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EFFECTS OF A TAX-TRANSFER SCHEME ON MIGRATION

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Abstract
A general equilibrium elaboration of the classic model of inter-regional migration is used to examine the effects of a local tax-transfer scheme on migration. It is shown that a fair tax-transfer scheme, which does not distort the real wage comparisons of the migrants, does not affect migration. On the other hand, an unfair system is shown to encourage migration the more the smaller are the repayments as compared to the tax payments. In the longer term, when people adapt their perceptions concerning the repayments, the effects are dampened and eventually reduced to zero, provided that the scheme is actually fair.

Key words: adaptive expectations, fair/unfair system, labour market
JEL classification: 931

1. Introduction

In the literature of regional and urban economics, the classic theory on inter-regional migration is based on the analysis of the interplay of local labour markets. In the model, perfectly free and costless migration is motivated by inter-regional differences in real wages. Migration equalises the differences between localities and ends up to a market equilibrium, where nobody can benefit from relocation. In the equilibrium, the spatial allocation of labour is efficient.

The literature of tax competition stresses that any local policy measures, which affect the welfare comparisons between localities must have influence on migration. This, in turn, yields constraints to policy variations. Particularly, labour income taxation in one locality should induce workers to migrate out from that locality, which makes the policy unsustainable in the longer run. However, in the spirit of the classic real wage model, a reasonable argument is that if taxes are fully compensated so that the real wage remains unaffected, there should be no effects on migration.

This paper investigates the effects of local policy on migration in a general equilibrium elaboration of the classic labour market model. A simple scheme of wage taxes and consumption price subsidies is introduced, and its effects on local labour market conditions, migration and the sustainability of the policy are studied. In deriving the main results, an application of the neo-Keynesian Adaptive Expectations Hypothesis is utilised concerning the fairness of the scheme. The results match to the above basic intuition, but also shed some further light into the issue especially from a long-term viewpoint.

The paper proceeds as follows. Chapter 2 presents the basic model to illustrate the local labour market circumstances under autarky and free migration in an economically determined market area,

which is henceforth called a locality. Chapter 3 constructs the tax-transfer scheme, and studies the effects of fair and sub-fair schemes on the local market equilibrium. The short-term and long-term emigration effects of the scheme are examined in chapter 4. Chapter 5 concludes the findings.

2. The model

The model is an elaboration of a basic neoclassical macroeconomic model (for more conventional presentations see e.g. Brown & Jackson, 1978, p. 286-294; Heijdra and van der Ploeg, 2002, p. 8-12). In the model, production is given by the production function

(1) $q = f(L,\underline{K})$,

where the capital stock, $\underline{K}$, is constant in the short term. Therefore, production depends on the amount of labour, L, measured in terms of labour time units. The standard neoclassical assumptions concerning the production function are made, namely constant returns to scale and $f_1 > 0$, f_{11}, $f_{22} < 0$, $f_{12} = f_{21} > 0$, where the subscripts refer to first and second derivatives of the function with respect to its arguments in order of appearance in function (1).

Define the short-run profits in the firm sector of the economy as $\pi = pq - wL$, where p is the market price and w is the market reward for labour time. Recalling (1), competitive profit maximisation with respect to labour use yields

(2) $w = pf_1$

for the demand for labour in the economy, written in terms of nominal wages. By function (2) the demand for labour input equals the value of the marginal product of the input and, following from the assumption of diminishing marginal product of labour, the demand curve is unambiguously downwards sloping. The nominal price level and the marginal product of labour together determine labour demand in the economy.

The household sector maximises utility $U(q,1-L)$ subject to the budget constraint $wL = pq$. Under the assumption of perfect foresight, the supply of the labour input derived from the optimal time use decisions of the households then reads

(3) $w = pg(L)$,

where $g(L)$ describes the valuation of time respective to its opportunity cost. It is henceforth assumed that the marginal cost of labour time is, on the aggregate, positive, $g' > 0$, which is to say that the substitution effects dominate the income effects in supplying labour time. The labour supply function (3) is therefore upwards sloping by assumption.

