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Factor Mobility and Fiscal Policy in the EU:

Policy Issues and Analytical Approaches

by

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Summary

This paper outlines some of the implications of factor market integration for fiscal policy in the countries of the EU and for the EU itself. It draws particular attention to the dynamic dimensions of factor market integration, and identifies some of the many issues for further research on these topics.

The past century has seen dramatic growth in the role of the public sector in the countries of Western Europe, both by extensive regulatory as well as fiscal interventions. By far the most important reason for the growth of public spending has been the increase in the level of redistributive (or social insurance) activities of governments. These include public pension systems and health care programs as well as a host of other policies. Tax policies also have the effect of redistributing income among different groups.

European economic integration, including prospective enlargement of the EU, contributes to the freer movement of factors of production, such as labor and capital, both within the EU and between the EU and neighboring regions. Integration of factor markets affects the distribution of income and factor movements depend on fiscal incentives, affecting the benefits and costs of redistributive policies.

The paper begins by recapitulating some of the basic principles that have emerged from the existing literature on fiscal competition. It then describes recent trends in international migration and capital movements. The evidence suggests that the countries of Europe are experiencing inter-regional movements of labor and capital of significant magnitude, but that these movements are far from instantaneous. Labor and capital markets are clearly linked across regions, but there appear to be obstacles to very rapid adjustments of labor and capital stocks, suggesting that labor and capital are mobile but imperfectly so.

The analysis of factor mobility with explicit dynamics thus offers promise. Different types of “stock adjustment” models of labor and capital mobility have important implications for the analysis of the distributional and allocative effects of fiscal policy. A formal analysis of fiscal competition with integrated capital markets and explicit costs of adjustment for the capital stock shows that sluggish capital adjustment creates incentives for governments to use tax policy to capture quasi-rents for their residents, even if it is impossible for any one government to impose net fiscal burdens on capital that is perfectly mobile in the long run.

Factor Mobility and Fiscal Policy in the EU:

Policy Issues and Analytical Approaches

I. Introduction

The past century has seen dramatic growth in the role of the public sector in the countries of Western Europe, both by extensive regulatory as well as fiscal interventions. In the fiscal sphere, the EU countries in recent decades have maintained public expenditures and revenues at roughly half of GDP. These expenditures partly finance the provision of classic public goods like national defense and this century has seen episodes – hopefully not to be repeated in the next – where a large share of public-sector spending has been devoted to defense and national security generally. But by far the most important reason for the growth of public spending has been the increase in the level of redistributive (or social insurance) activities of governments. These include public pension systems and health care programs whose benefits largely accrue to the old and that entail substantial intergenerational as well as intragenerational transfers. They also involve a host of other transfers: from the employed to the unemployed, toward the less-skilled, toward students, toward families with children, toward farmers, toward workers in specific industrial sectors such as shipbuilding or coal-mining, toward people or businesses in poor regions, and many others.

On the tax side, public expenditures have been financed by consumption taxes, payroll taxes, taxes on personal income, and taxes on business income, implying that the burden of public expenditures broadly falls more heavily on households with higher levels of consumption, income, and wealth. But of course the tax systems of Western Europe also fall unevenly on different types of households and businesses because of explicit and implicit distinctions between different types of income, consumption, and wealth and because of uneven levels of enforcement, administration, and evasion. All of these features of the revenue system of Western Europe themselves entail intentional or accidental redistribution of income, as well.

No simple generalization can accurately characterize such a vast system of public-sector policies. But it is fair to say that they reflect the outcome of a democratic policy making process that has not been prepared to accept the market-determined distribution of income in an unaltered form. The market-determined distribution of income, of course, reflects essentially the distribution of endowments and factor prices, and, even in a static

world, would exhibit inequality attributable to differences in ability, health, and other personal characteristics. Of course, the world and the distributed income are not static. The distribution of wealth, though fixed at any one moment, evolves over time as a result of household consumption, saving, and bequest behavior, and the distribution of income also evolves accordingly. Moreover, factor prices change continually – and often somewhat unexpectedly – due to technological change, demographic change, changes in demand, and associated changes in domestic and world product prices. Just to provide one illustration, returns to labor and capital in the agricultural sector in North America and Western Europe have failed to keep pace with returns elsewhere in the economy, leading to a century-long decline in the share of labor and capital allocated to this sector. This long-term shift can obviously be attributed in large part to technological change and also to world demographic shifts. It is noteworthy that this long-term shift has been accompanied by fiscal and regulatory policy efforts both in North America and in Europe that have had the effect of protecting the returns to resources in the agricultural sector. In addition to distributional consequences, of course, these policies, like many redistribution policies, have also interfered with efficient resource allocation by dulling the incentives for scarce resources to flow from less-productive to more-productive uses.

Changes in economic policy that directly or indirectly affect factor markets and factor prices obviously affect the distribution of income, sometimes in intended directions and sometimes not. The process of European economic integration – part but not all of which is the result of explicit steps toward liberalization of markets undertaken under the auspices of the EU – is bound to have important effects on factor markets and the distribution of income. In particular, integration of factor markets themselves affects factor prices directly. In addition, factor mobility affects the fiscal systems of countries that experience increases or decreases in population and labor forces and in the stock of capital.

This paper attempts to outline some of the implications of factor market integration for fiscal policy in the countries of the EU and for the EU itself. It draws particular attention to the dynamic dimensions of factor market integration, and identifies some of the many issues for further research on these topics.

The paper begins, in Section II, with a concise recapitulation of some principles that have emerged from existing literature on fiscal competition. For the most part, this literature has tended to rely on somewhat stylized analytical frameworks built on polar assumptions about factor mobility. This analytical approach exposes fundamental issues in a transparent fashion, but strong simplifying assumptions can also be misleading. Sec-

tion III describes recent trends in international migration and capital movements. The evidence suggests that the countries of Europe are experiencing inter-regional movements of labor and capital of significant magnitude, but that these movements are far from instantaneous. Labor and capital are clearly linked across regions, but there appear to be obstacles to very rapid adjustments of labor and capital stocks, suggesting that labor and capital are mobile but imperfectly so.

In view of the evidence on labor and capital mobility, analyses of factor mobility with explicit dynamics offer promise. Section IV discusses “stock adjustment” models of labor and capital mobility and their implications for the analysis of the distributional and allocative effects of fiscal policy. The discussion in Section IV draws on a formal analysis developed in the Appendix. Section V concludes with a discussion of some of the important policy issues that EU countries seem likely to face during coming decades.

