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Labour Tax Reform, the Good Jobs and the Bad Jobs*

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Abstract

We analyse recent proposals to shift the tax burden away from low-paid labour, assuming a dual labour market where the "good" high-paying jobs are rationed. A shift in the tax burden from low-paid to high-paid workers has an ambiguous effect on the *level* of aggregate employment while the *allocation* of aggregate employment is further distorted. Even if the tax reform raises total employment, economic efficiency may be reduced because labour is reallocated from high-productive to low-productive jobs. We also find that opportunities for on-the-job search have important implications for the policy effects.

Keywords: Dual labour markets; labour taxation; good versus bad jobs
JEL classification: *H*21; *J*21; *J*42

I. Introduction

In recent years many economists have advocated a cut in taxes on low-paid workers as a means of increasing their low rates of employment; see e.g. Drèze and Malinvaud (1994) and Phelps (1997). Inspired by these proposals, several governments have experimented with various "in-work" benefits as a way of lowering the fiscal burden on low-paid workers; examples include the Earned Income Tax Credit (EITC) in the US and the Working Families Tax Credit (WFTC) in the UK.

A shift in taxes away from low-paid labour will tend to increase the progressivity of the labour income tax, especially if it requires higher taxes on high-paid labour. Recent research on the effects of taxation in imperfect labour markets suggests that increased progressivity of the labour income tax

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may indeed stimulate employment, since high marginal tax rates reduce the incentive for unions to push for higher wages and make it less profitable for employers to pay high efficiency wages; see for example Hoel (1990), Lockwood and Manning (1993), Bulkley and Myles (1996), Koskela and Vilmunen (1996), Pissarides (1998) and Sørensen (1999).

Unfortunately these contributions assume that there is a single labour market populated by identical firms and workers. In reality labour markets are often segmented, with wages and productivity differing considerably across different sectors of the economy, even for equally skilled workers. This observation has motivated the theory of dual labour markets. According to this theory the labour market is segmented into an imperfectly competitive primary sector offering high-productive, high-wage career jobs, and a perfectly competitive secondary sector dominated by low-productive, low-paying routine jobs. The dual labour market hypothesis has become an established part of labour market theory since Harris and Todaro (1970) and is confirmed by a substantial body of empirical evidence; see for example Dickens and Lang (1985) and the survey in Saint-Paul (1996).

In this paper we show that the beneficial effects of tax progressivity stressed in the recent literature on imperfect labour markets are unlikely to survive once one allows for the dual character of the labour market. The outline of our model is as follows: in the primary sector, job functions are difficult to monitor, thereby inducing employers to pay high efficiency wages to promote work effort on the job. In the secondary sector, there are no monitoring problems and jobs are therefore remunerated by lower, competitive wages. Even for workers with similar skills, the primary sector pays persistently higher wages and has persistently higher productivity than the secondary sector. The "good", high-paying jobs in the primary sector are rationed, and workers who fail to find a primary sector job face two alternative options: they can accept a "bad", low-paying job in the secondary sector, or they can opt for unemployment, whereby they collect unemployment benefits and (in some cases) have a job-search advantage over secondary sector workers.

The equilibrium of our dual labour market model is characterised by two distortions. The *level* of employment is too low since the presence of labour income taxation and out-of-work transfers induce too many people to join the ranks of the unemployed. Moreover, the *allocation* of employment is distorted in favour of secondary sector employment due to the excessive primary wage. Within this framework we investigate the effects of a tax shift from low-paid to high-paid workers on employment and welfare. We find that the policy recommendation of the simple one-sector labour market models is not robust to the introduction of dual labour markets. First, the effect of increased tax progressivity on the level of employment is ambiguous. Second, the allocation of employment is distorted further away from the primary sector. Third, even if the tax shift away from low-paid workers succeeds in raising aggregate employment, it is likely to reduce welfare due to the deterioration in the allocation of employment.[1]

The intuition for these results is simple. In single labour market models, the degree of tax progressivity can be increased by raising the marginal tax rate while keeping the average tax rate constant for all workers. By contrast, in the dual labour market model, an increase in progressivity necessarily involves a reduction in the average tax rate of low-paid workers combined with an increase in the average tax rate of high-paid workers. This will boost employment of low-paid workers, but will also discourage employment of high-paid workers, so the effect on aggregate employment will generally be indeterminate.[2] Furthermore, since productivity is higher in the primary sector, the reallocation of labour from the primary to the secondary sector reduces welfare. The less efficient allocation of employment lowers average income, thereby generating negative feedback effects on the level of employment through product markets.

Our tool of analysis is inspired by the dual labour market model developed by Bulow and Summers (1986).[3] However, to deal with the effects of tax progressivity in a satisfactory way, we have extended their framework in several directions. First, we allow for the possibility of on-the-job search in the secondary sector, whereas Bulow and Summers rely on the assumption of Harris and Todaro (1970) that people have to line up in the unemployment queue before they can hope to obtain a primary sector job. We show that the opportunities for on-the-job search may be crucial for the effects of tax policy. Second, while Bulow and Summers retain the assumption of Shapiro and Stiglitz (1984) that the choice of work effort on the job is a zero–one decision (a worker can either work all the time or shirk all the time), we follow Pisauro (1991) in allowing effort to be varied in a continuous manner. This has the important implication that the level of effort and thus wage formation will depend not only on average tax rates but also on marginal tax rates. Third, given that effort is a continuous variable in our model, the awkward Bulow–Summers assumption that leisure on the job and secondary

[1] In a recent paper, Lommerud, Sandvik and Straume (2004) study tax policy in a dual labour market setting, where the primary sector is characterised by quasi-rents due to sunk capital investments and union bargaining. Their concern is with optimal redistribution and investment taxation.

