Scand. J. of Economics 97(4), 527–546, 1995

Factor Mobility, Risk and Redistribution in the Welfare State

*David E. Wildasin**

Vanderbilt University, Nashville TN, USA

Abstract

Economic integration reduces the costs of factor mobility, producing efficiency gains and contributing to equalization of net factor returns. This raises the *cost* of income-redistribution policy, thus threatening a basic function of the welfare state. A simple model of costly factor mobility under uncertainty shows that greater factor mobility enables factor owners to pool industry-specific, region-specific or occupation-specific risks (due to uncertain technology or terms of trade). Economic integration may thus reduce some of the potential social insurance *benefits* of redistributive policy.

I. Introduction

Economic integration is not easy to define a precise way, but in general it is clear that technological and political change over the past half-century or more has lowered the cost of many types of transactions among spatially separated agents. Better communication and transportation, the spread of knowledge about market opportunities and commercial practice, the liberalization of many types of economic policy through such institutions as the European Union and the North American Free Trade Agreement, and the collapse of the planning mechanisms of the state-dominated

* Earlier versions were presented at meetings of the Regional Science Association, Niagara Falls, and Allied Social Science Associations, Washington, DC, at the *SJE's* conference on "The Future of the Welfare State" and at conferences on "Topics in Public Ecnomics", Tel Aviv University, and "Distributional Aspects of Fiscal Policy: The Implications of Economic Integration", University of Essex. I am grateful to J. Burbidge, R. Musgrave, J. Rust, R. Schoeb, Y. Weiss and other participants, G. Eskeland, P. Mieszkowski, two anonymous referees and the editors for many useful comments. This reseach was initiated during a visit to the Norwegian School of Economics and Business Administration and continued at the Public Economics Division of the World Bank. I am grateful to these institutions for their hospitality and support.

economies of Eastern Europe and the former Soviet Union all exemplify and contribute to this trend. Goods and services now flow more freely within and among regions, businesses can attract capital from more fully developed and interlinked capital markets, and workers can move more freely among different jurisdictions. Increased interjurisdictional linkages of markets for goods and factors change significantly the economic environment within which government fiscal and other policies are implemented. In particular, income redistribution and social insurance policies, which more than any others define the modern welfare state, directly impinge upon and attempt to alter the equilibrium outcomes of factor markets.[1] Their effects are likely to depend sensitively on the nature of these markets. How does factor market integration affect income inequality and risk and what are its implications for social policies that deal with inequality and risk?

It may be noted, first, that increased integration of factor markets can impose new constraints on the ability of governments to engage in income redistribution. The potential mobility of factors of production in response to fiscal differentials underlies traditional arguments for centralization of the redistributive functions of government; see e.g. Oates (1972). Increased internationalization of factor markets implies that such a "central" government, i.e., one whose geographical extent coincides with that of the relevant factor market, cannot ordinarily be understood as a "national" government. The redistributive function of government has become increasingly decentralized over time due to the expanded geographical scope of the ambient factor markets within which redistributive policies are executed. However, while greater factor mobility may add constraints to the ability of governments to redistribute income, it can also in itself provide a form of market insurance against income risk. Access to "external" factor markets limits the extent of factor price variation through spatial arbitrage and may, to some degree, obviate the need for public sector insurance of such risks. Here, this aspect of increasing factor market integration is investigated for the insurance and redistributive role of the public sector. Recent macroeconomic literature (e.g. analyses of optimal currency areas; see De Grauwe (1992) and Eichengreen (1993) and references therein) have emphasized the possibility of risk *pooling* through centralized fiscal systems with immobile factors of production. The analysis here emphasizes risk *shifting*, and changes in the welfare costs of

[1] In a "short-run" and *ex post* sense, many welfare-state policies are redistributive in nature. From a "long-run" and *ex ante* perspective, however, they can also be viewed as insurance programs. Many authors have commented on the "social insurance" view of government income redistribution policy, and this view may indeed be one of the foundations of the modern welfare state; see e.g. Atkinson (1987, Section 2.3) and references therein to work by Harsanyi, Buchanan, Rawls, Varian and others.

redistribution, due to the increased mobility of some but not all factors of production.

Section II develops a model in which one immobile and one potentially mobile factor of production are employed together in a risky production process. The degree of integration of the market for the potentially mobile factor is parameterized by a mobility cost parameter. Section III investigates the impact of variations in this parameter to show how changes in factor mobility affect factor pricing and income risk, with or without government redistributive policies. While many of the most important results are quite general, the analysis is worked out in particular detail for a special case in which the possible consequences of factor market integration are especially striking. Section IV identifies some questions for further research.

II. The Model

It is helpful to begin by illustrating some of the basic ideas of the model with a simple parable. Imagine a group of specialized regions, in each of which workers produce a region-specific commodity for export, and suppose that regional weather conditions and the prices of export goods on external markets vary randomly and, to at least some degree, independently. If workers are unable to leave their native regions for alternative types of employment, the regional market-clearing wages will depend on region-specific weather and price realizations, so that, in a given year, some workers will experience high incomes while others have low incomes. If all of these regions were within the jurisdiction of a single government, it would be possible, in principle, to devise a system of taxes and transfers that would pool some or all of this income risk. If there is no such government and no market mechanisms through which to insure against these risks, however, the workers must simply absorb their regional income shocks.

Now suppose that it becomes possible for workers to move from one region to another after they observe the weather and the market price for the goods produced in each region. As long as the random shocks to each region are not perfectly correlated, the returns to workers will be higher in some regions than in others, and workers will tend to move from low-wage to high-wage regions. In doing so, they carry out a form of spatial arbitrage that brings wages in different regions closer together. They also improve the efficiency of resource allocation, increasing the total value of production. In the limit, if migration is costless, wages must be equalized among regions, so that all region-specific risk is perfectly pooled and the *ex post* distribution of income among workers is perfectly equal. In short, *the integration of labor markets can itself insure workers from income risk,* *obviating the need for any explicit private or public insurance.* Indeed, whereas such insurance might be valuable when the regional labor markets are completely isolated from each other, it might be harmful in the case where the markets are integrated. At least it would reduce the incentives for workers to relocate from low- to high-wage regions.