Given that the capital stock is constant, the production function together with the labour market conditions determine the equilibrium output, that is the aggregate supply of the economy, through the price adjustment mechanism in goods and labour markets. In the long term, aggregate supply is invariant to the price level in the economy. That is, the aggregate supply curve of the economy is vertical in p-q space. Exogenous changes in the capital stock shifts the vertical aggregate supply curve horizontally.

For a simple introduction of migration to the model, assume that the local capital stock is fixed and immobile and that there is no trade between localities, but allow for labour migration in response to inter-locality differences in real wages. Assume that people are perfectly capable to monitor the real wage differentials, and that migration is costless. Assume also that the considered locality is of atomistic size in the economy so that migration does not change the circumstances in the competitive economy-wide labour market.

Given that capital is immobile, there may exist inter-locality differences in initial factor endowments. This provokes differences in local productivity of labour and in real wages. Supposing that the real wage is lower in the considered locality than in the outer economy, the possibility of free migration implies not only emigration from the low wage locality but also adjustment of the local markets to the market conditions in the rest of the economy.

Figure 1 illustrates the market equilibrium of the basic model. The figure consists of four quadrants, the labour market in the northeast quadrant, the production function in the southeast quadrant, the aggregate goods market in the southwest quadrant and the real wage in the northwest quadrant.

(Figure 1 about here)

In Figure 1, at the autarky labour market equilibrium e_0, nominal wages and prices are w_0 and p_0, respectively, which give $w_0/p_0 = \omega_0$ for the equilibrium real wage. Labour use is L_0 and production is q_0. Since the aggregate supply schedule is invariant to the price level around the equilibrium point, it can be presented by the vertical graph AS_0 in the southwest quadrant of the figure. The relevant goods market equilibrium is presented by point ε_0 on the AS_0 curve.

The simultaneous e_0-ε_0 equilibrium is sustainable given that the goods market is in equilibrium. That is, the aggregate supply that results from the above analysis must equal aggregate demand at the equilibrium point. The derivation of the aggregate demand curve from the relevant IS-LM setting of the economy is ignored for simplicity, and the goods market equilibrium is henceforth simply assumed to hold.

In Figure 1 the market real wage of the outer economy is presented by the slope ω*, which is assumed to be steeper than that of the local real wage line ω_e. Under perfect mobility this fact must be taken as given in the local labour market, where labour demand and labour supply must adjust accordingly.

To examine the market adjustment take the simplest experiment and set the local price level fixed to p_0. Facing the market real wage line ω* and reading at p_0, the adjustment must be carried out fully by the rise of the local nominal wage to w_1. At this nominal wage, local employment falls to L_1 and production falls consequently to q_1. The aggregate supply curve shifts inwards from AS_0 to AS_1, along which the new goods market equilibrium occurs at ε_1. The induced emigration amounts to L'-L_1, measured in terms of labour time units.

The adjustment could be tracked out also by taking the nominal wage w_0 as fixed. From this point of view, adoption to ω* necessitates a fall in prices, which induces labour demand to decrease, and labour supply to increase. The result is essentially the same as above: local employment and production are L_1 and q_1, respectively, the aggregate supply curve shifts to AS_1, and the amount of emigration is L'-L_1. Adjustment in both prices and nominal wages could be allowed as well. As both adjust simultaneously as response to emigration from the locality, nominal wages rise because of the fall in labour supply, and prices fall because of the decrease of demand for local goods and

services. Under perfect foresight, the result is again the same as above: emigration is L'-L_1. (For details, see Laurila, 2004.)

To conclude, the fact that there exist real wage differences in the economy motors up migration and induces adjustment in the local labour and goods markets. In the setting of Figure 1 the initial welfare gap is unfavourable to the considered locality, and the market adjustment results in emigration and a fall of production, but also in higher real wages for those who stay put in the locality. The effects are reversed in a locality that confronts lower real wages in the outer economy.