[2] Andersen and Rasmussen (1999) also make the point that increased tax progressivity has an ambiguous effect on the level of employment in an economy where workers have different wage levels. However, in their model, wage differentials do not arise from labour market segmentation but rather from different individual effort levels.

[3] Although influential, the Bulow–Summers framework has not gone unchallenged. Pisauro (2000) summarises the points of criticism that have been raised against the model. Atkinson (1999, Ch. 4) also questions the role of unemployment insurance in a Bulow–Summers-type shirking model with segmented labour markets.

sector goods are perfect substitutes becomes more critical. We therefore assume that leisure and secondary goods are imperfect substitutes.

Like Bulow and Summers and the recent literature on taxation in imperfect labour markets, we maintain the assumption that all workers are identical *ex ante*. We adhere to this simplification to focus attention on the implications of labour market segmentation. However, as we explain in the last section, a distinction between skilled and unskilled labour can easily be incorporated into the model without affecting our main conclusions.

Our model is described in Section II. In Sections III and IV we analyse employment and welfare effects of labour tax reform under alternative assumptions regarding opportunities for on-the-job search. The concluding Section V explains how the model may be extended to allow for skill heterogeneity and addresses the policy implications of the model.

II. A Model of a Dual Labour Market

Households

We consider a stationary state in a closed economy inhabited by identical households with infinite horizons. The economy is divided into a primary sector and a secondary sector. Consumers derive utility from a Cobb–Douglas aggregate of the consumption of primary and secondary goods. The primary good is the numéraire, so the Cobb–Douglas consumer price index is p_s^β, where p_s is the relative price of secondary goods and β is the budget share of secondary goods. The pre-tax wage rate in the primary sector is w_p and the tax rate on this income is t_p. As the official working time is institutionally fixed and normalised at unity, the real net income of a primary worker is equal to $w_p\left(1 - t_p\right)/p_s^\beta$. The flow utility may then be described by the following quasi-linear function:

$$u_p = \frac{w_p \cdot \left(1 - t_p\right)}{p_s^\beta} - \frac{e_p^{1+\delta}}{1+\delta}, \tag{1}$$

where e_p is the effort exerted on the job, while δ is the marginal disutility of effort. In this specification, the actual working time may differ from the official working time. Since the effort of primary workers cannot be perfectly monitored, they have an incentive to shirk so as to gain utility from leisure on the job. This gain from shirking comes at a cost, however, through the relation between effort and the probability of being sacked. Specifically, we assume that the individual worker's firing probability s depends negatively on his work effort e_p relative to the average effort $\overline{e}$ exerted by his colleagues, i.e.,

$$s = \overline{s} - \eta \cdot \left(\frac{e_p}{\overline{e}}\right), \qquad \overline{s} > 0, \quad \eta > 0. \tag{2}$$

This formulation captures the effect of individual work performance (through η) as well as the ongoing labour turnover resulting from technological and organisational change (through $\bar{s}$). An equiproportional rise in the effort of all workers leaves the firing probability of each worker unaffected. This is appealing, since there is no reason to believe that a general rise in productivity will affect the amount of structural change and the associated rate of labour turnover at the macro level. Moreover, since all workers are identical, they will choose the same level of effort so that $e_p = \bar{e}$ in equilibrium. Thus, the rate of job destruction becomes constant, $s = \bar{s} - \eta$, which greatly simplifies the structure of the model.

Let V_p denote the expected lifetime utility of a worker employed in the primary sector, and let V^* indicate the lifetime utility in the best available outside option. V_p is equal to the present discounted value of the flow return to primary sector employment. This flow return is given by the flow utility, u_p, minus the expected "capital loss" resulting from the probability of being fired, $s \cdot (V_p - V^*)$. If the exogenous discount rate is ρ, we have

$$V_p = \frac{u_p - s \cdot \left(V_p - V^*\right)}{\rho} \quad \Leftrightarrow \quad V_p = \frac{u_p + s \cdot V^*}{\rho + s}. \tag{3}$$

The primary worker's problem is to choose his level of effort e_p so as to maximise (3) subject to (1) and (2). The first-order condition is

$$\frac{\partial s}{\partial e_p} \cdot \left(V_p - V^*\right) = \frac{\partial u_p}{\partial e_p} \quad \Leftrightarrow \quad \frac{\eta}{\bar{e}} \cdot \left(V_p - V^*\right) = e_p^{\delta}. \tag{4}$$

The LHS of this equation measures the expected gain in lifetime utility resulting from a reduced probability of being fired, while the RHS measures the marginal disutility of effort. Equation (4) implicitly defines the individual effort supply function, $e_p = e_p\ (w_p)$. By implicit differentiation of (4) it can be shown that $\partial e_p / \partial w_p$ is always positive and that $\partial^2 e_p / \partial w_p^2$ will be negative if and only if $\delta > 1$, i.e., if agents are sufficiently risk averse.