This parable suggests how the integration of factor markets can bring about both greater efficiency of resource allocation as well as greater equality in the distribution of income. It suggests that government policies that attempt to mitigate income risk may be more harmful to the efficiency of resource allocation as markets become more integrated, and it also suggests that the benefits of those policies may diminish as well. Perhaps, then, increased factor mobility associated with economic integration weakens the rationale for some of the traditional redistributive functions of the welfare state, both by making those functions more costly and by reducing whatever insurance benefits they might have provided.

Although the parable is suggestive, it is both imprecise and incomplete. Equilibrium models of factor mobility most naturally are based on the existence of some *immobile* factor. The presence of immobile factors implies that production in each region exhibits diminishing returns to mobile factors, giving rise to equilibrating adjustments of factor prices in response to factor migration.[2] The presence of immobile factors is also important in the analysis of income redistribution policy, since some degree of immobility is necessary for such policies to have any real effects on income distribution. If the existence of immobile factors is acknowledged, one must ask how the increasing mobility of some factors interacts with the pricing of other, less mobile factors and the income risk to which they are exposed. How do the incidence and allocative effects of redistributive policies depend on the presence of multiple factors with simultaneously determined prices? The interplay between mobile and immobile factors features prominently in the following analysis and differs from many macro models which assume complete factor immobility (e.g. models of optimal currency areas with centralized fiscal systems that pool risk among regions).[3]

---

[2] In the absence of fixed factors, there is no mechanism to stop the flow of factors from low- to high-return locations, other than *a priori* given migration costs. While such migration costs are certainly important, they do not in themselves offer a very complete or insightful theory of interregional factor allocations.

[3] See e.g. De Grauwe (1992), Bureau and Champsaur (1992), Drèze (1993) and Persson and Tabellini (1993) and, for a survey and additional references to the literature, Eichengreen (1993). Factor mobility, and the relationship between factor mobility, general equilibrium factor pricing, and the sharing of risk through factor markets are not generally considered in these discussions. By assuming a given degree of factor market integration, previous analyses take underlying income risks as given, whereas the impact of integration on the

To address these questions, a more formal analysis is necessary. Thus, consider an economy in which a single homogeneous output x is produced using one potentially variable factor of production, m, and one or more fixed factors. The production technology is subject to uncertainty, represented by a random variable θ, and is characterized by diminishing returns to m:

$$x = f(m, \theta), \qquad f_m > 0 > f_{mm}. \tag{1}$$

Note that the model is fundamentally static, with production occurring once after the realization of a single random shock. Factor markets are perfectly competitive and the price of the variable factor is determined after the state of the world is known. Expressing all prices relative to the homogeneous output, the return per unit of the variable factor is thus

$$w = f_m(m, \theta), \tag{2}$$

which, in general, is random. The returns to the fixed factors are given by

$$r = f(m, \theta) - wm \tag{3}$$

and are random, in general. It is assumed here that *factor owners are unable to buy private insurance against factor price fluctuations, so that they do bear income risk when factor prices vary.* Some of the issues that arise in the presence of such insurance are briefly discussed in the conclusion.

Factor supplies are perfectly inelastic at the level of individual households, so that labor/leisure, consumption/saving, and human capital investment decisions are ignored. The initial domestic endowment of the variable factor is denoted by $\bar{m}$. When this factor is mobile, the amount of the input used in local production, m, may differ from $\bar{m}$ either because of imports from external sources ($\bar{m} < m$) or because of exports to the external market ($\bar{m} > m$); mobility is the only source of factor variability. As one central case, the variable factor could be labor, with $\bar{m}$ the initial native population of mobile workers, and the fixed factor could be land and capital owned by other (non-mobile worker) native residents. In this case, movement of the variable factor corresponds to immigration or emigration. The analysis does not, however, require factors of production to be owned by (initial) domestic residents.

---

magnitude and distribution of these risks is a central issue here. Bureau and Richard (1994) provide a recent analysis of some of the implications of factor mobility for public insurance mechanisms. Analyses of convergence among regions, e.g. Barro and Sala-i-Martin (1991), have drawn attention to the potential importance of factor mobility but tend to focus on total per capita income variation among regions rather than the implications of partial factor mobility for the distribution of income and income risk within regions by type of factor. The analytical framework of Boadway and Wildasin (1990) is similar to that presented here but the focus there is on centralized rather than decentralized redistributive policy.

The domestic government may drive a wedge between gross and net factor returns through the use of (source-based) taxes and transfers. Let t denote a tax (or transfer, if negative) paid by (or to) the owners of the variable factor, so that its net domestic return is $w-t$. In general, t is allowed to depend on the state of nature or (equivalently) to depend on the realized income of the variable factor. The government budget constraint requires that taxes paid by the owners of one factor be transferred to the owners of the other factor, so that the net return to the owners of the immobile factors is given by $r+tm$.[4]

The level of employment of the variable factor is determined by factor mobility, which may be costly. Let $\bar{w}$ denote the certain net return to the variable input on external markets, taken as exogenously fixed. Let c be the per-unit cost of moving the variable factor into or out of the domestic economy. Migration equilibrium requires that the net return to the variable factor be equalized across locations, net of migration costs, i.e.,

$$\bar{w}-c \leq w-t \leq \bar{w}+c \tag{4a}$$

$$m>\bar{m} \rightarrow w-t=\bar{w}+c \tag{4b}$$

$$m<\bar{m} \rightarrow w-t=\bar{w}-c \tag{4c}$$

$$\bar{w}-c<w-t<\bar{w}+c \rightarrow m=\bar{m}. \tag{4d}$$

Substituting from (2), equations (4) determine the equilibrium value of m conditional on the state of the world θ and on the tax/transfer policy t.

