perhaps still useful for some purposes, but unlikely to be informative about the varied effects of growth on poverty reduction. Kanbur (2000) has argued that the Kuznets curve has become something of a straitjacket in this field. Studying the distributional consequences of different types of growth, as in this paper, may be a more promising research strategy, and one that is of more direct use to policy-makers.

One priority for this research should be to develop a richer understanding of the interdependence between rural and urban areas, and the implications for poverty alleviation. In the framework used here, relative prices are exogenously fixed by world prices. This means that the connections between the urban and rural sectors rely on the possibility of intersectoral capital flows, and rural-urban migration. Yet urban poverty has been found to be reduced by rural growth in

[10] One well-known result in this area is the finding of Anand and Kanbur (1993) that, for the decomposable measures of inequality they consider, the distribution of income must worsen at the start of development. Although this result seems quite powerful, it is less strong than it first appears. Anand and Kanbur define the start of the process as an increase in the share of population in the modern sector *from zero*. Arguably, the initial state of the Kuznets migration process should be seen as a steady state with at least some modern sector employment, even in the very poorest countries.

[11] A few other papers analyse distributional issues in the context of social welfare, the appropriate shadow wage or foreign capital inflows. See Chakravarty and Dutta (1990) and Gupta (1988, 1994).

India (Ravallion and Datt 1996) even though migration flows within India have typically been relatively small. Alternative models such as that of Eswaran and Kotwal (1993) may ultimately shed more light on the interdependence between sectors and the consequences for poverty.[12]

Another problem with the Harris-Todaro framework should be noted. The empirical literature on the 'wage curve' provides evidence that wages (conditional on individual characteristics) are negatively related to unemployment rates across regions, rather than positively as the simplest version of Harris and Todaro would suggest (Blanchflower and Oswald 1995, Hoddinott 1996, Kingdon and Knight 1998). That said, much of the available evidence covers developed countries rather than LDCs, and it remains unclear whether the current evidence for LDCs weakens the case for a Harris-Todaro relationship in the long run. The Harris-Todaro relationship is itself likely to be a conditional one, and could be obscured in the data if the spatial pattern of unemployment and wages partly reflects differences in amenities, or other considerations relevant to locational choices (Hoddinott 1996).

It is worth noting that, even if the Harris-Todaro framework is a poor approximation to the operation of labour markets in less developed countries, the results of the current paper have wider relevance. This is because the Harris-Todaro framework can easily be reinterpreted as a model of a dualistic labour market with a primary sector (high-paying but rationed jobs) and a secondary sector (low paid jobs with wages competitively determined). The results of this paper could then be useful in the analysis of income inequality even in developed countries. For example, 'rural growth' now corresponds to a positive step change in the productivity of the secondary sector, and its distributional consequences can be considered exactly as before. A more complete analysis of these questions would need to allow for the possibility of on-the-job search by workers in the secondary sector, as in Kleven and Sorensen (1999). Another relevant paper is that by Lommerud et al. (2002), who consider distributional issues in a model of primary and secondary labour markets, where primary sector wages are influenced by trade unions.

7 Conclusions

This paper shows how a simple model of a dual economy can be used to study the distributional effects of various types of growth. In principle, this line of research could draw on a large existing literature on dualism, including work

[12] See also Ravallion and Datt (2002) for further discussion of sectoral interdependence and the varying impacts of growth on poverty.

by prominent trade theorists such as Corden and Findlay (1975). Yet recent research on growth and development, including work on growth and inequality, has only rarely made use of ideas from trade theory. This is perhaps due to a perception that trade models are typically static, and therefore unsuited to the analysis of development issues.

This is a fundamental misunderstanding, and it is possible that a great deal can be learnt from trade theory. The workhorse models of trade theory are essentially small scale general equilibrium models, and are therefore well suited to analysing the effects of a step change in sectoral productivity or the capital stock. This kind of analysis is rarely carried out, perhaps because of the confused idea that one can only learn about development using long-run growth models that allow growth to be sustained indefinitely.

The current paper studies the effects of various types of growth on wage inequality, in the presence of a wage floor in the urban sector. The basis for the analysis is a simple version of the Harris-Todaro model. First of all, I show that wage inequality in this model can be understood using just two variables, the urban unemployment rate and the number of unemployed. This makes it very easy to derive a set of necessary and sufficient conditions for unambiguous movements in wage inequality, corresponding to outward or inward shifts in the entire Lorenz curve. Compared to many earlier studies of inequality in dual economies, the use of Lorenz curves is a considerable strength, and means that the analysis is not tied to summary measures that embody restrictive assumptions.