Note that the optimal effort is not limited from above by the official working time. In principle, work effort could be greater than one if the return to working is sufficiently high. Instead, there is an upper limit on effort due to the constraint that the probability of dismissal must be non-negative. Formally, the solution for e_p takes the general form $e_p = \min(e_p\ (w_p), \hat{e})$, where $\hat{e} = \bar{e}\,\bar{s}/\eta$. However, the corner solution $\hat{e}$ may be ruled out as an equilibrium candidate, since it would imply that effort is insensitive to the wage rate, which is incompatible with the firm's optimum conditions derived below.

Workers who do not obtain a job in the primary sector have two alternative options. Either they can choose to go unemployed, thereby receiving real after-tax benefits b and having probability a_u of future employment in the primary sector, or they can accept a job in the secondary sector. In this sector there are no moral hazard problems, since work effort can be perfectly monitored, and the secondary labour market is therefore perfectly competitive. A secondary sector job involves a fixed working time normalised at unity and pays a wage w_s which is subject to the tax rate t_s. Workers employed in the secondary sector have probability a_s of obtaining a primary sector job.[4]

The flow utilities of households outside the primary sector may be written in the following way:

$$u_s = \frac{w_s \cdot (1 - t_s)}{p_s^\beta} - \frac{1}{1 + \delta}, \tag{5}$$

$$u_u = b. \tag{6}$$

The lifetime utilities of these two groups are given by the present discounted value of the flow-return to unemployment and to secondary sector employment, respectively. The flow-return in each of these two states equals the flow-utility enjoyed in that state plus the expected "capital gain" arising from the probability of obtaining a job in the primary sector:

$$V_s = \frac{u_s + a_s \cdot (V_p - V_s)}{\rho} \quad \Leftrightarrow \quad V_s = \frac{u_s + a_s \cdot V_p}{\rho + a_s}, \tag{7}$$

$$V_u = \frac{u_u + a_u \cdot (V_p - V_u)}{\rho} \quad \Leftrightarrow \quad V_u = \frac{u_u + a_u \cdot V_p}{\rho + a_u}. \tag{8}$$

Since the secondary labour market is perfectly competitive, an unemployed person always has the option of taking a secondary sector job, thereby enjoying lifetime utility V_s. Similarly, a secondary sector worker can choose to quit his job in order to join the ranks of the unemployed, thereby receiving lifetime utility V_u. In equilibrium, the unemployed individuals prefer not to take a job ($V_u \geq V_s$), and workers in the secondary sector prefer not to quit ($V_s \geq V_u$), implying the arbitrage condition

$$V_u = V_s = V^*. \tag{9}$$

Firms

Production technology is linear in both sectors of the economy. With N_p denoting the number of persons employed in the primary sector, each putting

[4] Although we use the convenient term "probability" for the parameters associated with a change of state (s, a_u, a_s), they are not probabilities in the strict sense of the word, but rates of Poisson processes.

e_p (w_p) units of effort into the job, output in this sector is e_p $(w_p) \cdot N_p$. Since the official working time is equal to 1, the primary sector profit is e_p $(w_p) \cdot N_p - w_p \cdot N_p$. The representative wage-setting primary sector firm maximises profit with respect to N_p and w_p, and its first-order conditions are

$$e_p = w_p, \tag{10}$$

$$\frac{\partial e_p}{\partial w_p} \cdot \frac{w_p}{e_p} = 1. \tag{11}$$

Equation (10) is a zero-profit condition, while (11) is the well-known Solow condition, obtained by calculating the first-order condition for w_p and inserting (10). The second-order conditions for this problem reduce to the requirement that the effort function of workers be concave. As noted above, this is the case if $\delta > 1$.

In the secondary sector the profit is given by $p_s \cdot N_s - w_s \cdot N_s$, where N_s is the number of persons employed in the secondary sector, and each secondary worker supplies one unit of labour. By maximising profit with respect to N_s, we get the zero-profit condition for the secondary sector,

$$w_s = p_s. \tag{12}$$

Wage Formation

Using (1) to (4), and recalling that all primary workers will choose the same level of effort so that $e_p = \overline{e}$ in equilibrium, we can write the Solow condition (11) as

$$e_p = \left[\frac{w_p \cdot \left(1 - t_p\right)}{p_s^{\beta}} \cdot \frac{\eta}{\delta \cdot (\rho + s)}\right]^{1/(1+\delta)}. \tag{13}$$

Next we insert the first-order condition for effort (4) and $e_p = \overline{e}$ into (13) so as to get

$$\frac{w_p \cdot \left(1 - t_p\right)}{p_s^{\beta}} = \delta \cdot (\rho + s) \cdot \left(V_p - V^*\right). \tag{14}$$

Since $V^* = V_s$, it follows from (14) that $V_p > V_s$. This means that secondary workers envy their colleagues in the primary sector and that the good primary sector jobs are rationed. Because (9) also implies that $V^* = V_u$, we can insert (1), (3), (6), (8) and (13) into (14) to get the wage curve

$$\frac{w_p \cdot \left(1 - t_p\right)}{p_s^{\beta}} = \frac{1}{c} \cdot b, \qquad c = 1 - \frac{(1+\delta) \cdot (\rho + s + a_u) + \eta}{\delta \cdot (1+\delta) \cdot (\rho + s)}. \tag{15}$$

The variable $c < 1$ is the (endogenous) net replacement ratio in the primary sector. Net wages in the primary sector are simply a mark-up over net unemployment benefits and, according to (15), the mark-up is positively related to the job-finding probability a_u. The higher a_u, the easier it is to get another primary job if a worker is fired for shirking. This reduces the cost of shirking, and to offset the resulting tendency for labour productivity to fall, employers pay higher wages.