A special case. Given the state of the world and the redistributive policy of the domestic government, the system of equations and inequalities in (2) and (4) constitutes a simple general equilibrium model that can be used to

[4] It is trivial to allow for other exogenously fixed government expenditures or revenues, but since none of the results are affected by ignoring such policies, they are omitted for ease of exposition. If provision levels are held fixed, expenditures on pure or non-rival public goods would not vary with factor movements. Differences in levels of provision among regions, like differences in climate and other amenities, would give rise to compensating differentials in equilibrium wages in the presence of full factor market integration, a fact that many authors have exploited to estimate revealed valuations of amenities and public goods. Allowing explicitly for such differences among regions would complicate the details of the following analysis but not its essential features. The benefits from provision of rival or congestible public goods, including cash subsidies as well as various in-kind transfers and public services, are captured in the model through the fiscal variable t. This variable should be interpreted to represent the fiscal contribution per unit of the variable factor, net of any costs incurred for the provision of rival public goods and services. There is some loss of important detail in this interpretation insofar as the value of the benefits provided by public expenditures differ from the cost of provision, but once again the analysis would be complicated, although not affected in its essential features, by explicit inclusion of congestible public goods in the model.

determine equilibrium levels of the variable factor and output, equilibrium gross and net factor prices, and the distribution of income. It would be possible to study this model in its most general form, and the anlaysis below contains several results that apply in the general case. However, the nature and mechanics of equilibrium in the model are most easily understood by considering an illustrative special case.

The special case involves restrictions on the production function and on the distribution of the random variable θ. First, the production function is assumed to be quadratic in m with a marginal product for the variable factor that is subject to additive uncertainty, i.e., $f(m, \theta)=(a+\theta)m-bm^2/2$, so that $f_m=a+\theta-bm$. For the sake of brevity, let us call this the *additive-quadratic* production technology. Second, suppose that θ is a discrete random variable, taking on only the values θ_1, θ_2 with equal probability. Without loss of generality, assume that $\theta_1>\theta_2$ (so that θ_1 is a "good" state of the world) and that $\theta_1+\theta_2=0$ (that is, the parameter a is adjusted so that the θ_i's have zero mean). Figure 1 shows the linear downward-sloping marginal productivity curves for the variable factor for each of the two states of the world. Moreover, assume that $a-b\bar{m}=\bar{w}$, so that the mean domestic marginal product of the variable factor, when only the domestic endowment of the factor is employed, is equal to its external net rate of return. This assumption provides a reference point or normalization for the analysis, by anchoring the expected return to the variable input to that obtainable externally.[5] To depict the equilibrium, suppose first that there is no government redistributive policy so that $t=0$. If c is sufficiently large — specifically, if $c>\theta_1=|\theta_2|$ — there will be no movement of the variable factor in either state of the world. Hence $m=\bar{m}$ in equilibrium, and the equilibrium price of the variable factor is $\bar{w}_i \equiv f_m(\bar{m}, \theta_i)$ in state θ_i, as shown in Figure 1. This corresponds to the equilibrium condition (4d). Total output and the return to the fixed factor are given by $O(a+\theta_1)A\bar{m}$ and $(a+\theta_1)A\bar{w}_1$, respectively, for the good state, and by $O(a+\theta_2)D\bar{m}$ and $(a+\theta_2)D\bar{w}_2$ for the bad state.

If $c<\theta_1$, factor migration will occur in each state of the world. In the extreme case where $c=0$, migration will occur in either state of the world, with $m=m_{\max}$ if $\theta=\theta_1$ and $m=m_{\min}$ if $\theta=\theta_2$, as shown in Figure 1. The net domestic return to the variable factor will be equal to that on the external market, $\bar{w}$, independently of the realization of θ. Total output and the return to the fixed factor will be $O(a+\theta_1)Bm_{\max}$ and $(a+\theta_1)B\bar{w}$ in the good state and $O(a+\theta_2)Cm_{\min}$ and $(a+\theta_2)C\bar{w}$ in the bad state. More

[5] If the mean domestic return is higher or lower than that in the external market, the owners of the variable factor would obtain a higher or lower expected return, respectively, when factor markets are integrated.

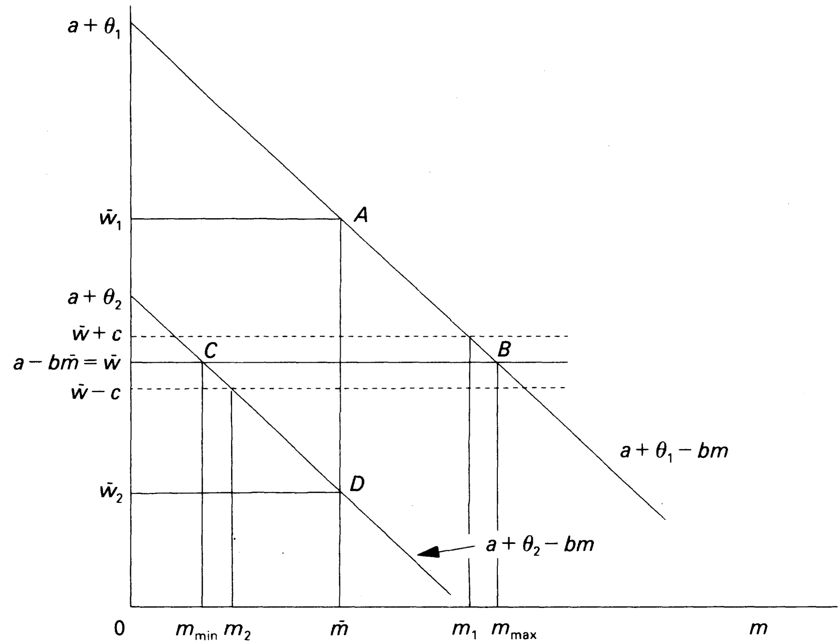

Fig. 1.

generally, if $0<c<\theta_1$, the equilibrium domestic price for the variable factor is $\bar{w}+c$ in the good state (corresponding to equilibrium condition (4b)) and $\bar{w}-c$ in the bad state (corresponding to equilibrium condition (4c)). The equilibrium level of employment of the variable factor is m_i in state i, with $m_{min}<m_2<\bar{m}<m_1<m_{max}$, as shown in the figure. Total output and the return to the fixed input can be read from the figure as before.