II. Redistributive Policy with Factor Mobility: Atemporal Models

Much of the economic analysis of fiscal competition has focused on polar cases in which factors of production are assumed either to be completely immobile or costlessly mobile. Even though analyses based on stylized assumptions can be criticized for lack of realism, the study of polar cases is nevertheless quite helpful in obtaining clear insights into complex issues, providing important benchmarks and reference points.¹

The simplest way to begin the exploration of the implications of factor market integration is to suppose that a previously-immobile factor of production becomes costlessly mobile among a large number of small jurisdictions. The assumption of “small open” jurisdictions means that the factor of production is available to each jurisdiction at an externally-fixed net rate of return. As examples, one might imagine that a small locality within a large country, such as a single local school district within the United States or a

¹ There is a now large and rapidly-growing literature on fiscal competition. For the sake of brevity, the present discussion omits many important ideas in to be found in this literature. For more thorough surveys focusing on fiscal competition and redistribution, with many additional references, see Cremer *et al.* (1996) and Wildasin (1998). The efficiency implications of fiscal competition are also critically important; see Oates (forthcoming) for discussion and references. For simplicity, the present discussion focuses almost entirely on the interplay between redistributive policy and factor mobility, rather than on the more classical margins of behavioral adjustment to fiscal policy such as labor-leisure tradeoffs. For a recent analytical survey of redistributive policy that addresses these and other issues, see Boadway and Keen (forthcoming).

single small town in Germany, suddenly faces an infinitely-elastic supply of capital. ²

If capital were perfectly immobile, a local source-based local capital tax, such as a property tax or a corporation income tax, would reduce the net rate of return to capital by the amount of the tax. By contrast, when capital is costlessly mobile, local taxes cannot significantly reduce the net return to capital within the locality. ³

Despite the mobility of capital, it remains feasible for the locality to impose such a tax and to use the revenue to provide public goods and services to its residents, or even simply to transfer cash to them. However, whereas this policy would make the beneficiaries of local public services better off at the expense of local capital owners if capital were fixed in supply, this is no longer the case when capital can adjust freely. Rather, the imposition of the local tax will drive capital out of the locality until its before-tax rate of return is sufficiently high to compensate capital owners for local taxes. The outflow of capital from the locality must reduce the gross return to labor. Because the local capital tax distorts the allocation of capital – in equilibrium, it will now be more productive in this locality than its opportunity cost to the locality, i.e., than the external net rate of return – the loss of income to local workers will exceed the value of the tax revenue collected from capital taxation. Except to the degree that public expenditures have a greater value to local residents than the tax revenue used to finance them, this policy ends up lowering the welfare of local residents. ⁴ In other words, a small open locality can engage in redistributive policies in

² The case of the small open locality facing a perfectly-elastic supply of capital might be described as the “canonical” model of tax competition. For a recent survey of the literature on this subject, see Wilson (forthcoming).

³ It is tempting but inaccurate to say that capital does not bear the burden of the local tax. As shown by Bradford (1978), building on the insights of H.G. Brown (1938), while the local tax only reduces the net return to capital by a very small amount, the reduction in the net return falls on the worldwide stock of capital. The loss in real income for capital owners worldwide is of the same order of magnitude as the local tax. For more discussion, see Wildasin (1986, 107–108).

⁴ The provision of public goods and services – such as education, health, public safety, or transportation – is sometimes not viewed as part of redistributive policy, on the grounds that the public sector is performing an efficiency-enhancing allocative function in the face of some sort of market failure. To the extent that this is true, the value of inframarginal and possibly marginal public goods and services may exceed their cost. Nevertheless, if the cost is borne by agents other than those who obtain the benefits of the public goods, the combined operation of the tax and expenditure system achieves what amounts to an in-kind redistributive transfer from taxpayers to the beneficiaries of public services. Most of the

which it imposes fiscal burdens on a mobile factor of production, but its incentive to do so is limited or completely negated by the harm that this does to local residents. This is in striking contrast to the effect of the same policy when the taxed factor of production is completely immobile.

To generalize this simple model slightly, suppose that there are several costlessly-mobile factors of production. For example, one might imagine that the local production process uses capital k , highly-skilled labor h , and unskilled labor, and that both capital and highly-skilled labor are costlessly mobile among jurisdictions. Let $f(k, h)$ denote the value of local production in a single jurisdiction, where f is strictly increasing in both arguments and strictly concave – the strict concavity reflecting diminishing returns to low-skilled labor as it is combined with larger amounts of capital and highly-skilled labor. Let r and w_h denote the net incomes that owners of capital and highly-skilled labor can earn outside of the locality, and let τ_k and τ_h represent the net tax burdens imposed by the locality on each of these factors, each expressed for convenience on a per-unit basis. Assuming competitive factor markets, it follows that

$$f_k(k, h) - \tau_k = r \tag{1.1}$$

$$f_h(k, h) - \tau_h = w_h \tag{1.2}$$

in equilibrium. Assuming that the net revenue collected from taxation of capital and highly-skilled labor accrues to unskilled workers either in the form of cash redistributive transfers or in the form of public goods and services of equal value, the net income of unskilled workers will be

$$x = f(k, h) - f_k(k, h)k - f_h(k, h)h + r\bar{k} + \tau_k k + \tau_h h \tag{2}$$

where $r\bar{k}$ represents the return to any capital with which the local unskilled workers may initially be endowed.

Although this model allows for two mobile factors of production rather than just one, its implications are essentially the same as the simpler model previously described. In

discussion in this paper assumes that public expenditures provide benefits to beneficiaries that are equal to the level of public spending itself; this would be precisely accurate in the case of pure cash redistributive transfers. To the extent that public expenditures are used in ways that produce benefits that either exceed or fall short of their costs, this assumption should be viewed simply as a first approximation. The reader can easily see how the results would change under alternative assumptions.

particular, it is straightforward to show that the welfare of the local unskilled workers, as measured by their net income x , is maximized by setting $\tau_k = \tau_h = 0$. While it would be possible for the locality to raise revenue by taxing capital and highly-skilled workers, the net effect of such a policy is to harm immobile, unskilled workers.