The reservation wage in the secondary sector can be found by rewriting the arbitrage condition (9). Using equations (1), (5)–(9), (13) and (15), we get the wage curve

$$\frac{w_s \cdot (1 - t_s)}{p_s^{\beta}} = \frac{1}{1+\delta} + b + \frac{a_u - a_s}{\delta \cdot (\rho + s)} \cdot \frac{b}{c}. \tag{16}$$

The secondary sector wage must settle at a level ensuring that the welfare of a secondary worker equals the welfare of an unemployed person. If the probability of finding a future primary job does not depend on whether the worker is unemployed or employed in the secondary sector ($a_u = a_s$), this arbitrage condition is met when the real after-tax wage rate equals the real net unemployment benefit plus a mark-up compensating for the disutility of work. If the probability of finding primary sector employment is higher for the unemployed ($a_u > a_s$), the market-clearing secondary wage includes additional compensation for the expected capital loss resulting from the less favourable employment prospects. By contrast, if a_u were less than a_s, the wage in the secondary sector would fall below the sum of the benefit rate and the disutility of work.

Closing the Model

The government budget constraint is given by

$$b \cdot N_u = t_p \cdot \frac{w_p}{p_s^{\beta}} \cdot N_p + t_s \cdot \frac{w_s}{p_s^{\beta}} \cdot N_s, \tag{17}$$

where N_u is the number of unemployed persons. We assume that the unemployment benefit b and the tax rate on secondary workers t_s are set exogenously, while the tax rate on primary workers t_p adjusts endogenously to ensure budget balance.

In general equilibrium product markets must clear. Since the Cobb–Douglas specification implies that consumers spend a constant fraction β

of their income on secondary sector products, we may write the market-clearing condition for the secondary sector as

$$p_s \cdot N_s = \beta \cdot \left[e_p \cdot N_p + p_s \cdot N_s\right]. \tag{18}$$

By Walras' law, (18) implies that the market for primary products will also clear.

In a stationary state, the outflow of workers from the primary sector equals the inflow of workers into the sector,

$$s \cdot N_p = a_u \cdot N_u + a_s \cdot N_s, \tag{19}$$

where

$$a_s = \alpha \cdot a_u, \qquad \alpha \geq 0. \tag{20}$$

The parameter α depends on the structural characteristics of the labour market determining the opportunities for on-the-job search in the secondary sector.

Finally, by normalising total population at unity, we have the following identity:

$$N_u + N_p + N_s = 1. \tag{21}$$

The complete model can now be summarised by equations (10), (12), (13), (15), (16), (17), (18), (19), (20) and (21), which determine the variables N_p, N_s, e_p, w_p, w_s, t_p, p_s, a_u, a_s and N_u.

III. A Benchmark Case where $a_s = a_u$

The convention in the theory of dual labour markets has been to set $a_s(\alpha)$ equal to zero, thus ruling out on-the-job search in the secondary sector. This assumption goes back to the classical contribution of Harris and Todaro (1970), who studied rural migration and urban unemployment in developing countries. In that setting it seems natural to assume that secondary sector workers have no opportunity to obtain primary sector jobs, since the secondary (rural) and primary (urban) sectors are separated geographically. The Harris–Todaro assumption has been maintained in the subsequent literature on dual labour markets, including studies in the context of developed countries; see e.g. Bulow and Summers (1986).

In a developed economy, however, the primary and secondary sectors are not separated geographically, so the original reasoning behind the Harris–Todaro assumption does not apply. In fact, as pointed out by Lindbeck and Snower (1990), the assumption is contradicted by a substantial body of evidence indicating that workers who come directly from another job account for a large fraction of new hirings. The findings of Clark and Summers (1979) and Pissarides and Wadsworth (1994), for example, suggest that the chances of finding a new job are at least as high for those already employed as for the unemployed. Against this background we analyse a benchmark case in which it is equally possible for a secondary worker and an unemployed person to find a job in the primary sector ($a_s = a_u$). In Section IV we then investigate the more general case where a_s may be higher or lower than a_u.

Reducing the Model

Given $a_s = a_u$ ($\alpha = 1$), we are able to reduce the system further. Using (12), the wage curve in the secondary sector (16) may be written as

$$w_s = \left[\frac{1 + b(1+\delta)}{(1-t_s)(1+\delta)}\right]^{\frac{1}{1-\beta}}. \tag{22}$$

Since b and t_s are exogenous, this equation uniquely determines the equilibrium wage in the secondary sector. By inserting (12) and (13) into the zero-profit condition for the primary sector (10), we get

$$w_p = \left[\frac{1-t_p}{w_s^\beta} \cdot \frac{\eta}{\delta \cdot (\rho + s)}\right]^{1/\delta}. \tag{23}$$

Using (12), (19) and (21), we may rewrite the wage curve in the primary sector (15) as

$$w_p = \frac{b \cdot w_s^\beta}{1-t_p} \cdot \left[1 - \frac{(1+\delta) \cdot \left(\rho + [s/(1-N_p)]\right) + \eta}{\delta \cdot (1+\delta) \cdot (\rho + s)}\right]^{-1}. \tag{24}$$

This expression is analogous to the no-shirking condition in Shapiro and Stiglitz (1984) and Bulow and Summers (1986): an increase in primary sector employment N_p reduces the cost of shirking, thus inducing firms to pay higher wages to prevent too much shirking.