It is straightforward to show how taxes or transfers are incorporated into this model. If, for instance, the variable factor is subject to a positive per-unit tax of t in the good state, the curve $a+\theta_1-bm$ in Figure 1, shifted down by the amount t, would show the *net* return to the variable input as a function of the level of employment. The level of m at which this net return is equal to $\bar{w}+c$ would determine the equilibrium level of m in the good state, assuming that it exceeds $\bar{m}$. If the variable input receives a subsidy (i.e., $t<0$) then the curve would be shifted upward by the appropriate amount to determine the equilibrium. The level of employment of the variable input generally depends on the tax-transfer policy t.

Although this special case of the model entails quite restrictive assumptions, it illustrates clearly the essential elements of the determination of equilibrium. Most importantly, it shows how the equilibrium level of employment and gross and net factor prices depend on the state of nature, government redistributive policies and the level of migration costs. If migration costs are sufficiently high, the variable factor is effectively immobile and external factor prices do not affect domestic factor prices. If migration costs are sufficiently low, domestic factor prices are linked by spatial arbitrage through factor mobility to external prices. These are important and *general* properties of the model, not dependent on specific assumptions about the form of the production function or the nature of uncertainty.

In closing the description of the basic model, it is worth noting some possible interpretations and extensions. First, the underlying source of risk in the economy, the random variable θ, could refer to technological uncertainty in an economy where the homogeneous output is "corn", an all-purpose commodity in which incomes are denominated and which is used directly for consumption. Alternatively, one might suppose that the domestic economy is small and open with respect to commodity trade and that it is specialized in the production of particular goods which trade on world markets at uncertain prices. This corresponds to the special case of (1) where θ enters f multiplicatively and is interpreted as the world price of the domestically produced good relative to the price of "corn;" "corn" itself could be a Hicksian composite commodity that encompasses all other tradeable goods for which world relative prices are fixed.

The fixed input(s) could include land, natural resources and public infrastructure such as transportation and communication systems. Depending on the desired application, either labor or private capital, or specific types of each, might be either fixed or variable. Just to name three possibilities: (i) all private capital could be mobile while all labor is fixed, more or less corresponding to the view of many commentators when evaluating the "southern tier" EU countries in relation to existing EU members, (ii) labor could be mobile while capital is fixed, more or less corresponding to the situation in Germany in the "short run" following unification, or to eastern Europe in relation to western Europe if border controls on labor movement were to be removed or greatly eased, and (iii) skilled (or young) labor could be mobile while unskilled (or old) labor and capital are immobile, as in "brain drain" models. The degree of factor mobility in general depends on time horizons and on policy restrictions as well as on intrinsic mobility costs.

It is straightforward to extend the model to allow explicitly for other traded factors of production or for many traded goods, provided that these commodities trade at fixed external prices and that they are not the subject of any fiscal policies or other distortions. Adding extra inputs to the production process at fixed prices does not change the nature of factor price determination for the two inputs described already; see Sandmo and

Wildasin (1994) for further discussion. Trade in goods can lead to factor price equalization, in which case "commodity movements and factor movements are substitutes"; cf. Mundell (1957). Although factor price equalization could obviate much of the present analysis by eliminating migration incentives, it is worth recalling that the underlying assumptions of identical production technologies among jurisdictions and free intersectoral factor mobility are quite strong.[6] In the present model, the random variable θ can be interpreted as random departures from the production technology prevailing in the rest of the world. Under this interpretation, factor-price equalization is precluded by jurisdiction-specific production technologies built directly into the model. Alternatively, one could think of θ as a terms-of-trade shock which affects factor prices because some factors of production are not only interjurisdictionally but intersectorally immobile (at least over the relevant time horizon). At the empirical level, observed factor mobility as well as (binding) constraints on factor mobility (such as immigration quotas or capital controls) testify to the existence of spatial variations in net factor returns, suggesting the value of models in which factor price equalization does not hold.

III. Economic Integration and Income Risk

Income Risk in the Absence of Income Redistribution Policy

Consider now the nature of income risk in the foregoing model. We begin with the case where the government does not intervene to change the distribution of income.

Suppose first that migration costs are prohibitively high, so that no factor reallocations occur in any state of the world. Domestic factor prices and incomes will in general be stochastic, with distributions that depend both on the distribution of the underlying random variable θ and on the way that uncertainty enters the production technology. When the production function is additive-quadratic, the gross price of the variable factor has a variance equal to the variance of θ itself, while the gross return to the fixed input is non-stochastic.[7] This is illustrated for the particular case of a two-point distribution of θ in Figure 1, where the return to the fixed factor

[6] Indeed, any plausible theory of technological uniformity requires an explanation of technological diffusion; since technology is frequently embodied in either human or non-human capital, factor mobility may actually contribute importantly to the establishment of identical production technologies in different regions or countries.

[7] Given $f(m, \theta) = (a + \theta)m - bm^2/2$, the equilibrium price of the variable factor with no migration is $a - b\bar{m} + \theta$. Since $\boldsymbol{E}(\theta) = 0$, the expected return to the variable factor is just $a - b\bar{m}$ and the variance is $\boldsymbol{E}(a - b\bar{m} + \theta - [a - b\bar{m}])^2 = \boldsymbol{E}(\theta)^2 = \text{Var}(\theta)$. From (3), $r = (a + \theta)\bar{m} - b\bar{m}^2/2 - ([a + \theta]\bar{m} - b\bar{m}^2) = b\bar{m}^2/2$, which is indepenent of the value of θ.

is the area under the marginal product curve for m and above its equilibrium price, i.e., the triangular area $(a+\theta_1)A\bar{w}_1$ in the good state and $(a+\theta_2)D\bar{w}_2$ in the bad state. These triangles are clearly equal in size, showing that the return to the fixed factor is state independent.