To interpret the findings of this simple analysis, note that the fiscal instruments τ_k and τ_h reflect the *net* impact of all taxes and benefits that are borne by or that accrue to capital and skilled labor, respectively, contingent on their location within the locality. Thus, for example, τ_h would include local income taxes, local payroll taxes (whether assessed against highly-skilled workers or their employers), and local consumption taxes (taxes on retail sales or value-added, local excises) paid by highly-skilled residents of the locality. As discussed earlier, *source-based* local taxes on capital or capital income enter into τ_k . But *residence-based* local taxes on capital income – for instance, personal income taxes on dividends, interest, and capital gains – would be part of τ_h , as highly-skilled workers who reside within the locality are taxed on their non-wage income. It is thus interesting to note that residence-based taxation of *capital* income can distort the spatial allocation of *labor*; moreover, it is the *average* rather than the marginal tax rate on capital income that affects household locational incentives.⁵ On the *expenditure* side of local fiscal policy – cash transfers and subsidies plus the monetized value of local public goods and services – the benefits that accrue to capital and to skilled labor enter *negatively* into their respective tax rates.

Tax and expenditure policies that help unskilled workers when capital and highly-skilled labor are immobile harm them when these factors are mobile. On the basis of this

⁵ Residence-based taxation of capital income is especially likely to affect the locational choices of high-income households, for whom non-wage income is particularly important. Just to illustrate this well-known empirical regularity with reference to the US, for the approximately 5% of US taxpayers with the highest levels of adjusted gross income in 1997, wage and salary income only amounted to approximately 57% of total AGI, whereas the comparable figure for taxpayers with average AGI levels was 83% (Hollenbeck and Kahr, 1998-1999). (Note that since these figures are based on the incomes of taxpayers as reported for tax purposes, they already reflect the fact that much non-wage income is sheltered from taxation.) These top-bracket taxpayers had an average level of taxable dividend, interest, and capital gains income of approximately \$21,000. Residence in a locality that taxes this income thus entails an annual stream of tax liabilities of about \$200 per percentage point of the average tax rate. Discounting at 5%, then, a permanent move between localities whose average tax rates differ by 10% would thus result in a wealth gain or loss of about \$40,000. See Wildasin (1993) for discussion of interstate differences in average tax burdens in the US and their implications for migration incentives.

analysis, then, one might expect that an increase in the mobility of capital and highly-skilled labor would lead to some restructuring of local fiscal policy in ways that would move τ_k and τ_h closer to zero. Reforms of the revenue system, such as reductions in the progressivity of the personal income tax, reductions in corporation income tax rates, or increased reliance on user fees and charges could be part of this restructuring. Privatization of public enterprises removes the expenditures and revenues of these activities from the public-sector accounts, implying a reduction in redistributive transfers through regulated prices that embody cross-subsidization among consumers and through net fiscal transfers to loss-making enterprises. On the expenditure side, reductions in means-tested cash and in-kind transfers, increases in the provision of infrastructure that enhances the return to private capital, and increases in public services value by highly-skilled workers would also reduce the effective fiscal burdens on mobile resources. Note that the analysis certainly does not suggest that all fiscal adjustment occurs solely on the tax side of the public-sector accounts; thus it is more appropriate to characterize fiscal adjustment to factor mobility as *fiscal* competition rather than as *tax* competition.

To vary the analysis slightly, suppose that both skilled and unskilled labor as well as capital are initially immobile, and that the local government imposes taxes on capital ($\tau_k > 0$) in order to provide transfers or public services to skilled labor ($\tau_h < 0$). As an example, one might think of using corporation income tax revenues to help finance higher education, a service that is disproportionately beneficial to skilled (or soon-to-be-skilled!) workers. Suppose that unskilled workers are neither net fiscal contributors nor net fiscal beneficiaries, paying taxes just equal to the value of public services provided on their behalf. Thus, suppose that the local fiscal policy satisfies

$$\tau_k k + \tau_h h = 0, \tag{3}$$

i.e., it is purely redistributive between capital and skilled labor. When these factors of production are immobile, this policy reduces the net income of local capital owners and raises the net income of skilled workers. If, on the other hand, both of these factors are freely mobile, the policy can no longer benefit the latter at the expense of the former, since their net incomes are fixed externally to the locality. Rather, the impact of the policy now is to reduce the net incomes of unskilled workers. To see this, one can use (3) to eliminate τ_h in terms of τ_k (assuming that the locality has not chosen tax rates in excess of those that maximize total tax revenue). Using (1) and (2), one can then calculate that $x = f(k, h) - rk - w_h h + r\bar{k}$ and hence (letting $d(\cdot)/dt_k$ denote a total derivative, including

all general-equilibrium adjustments)

$$\begin{aligned} \frac{dx}{dt_k} &= (f_k(k, h) - r) \frac{dk}{dt_k} + (f_h(k, h) - w_h) \frac{dh}{dt_k} \\ &= t_k \frac{dk}{dt_k} + t_h \frac{dh}{dt_k} < 0, \end{aligned} \tag{4}$$

where the inequality follows from the assumption that $t_k > 0 > t_h$ and from the fact that $dk/dt_k < 0 < dh/dt_k$.⁶ Thus, whereas unskilled workers were “innocent bystanders” who were completely unaffected by the locality’s redistributive policy when both capital and skilled labor were immobile, they are now left “holding the bag,” suffering reductions in net income from redistributive policies in which they themselves do not directly participate either as contributors or as beneficiaries.

The consideration of these simple models, based on extreme polar assumptions, shows that integration of factor markets – represented here by the free mobility of previously-immobile factors of production – can have significant implications for redistributive fiscal policies. By opening up locational choice as a new margin of behavioral response, factor market integration can dramatically change the distributional effects of fiscal policy. In addition, increased factor mobility implies that fiscal policies entail new types of allocative inefficiencies. This is of critical importance not only for normative policy evaluation, but for understanding the political economy of fiscal policy.

III. Factor Mobility: Some Recent International Trends

While simple models based on polar assumptions offer great analytical advantages, they may also be misleading. In the context of European integration, it is difficult to justify *a priori* characterizations of capital and labor mobility in terms of extreme polar assumptions. With respect to labor mobility, language and cultural barriers are obviously important impediments to movement among some countries; by the same token, it is obvious that these impediments are not prohibitively high. Moreover, while the European countries do present non-trivial barriers to migrants from the rest of the world, migration between Europe and the rest of the world certainly does exist. The movement of financial capital among financial centers now entails only minimal intrinsic costs, but there remain important regulatory barriers to integration of financial markets. Furthermore, foregin

⁶ To verify this last inequality, solve (1) implicitly for (k, h) as functions of (t_k, t_h) . The inequality now follows from the strict concavity of $f(k, h)$ and from (3).

direct investment, the relocation of business enterprise, and the establishment of productive capacity in new locations is neither costless nor prohibitively costly.