3. The tax-transfer scheme

To introduce public policy in the considered locality, let the locality implement a tax-transfer scheme, which imposes a tax on labour income, and uses the tax revenue to support a transfer program. The tax rate is t, $0<t<1$, issued on nominal wages. The respective transfers are given in the form of a price subsidy of rate s, $0<s<1$. The net nominal wage for the workers then is $(1-t)w$, and the net consumption price level is $(1-s)p$.

The tax-transfer program changes the situation in the local labour market somewhat. Since the program does not concern the firms the labour demand function (2) remains unaltered. The labour supply function (3) is, however, affected by the scheme and reads now

(3') $w = \alpha pg(L)$,

where $\alpha = (1-s)/(1-t) > 0$ is the inverse of the implicit rate of return of the scheme. Under a fair system, where the taxes are fully repaid to the taxpayers, $t = s$ and $\alpha = 1$, which is to say that the

workers' real wage, $\omega = (1-t)w/(1-s)p$ remains unaffected. The implicit rate of return of the system is one-to-one.

If $t > s$, that is $\alpha > 1$, the implicit rate of return of the tax-transfer scheme falls below one-to-one. This is to say that the scheme is unfair or, in particular, sub-fair. This may happen for several reasons. First, the scheme may be intentionally sub-fair because of other policy goals. Second, the scheme may end sub-fair because of administrative transaction costs, or due to inefficiencies in the public sector. And third, people may be myopic and have adaptive-like expectations concerning the working of the system (about AEH, see Heijdra & van der Ploeg, 2002, p. 31-35).

If $s > t$, and $\alpha < 1$, the implicit rate of return of the scheme becomes higher than one-to-one. This kind of a scheme can be labelled super-fair. In the present static model a super-fair program might be reasoned by referring to over-optimistic expectations concerning the working of the system. However, this kind of an interpretation is not very appealing in practice, and even the original AEH presentations seldom refer to these kinds of adaptation paths.

To study the comparative static properties of the model, use functions (2) and (3'), totally differentiate and manipulate. Evaluate at $\alpha = 1$, $dK = 0$ and have

(4) $\frac{\partial L}{\partial \alpha} = \frac{g(L)}{f_{11} - g'} < 0,$

which says that a fall in the implicit rate of return of the scheme (a rise in α) makes the labour market equilibrium shift backwards along the labour supply curve. The respective effect on production reads, after totally differentiating function (1), solving for dL and substituting in functions (2) and (3')

(5) $\frac{\partial q}{\partial \alpha} = f_1 \frac{g(L)}{f_{11} - g'} < 0.$

The result simply states that the induced change in production is the fall in labour supply given by expression (4) times the marginal product of labour. That is, for a given capital stock, the smaller is the implicit rate of return of the program (the higher is α) the lower is the equilibrium output of the economy

The change in the real wage faced by the employers can be derived by totally differentiating functions (2) and (3'), and substituting for *dL* from the latter to the former. After manipulation,

(6) $\frac{d\omega}{d\alpha} = f_{11} \frac{g(L)}{f_{11} - g'} > 0,$

saying that the employers face a rise in the real wages because of the fall in labour supply given by expression (4). The respective real wage faced on the supply side can be derived by defining the workers' real wage as $\varpi = \omega / \alpha$ and substituting the definition into (2) and (3'). The effect reads

(7) $\frac{\partial \varpi}{\partial \alpha} = f_1 \frac{g'}{f_{11} - g'} < 0,$

which states the fact that the workers' real wage is reduced if the repayment rate from the scheme falls below one-to-one.

Figure 2 illustrates the comparative static properties of the model outlined by the above expressions (4)–(7). The figure considers only effects of fair and sub-fair programs. A super-fair program is not presented because of its minor practical relevance.