In the opposite extreme case where migration costs are negligible, the equilibrium domestic factor price for the variable input is equal to the price fixed on external markets and is thus completely certain. Income risk for the owners of the variable factor disappears in this case. It does not disappear for the economy as a whole. Rather, all risk is shifted to the owners of the immobile factor. A complete opening of the economy to the external market for the variable input does not merely imply that the fixed factor absorbs all risk, however. It also changes the mean return to the fixed factor. In the special case illustrated in Figure 1, for example, the mean return to the variable input is unchanged when it becomes perfectly mobile, but the mean return to the fixed input becomes $0.5(a+\theta_1)B\bar{w}+0.5(a+\theta_2)C\bar{w}$, in contrast to a mean return of $0.5(a+\theta_1)A\bar{w}_1+0.5(a+\theta_2)D\bar{w}_2$ when the variable input is completely immobile. Moving from complete immobility to perfect mobility of the variable input thus increases the mean return to the fixed input by the amount $\bar{w}_1AB\bar{w}-\bar{w}CD\bar{w}_2=(\bar{m}-m_{\min})\theta_1$. There is an "efficiency gain" that results from an increase in the mobility of the variable input, in the form of an increase in the mean income accruing to the factor owners in the domestic economy.

Although the comparison of the polar extreme cases of complete immobility and complete mobility of the variable input is informative, the process of economic integration does not occur all at once, as represented in the model by a reduction in c from some very high level to 0. A more realistic view of the process is that the variable input is partially mobile initially, but that it becomes increasingly mobile over time. What happens to income and income risk for each type of factor as the domestic market for the variable input becomes *increasingly* integrated with the external market? This amounts to asking for a comparative-statics analysis of the effect of a reduction in c on the distribution of returns to both factors.

When the variable input is immobile (e.g. if c is infinite), the cumulative distribution of w is given by

$$\Pr\{w\leq w_0\}=\Pr\{f_m(\bar{m},\theta)\leq w_0\}$$

for any $w_0\geq 0$, a distribution that can be determined for any given production technology and distribution of θ. For instance, in the additive-quadratic case, the distribution of $w-a+b\bar{m}$ is identical to that of θ. Reductions in c truncate the distribution of w at both tails, such that

$$\Pr\{w=\bar{w}+c\}=\Pr\{f_m(\bar{m},\theta)\geq \bar{w}+c\}\equiv P_1 \tag{5a}$$

$$\Pr\{w = \bar{w} - c\} = \Pr\{f_m(\bar{m}, \theta) \leq \bar{w} - c\} \equiv P_2 \tag{5b}$$

$$\Pr\{w \leq w_0\} = P_2 + \Pr\{\bar{w} - c \leq f_m(\bar{m}, \theta) \leq w_0\} \ \forall \ w_0 \in [\bar{w} - c, \bar{w} + c]. \tag{5c}$$

In particular, if θ is symmetrically distributed and if $\bar{w} = a - b\bar{m}$, reductions in c trim the tails of the distribution of w without changing its mean, so that *the only effect of increased integration on the return to the variable factor is to reduce its risk.* If the external rate of return to the variable factor were higher or lower than $a + b\bar{m}$ or if θ were not symmetrically distributed, greater integration would raise or lower its mean return while still limiting the range of its variation.

The effect of reductions in c on the distribution of returns to the immobile factor is more difficult to ascertain in general. However, analysis of a useful special case — that of an additive-quadratic production technology and uniformly distributed technology shocks — confirms what the polar cases of complete immobility and complete immobility suggest should be true. First, as shown in Figure 2, *reductions in the cost of factor*

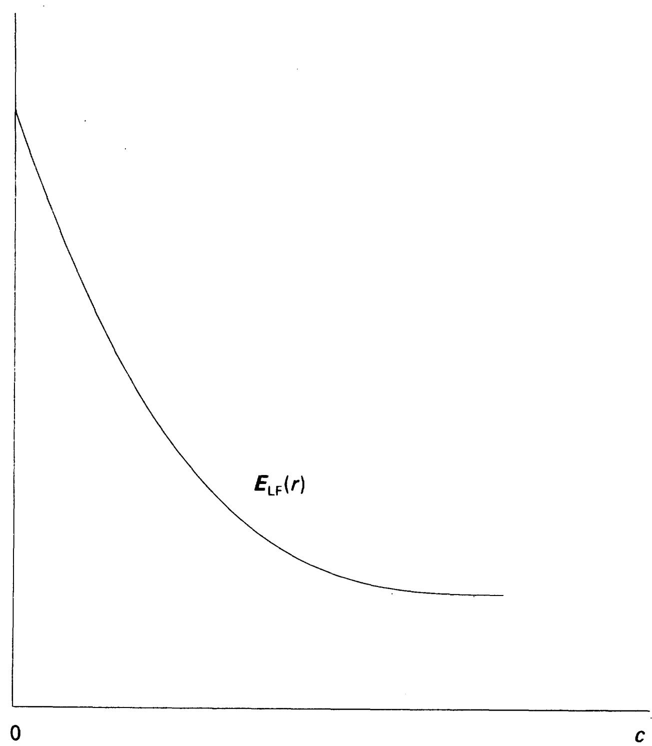

Fig. 2. Expected return to fixed factor.

mobility raise the expected return to the fixed input. That is, there is an "efficiency gain" from improved mobility of the variable input and the fact that it can be allocated more easily where its productivity is higher. (The subscript LF in these figures denotes *laissez-faire*, in reference to the absence of government redistributive policy.) Second, *the variance of the return to the variable input diminishes as its mobility improves*, as shown in Figure 3. Third, *the variance of the return to the fixed factor rises as the mobility of the variable input increases.*

Economic Integration, Risk, and Income Redistribution

Let us now consider now the impact of government redistribution policy as the mobility of the variable factor changes.