A look at recent trends may be useful, taking the US case as a benchmark for comparison with European countries. To begin with, consider capital mobility. Gross flows of financial capital are of immense magnitude; many of these flows represent offsetting movements through which financial and other institutions achieve portfolio diversification and protection against exchange rate and other financial risks.⁷ Net foreign investment flows are substantially smaller than gross financial flows, and, both for the US and for EU countries, normally amount to less than 5% of GDP. FDI flows are significantly smaller still: in 1996, inward foreign direct investment in the US was 1.15% of GDP, as compared with .85% of GDP in 1986. By comparison, inward FDI for the largest EU countries (France, Germany, Italy, and the UK) amounted to about 2% of GDP in 1996, as compared with around .9% of GDP in 1986, with substantial variation among countries. Outward FDI for the US in 1996 was 1.16% as compared with a figure of .42% in 1986; for the largest EU countries, the corresponding figures are about 1.8% for 1996 and 1.3% for 1986, again with substantial variation among countries. These figures suggest that FDI seems to be at least as important in the EU countries as for the US; they also indicate that *net* flows of FDI are far smaller than *gross* flows.

As for labor mobility, international comparisons are made somewhat difficult because of different systems for defining and measuring migration. Perhaps the most important distinction is between “foreign” population, i.e., residents who are non-citizens, and the “foreign-born”, i.e., those born in other countries, irrespective of current citizenship status. In many of the countries using the former classification, which includes many EU countries, people effectively lose their immigrant status in population records once they acquire citizenship, which, in some countries, is relatively easily obtained.⁸ In addition, of course, the measurement of illegal immigration is highly problematic. (See Chiswick,

⁷ In the US in 1991, net financial investment from abroad was approximately \$90 billion (1.5% of GDP), while net financial liabilities grew by about \$38 billion (.6% of GDP), for a net financial inflow of \$52 billion (.8% of GDP). (See Board of Governors of the Federal Reserve System, 1999.) For 1998, net financial investment from abroad was approximately \$511 billion (6% of GDP), net financial liabilities rose by \$274 billion (3.2% of GDP), and \$237 billion (2.7%). The growth of these flows in relation to GDP is particularly noteworthy. Comparable data for the EU would reveal analogous increases in international financial flows.

⁸ In France, in particular, approximately 100,000 people per year have acquired citizenship in recent years.

1988, for discussion of illegal immigration and immigration policy.)

Nevertheless, broad characterizations of migration trends are possible. First, in the US, 9.3% of the population in 1996 was foreign-born, as compared to 6.2% in 1986. The “foreign” population in the US is not available on an annual basis, but, as of the 1990 decennial census, it amounted to 4.7% of the population; in that year, 7.9% of the US population was foreign-born.⁹ For France, the foreign population in 1996 was 6.3% of the total, down slightly from the 1986 figure¹⁰ of 6.8%; for Germany, the 1996 figure is 8.9%, up from the 1986 figure of 7.4%; for the UK, 3.4% of the 1996 population consisted of foreigners as against 3.2% in 1986. Of the large EU countries, Italy has the smallest share of foreign population, at 2.0% in 1996, up from .8% in 1986. These statistics, as well as those for smaller EU countries, suggest that immigrant populations for the more affluent EU countries are quite comparable in size to that in the US, and are smaller for the less-affluent. Within the EU countries, a substantial minority of the foreign population is drawn from other EU countries (a share of one-third is perhaps representative), but the majority of foreigners are from non-EU countries.

For the US, annual inflows of immigrants have varied in the range .6–1.8 million in the past decade; for Germany, the EU country that has experienced the largest recent levels of immigration, gross annual inflows have fluctuated in the range .6–1.2 million during the same period, with net immigration of .1–.6 million. It is striking that Germany, with a population only one-third of that of the US, has experienced absolute levels of immigration not much below those for the US. Data on population outflows are not available for many countries, but, where data are available, they indicate that *gross* inflows into EU countries substantially exceed *net* inflows; for example, net inflows in 1995, expressed as a proportion of gross inflows, amounted to 28% for Germany 37% for Belgium, 67% for the Netherlands, and 57% for Sweden. Figures for migration among major census regions of the US show, similarly, that gross migration flows among regions greatly exceed the

⁹ These and the following statistics are official OECD data (OECD, 1998). Measurement of illegal immigration is obviously highly problematic, but is conjectured to be quite important both in the US and in the EU countries.

¹⁰ The 1996 figure for France would be approximately 7.3% if one adds to the stock of foreigners just those people who acquired citizenship during the period 1988–1996.

amount of net migration.

As is well known, fertility rates and rates of population growth have fallen substantially in the postwar period both in the US and in the EU countries. Rates of natural increase have declined and in some cases – notably Germany and Italy – have actually turned negative. In the US, natural increase still accounts for most population growth, but, for the past decade, immigration has been larger than natural increase as a source of population growth in the EU countries. It is fair to say, then, that migration has become a major determinant of population and labor-force trends both in North America and in the EU countries, but especially so for the latter.

In summary, the flows of capital and labor to which EU countries are increasingly exposed suggest that factor mobility is empirically important in these countries, and that it needs to be taken seriously in the evaluation of fiscal policy. Especially in view of the magnitudes of *gross* factor flows, it would be difficult to accept the stylized assertions that “labor is immobile” or “capital is immobile” in the EU context. Particularly when one contemplates the gradual evolution of the fiscal and other institutions of the modern welfare state over a period of several decades, it is obvious that the cumulative impact of sustained movements of labor and capital can be very substantial indeed. By the same token, international flows of labor and capital, especially *net* flows are sufficiently small that it is equally difficult to accept the stylized assertions that “labor is perfectly mobile” or “capital is perfectly mobile” in the EU context. Rather, it seems that some intermediate characterization of labor and capital mobility is most appropriate.

IV. Factor Mobility and Fiscal Competition in a Dynamic Context

In considering how to extend the analysis of fiscal policy to take imperfect factor mobility into account, it is useful to recognize that the stock and composition of productive human and non-human capital within a region depends on a host of economic and demographic factors aside from interregional factor flows. Fertility, mortality, health, education, and retirement behavior all affect the size of the effective labor force over time. The stock of non-human capital is subject to gradual deterioration over time; flows of replacement, maintenance, and net investment can preserve and augment the stock of non-human capital. Many types of economic behavior and economic policy *within* a region affect the evolution of the stocks of human and non-human capital. A region that is open to factor flows has additional margins of adjustment. Like other forms of dynamic adjustment of these stocks, the migration of labor and the flow of capital across regional boundaries is

not instantaneous, but rather proceeds at a rate that reflects economic incentives, intrinsic costs of adjustment, and economic policy and institutions.

