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POLICY IMPLICATIONS ON FACTOR MIGRATION

Hannu Laurila

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

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A Note on the Mundell-Fleming Model: Policy Implications on Factor Migration

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Hannu Laurila

Department of Economics and Accounting
FI-33014 University of Tampere

Abstract
The policy implications of the seminal Mundell-Fleming model are reviewed in the classical long-term regime of the full Neo-Keynesian macroeconomic model. It is shown that, besides the temporary capital flows described by the Mundell-Fleming model, both fiscal and monetary policy may have longer lasting effects on factor migration. A positive policy shock motivates emigration of labour and inflow of capital, and vice versa. Under imperfect mobility of labour, the effect on labour migration depends on whether the domestic transaction costs of revising the contracts are higher or lower than the costs of international mobility.

Key words: exchange rates, fiscal and monetary policy

JEL classification: E63, F22
1 Introduction

The seminal Mundell-Fleming macroeconomic model says that stabilisation policy may have short-run effects on production and employment, but that in the longer run, around classical full employment, the policy is neutral in real terms. The short-term effects are explained by perfect international mobility of capital, which has its implications on the real and monetary sides in the considered economy. The effects also depend on the exchange rate system – fiscal policy is effective under fixed and monetary policy under flexible exchange rates.

In this paper both capital and labour are taken to be internationally mobile. A Neo-Keynesian macroeconomic model is constructed to illustrate the market conditions on the national level. The final goods and the capital inputs are assumed to be perfectly mobile, whereas the labour input may move somewhat imperfectly. The aim is to show that stabilisation policy may cause international factor movements thus having long-term real effects on the geographical factor allocation and on the K/L ratios of the national economies. This can happen even though factor use, production and social welfare remain unaffected everywhere. The focus is on explaining labour migration and its consequences, but a closer look on the effects on capital migration is also provided.

The paper proceeds as follows. Section 2 presents the Neo-Keynesian macroeconomic model consisting of people’s inter-temporal utility maximisation over consumption and leisure, and of firms’ profit maximisation. The model describes the aggregate supply of final goods determined by classically operating labour and capital markets and the classical production function, and the aggregate demand for the goods determined by the Keynesian IS-LM model. Section 3 yields the graphical analyses of the short-run and long-run effects of expansionary fiscal and monetary policy. Section 4 concludes and discusses the findings.
2 The model

Consider a national economy described by competitive factor and goods markets. On the aggregate level in the economy, the supply side in the goods market is determined by the production function and by the factor market conditions. The production function reads

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

where \( q \) is the supply of goods, \( L \) is labour, and \( K \) is capital. The standard assumptions \( f_L, f_K > 0, f_{LL}, f_{KK} < 0, f_{LK} = f_{KL} > 0 \) apply. In the domestic labour market, the aggregate labour demand derived from competitive firms’ profit maximisation reads

\[ w = pf_L, \]

where \( w \) denotes nominal wages and \( p \) denotes the price level. Function (2) says that nominal wages can, at the highest, equal the marginal revenue product of labour. The labour demand curve has a negative slope in \( L-w \) space by the properties of the production function (1). Aggregate labour supply is derived from people’s optimal time use decisions. This yields in inverse form

\[ w = pg(L) \]

where the right-hand-side tells the market valuation of time. By assumption \( g’ > 0 \), so that the labour supply curve is upward sloping in the \( L-w \) space.

In the capital market, the aggregate demand for capital derived from firms’ profit maximisation reads, after manipulation,
(4) \( p = r/f_K, \)

where \( r \) denotes the market interest rate. By the properties of the production function, the capital demand curve has a positive slope in \( K-p \) space. The supply of capital is derived from people’s saving decisions. The aggregate capital supply function reads, in inverse form,

(5) \( p = r/\varphi(K). \)

The capital supply curve slopes downwards in the \( K-p \) space because of the classical assumption that aggregate saving responds positively to its market yield, \( \varphi' > 0. \)

The demand side of the national economy is determined by the Keynesian IS-LM model. The IS-equilibrium is given by the income-expenditure identity