Full insurance for the variable factor. Begin with the case where the variable factor is completely immobile. As noted above, the gross income

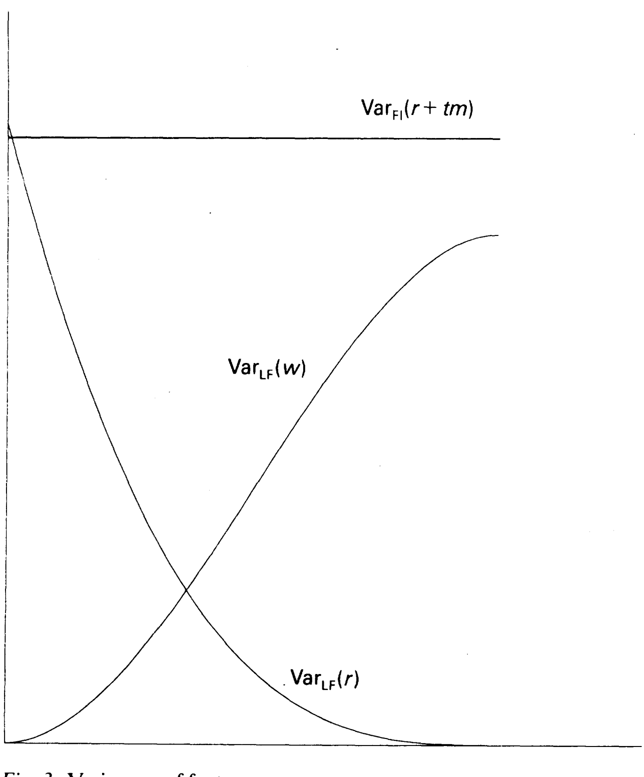

Fig. 3. Variances of factor returns.

of this factor varies with the state of nature in this case; the income of the immobile factor may not. Government policy cannot eliminate income risk under the assumptions that we have made, but it can change how that risk is distributed. For instance, it would be possible to impose a tax/transfer policy such that the net income of the variable input would be the same in all states of the world, the case of *full insurance* for the variable factor. This outcome can be achieved by setting $t = f_m(\bar{m}, \theta) - \bar{w}$, in which case the net income of the variable input would be equal to $\bar{w}$ in every state while the income of the fixed input would be equal to $f(\bar{m}, \theta) - \bar{w}\bar{m}$, thus absorbing all income risk. Income redistribution policy has no effect on the physical allocation of resources in this case.

Now suppose that the variable input is potentially mobile, at a cost of c per unit, and that the government continues to use redistributive policies that keep the net income of the variable input fixed at $\bar{w}$. As long as this policy is in place, there is no incentive for domestic or foreign owners of the variable input to incur the cost of removing it from or bringing it to the domestic economy, i.e., this policy forestalls any factor mobility for any positive value of c. Under this policy, then, changes in the level of c have no effect on input or output levels or on gross or net incomes in any state of the world. By comparison with the *laissez-faire* case, for each value of c, the mean return to the variable input is the same, but its variance is lower (specifically, zero) in the presence of this government policy. On the other hand, the mean return to the immobile factor is lower because the efficiency gains from factor mobility, identified in (7) above, are not exploited. This is an "efficiency loss" from the imposition of the government's redistributive policy.

How does this policy of full insurance for the variable factor affect the variability of the net return to the fixed factor? The answer is clear in general terms: the fixed input absorbs all income risk in the economy and this risk is independent of the level of c (because the allocation of resources is independent of c in the presence of full public insurance for the variable input). This is illustrated by the horizontal line in Figure 3 labelled $\mathrm{Var}_{\mathrm{LF}}(r)$ for "full insurance". Interestingly, it is possible that the variability of the return to the fixed factor can be lower in the full insurance case than under *laissez-faire* for sufficiently small values of c. In the case illustrated in Figure 3, however, this occurs only at very low values of c.

Partial insurance of the variable input. An extreme policy of using taxes and transfers to shift all income risk from the variable to the fixed factor destroys all incentives for the variable factor to relocate after the state of nature is known. This policy thus completely negates any allocative gains from reductions in the cost of factor mobility. While this extreme case is illustrative, it is clearly quite special; *a priori*, findings for this case may not extend to more interesting intermediate cases. For instance, suppose that the government imposes a proportional tax or subsidy on deviations from the mean return of the variable input, such

$$t = \alpha(w - \bar{w}), \qquad \alpha \in [0, 1]. \tag{6}$$

This policy encompasses the *laissez-faire* and perfect insurance policies as polar extremes, corresponding to $\alpha = 0$ and $\alpha = 1$, respectively. More generally, a policy with $\alpha \in (0, 1)$ proportionally shrinks the variation in w, and can be viewed as a proportional income tax/negative income tax scheme with a constant marginal tax rate of α and a break-even level of income of $\bar{w}$. The net return to the variable input under this policy is a simple weighted average of the gross return w and the mean return $\bar{w}$:

$$w - t = \alpha\bar{w} + (1 - \alpha)w. \tag{7}$$

Although it is quite difficult to derive general conclusions about the effects of increased factor mobility on factor allocations and income distribution under this policy, results can be obtained computationally for the simple special case where the production technology is additive-quadratic and θ is uniformly distributed. A policy of partial insurance for the variable input implies that the gross and net returns to each factor diverge, due to the presence of the taxes and transfers through which the insurance is implemented. For any *given* value of the cost of migration c, one can show that (i) the expected gross and net return to the variable input is equal to $\bar{w}$ in the presence of partial insurance (by construction), (ii) the variance of the net return to the variable input is less than the variance of the gross return, (iii) the expected net return to the fixed input is less than its expected gross return, and (iv) the variance of the net return to the fixed input exceeds that of the gross return.[8] What is of most interest for present purposes, however, is how these moments of the factor price distributions change as the cost of mobility changes. Essentially, the results parallel those for the *laissez-faire* case. As economic integration proceeds, the variance of both the gross and net return to the variable input falls. In the extreme case of perfect mobility, both variances drop to zero as a result of perfect arbitrage between the internal and external factor markets. Reductions in c raise the expected gross and net return to the fixed factor and also raise the variance of both the gross and the net return. These impacts are qualitatively in the same direction as for the *laissez-faire* case, though of course their quantitative magnitudes are different.