These considerations suggest that fiscal competition in a world of imperfect factor mobility may best be analyzed in an explicitly dynamic framework. Over time, businesses within any one locality have to make decisions about whether to replace or maintain machines, buildings, and other capital assets that gradually depreciate. At any one moment in time, however, some significant fraction of the capital stock will be of relatively recent vintage, and immediate relocation of that part of the capital stock would entail the destruction of a substantial portion of its value. Similarly, most if not all individuals can consider changing locations over the course of their lifetimes, but the cost of doing so varies over the life cycle. Every year, some young soon-to-be workers complete their education and enter the work force with little or not prior attachment to specific employers; even younger “workers” are in the process of obtaining skills and education and do not even have strong attachments to particular types of occupations. These young people also are either single, have no children, or have very young children. For these and other reasons, it is relatively easy for them to consider changing locations. As workers age, however, their attachments to specific occupations, employers, and places tend to deepen, with the result that turnover and migration rates tend to fall over the life cycle (see. e.g., Topel (1986, 1991), Topel and Ward (1992)). Thus, at any moment in time, there is a significant fraction of the work force for which relocation is relatively costly.

Overlapping Generations

There are several ways to model imperfect mobility of labor and capital in an explicitly dynamic context. The overlapping-generations model provides one natural framework for the analysis of labor mobility. In a simple version of that model, households might be assumed to live for only two periods, the first of which corresponds to youth and the second to mid-life and old age. One might then suppose that the degree of mobility of individual workers declines over the life cycle.¹¹ In this setting, workers are neither completely mobile nor completely immobile, but rather differentially mobile over time. Fiscal policies that affect workers can then differentially affect workers of different ages, in a variety of ways.

¹¹ For recent analyses that utilize this type of framework, and additional references, see Wildasin and Wilson (1996), Konrad (1997), and Leers *et al.* (1999).

For example, suppose that a local government imposes a general tax on wage incomes. If young workers are highly mobile, this tax may discourage entry into the locality and the before-tax wages of young workers will rise to compensate them for the burden of local fiscal policy. If young workers are perfectly substitutable for older workers, the mobility of the former insulates the latter, as well, from the burden of a wage tax. If, on the other hand, young and old workers are not perfect substitutes, the intergenerational impact of an earnings tax may be quite different. For example, suppose that young and old workers are complementary inputs in the production process. Then a tax on earnings reduces the productivity and the before-tax wages of older workers by reducing the supply of young workers. Since the old are relatively immobile, they suffer not only the burden of an earnings tax that they cannot escape, but the added burden of lost productivity and reduced gross wages.

This example focuses on the impacts of fiscal policy on young and old *workers*. Alternatively, one might adapt the overlapping-generations model to distinguish between workers and retirees. A large portion of “welfare state” fiscal policy involves intergenerational transfers from those in the working part of the life cycle to those who are retired, particularly through income and payroll taxes imposed on workers (or their employers) and the provision of public pensions and health care for retirees. Especially in the EU countries, the aging of the population is giving rise to increased financial stress on fiscal systems as the population of current beneficiaries increases in relation to the population of current contributors. Some commentators suggest that migration may play an important role in helping to restore the financial health of EU public pension systems.¹² What are the implications of labor mobility for the intergenerational transfer systems of the EU?

First, note that individual workers interact with the fiscal system in different ways over their life cycles. They are contributors when young but beneficiaries when old; in principle, any one worker could be either a net fiscal contributor or a net fiscal beneficiary over the entire life cycle, in present-value terms. Using standard generational accounting methods (see, e.g., Kotlikoff (1992)), however, it is clear that young workers are net fiscal contributors under existing policies, that is, they pay more into the fiscal system, in present-value terms, than the benefits that they receive.

¹² See, e.g., Strauhaar and Zimmermann (1993) for a general discussion of policy issues associated with migration in Europe.

If young workers are perfectly immobile, relocation offers no escape from the burdens that the fiscal system imposes on them. If, on the other hand, young workers are freely mobile, the ability of the fiscal system of a small country to impose net burdens on them disappears. Moreover, the potential gains to the elderly from taxing the young are diminished. As owners of capital, land, natural resources, and other immobile factors of production, the old are harmed by fiscal burdens imposed on mobile workers. The analysis in part A suggests that the elderly would be harmed, on balance, by fiscal policies that impose net fiscal burdens on young workers. Accordingly, it would be in the interest of the old to alter fiscal policies in a way that would undo some of the intergenerational transfers embedded in the existing structure of taxes and transfers.¹³ In short, free mobility of young workers does *not* in itself imply that existing programs of intergenerational transfers can effectively redistribute income from young to old workers. On the contrary, mobility of the young suggests that these programs are more costly and less effective than otherwise. It should, however, be emphasized that older households in EU countries can still benefit from increased immigration of younger workers. Flows of workers into EU countries from the rest of the world raises the returns to existing stocks of resources (including not only commercial and industrial but also residential capital) that are predominantly owned by older EU residents. Liberalization of migration policies can increase the benefits to the old from higher returns to non-human resources, even if it undermines their ability to extract resources from the young through fiscal policies.

An Adjustment-Cost Approach

While a two-period overlapping generations model may provide a natural framework for describing the differential mobility of workers in different age groups, it shares with the atemporal modeling approach of part A above the somewhat unattractive “putty-clay” feature that workers are still sharply characterized either as perfectly mobile or perfectly immobile, depending on their age. Plausibly, however, the ability or willingness of workers at various ages to change locations depends not only on their age but on the magnitude of the fiscal and other migration incentives that they face. Consider, as an alternative, the application of standard adjustment-cost models of investment to the problem of factor mobility.

¹³ For some rough empirical estimates of the welfare gains from reductions intergenerational transfers in EU countries, see Wildasin (forthcoming).

