EFFECTS OF A TAX-TRANSFER SCHEME ON MIGRATION

Hannu Laurila

Working Paper 37
December 2004

DEPARTMENT OF ECONOMICS AND ACCOUNTING
FI-33014 UNIVERSITY OF TAMPERE, FINLAND

ISSN 1458-1191
ISBN 951-44-6228-9
EFFECTS OF A TAX-TRANSFER SCHEME ON MIGRATION

Hannu Laurila
Department of Economics and Accounting
FI-33014 University of Tampere

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

\[ q = f(L, K), \]

where the capital stock, \( K \), 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

\[ w = pf_1 \]
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 $e_0$ on the $AS_0$ curve.
The simultaneous $e_0-e_1$ 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 $\omega^*$, which is assumed to be steeper than that of the local real wage line $\omega_e$. 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 $\omega^*$ 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 $e_1$. 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 $\omega^*$ 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

\[
(4) \quad \frac{d\omega}{d\alpha} = \frac{g(\alpha)}{\beta} < 0,
\]

which says that a fall in the implicit rate of return of the scheme (a rise in \( \alpha \)) 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’).
\[ \frac{\partial q}{\partial \omega} = f_1 \frac{g(L)}{f_1 - g} < 0. \]

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 \(\alpha\)) 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,

\[ \frac{\partial \omega}{\partial \alpha} = f_{11} \frac{g(L)}{f_1 - g} > 0, \]

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

\[ \frac{\partial \varpi}{\partial \alpha} = f_1 \frac{g}{f_{11} - g} < 0, \]

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 $\omega_0$, employment is $L_0$, production is $q_0$, and the corresponding goods market equilibrium is at point $e_0$ 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 $\omega_0$. 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 \( \epsilon_0' \) on the vertical \( AS_0 \) curve, corresponding to point \( E_0' \) along \( \omega_0 \) 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 \( \epsilon_0 \) 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 \( \omega_0 \) to \( \varpi_1 \) and by the shift of the firms’ real wage from \( \omega_0 \) to \( \omega_1 \), 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 \( \epsilon_1 \), 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 \( e_1'e_0e_0' \) (compare to Hansen & Nielsen, 1997, p. 68).
The case of partially perceived repayments, \( t > s \geq 0, 1 < \alpha < 1/(1-t) \) is presented by the real wage pair \( \varpi_2 \) for workers and \( \omega_2 \) 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 \( S_i \), 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 \( \varepsilon_2 \), 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 \( t_w_2, t_w_1 > t_w_2 > t_w_0 \). The induced welfare loss can be inversely measured by that part of the area \( e_1'e_0\varepsilon_0'' \), 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 $\omega^*$. 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 $AS_b$. 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 $\omega_0$ 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 $\omega_0$ in the northwest quadrant of the figure.

Taking the workers’ perspective and reading at $p_0'$, free migration implies adjustment from $\omega_0$ to $\omega^*$, 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 $\omega^*$. The tax wedge is the vertical distance between points $a$ and $a'$, and the budget balance holds at the real wage $\omega^*$. 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 $\varpi_1$. Under these circumstances, reading at $p_0$, adjustment to the market real wage $\omega^*$ 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 $\omega^*$. 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 $\varpi_2$ 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 $\omega_*$ (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.
References:


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