When thinking about the distributional effects of growth, the urban unemployment rate and the number of unemployed are clearly endogenously determined. The second contribution of the paper is to treat these variables as endogenous, and study how they evolve in response to step changes in sectoral productivity or the capital stock, drawing on the classic analysis of Corden and Findlay (1975). Although the model cannot provide a complete account of the evolution of inequality as development proceeds, it does draw attention to some relevant considerations, including the interdependence of sectors that arises naturally when a two sector model includes factor market equilibrium conditions.

Perhaps the most striking result is that rural growth leads to an unambiguous reduction in wage inequality. The effects of growth in the non-agricultural sector are less clear-cut. In each case, general equilibrium effects are important. For example, an improvement in prospects in the urban sector will often be associated with rural-urban migration, and potentially greater inequality as a result.

As with previous research in this field, the paper provides only partial insight

into the relationship between development and inequality. Nevertheless, it is clear that two sector models can make a useful contribution to understanding these issues. A particular strength of the two sector approach is that one can easily distinguish between the effects of different forms of economic growth. This could be a more productive research strategy than one restricted to reduced form, Kuznets-type relationships between levels of GDP per capita and inequality.

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Figure 1 – The Lorenz curve in the Harris-Todaro model

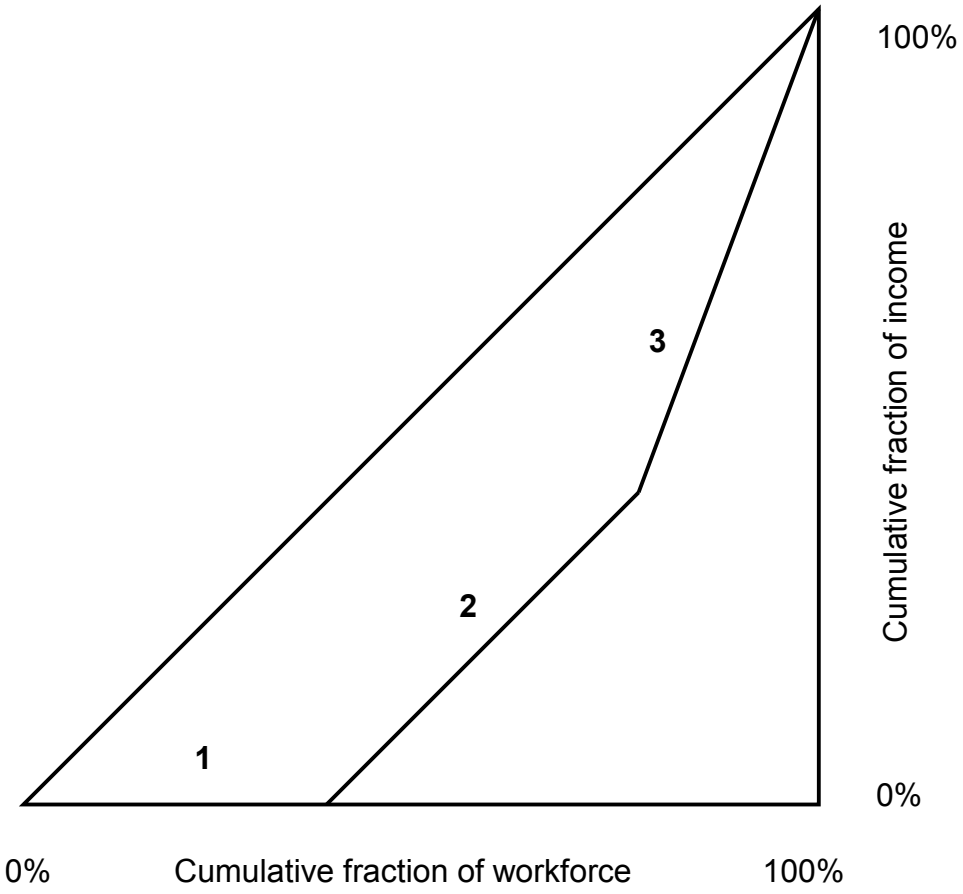

Figure 2 – Intersectoral labour allocation in the Harris-Todaro model