Adjustment cost models are now standard tools for the analysis of the investment behavior of firms. These are explicitly dynamic models in which the flow of output is assumed to depend on the flow of services from the stock of capital and the flow of labor services used in the production process. Capital is a *stock* which is gradually depleted over time due to depreciation but which can be maintained or increased through a flow of purchases of new capital. If firms could costlessly adjust their capital stocks in response to changes in policy or other shocks, investment flows would occur at extremely high rates in extremely short bursts: firms would simply make their capital stocks adjust instantaneously to their new desired levels. In practice, however, the process of investment occurs gradually because it is costly to add, refurbish, or replace plant and equipment. Moreover, the costs of adjusting the capital stock are likely to rise as the rate of investment rises. While it is often possible to accelerate the planning and execution of investment projects, doing so normally entails extra out-of-pocket expense, disruption of existing operations, and other costs. Increasing adjustment costs provide firms with incentives to maintain a steadier flow of investment over time, resulting in slower adjustment of the capital stock to new, desired levels in response to changes in fiscal policy or other economic conditions.

As spelled out in detail in the Appendix, the adjustment-cost model of investment can be used to study tax competition in a dynamic setting. Following the traditional assumptions of tax-competition models, suppose that individual jurisdictions are small and open with respect to the external capital market, each thus facing a perfectly elastic supply of capital, and suppose that each can impose a source-based tax on capital located within its boundaries. In contrast to the traditional models, suppose that the capital stock within a given jurisdiction entails costs of adjustment that are increasing in the level of investment.

In this setting, a local source-based tax on capital does result, eventually, in an outflow of capital. In the long run, capital invested within the locality continues to earn the same net rate of return as elsewhere. Just as in the standard atemporal models of tax competition, owners of immobile resources are harmed, in the long run, by fiscal policies that redistribute resources to immobile factors by taxing capital. However, these long-run effects do not materialize instantaneously when there are adjustment costs. In the short run, the local capital stock adjusts very little in response to a tax increase because it is too costly for capital owners to make a rapid adjustment. As a result, a tax on the returns to local capital does actually harm capital owners, and can be used to raise the net incomes of local labor or other immobile factors of production.

In this model of explicit dynamic adjustment, it is not correct to describe capital either as “perfectly mobile” or as “perfectly immobile.” In fact, the adjustment-cost model effectively includes these polar opposites of the atemporal model as special cases. In the very long run, the response of the local capital stock to a change in fiscal policy is precisely what the atemporal model with freely mobile capital would predict. In the very short run, the local capital stock is completely fixed. Thus, depending on the time horizon, capital could be described both as perfectly mobile and as perfectly immobile. The form of the adjustment cost function dictates the speed of adjustment of the capital stock: as the costs of adjustment rise, the rate of adjustment of the capital stock falls. In the extreme case where there are no adjustment costs, adjustment is instantaneous and capital is “perfectly mobile.” As adjustment costs rise, the “short run” becomes, effectively, longer and longer, and the model behaves increasingly like one in which capital is “perfectly immobile.”

The fact that capital is not very mobile in the short run means that capital income can be a target for redistributive policy: the returns to the owners of local capital consist of quasi-rents that can be captured by local tax or other policies. While such policies do eventually reduce the net flow of income to the owners of immobile local resources, the short-run gains are discounted less than the long-run costs. If local policies are chosen in order to maximize the appropriately-discounted welfare of the owners of local immobile factors, the optimal local tax on capital is *positive*, not zero, as the atemporal analysis would suggest. The lower the costs of adjustment, i.e., the greater the rate at which the capital stock adjusts, the lower is the optimal rate of tax.

While it is most conventional to use adjustment-cost models to study investment in non-human capital, they can be applied as well to analyze labor mobility. Suppose, for example, that firms can increase or decrease the number of high-skilled workers that they employ, but that they incur costs in doing so, whether implicitly or explicitly. These costs might include employee moving costs, signing bonuses, severance pay, and on-the-job training costs. Assume that highly-skilled workers earn a net income of w_h on external markets. A mere reinterpretation of the previous model permits one to conclude that highly-skilled workers earn quasi-rents that could be captured or augmented by redistributive fiscal policies.

A somewhat more complex version of the adjustment-cost model would allow for costly dynamic adjustment with more than one variable factor of production. For example, one might suppose that the stocks of both capital and highly-skilled labor within a given local jurisdiction can be adjusted gradually over time – in effect, a dynamic version of the model

developed in Section II. The formal analysis of such a model remains to be undertaken. It seems fairly clear that such an analysis would show that both capital and highly-skilled labor earn quasi-rents and that redistribution involving either or both of these factors would affect their net returns in the short run but not in the long run. Their adjustment dynamics would normally be interdependent, however, which may potentially give rise to some interesting implications for redistributive policy.

V. Conclusion: Challenges for Fiscal Policy in Europe

The process of economic integration in Europe is unfolding gradually over time. Looking forward over the next half-century or so, demographic change – especially the effects of low fertility and mortality in affluent countries surrounded by lower-wage regions – seems likely to play a crucial role in the evolution of fiscal policy. This section discusses several of the challenges that EU countries are likely to confront over this time horizon.

Migration Policy and Fiscal Policy

Let us begin with the observation that EU labor markets have been magnets for migrants. A first question for policy is whether and by how much to impede the flow of population into the EU countries. One might suppose, theoretically, that strict immigration controls are possible. Indeed, there was little East-West migration during the past half-century. The low levels of East-West migration during the Cold War, however, must be attributed in large part not to the anti-immigration policies of the EU countries but rather to the anti-emigration policies of the Warsaw Pact countries, who exercised substantial control over their borders and went to considerable lengths to limit emigration. This experience is unlikely to be repeated. Even if they were disposed to do so, it would be quite difficult for the countries of the former Warsaw Pact to re-establish the kinds of economic and police powers that would enable them to impose harsh restrictions on emigration. The EU countries, one may safely assume, will not resort to Draconian measures to limit immigration. The question, then, is not whether the EU countries will experience net immigration, but rather at what *rate* immigration will proceed. In terms of the dynamic model described above, policymakers may be able to affect the “adjustment cost technology” for labor, facilitating immigration and speeding up the adjustment process or impeding labor mobility and slowing it down.¹⁴

¹⁴ See Decressin and Fatás (1995) for some empirical analysis of the speed with which labor markets in EU countries adjust to (temporary) regional shocks. Their study suggests that interregional labor flows proceed at about half the speed that they do in the US.

From the welfare viewpoint, there are many advantages to liberalized migration policies. Most importantly, there are obvious efficiency gains to be realized by allowing labor to be employed productively. Low labor productivity in regions around the EU result from many factors: low levels of private capital, low levels of public infrastructure, insecure property rights and ineffective legal institutions, including political uncertainty and the risk of violent conflict, obstacles to international trade, and low levels of human capital. While these conditions persist, real income differentials will continue to attract labor – much of it relatively low-skilled – toward more productive employment in the EU. The aging of the EU labor force may accentuate the efficiency gains from migration, as retirement makes labor within the EU countries increasingly scarce.