(6) \( q = c(q) + i(r) + n(q,e) + b, \)

where \( c \) is consumption, \( i \) is investment and \( n \) is net exports, in which \( e \) denotes the exchange rate. The standard assumptions \( c' > 0, i' < 0 \) say that the IS curve declines in the \( q-r \) space. The property \( n_q < 0 \) derives from imports being positively related to incomes, and \( n_e > 0 \) is due to the definition of the exchange rate – a higher price for foreign currency improves net exports and vice versa. In other words, devaluation of the domestic currency shifts the IS curve outwards and revaluation inwards. Parameter \( b \) refers to the budgetary status of the government. Expansionary fiscal policy turns an initially balanced budget \( (b = 0) \) into deficit \( (b > 0) \), and contractive policy into surplus \( (b < 0) \). Expansionary fiscal policy thus shifts the IS curve outwards and vice versa.
The money market equilibrium of the economy, that is the LM curve, is given by

\[ (7) \quad m/p = l(q,r) \]

saying that the real supply of domestic currency equals the demand for money. The amount of money, \( m \), depends positively on the domestic credit issued by the banking system and on the stock of international reserve assets generated in the currency market. The demand for money is reasoned by transaction purposes depending on income and by inter-temporal purposes depending on the interest rate. Assuming that \( l_q > 0, \ l_r < 0 \) the LM curve slopes upwards in the \( q\)-\( r \) space. Expansionary monetary policy shifts the LM curve outwards and vice versa.

The equations (1)–(5) determine the aggregate supply and (6)-(7) the aggregate demand in the local goods market. Graphically, in the \( q\)-\( p \) space, the classical aggregate supply schedule (the AS curve) is vertical at full factor employment, and the aggregate demand schedule (the AD curve) has a negative slope. The policy induced shifts of the IS and LM curves manifest in corresponding shifts of the AD curve, but since the AS curve is vertical, there should be no real effects in the long term.

Figure 1 below illustrates the model. Panel (i) of the Figure presents the labour market, the production function (with \( K \) constant) and the goods market with respect to the real wage \( \omega = w/p \). Panel (ii) presents the capital market, the production function (with \( L \) constant) and the IS-LM equilibrium with respect to the real interest rate \( \rho = r/p \). The Panels have two variables in common, namely real production \( q \) and the price level \( p \). It is assumed that there initially exists an equilibrium within and between the national economies so that the equilibrium real wage \( \omega^* \) and the equilibrium real interest rate \( \rho^* \) in the considered national economy equal to the international rates.
In Panel (i) of Figure 1, the local labour market is in equilibrium at point $e_0$ for nominal wages $w_0$ giving $L_0$ for employment. In Panel (ii), the capital market equilibrium $e_0$ gives $K_0$ for capital use at the nominal interest rate $r_0$. The factor markets together determine equilibrium production $q_0$ and the vertical aggregate supply curve $AS$. The aggregate demand curve $AD_0$ is determined by the IS-LM equilibrium. Point $E_0$ of Panel (ii) refers to the goods market equilibrium $E_0$ in Panel (i), which gives $p_0$ for the equilibrium price level. If the price level should rise, for some reason, to $p_1$, the market equilibrium would simply adjust to $e_1$, $e_0$, $E_1$, $E_1$ thus leaving all the real terms unchanged.

3 Policy implications
3.1 Short-term effects of fiscal policy

Analyse first the short-term effects of fiscal policy in the Neo-Keynesian model constructed above. Suppose that expansionary fiscal policy is implemented nationally so that the balanced budget $b = 0$ turns into deficit, $b > 0$. Assume fixed exchange rates to see the short-term real effects in the original spirit of the Mundell-Fleming model. Concentrate first on these effects and recall that the price level is assumed fixed on the short term so as to reflex the Keynesian special case of a flat AS curve. Therefore, Panel (i) of Figure 1 is omitted and the analysis is done in terms of Panel (ii) only.

The exogenous demand shock shifts the IS curve outwards from $IS_0$ to $IS_1$ in Figure 2. Aggregate demand in the goods market shifts accordingly (not shown in the Figure). On impact, the interest rate rises along $LM_0$ to $r'$ so that the real interest rate rises from $\rho^*$ to $\rho'$, attracting foreign capital to
move in. The supply of foreign currency in the market increases thus tending to revaluate the domestic currency, \( de < 0 \).

Note that there is a momentary oversupply in the capital market, of which the part \( \varepsilon_0 b \) is due to the inflow of foreign capital and the part \( a \varepsilon_0 \) is due to decreased domestic demand for capital. Under fixed exchange rates the central bank must intervene by buying foreign currency, which raises the international reserve assets. The domestic money supply thereby increases shifting the LM curve outwards to \( LM_1 \) to equalise the domestic interest rate again to the foreign interest rate. The short-term IS-LM equilibrium shifts from point \( \Sigma' \) and settles to \( \Sigma'' \). The short-term real effect is that production rises from \( q_0 \) to \( q' \). As is evident by the figure, however, this effect is not sustainable. Let us come back to this issue after viewing the respective short-term effects of monetary policy.

3.2 Short-term effects of monetary policy

Figure 3 provides the analysis of the effects of monetary policy. The exchange rates are now assumed flexible to follow again the original spirit of the Mundell-Fleming model.