The market-clearing condition for secondary goods (18) can be written as

$$w_s = \left(\frac{\beta}{1-\beta}\right) \cdot w_p \cdot \frac{N_p}{N_s}, \tag{25}$$

where we have used (10) and (12). To close the system we need the government budget constraint. By inserting (12) and (21) into (17), we get

$$b \cdot w_s^\beta \cdot \left(1 - N_p - N_s\right) = t_p \cdot w_p \cdot N_p + t_s \cdot w_s \cdot N_s. \tag{26}$$

Equations (22)–(26) determine w_p, w_s, N_p, N_s and t_p. To gain a better understanding of the model, let us ignore the government budget constraint for a while and treat t_p as an exogenous variable. Given t_p the system is recursive: the wage curve in the secondary sector (22) determines w_s and, knowing w_s, we can infer the value of w_p from the zero-profit condition for the primary sector (23). Given w_s and w_p, the wage curve in the primary sector (24) determines primary sector employment N_p. Secondary sector employment N_s is found from the equilibrium condition for secondary sector goods (25).

The general equilibrium of the dual labour market model is illustrated in Figure 1. The vertical axis indicates wage rates in the two sectors, measured in units of the primary sector numéraire good. The length of the horizontal axis equals the total labour force. From left to right we measure primary sector employment, N_p, and from right to left we measure employment in the secondary sector, N_s. The horizontal distance between N_p and N_s is equal to the number of unemployed persons, N_u. The horizontal w_s-curve corresponds to (22). Given the location of the w_s-curve, we can draw the zero-profit condition for the primary sector ZPC_p (23) and the w_p-curve (24). The intersection of the w_p- and ZPC_p-curves determines wages, employment and, thus, total income in the primary sector. Knowing primary sector income, we can draw the product market-clearing condition for the secondary sector, PMC_s, from (25). The equilibrium level of employment in the secondary sector is given by the intersection of the PMC_s- and w_s-curves.

It is not coincidental that the primary sector wage is higher than the secondary sector wage in Figure 1. If this were not the case, a primary worker would suffer no loss if fired for poor work performance. Hence primary workers would shirk all the time, implying a zero level of primary

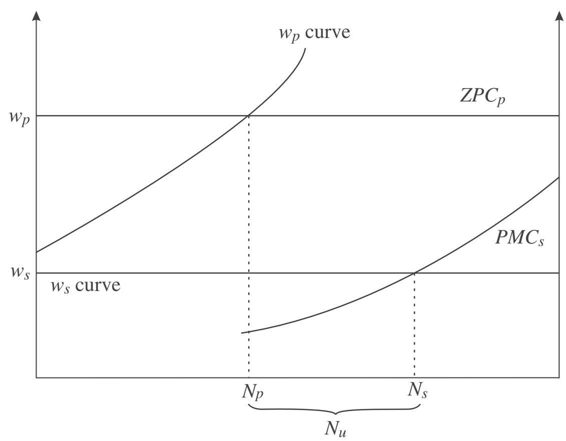

Fig. 1. General equilibrium in the dual labour market model

sector output. In equilibrium, primary workers therefore have to earn a rent comparable to their less fortunate colleagues in the secondary sector and in the unemployment pool. The resulting wage and productivity gap implies an intersectoral distortion away from the primary sector. A reallocation of workers from secondary to primary employment would generate a welfare gain stemming from an increase in average labour productivity.

Actually there are two "sector" distortions in this economy. First, efficiency wage setting in the primary sector causes too many workers to be outside that sector. Second, the tax-transfer system causes too many of those remaining to opt for unemployment. Concern about the first distortion calls for a lower tax on high-paid workers, while concern about the second distortion suggests the need for a lower tax on low-paid workers. However, reducing both taxes at the same time is not feasible unless there are Laffer curve effects. Absent such effects, a lower tax burden on one type of workers must be financed by a higher tax burden on the other type of workers. *A priori* it cannot be concluded in which direction the tax burden should be shifted in order to improve employment and welfare.