One of the principal challenges for policy arises from the distributional impact of migration. Inflows of labor from neighboring countries put downward pressure on wages in the EU countries, which harms native workers whose labor is substitutable with that of migrants. Within the context of highly-structured EU labor markets, reductions in real wages may occur rather slowly, during which time slackness in labor markets is likely to manifest itself in the form of unemployment. Indeed, immigration may create pressures to protect the employment and earnings of existing workers, perhaps retarding the process of institutional change in the labor market in the short run, even as it undermines the institutions that support labor market rigidities in the long term.¹⁵ But whether immigration contributes to lower real wages or to higher unemployment, it worsens the labor-market environment for existing workers, especially those with fewer skills.

Of course, if there are efficiency gains from inter-regional migration, gains to gainers must exceed losses to losers. Redistribution from gainers to losers in principle provides a means by which policymakers can offset any adverse distributional effects arising from increased immigration. Appropriate compensation mechanisms are not easily devised, however. Most of the obvious forms of compensation – instruments such as means-tested

¹⁵ The example of German unification is instructive. As explained by Sinn and Sinn (1994) and Sinn (1995), the efforts of labor unions and policymakers have succeeded in extending high real wages into the former East Germany, simultaneously protecting the real wages of workers in the West and contributing to higher unemployment. For recent discussions of labor market institutions and the unemployment problem in the EU countries, see, e.g., Bertolo and Ichino (1995), Burda and Mertens (1995), Siebert (1997), and Nickell (1997). Schöb and Wildasin (1998) analyze the efficiency and distributional effects of labor market integration in a system of jurisdictions with unemployment.

cash and in-kind benefits financed by taxes on high-income individuals and source-based capital income taxes – are traditionally offered on a residence basis to all households who qualify on the basis of income, unemployment, or other criteria.¹⁶ If immigrants are not or cannot be excluded from social benefits, then the attempt to compensate those who are adversely affected by immigration will in itself increase the incentives for further immigration. Indeed, it can be shown (Wildasin, 1994) that labor market integration will often not be Pareto-improving for the residents of a given jurisdiction if fiscal discrimination between immigrants and native residents is not feasible or is disallowed, even though aggregate income within the jurisdiction may rise.

Liberalized immigration for the EU countries is therefore likely to be a mixed blessing, bringing benefits to some but not all existing residents.¹⁷ Increased immigration is especially attractive if migrants are net fiscal contributors, bearing more in taxes than they receive in benefits. These fiscal gains are eroded by providing social benefits to immigrants, however, and increased immigration would likely increase the pressure on policymakers to limit fiscal expenditures that benefit migrants. By the same token, competition creates incentives for policymakers to limit the fiscal burdens imposed on migrants, especially those at the upper end of the income distribution, from whom more substantial fiscal contributions might be obtained. Similarly, limitations on the fiscal benefits accorded to low-skilled, low-income migrants reduces the incentive to restrict immigration.

¹⁶ Non-discriminatory fiscal treatment for citizens of EU member states is guaranteed by the Treaty of Rome. Furthermore, exclusion from many types of social benefits is infeasible, even if it is legally permissible. In an interesting recent related development in the US, a May 1999 Supreme Court decision (*Saenz v. Roe*) holds that it is unconstitutional for individual states to delay the extension of welfare benefits to poor residents who have recently arrived from other states, thus constraining further the potential for states to discriminate in their fiscal treatment of “natives” and “immigrants.” This decision is likely to attract renewed attention to the issue of the implications of mobility of the poor for welfare policy and reform in the US; see Peterson and Rom (1990) for policy discussion and Brueckner (1998) for a recent survey of relevant theoretical and empirical literature on this subject.

¹⁷ The magnitudes of both the efficiency gains and many of the distributional effects resulting from labor migration between neighboring countries and the EU depend on the size of interregional productivity disparities. Issues such as prospective EU enlargement bring this fact sharply into focus. As discussed by Persson (1995) and Goodspeed (1997), it is remarkable and perhaps paradoxical that the extent of redistributive policies seems to be greater when undertaken in a region where income disparities are relatively small.

Regional Policy

The EU countries as a whole are affluent. However, some regions within the EU are relatively poor. One goal of the EU's structural funds is to promote economic development in poor regions, or to assist the residents of these regions. The CAP, which helps to maintain incomes for those in the agricultural sector, should probably also be viewed as part of the EU's regional policy. The agricultural work force in Europe has been in a gradual decline, a process that is of course associated with rural-urban migration.¹⁸ The reallocation of labor from rural agriculture toward urban industry and services has been the result of intersectoral and interregional real-income differentials, an adjustment process that would have proceeded more rapidly in the absence of the CAP (and perhaps other policies), which has propped up incomes for workers in the rural areas of EU countries.¹⁹

Regional policy for the EU countries, however, involves not only the regions within existing EU member states, but other neighboring regions as well – the countries of eastern and southeastern Europe and of North Africa, in particular. Policies dealing with regions outside the EU are less systematized than for those within, but include trade policy, migration policy, and economic development policies. One of the main questions of regional policy in this regard is actually the issue of EU enlargement. Since EU membership entails free trade and free movement of labor and capital, it offers substantial potential benefits to many of the residents of new member states.

Equity considerations often figure prominently in regional policies. Rich regions typically transfer resources to poor regions, foreign aid generally flows from rich countries to poor countries, and sectoral subsidies generally flow to declining rather than to growing sectors of the economy. A perennial question is whether these policies promote reasonable economic goals or whether they simply interfere with the efficient functioning of markets. If a region is subject to adverse demographic, technological, political, economic, or other factors, is it better to expend resources in developing or simply subsidizing the region or to facilitate the flow of population and capital away from the region?

¹⁸ Just during the decade 1986–1996, agriculture's share of employment in the EU has fallen from 7.9% to 5.1% (OECD 1997).

¹⁹ The magnitude of the CAP subsidies varies substantially among countries. As described in Baldwin *et al.* (1997), 1994 CAP expenditures per farmer were as high as 12,290 ecu in Belgium and as little as 1514 ecu per farmer in Portugal, with a mean level of 5621.