(Figure 2 about here)

In Figure 2, the initial autarky equilibrium of the local labour market occurs at the intersection point e_0 of the labour demand and labour supply schedules D_0 and S_0. The equilibrium real wage being ω_0, employment is L_0, production is q_0, and the corresponding goods market equilibrium is at point ε_0 along the AS_0 curve in the southwest quadrant of the figure.

The implementation of the wage tax t imposes a tax wedge tw in the labour market, and results in a split of the labour demand curve into two curves D_0 and D_0'. The former is the gross wage curve encountered by the firms. Since the tax-transfer scheme does not affect the firms, the demand side remains to be determined by the initial marginal physical product of the labour input described by D_0. The latter curve is the net wage curve encountered by the workers. The D_0' curve is flatter than the D_0 curve because the constancy of the tax rate t implies that the tax wedge tw is a constant proportion of the available gross wage, given by D_0. Therefore, the tax wedge gets narrower in absolute terms as L increases.

The new autarky equilibrium now depends on the reaction of labour supply. Under a fair tax-transfer scheme, $\alpha = 1$, the taxes are fully compensated in the form of price subsidies. Therefore, the real wage of the workers remains unaltered at ω_0. As a response to the inwards shift of the perceived labour demand curve D_0', the labour supply curve shifts outwards to S_0' so that the new autarky equilibrium occurs at e_0' horizontally below e_0. Employment and production remain at L_0

and q_0, respectively. From the workers' point of view, the goods market equilibrium is described by point ε_0' on the vertical AS_0 curve, corresponding to point E_0' along ω_0 in the northwest quadrant of Figure 2. The net nominal wage is $w_0' = (1- t)w_0$ and the subsidised price level is $p_0' = (1—s)\ p_0$. The tax wedge is tw_0 in terms if nominal wages and sp_0 in terms of prices. The tax wedge separates the labour supply equilibrium e_0' from the labour demand equilibrium e_0. However, the wedge does not create any dead weight loss because the separation occurs vertically around the efficient labour market equilibrium. The goods market equilibrium is at point ε_0 on the vertical AS_0 curve.

The labour supply response is different if the system is sub-fair, $\alpha > 1$. The benefit side of the scheme falls below or is undervalued as compared to the tax payments. Furthermore, expressions (6) and (7) suggest that, in this case, the real wage perceived by the workers deviates from that faced by the firms. In particular, $\varpi < \omega$.

In the extreme version of a sub-fair system the tax payments remain totally uncompensated, that is for any $t > 0$, $s = 0$ and $\alpha = 1/(1-t)$. In Figure 2 this version is described by the shift of the workers' real wage from ω_0 to ϖ_1 and by the shift of the firms' real wage from ω_0 to ω_1, reasoned by expressions (6) and (7), respectively. Since the workers do not anticipate any decline in prices, the labour supply curve does not shift. The labour supply equilibrium thus shifts from e_0 to e_1', and the corresponding labour demand equilibrium shifts from e_0 to e_1 in the northeast quadrant of the figure. According to expressions (4) and (5), employment falls to L_1, and production decreases to q_1. The workers' goods market equilibrium shifts to ε_1, which implies that the AS_1 curve is not properly determined – the firms' and the workers' decisions deviate horizontally in this case. The tax wedge is now $tw_1 > tw_0$. The market distortion causes a welfare loss that can be measured by the area $e_1'e_1e_0$, or inversely by the area $e_1'\ e_0\ e_0$" (compare to Hansen & Nielsen, 1997, p. 68).