Shifting the Tax Burden from Low-paid to High-paid Workers

In Figures 2 and 3 we illustrate the effects of shifting the tax burden away from low-paid labour (reducing t_s) towards high-paid labour (increasing t_p). A lower tax rate for secondary sector workers (Figure 2) reduces the reservation wage of the unemployed, and thus the w_s-curve shifts downwards. The

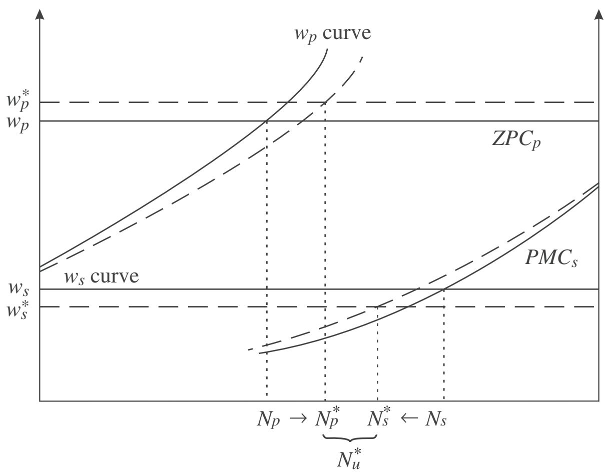

Fig. 2. Reducing the tax rate in the secondary sector

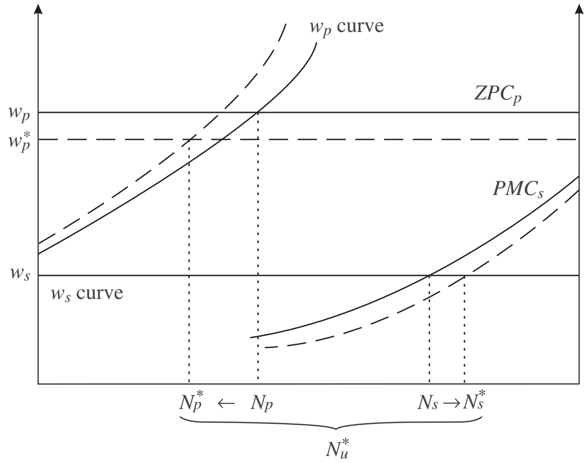

Fig. 3. Increasing the tax rate in the primary sector

reduction in secondary sector wages causes the price of secondary sector goods to fall. Hence the real consumer wage in the primary sector goes up, inducing primary workers to increase their work effort. With a greater work effort, the product wages in the primary sector will have to increase to prevent the emergence of positive profits. This explains the upward shift in the ZPC_p-curve. At the same time the reduction in the relative price of secondary goods implies that firms in the primary sector can maintain a given level of real consumer wages (and hence a given level of effort) with a lower real product wage. As a result the w_p-curve moves downwards, and the new equilibrium in the primary sector is characterised by wage level w_p^* and employment level N_p^*. Due to higher wages and employment in the primary sector the total income generated in that sector goes up, causing higher demand for goods produced in the secondary sector. Hence the PMC_s-curve shifts upwards, so the new equilibrium level of secondary sector employment is given by N_s^*. Thus, reducing the tax rate in the secondary sector has a positive effect on employment in both sectors of the economy.

Unfortunately, the government budget constraint implies that in order to reap the above benefits, it is necessary to raise the tax rate on the high-paid workers in the primary sector. The effects of this less attractive component of the policy experiment are illustrated in Figure 3. A higher marginal tax rate reduces the effort exerted by workers in the primary sector, thus shifting the zero-profit condition ZPC_p downwards. At the same time the w_p-curve shifts upwards since primary sector firms have to pay higher pre-tax wages to maintain a given level of effort. In the new equilibrium wages and employment in the primary sector are lower, implying a fall in total primary sector income which reduces the demand for secondary sector goods, thereby reducing employment in that sector as well.

This graphical analysis highlights the various mechanisms involved in shifting the tax burden from low-paid to high-paid labour. It also shows that the net effect on employment in either of the two sectors is theoretically ambiguous. To extend the analysis, we therefore resort to numerical simulations, accounting for the government budget constraint and allowing for the possibility that $a_s \neq a_u$.

IV. The General Case

Our simulations are based on the following calibration of the model. The elasticity of the marginal disutility of work effort (δ) is set equal to 4. This implies an elasticity of effort w.r.t. the real net wage equal to 0.2, broadly in line with the estimates of labour supply elasticities surveyed by, for example, Blundell and MaCurdy (1999). The rate of time preference (ρ) is calibrated to generate a numerical elasticity of w_p w.r.t. N_u equal to 0.05 along the wage curve for the primary sector. This is a fairly conservative wage curve elasticity within the range of estimates in the extensive cross-country study by Blanchflower and Oswald (1994). Following Pissarides (1998, p. 170), we set the rate of labour turnover in the primary sector (s) equal to 0.2. The sensitivity of the individual worker's firing probability w.r.t. the level of work effort (η) is calibrated such that the net replacement ratio is 0.6 in the initial equilibrium, corresponding to the average net replacement rate for representative families in the OECD area in 1999; see OECD (2001, Table 3.10). The absolute level of the real net unemployment benefit (b) is set to generate an equilibrium unemployment rate equal to 0.08, in line with typical estimates of structural unemployment rates for many OECD countries. Finally, in our initial simulations we set the budget share of goods produced in the secondary sector (β) equal to one-fourth.

We simulated the effects of a 5 percentage point cut in the tax rate on low-paid (secondary) labour, allowing the model to determine the required rise in the tax rate on high-paid (primary) labour. The results are reported in Table 1, which reflects three different scenarios for on-the-job search. In the first column we show the effects in the benchmark case $a_s = a_u$. Cutting t_s by 5 percentage points requires increasing t_p by 2.4 percentage points. Such a policy will increase employment in the secondary sector by 4.0 percent while reducing employment in the primary sector by 2.7 percent, thus causing an overall increase in the unemployment rate from 8.0 to 8.7 percent.