[8] Details and illustrations of the calculations are omitted to save space. These properties are as expected: (ii) implies that the partial insurance policy actually does lower the variance of net relative to gross income for the "insured" factor, (iii) implies that there is an "efficiency loss" from the policy, and (iv) implies that the policy shifts risk from the variable to the fixed input.

Economic Security in the Welfare State

The welfare states of the advanced democracies face an increasingly liberalized economic environment. In part this is a result of more or less deliberate policy choices, and in part it is a result of long-run technological and other trends. One aspect of this liberalization is an increase in factor mobility. Freer markets generally create incentives for greater responsiveness to shocks, with resulting gains in efficiency. The analysis of Sections II and III bears this out: as factor mobility increases, expected income rises. Shocks give rise to larger fluctuations in input and output levels, with higher levels of employment in high-productivity states of the world and lower levels in states where productivity is low. Efficiency is improved and expected returns rise. In the specific model used, the increase in efficiency of resource allocation accrues only to the immobile input, while the expected return to the variable input remains unchanged. These efficiency gains may be lost if government redistributive policies dull the incentives for state-contingent reallocations of the variable input, however. In the extreme case of full insurance, none of the potential efficiency gains from greater factor mobility may be realized.

What are the distributional implications of greater factor mobility? Do the efficiency gains of greater factor mobility come at the cost of equity? These questions are by their nature not easily resolved due to the difficulty in defining what is equitable. Still, some useful lessons can be drawn from the foregoing analysis by considering different possible scenarios.

Suppose, for example, that there are only two factors, labor and capital, and that labor is the variable input. In the *laissez-faire* economy, greater labor mobility raises the expected return to capital. Workers do not, on average, obtain higher incomes. They do, however, experience reduced income risk, as greater mobility provides them with better access to external market opportunities. Capital income becomes increasingly risky as labor mobility improves. Government policies that pool income risk bring about efficiency losses but also shift income risk from labor to capital. If protection of labor income through market mechanisms is infeasible, then there may be substantial benefit from government redistributive policies in a relatively closed economic environment where workers in unproductive regions have very few opportunities to escape to more rewarding pursuits. However, the benefit from these policies is diminished, and their cost is increased, when labor mobility increases. These policies now inhibit state-contingent factor reallocations that both increase efficiency and reduce income risk for workers. Although a more open economic environment may limit the ability of policymakers to redistribute income and cause some retrenchment of programs aimed at insuring wage incomes, it does not necessarily follow that the *objectives* of those programs are compromised. Rather, the mechanism of wage income insurance may simply shift from public sector redistributive policy to private sector wage equalization through migration.

Suppose now that capital rather than labor is "the" mobile factor of production. The foregoing analysis implies that greater integration of factor markets may increase earnings risk for labor. Greater capital mobility may reduce the riskiness of investment returns at their source. To the extent that capital income streams are tradeable through financial markets, however, the risks to capital income recipients may already be widely shared. Reductions in capital income risk at source may therefore not reduce the income risk of capital owners very substantially. The riskiness of wage income, however, may increase significantly. The analysis presented in Section III suggests that such wage risk can be diminished by reductions in the degree of insurance provided to capital income. One way to do this is by restructing fiscal and other policies. Reductions in effective corporate income tax rates, for example, could reduce the burden of risk shifted from capital income to labor income while simultaneously raising the net return to labor by improving the efficiency of resource allocation.

As a further variation on the model, suppose that there are three factors of production. Suppose that highly-skilled and (generally) high-income workers are treated as a variable input while low-skilled and (generally) low-age workers are relatively immobile. Capital is freely mobile and untaxed and, as indicated in Section II, can be subsumed within the model with no change in the analysis. In this world, greater mobility of high-skilled workers does not raise their average incomes, but it does result in an increase in the average income of *low-skilled* workers, as illustrated in Figure 2. In this respect, greater mobility of high-skilled labor would be inequality-reducing. Nevertheless, low-skilled workers may experience greater income risk as a result of greater mobility of high-skilled workers, while the income risk of the latter may diminish. The allocative losses due to government policies such as personal income taxes, payroll taxes and consumption taxes increase if the market for the high-skilled workers becomes freer. Since these policies also shift income risk to less-skilled workers, scaling back the extent of income-conditioning of tax-transfer policies that apply to high-skilled workers may reduce some of the income shocks to which less-skilled workers might otherwise be exposed.

IV. Conclusion

There are many issues relating to factor market integration and risk that have been ignored here. For this reason, the analysis should be regarded only as suggestive. Important and difficult empirical questions have already been mentioned. In closing, it is useful to highlight some additional topics that warrant further investigation.

Markets for risk. The foregoing analysis applies, in principle, to any situation where there is one potentially mobile variable input that is employed along with a fixed input subject to uncertainty. The focus of the analysis has been on the mean and variance of the income stream at its source. Some income streams, however, notably those accruing to capital investments, can be traded and thus diversified. Increases in capital market integration may not therefore reduce the *cost* of risks that can be pooled by other means, but may instead substitute for some of the functions of financial markets; conversely, development of financial markets may reduce some of the benefits of interjurisdictional capital flows.

Risk-pooling among jurisdictions generally requires cross-ownership of claims on income streams; complete diversification across many jurisdictions implies that the tradeable assets employed in a given jurisdiction will be owned, in equilibrium, by non-residents. This, however, creates an incentive for each local jurisdiction to tax away the income of diversifiable assets, or to seize the assets themselves; see Wildasin and Wilson (1994), Nielsen (1994) and the literature on sovereign debt, e.g. Eaton and Gersovitz (1989). There is therefore a real question about the sustainability of a regime with diversified cross-ownership of assets unless governments can somehow agree, in a *credible* fashion, to restrain themselves from source-based taxation of income or assets owned by non-residents. Liberalization of regulatory constraints on factor movements may provide one means by which such commitments could be made or signalled, perhaps thereby facilitating trading of risky assets.