The case of partially perceived repayments, $t > s > 0$, $1 < \alpha < 1/(1-t)$ is presented by the real wage pair ϖ_2 for workers and ω_2 for firms in the northwest quadrant of Figure 2. Perceiving net prices p_2, and anticipating a fall in real wages induces the workers to work less than under a fair system, but more than without any repayments. Their labour supply curve settles to S_1, the workers' equilibrium is described by points e_2' and E_2', and the firms' equilibrium is described by e_2 and E_2. As a result, employment is L_2, and production is q_2. The respective workers' goods market equilibrium is at ε_2, which means that the (short-term) aggregate supply curve AS_2 is not properly determined – the firms' and the workers' decisions deviate along an upwards-sloping line in p-q space. The tax wedge is now tw_2, $tw_1 > tw_2 > tw_0$. The induced welfare loss can be inversely measured by that part of the area $e_1'\ e_0\ e_0''$, which remains rightwards from the L_2e_2 line in the northeast quadrant of the figure.

However, provided that the tax-transfer scheme is actually fair, the above two solutions concerning the sub-fair case are short-term in nature. Because the budget of the tax-transfer scheme is, by definition, in balance in the fair case, a sub-fair system runs a budget surplus. In the extreme version, where the prices are totally unsubsidised, $s = 0$, the system runs a surplus of tw_1, and in the case of partial repayments the surplus is $tw_2 - (p_0-p_2) > 0$. Supposing that the tax revenue is not used to promote other policy goals or to cover transaction costs and inefficiencies, accumulation of the budget surplus gives the workers reason to change their perceptions concerning the system. By the AEH interpretation of the model, workers adapt towards a fair system. In the long term, labour supply and production increase towards L_0 and q_0, respectively. The aggregate supply curve eventually converges to the vertical AS_0 schedule.

4. Effects on migration

To complete the analysis, allow for free migration in the economy, and examine the effects of the local tax-transfer scheme on emigration. Figure 3 represents the situation of an atomistic locality, in which the equilibrium real wage is lower than that in the rest of the economy.

(Figure 3 about here)

In Figure 3, all emigrants from the locality can find work elsewhere for the constant real wage ω^*. To give a benchmark for migration responses, the pre-policy situation is presented by the autarky equilibrium point e_0 in the labour market and by the corresponding point E_0 in the northwest quadrant of the figure. Local employment is L_0 and local production is q_0. In the absence of local policy, the migration response to the real wage difference $\omega^* - \omega_0$ can be read at p_0 as a vertical shift from E_0 to F. Horizontally, this amounts to emigration measured by the length of the line segment ab in the northeast quadrant of the figure. Local employment falls from L_0 to L_a, local production falls from q_0 to q_a and the vertical aggregate supply curve shifts from AS_0 to AS_0. The free migration equilibrium is efficient.

Now, consider the migration response under a tax-transfer scheme. Under a fair system, $\alpha = 1$, the local real wage ω_0 remains unchanged. The net wage for workers is given by D_0', and the respective the labour supply is given by S_0' in Figure 3. The workers' equilibrium e_0' is vertically separated from the firms equilibrium e_0 in the northeast quadrant, and the respective equilibrium point E_0' is separated from E_0 along ω_0 in the northwest quadrant of the figure.

Taking the workers' perspective and reading at p_0', free migration implies adjustment from ω_0 to ω^*, that is from E_0' to F' in the northwest quadrant of Figure 3, which amounts to emigration measured by the line segment $a'b'$ in the northeast quadrant. The respective firms' optimum is at

point *a*. Points *a* and *a'* are vertically one upon the other, and both the workers and the firms face the same equilibrium real wage ω^*. The tax wedge is the vertical distance between points *a* and *a'*, and the budget balance holds at the real wage ω^*. Since *a'b'* = *ab*, neither local employment and production nor migration are affected by the scheme. The conclusion is that a fair tax-transfer scheme does not distort the efficient free migration equilibrium.

The result is somewhat different under a sub-fair system. The extreme case, where $\alpha = 1/(1-t)$, is represented in Figure 3 by the workers' equilibrium e_1' in the labour market, and by the corresponding point E_1' on the real wage line ϖ_1. Under these circumstances, reading at p_0, adjustment to the market real wage ω^* implies a shift from E_1' to *F*. The respective solution on the firms' side (not drawn in the figure) is on D_0 at the employment level L_c, which implies that their real wage line is steeper than ω^*. Thus, the short-term equilibrium is distorted. The consequent amount of emigration is measured by the line segment *cb* in the northeast quadrant of the figure. Quite unambiguously, *cb* > *ab*, which says that a pure tax system accelerates emigration in the short run.