The welfare effect of the tax reform is measured by its impact on the expected lifetime utility of the representative worker, i.e., the lifetime utility

Table 1. *Labour tax reform and the opportunities for on-the-job search*

	$\beta = ¼$			$\beta = ½$
	$a_s = a_u$	$a_s = 0$	$a_s = 2a_u$	$a_s = a_u$
Effects on taxes and employment (%):				
Tax rate in secondary sector[a]	−5.0	−5.0	−5.0	−5.0
Tax rate in primary sector[a]	2.4	1.7	2.1	5.8
Employment in secondary sector	4.0	5.0	3.3	3.9
Employment in primary sector	−2.7	−2.0	−2.1	−6.0
Unemployment[a]	0.7	0.0	0.4	0.5
Effects on welfare (% of GDP):				
Change in sectoral allocation	−0.9	−0.4	−1.0	−1.4
Change in total employment	−0.4	−0.0	−0.2	−0.1
Total change	−1.3	−0.4	−1.2	−1.5

[a]The change is expressed in percentage points.

which the worker expects *ex ante* before knowing his employment status. Using (1), (3), (6), (8), (9), (13), (15), (19), (20) and (21), we find that expected lifetime utility $V^e = N_p V_p + N_s V_s + N_u V_u$ may be written as

$$V^e(N, n_p) = b \cdot \left[\theta - \frac{s \cdot (1+\delta) \cdot n_p}{N^{-1} + \alpha \cdot (1 - n_p) - 1}\right]^{-1} \left[n_p \cdot N \cdot (1+\delta) + \frac{\theta}{\rho}\right], \quad (27)$$

where $N \equiv N_p + N_s$, $n_p \equiv N_p/N$, and $\theta \equiv (1+\delta)\ (\rho + s)\ (\delta - 1) - \eta$. As noted earlier, our model economy is characterised by an inefficiently low level of aggregate employment and by an inefficiently low primary sector share of total employment. Accordingly, equation (27) implies that expected utility will unambiguously increase in case of either a rise in total employment, N, or a rise in the primary sector employment share, n_p.

The total welfare effects given in the bottom row of Table 1 are measured by the *ex ante* equivalent variation, defined as the hypothetical change in lump-sum income which would generate the same change in expected utility as the labour tax reform under consideration. In the third row from the bottom of Table 1 we report the isolated welfare effect of the change in the primary sector share of total employment (n_p), keeping total employment N constant at its initial level. In the second row from the bottom the residual part of the total welfare effect is then ascribed to the change in aggregate employment. In the $a_s = a_u$ case, we see from Table 1 that the labour tax reform causes a drop in welfare corresponding to 1.3 percent of initial GDP. It is interesting to note that the sectoral shift from primary to secondary sector employment accounts for most of the fall in welfare, while the fall in total employment contributes much less to the negative welfare effect.

The second column of Table 1 shows another benchmark case where $a_s = 0$, i.e., the Harris–Todaro assumption usually adopted in dual labour market models. To understand the differences between the $a_s = a_u$ scenario and the $a_s = 0$ scenario, let us consider how the tax reform will affect wage formation in the two sectors of the economy, noting from Table 1 that both scenarios involve a reduction in N_p and an increase in N_s. In both cases the fall in N_p reduces the number of new hirings in the primary sector and increases the number of workers applying for a primary sector job. Clearly this reduces the employment probability for all job applicants. But in the Harris–Todaro case there is an offsetting effect, since the reallocation of workers from unemployment to secondary sector employment (the increase in N_s) will reduce the number of workers applying for primary sector jobs. *Ceteris paribus*, this will increase the employment probability for those who remain in the unemployment pool. The effect of this isolated tendency for a_u to increase is to drive up wages in the primary sector, thereby causing a further reduction of employment in that sector. This additional effect arising in the Harris–Todaro case may be termed the "primary sector wage effect".

The second difference between the two cases relates to wage formation in the secondary sector. In the $a_s = a_u$ case, the secondary sector wage equals the sum of the unemployment benefit and the disutility of work, but in the Harris–Todaro case the secondary sector wage also includes a wage premium compensating for the forgone chance of obtaining a job in the primary sector. This wage premium is positively related to an unemployed worker's probability a_u of obtaining a primary sector job. In the Harris–Todaro case, the tax reform involves both a positive and a negative effect on a_u since the increase in N_s reduces the number of job applicants, while the reduction in N_p implies both fewer hirings and more job applicants. If the latter effect is stronger (and this turns out to be the case in the simulation experiment) a_u will go down, thereby generating a lower secondary sector wage and a greater rise in secondary employment in the Harris–Todaro case relative to the $a_s = a_u$ case. We term this the "secondary sector wage effect".

If the secondary sector wage effect on employment is positive and outweighs the primary sector wage effect, the impact of the labour tax reform will be more beneficial in the Harris–Todaro scenario. Comparing the first two columns in Table 1, we see that this is indeed the case, given our plausible parameter values. Thus, when $a_s = 0$, the contraction in primary sector employment is smaller, and the expansion in secondary sector employment is greater than when $a_s = a_u$. As a result, total employment and unemployment is unchanged. Nevertheless, consumer welfare falls due to the deterioration in the sectoral allocation of employment.