Localization economies and factor market integration. Urban agglomerations may provide another market mechanism for pooling risk. Krugman (1991, esp. Appendix C) presents a model in which firms with uncorrelated production risks locate together, providing risk-averse workers with protection from wage risk. If firms can bear risk more easily than workers, agglomerations can arise. In its emphasis on pooling of risk through access to dense markets, the present analysis parallels that of Krugman. However, in Krugman's case, dense markets arise through urban agglomerations, whereas in the present analysis it is lower costs of movement to other regions that allow owners of mobile factors to access markets with more stable factor prices. This raises several interesting issues for further analysis, formulated here as conjectures. First, to the extent that agglomerations arise from pooling of labor market risk, greater mobility of labor among regions or countries reduces the benefits of agglomeration and may lead to smaller equilibrium city sizes. By the same token, increases in labor mobility among uncorrelated employers within a metropolitan area due to urban growth or diversification of urban industry reduces the attractiveness of inter-regional migration. Second, although the analysis here has suggested that redistributive policies may reduce interregional factor mobility and the sharing of risks through factor markets, there would seem to be a corollary in the localization-economies context: social insurance reduces the benefits of urban agglomeration and, presumably, leads to smaller equilibrium city size.

Unequal regions and the gains and losses from federation. As noted at the outset, a public policy that provides "insurance" in a long-run sense may be viewed as "redistribution" in the "short run". Incomes *per capita* in different regions of the U.S. have converged substantially over the course of the past century; see e.g. Mills and Hamilton (1984, Figure 2.1). Comparatively free migration of labor and capital within the U.S. has surely assisted that process. For most of the century, however, some regions (notably the South) have been poor relative to other regions. To the extent that labor and capital mobility have contributed to equalization of factor returns, there hve been losers in this process as well as gainers. Within the long-run perspective of the U.S. constitution, such gains and losses may not in themselves be of much concern. For a period of decades, workers or capital owners in one region may suffer reductions in income because of competition from immigrant capital or labor from other regions, but workers and capital owners in each region (locality, etc.) value the option to be able to move elsewhere should economic prospects in their current location take a turn for the worse. Indeed, relative freedom of factor movements within countries is commonplace, and it is clear that restrictions on such freedom (e.g., a prohibition on seeking employment outside of one's city of birth) would result in significant increases in income risk.

Consider, by contrast, the issue of freedom of migration between eastern and western Europe. Rather like the American South, the countries of eastern Europe have incomes much below that of their neighbors to the west. Unrestricted movement of labor and capital among these countries would certainly contribute to "pooling of income risks" or equalization of factor returns. However, it is not clear that this is in the interest of affluent western countries. The analysis in Wildasin (1994) shows that immigration is necessarily harmful to at least some of the initial residents (or, more precisely, the initial owners of the factors of production) of a region if immigrants are net beneficiaries of the fiscal system. (It is even possible that the initial residents may benefit from making transfers to a source jurisdiction if this inhibits immigration.) In the "short run", then, the welfare states of western Europe may be net losers from increased factor mobility. In the "long run", residents in these countries value the option of being able to employ their productive resources outside of their home countries, and might therefore wish to commit to institutional arrangements, such as EU membership, that expand such options. Whether a country gains or loses from membership in a common market, or from allowing another country to join a common market, is therefore a complex question that depends, in part, on the durability of the institutional arrangements.

References

Atkinson, A. B.: Income maintenance and social insurance. In A. J. Auerbach & M. S. Feldstein (eds.), *Handbook of Public Economics*, North-Holland, Amsterdam, 1987.

Barro, R. J. & Sala-i-Martin, X.: Convergence across states and regions. *Brookings Papers on Economic Activity*, 107–82, 1991.

Boadway, R. W. & Wildasin, D. E.: Optimal tax-subsidy policies for industrial adjustment to uncertain shocks. *Oxford Economic Papers 42*, 105–34, 1990; reprinted in P. J. N. Sinclar & M. D. E. Slater (eds.), *Taxation, Private Information, and Capital*, Clarendon Press, Oxford, 105–34, 1991.

Bureau, D. & Champsaur, P.: Fiscal federalism and European economic unification. *American Economic Review Papers and Proceedings 82*, 88–92, 1992.

Bureau, D. & Richard, C.: Public insurance and mobility: An exploratory analysis in the context of European economic unification. Ministère de l'économie, Direction de la prévision; presented at conference on "Decentralization and the Economic Organization of Space", GREQAM, Marseille, 1994.

De Grauwe, P.: *The Economics of Monetary Integration*. Oxford University Press, Oxford, 1992.

Drèze, J.: Regions of Europe: A feasible status, to be discussed. *Economic Policy 17*, 265–307, 1993.

Eaton, J. & Gersovitz, M.: Country risk and the organization of international capital transfer. In G. Calvo *et al.* (eds.), *Debt, Stabilization, and Development*, Basil Blackwell, Oxford, 1989.

Eichengreen, B.: European monetary integration. *Journal of Economic Literature 31*, 1321–57, 1993.

Krugman, P.: *Geography and Trade*. MIT Press, Cambridge, 1991.

Mills, E. S. & Hamilton, B. W.: *Urban Economics*, third edition. Scott Foresman, Glenview, 1984.

Mundell, R. A.: International trade and factor mobility. *American Economic Review 47*, 321–35, 1957.

Nielsen, S. B.: Withholding taxes and country-specific shocks. Mimeo, Copenhagen Business School, 1994.

Oates, W. E.: *Fiscal Federalism*. Harcourt, Brace, Jovanovich, New York, 1972.

Persson, T. & Tabellini, G.: Federal fiscal constitutions: Part I: Risk sharing and moral hazard. EPRU WP, Copenhagen Business School, 1993.

Sandmo, A. & Wildasin, D. E.: Taxation, migration, and pollution. Norwegian School of Economics and Business Administration, Institute of Economics DP 3/94; Vanderbilt University WP 94-W02, 1994.

Wildasin, D. E.: Income redistribution and migration. *Canadian Journal of Economics 27*, 637–56, 1994.

Wildasin, D. E. & Wilson, J. D.: Risky local tax bases: Risk pooling vs. rent capture. Vanderbilt University WP, 1994.