The above finding that an increase in the local tax rate accelerates emigration corresponds to the basic intuition. Yet, since the scheme actually runs a surplus, AEH type adjustment towards the above long-term equilibrium is induced. Responding to the accumulation of the surplus, the workers' gradually increase their work effort. The migration effect is eventually dampened, and the long-term effect converges to that of a fair system, namely zero.

Under a sub-fair system of partial repayments, $1 < \alpha < 1/(1-t)$, the workers' equilibrium in the labour market is, say, e_2 in the northeast quadrant, and the respective point along the real wage line ϖ_2 is E_2' in the northwest quadrant of Figure 3. Reading at the relevant price level p_2, the

adjustment leads from E_2' to F", and the resulting emigration is measured by the line segment df in the northeast quadrant. The firms' solution is again based on a real wage line steeper than ω^* (not drawn in the northwest quadrant). It is quite evident that $ab < df < cb$, which says that this kind of a system accelerates emigration, but less than a pure tax system. The result is intuitive.

The above solution is again both distorted and short-term in nature. The budget of the scheme runs a surplus, which again induces AEH type adjustment towards the efficient long-term solution. If the workers' are actually fully compensated, they are also induced to gradually increase their work effort. The adjustment path leads to the long-term solution, where the migration effect is reduced to zero.

5. Conclusions

The paper provides a simple and illustrative model for the analysis of the effects of local policy on inter-locality migration. A local tax-transfer scheme of wage taxes and consumption price subsidies is introduced. The effects of the scheme are shown to depend on whether the scheme is fair or unfair, which again depends on if taxes are expected to be fully repaid in terms of subsidies or not. Even an actually fair scheme may be anticipated sub-fair in the short term, during the AEH type adaptation path towards the long-term equilibrium.

The main lesson from the analysis is three-fold. First, a fair and correctly perceived tax-transfer scheme does not affect migration. This is because a fair system leaves the local real wage unchanged and thus has no effects on inter-locality welfare comparisons. The free migration equilibrium is efficient. The result holds in a perfect foresight type world, around a market solution that is long-term in nature.

Second, a sub-fair tax-transfer scheme has a short-term effect that encourages emigration. The effect is the stronger the farther away the short-term equilibrium is from the long-term one. A pure tax system with no (anticipated) repayments quite intuitively has the strongest effect. Even partial(ly anticipated) repayments from the system weaken the motives to emigrate. The short-term migration equilibrium is distorted because the real wage faced by the workers deviates from that faced by the firms.

And third, under the sub-fair tax-transfer scheme, the short-term effects of the scheme are eventually dampened in the longer term, provided that the tax revenue is not wasted or used to other purposes, which do not benefit the worker-taxpayers. This is because continuing accumulation of the budget surplus of the scheme promotes AEH type adjustment in the supply of labour, and leads to convergence towards the efficient long-term equilibrium.

The results of the paper concern the effects of a fair or sub-fair tax-transfer scheme on emigration, but they can, of course, be converted to cover immigration and super-fair programs. The main intuition is based in any case on the effects of the scheme on local labour supply: fair programs induce local workers to respond so that domestic labour supply remains unchanged, while sub-fair programs induce less than appropriate and super-fair programs induce more than appropriate increases in domestic labour supply. The changes in the local market conditions then have the obvious short-term effects on emigration and immigration, which dampen out in the longer term.