(Figure 3 here)

In Figure 3, the central bank increases the domestic money supply, \( \Delta m > 0 \), thus shifting the LM curve outwards from \( LM_0 \) to \( LM_1 \) in Figure 3. Aggregate demand again shifts accordingly outwards. On impact, the interest rate falls along \( IS_0 \) so that the real interest rate now falls from \( \rho^* \) to \( \rho' \) thus inducing domestic capital to move out.

There emerges momentary over-demand in the capital market, part of which (namely \( a \varepsilon_0 \)) is due to the outflow of foreign capital and part of which (namely \( \varepsilon_0 b \)) is due to increased domestic demand
for capital. Capital outflow tends to devaluate the exchange rate \((de > 0)\) and, under flexible exchange rates, the domestic competitiveness improves thus increasing net exports. As a result, the IS curve shifts outwards to \(IS_t\) to equalise the domestic interest rate again to the foreign interest rate. The short-term IS-LM equilibrium is again at point \(\Sigma''\), and the short-term production effect is from \(q_0\) to \(q'\). Just like in the case of fiscal policy this effect is not sustainable in the longer term.

### 3.3 Long-term effects

In the longer term, the domestic price level must also adjust with due effects of the factor markets. Figure 4 illustrates the full macroeconomic adjustment to a positive policy shock caused by either fiscal or monetary policy.

(Figure 4 here)

In Panel (i) of Figure 4, the domestic price level is induced to rise along \(AD_2\) from \(p_0\) to \(p_1\) as the goods market equilibrium shifts from \(E'\) on the short-term aggregate supply curve \(AS^{ST}\) to \(E_1\) on the long-term aggregate supply curve \(AS^{LT}\). The rise in prices implies that, in Panel (ii), the LM curve shifts inwards from \(LM_1\) to \(LM_2\) thus causing the IS-LM equilibrium to shift from \(\Sigma''\) to \(\Sigma_1\). The nominal interest rate rises from \(r_0\) to \(r_1\). In the classical regime of the model, the real production remains unchanged at \(q_0\) in both Panels (i) and (ii) of the Figure after the proper adjustment of the factor markets. The factor market adjustment can happen purely in nominal terms, which is the abstract interpretation of the classic model, or in both nominal and real terms, in which case the latter mode is carried out by factor migration.

Start by examining the adjustment in the labour market in Panel (i) of Figure 4. The classical idea is that the increase in aggregate demand makes the prices rise thus causing a momentary fall in the
real wage below $\omega^*$. This is reflected by shifts in labour demand and labour supply: the labour demand curve shifts outwards from $D^L_0$ to $D^L_1$ and the labour supply curve shifts inwards from $S^L_0$ to $S^L_1$. On impact, the nominal wages adjust from $w_0$ to $w_1$ and the labour market equilibrium shifts from $e_0$ to $e_1$ so that the real wages remain unchanged. Employment remains at $L_0$ and production at $q_0$ so that no real effects occur in these respects, either.

The above intuition is clear under perfect foresight (or under rational expectations), but it is still worthwhile to examine the classical mechanism in closer detail. The market mechanism can work basically in two ways, within and between the national markets. The first alternative refers to the case of perfectly immobile labour and the latter to perfectly mobile labour input.

Within the national markets, the market mechanism still has two practical alternatives. The first alternative is that the contracts are continuously updated between the employers and the employees so that the nominal wages are corrected in the contracts whenever changes in prices occur. The result is a vertical shift from $e_0$ to $e_1$ in Panel (i) of Figure 4. The second alternative is that the adjustment is based on exchange of jobs: the contracts are renewed by quitting the present jobs and taking new ones with better specifications. The momentary fall in the real wage implies momentary over-demand of labour at $w_0$ measured by the horizontal difference $e'' - e'$, of which $e'' - e_0$ is due to the quitting of jobs. Nominal wage offers must rise domestically until all the quitters have been drawn back to work, and the equilibrium settles to $e_1$ at $w_1$.

If the labour input is perfectly mobile the jobs can be exchanged also internationally between the national economies. The workers can respond to the momentary fall in the real wages by taking new jobs in the international labour market, where the real wage is constantly at $\omega^*$. This can be seen in Panel (i) of Figure 1, where the local labour market adjusts to the initial shock by emigration until
the domestic nominal wage rises to \( w_1 \) thus restoring \( \omega^* \) in the labour market. Technically, the labour supply curve turns vertical between \( w_0 \) and \( w_1 \), above which it shifts inwards in parallel form. The outcome is a kinked new labour supply curve \( S^L_1 \). The labour market equilibrium shifts from \( e_0 \) to \( e_1 \) as before saying that employment and production remain unchanged at \( L_0 \) and \( q_0 \). Yet, there are real effects since emigration of labour amounts to \( L_1 - L_0 \) at \( w_1 \).