The third column of Table 1 considers a case where it is easier for workers to find a primary sector job if they are already employed in the secondary sector than if they are unemployed ($a_s = 2a_u$). According to the evidence discussed in the preceding section, such a case may well be empirically plausible. Again we see that the tax shift is welfare-reducing, primarily because of the reallocation from good jobs to bad jobs, and that the presence of on-the-job search amplifies the drop in welfare compared to the Harris–Todaro case. Compared to the benchmark case $a_s = a_u$, the alternative scenario $a_s = 2a_u$ involves a smaller boost to employment in the secondary sector, since the fall in a_u now tends to drive up wages for secondary workers by reducing the value of their job-search advantage over unemployed workers. In other words, the secondary sector wage effect on employment is now negative. On the other hand, the reallocation of workers from unemployment to secondary employment intensifes the competition for primary sector jobs when secondary workers have better job-search opportunities than their unemployed colleagues. This puts downward pressure on primary sector wages and reduces the fall in primary employment, compared to the benchmark scenario $a_s = a_u$. Hence the primary sector wage effect on employment is positive and sufficiently strong to ensure that unemployment increases by less than in the benchmark case, despite the smaller boost to secondary employment. As a result of the smaller rise in unemployment, the welfare loss is also slightly smaller than the loss occurring in the benchmark scenario.

These simulations illustrate that the welfare loss from the tax reform does not increase monotonically with the opportunities for on-the-job search. As we move from the benchmark case towards the Harris–Todaro scenario, a secondary sector wage effect works to reduce the welfare loss from the reform. As we move in the opposite direction towards a setting with better job-search opportunities for secondary workers, a primary sector wage effect tends to dampen the welfare loss.

In the first three columns of Table 1 we have assumed that the budget share of secondary sector goods (β) is ¼. Since little is known about the magnitude of this parameter, the fourth column of the table considers an alternative scenario where $\beta = ½$ and $a_s = a_u$. Since the primary sector is now relatively smaller in the initial equilibrium, the 5 percentage point cut in the tax rate on secondary workers now requires a larger increase in the tax rate on primary workers, thereby inducing a greater percentage drop in primary employment. Owing to the larger reallocation towards the less-productive secondary sector, the welfare loss from the reform is slightly larger than in the benchmark case shown in the first column of Table 1. However, given the uncertainty regarding the true value of β, it is reassuring that the overall effects on unemployment and welfare do not seem particularly sensitive to this parameter.

V. Concluding Remarks

The recent literature on tax policy in imperfect labour markets has used a representative agent framework with a single labour market to argue that tax progressivity may be good for employment. Our analysis indicates that this result is unlikely to carry over to a setting with a dual labour market. It also suggests that even if a tax shift from low-paid to high-paid workers succeeds in raising total employment, it may not raise total welfare because it shifts employment from high-productive to low-productive jobs.

Although our model extends much of the literature on labour taxation by allowing for labour market segmentation, it does not incorporate skill heterogeneity. In public policy debates, proponents of tax cuts for low-paid workers have argued that this policy could increase the relative net wages of unskilled workers and reduce their unemployment rate. This policy concern for the unskilled may be addressed by considering the following simple extension of our model.[5] Suppose there are two groups of workers, skilled and unskilled. Suppose further that unskilled workers can work only in the secondary sector, while skilled workers can work in both sectors. Finally, suppose that labour input in the secondary sector is a Cobb–Douglas aggregate of the inputs of skilled and unskilled labour, and that the wages of both groups of secondary workers adjust to keep them indifferent between secondary employment and unemployment. In such a setting we obtain a dual labour market model very much like the one described above. Indeed, in the benchmark case where skilled workers have the same probability of finding a primary job regardless of whether they are unemployed or employed in the secondary sector, the extended model is in principle similar to the model above. Hence our main conclusions will carry over to such a setting with heterogeneous labour. In particular, although a tax shift from low-paid to high-paid workers will unambiguously stimulate the employment of unskilled workers, it will not necessarily increase total employment, and it will cause a welfare-reducing reallocation from good jobs to bad jobs. Moreover, the tax reform will not affect the welfare of the unskilled, since their utility level is pinned down by the exogenous real net unemployment benefit determining their net wages.

In practice, one way of cutting the tax burden on low-paid workers is to introduce an EITC which is phased out as the level of labour income increases. According to Blundell and Hoynes (2001), the expansions of the EITC in the United States in the 1980s and 1990s led to significant increases in employment rates for low-skilled workers.[6] At the same time, the employment rate of high-skilled workers has not decreased. These trends are quite

[5] The model extension described below is documented in an Appendix available from the authors.

[6] The recent expansions of in-work benefits in Britain have not (yet) led to a similar increase in employment. As pointed out by Blundell and Hoynes, the British programmes involved rather small incentives to enter the labour market, especially when the interaction of in-work benefits with other means-tested benefits is taken into account.

consistent with our analysis, given that the expansion of the EITC was not accompanied by an increase in the tax burden on high-paid labour but was financed in other ways. Indeed, our analysis shows that an isolated tax cut for low-paid workers will tend to increase the employment rate for the high-paid as well as for the low-paid. Thus, a tax cut at the bottom end of the pay scale might be well justified for efficiency as well as equity reasons. But our analysis suggests that it is a bad idea to finance such tax cuts by raising taxes on high-paid labour, in contrast to the impression left by much of the recent research on taxation in imperfect labour markets.

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