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Figure 1: The local market equilibrium

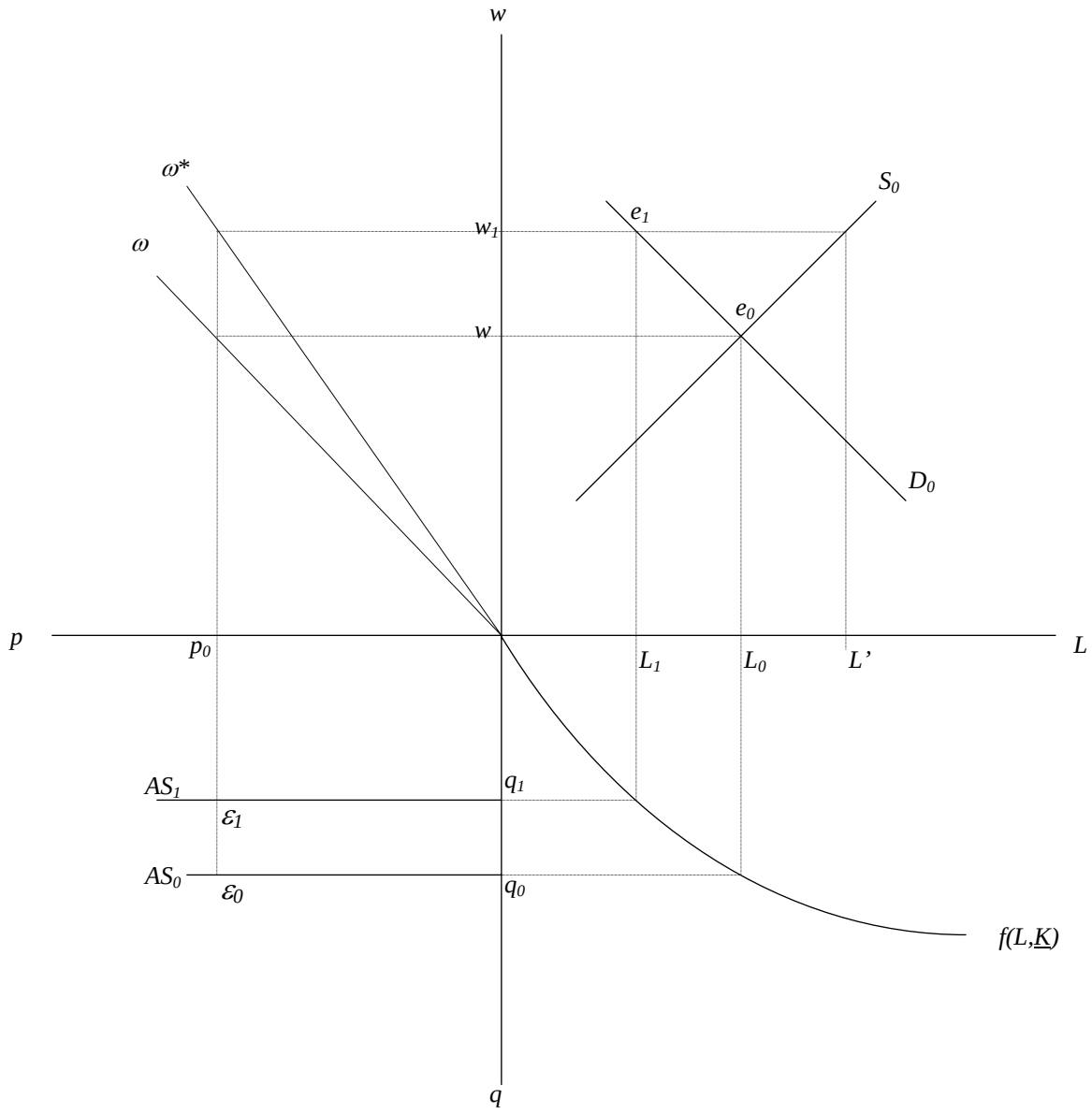