Next, turn to the adjustment in the capital market in Panel (ii) of Figure 4. The assumption of perfect mobility is better justified in the capital market than in the labour market. This is not only because of practical evidence, but also because there is considerable rigidity in the adjustment of the supply of capital caused by its inter-temporal nature: the national residents decide on their saving on this period thus contributing to the capital stock of the next period.

The policy shock makes the nominal interest rate rise from \( r_0 \) to \( r_1 \) inducing capital demand to shift backwards from \( D^K_0 \) to \( D^K_1 \) in Panel (ii) of Figure 4. At \( p_0 \) this causes momentary over-supply of domestic capital thus inducing the prices to rise. Furthermore, it makes the domestic real interest rate rise momentarily over the international rate \( \rho^* \) attracting the perfectly mobile capital to flow in. The local capital market adjusts to a new equilibrium by the rise in the price level from \( p_0 \) to \( p_1 \) and by the capital inflow \( K_0 - K_1 \), which is the horizontal difference between \( D^K_1 \) and \( S^K_0 \) at \( p_1 \). The capital inflow turns the capital supply curve kinked, since the curve turns vertical between \( p_0 \) and \( p_1 \) and shifts horizontally outwards to \( S^K_1 \) above \( p_1 \). The capital market equilibrium shifts from \( e_0 \) to \( e_1 \). Capital use remains at \( K_0 \) and production at \( q_0 \). Real effects occur in the form of capital reallocation.

4 Conclusions

The conventional wisdom of the Mundell-Fleming model that stabilisation policy has no real effects around full employment is challenged, when both capital and labour are mobile. It is found that
while policy does not affect factor employment, production, welfare and other such issues, it may well have real effects on the geographical allocation of the production factors.

In particular, the paper shows that a positive policy shock induces labour to emigrate and capital to immigrate, and vice versa. The result may seem surprising, but the intuition is sound. A positive demand shock with its inflationary pressure makes the real wage in the present job contracts momentarily lower than the international real wage thus inducing people to take better paying jobs abroad. Likewise, as the inflationary shock implies a decrease in demand and an increase in supply in the domestic capital market, there may momentarily exist over-demand for capital, which is rapidly filled by the inflow of the perfectly mobile factor. Factor migration simply constitutes a re-equilibrating market adjustment mechanism that works between the national economies.

The effects of policy shocks on factor migration are mitigated by the conventional domestic alternatives for the market adjustment, which involve purely nominal issues. This is true especially in the labour market, where the nominal wages can adjust through employer-employee re-contracting of the existing job contracts and/or through the more market-like mechanism of workers’ continuous exchange for the best paying jobs.

In practice, the domestic modes of adjustment cause transaction costs to the workers in terms of money and time. The re-contracting option necessitates monitoring, negotiating, enforcement and other such efforts, and the exchange option causes search costs the more the longer it takes for the domestic markets to adjust to the new equilibrium. Yet, international migration causes transaction costs, too. The key point is that the workers can substitute migration for domestic re-contracting and/or search when responding to the policy-induced changes in the market parameters. If the domestic re-contracting and/or search costs are too high as compared to the mobility costs, people
rather move in the international labour market and take those jobs, in which the equilibrium real wage is straightforwardly available.

In the capital market adjustment by migration is a more obvious option than in the labour market. This is because the mobility costs of capital are quite reasonably lower than those of labour, while the domestic adjustment costs of capital are reasonably higher than in the labour market because of the rigidity of the inter-temporal supply of capital. Thus it is quite plausible that policy has long-term effects on capital migration. Moreover, in the case of monetary policy, the short-run and the long-run effects are of opposite sign: a monetary expansion causes capital outflow in the short run and capital inflow in the long run, and vice versa.

One complication must be noted, though. The good mobility of capital is at least partially because of the fact that capital is not attached to its owner and that the yields can be easily transported internationally. It may thus well be that it is the nominal interest rates rather than the real interest rates that explain the movements of capital. If that is the case, the present model is not able to provide unambiguous results.

To conclude, the real effects of stabilisation policy depend on the mode of adjustment prevailing in the factor markets, which in turn depends on the relative adjustment costs in the alternative modes. The domestic and international modes substitute each other in individual behaviour and as market mechanisms. The aggregate effects on factor migration therefore depend on the relative transaction costs faced by the individual market agents. If the domestic adjustment too costly as compared to the costs of migration, the real effects on migration become stronger and vice versa. The issue of course remains an empirical one.
Reading:


Figure 1: The model

Panel (i)

Panel (ii)
Figure 2: The effects of fiscal expansion under fixed exchange rates
Figure 3: The effects of monetary expansion under flexible exchange rates
Figure 4: The long-term effects of expansionary policy

Panel (i)

Panel (ii)