Figure 2: Effects of a tax-transfer scheme on the autarky equilibrium

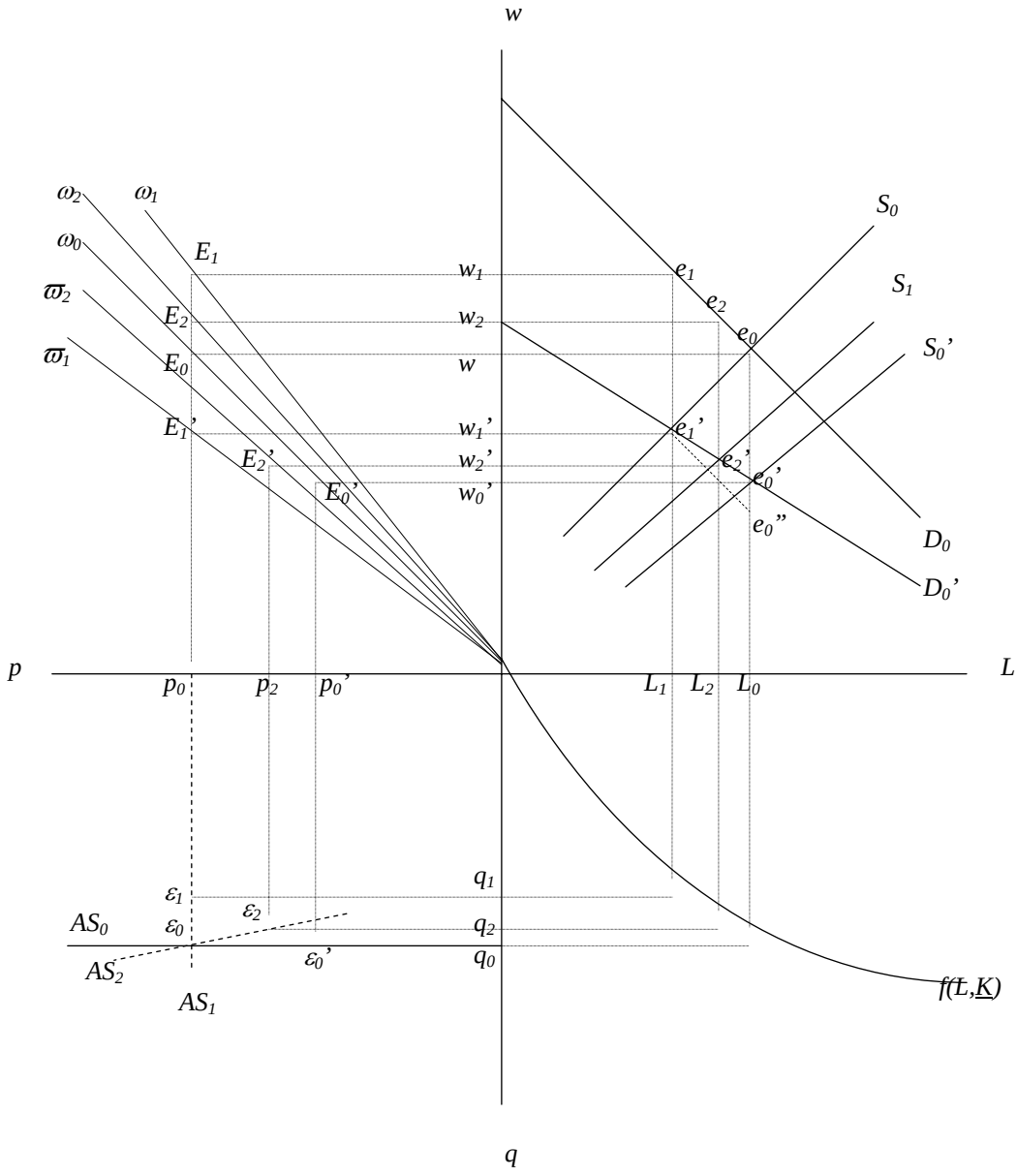

Figure 3: Effects of a tax-transfer scheme on emigration