The impact of regional policies is critically dependent on the degree of factor mobility. Subsidies that promote investment or employment in a region may raise wages there if workers are immobile. If, on the other hand, workers are interregionally mobile, these policies will reduce the flow of labor out of the region, benefiting owners of land, natural resources, and long-lived capital, but at a cost in terms of lost opportunities for workers to move to regions where they could be more productively employed. To consider one dramatic recent example, consider the Balkan situation. Because of political and military strife, the EU countries face the dilemma of managing a significant number of displaced persons. Current policy discussions focus on the rebuilding of Kosovo, Albania, Macedonia, and presumably Montenegro and Serbia as well, at the conclusion of military action, in order to achieve the resettlement of Kosovars in Kosovo. Such a policy is bound to be quite costly, though necessary to restore the economic health of the region. As an alternative, one might allow or even facilitate the relocation of refugees to EU countries. The people of Kosovo are clearly somewhat mobile, and one suspects that many might willingly settle elsewhere in Europe. Indeed, the flourishing trade in illegal immigrants across the Strait of Otranto even prior to the outbreak of the recent hostilities evidences the potential for migration from the Balkans, even in the absence of explicit liberalization of immigration policy in the EU.

This example highlights the policy tradeoffs for the EU countries: in the absence of economic growth and prosperity in neighboring regions, migration pressure is heightened, making it more difficult to enforce immigration restrictions and exacerbating whatever difficulties immigration poses for the destination countries. One way to promote economic development of poor regions is through interregional transfers, whether in the form of simple economic relief, through investment in infrastructure, or through subsidies to private investment. These transfers, however, impose fiscal burdens on the donor regions. As an alternative, greater integration of the markets for labor, capital, and goods and services may promote more rapid economic development of poor regions and the opportunity for mobile factors in poor regions to escape to more productive uses elsewhere. This alternative, however, may not help the owners of relatively immobile factors of production in the poor region – landowners, business owners, or older or less-skilled individuals, and it entails distributional impacts that destination regions might wish to avoid, assuming, as before, that ideal compensatory redistributive policies are not feasible. Sometimes, in fact, it can be Pareto-improving for the residents of the destination region – the EU countries, especially the richer ones – to make fiscal transfers to poor regions, such as the Balkans,

the countries of Eastern Europe, or the countries of North Africa.²⁰

The Dynamics of Political Economy: Exit and Voice

A final issue that warrants attention is the implications of factor mobility for the political economy of public policy, especially redistributive fiscal policies. Returning for the moment to the atemporal models of fiscal competition described in Section II, note that factor mobility carries potentially rather powerful implications for public choice. In a world where several different resources are immobile, the coercive power of the public sector can be exploited, through the political process, to transfer rents among resource owners – for examples, from owners of land in the western part of a locality to landowners in the eastern part, or from immobile rich workers to immobile poor workers. Each of these groups has an incentive to participate in the political process to exploit the other, and to defend itself against exploitation by the other. In the language of Hirschman (1970), each has an incentive to use “voice.”

But suppose now that a resource, previously immobile, becomes freely mobile. It is no longer in the interest of others in the jurisdiction to target this resource as a contributor in some redistributive mechanism, since it no longer earns rents that can be captured through fiscal policy. By the same token, the owners of the now-mobile resource no longer have an incentive to participate in the local political process since, on the one hand, the benefits of any fiscal transfers directed toward them would be eroded by inflows of competing resources, and, on the other hand, the burden of any transfers directed against them can be avoided by leaving – Hirschman’s “exit” option. It is perhaps one of the paradoxes of increasing factor mobility that as political power becomes increasingly concentrated in the hands of immobile factor owners, the value of exercising that power tends to diminish.

More generally, in a more realistic world with imperfect factor mobility, the clear-cut distinction between “voice” and “exit” becomes blurred. But, even in an explicitly dynamic model of factor mobility such as that discussed in Section IV, the implications of increased factor mobility seem reasonably clear. Whether brought about by changes in policy (such as EU enlargement, relaxation of capital controls and immigration quotas, or the easing of occupational licensure and related labor market regulations) or through reductions in the fundamental real costs of factor movement, greater factor mobility reduces adjustment

²⁰ See Wildasin (1994) for a formal demonstration and Razin and Sadka (1995) for further discussion.

costs and raises the speed with which stocks of factors respond to fiscal incentives. It also reduces the quasi-rents that owners of these factors can gain or lose through favorable or adverse manipulation of fiscal policies. Even as the “voices” arguing for more favorable fiscal treatment of capital or highly-skilled young workers become less insistent, fiscal policy may become more and more favorable toward them. The locus of political debate may shift toward disputes among those resources that remain relatively immobile – “landowners in the east” and “landowners in the west”, owners of natural resources and the elderly, and others whose incomes are directly or indirectly tied to locationally-fixed resources.

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APPENDIX

This appendix presents an explicit comparative-dynamic analysis of the effects of fiscal competition in a world with imperfectly-mobile capital. The imperfect mobility of capital arises because of the costs of adjustment associated with investment.

A. Model Structure

The analysis focuses on a single small jurisdiction. Within this jurisdiction, capital is combined with immobile and inelastically-supplied factors of production – called “labor”, but also interpreted to include land, natural resources, public infrastructure, and other fixed inputs – to produce one or more traded goods. Assuming that the prices of traded goods are unaffected by local policies, these goods may be treated as a composite commodity which is taken as numéraire. Thus, let $f(k_t)$, with $f' > 0 > f''$, denote output within the locality at time t , expressed as a function of the amount of capital employed within the jurisdiction at that time, k_t . The strict concavity of f reflects the presence of other, fixed factors of production. Assuming that local factor markets are perfectly competitive, these factors will receive a gross income at time t equal to $w_t \equiv f(k_t) - k_t f'(k_t)$. It is assumed that these factors are owned by local residents who themselves are immobile and assumed to be identical. In order to obviate any issues relating to intergenerational transfers, these households are also assumed to be infinitely-lived (or, equivalently, to be linked through altruistically-motivated intergenerational transfers).

Capital is traded in external markets, where it earns a rate of return r that is unaffected by local policies and is thus taken as exogenously fixed for the purposes of the analysis. It is also assumed to be time-invariant. Firms located within the locality can acquire capital at a cost of r and also must pay a local tax on capital. In order to keep the analysis of capital tax policy as simple as possible, and, in particular, to obviate issues of time consistency as well as to maintain ease of comparison with atemporal models used in previous literature, assume that the locality imposes a per-unit tax on capital at a *time invariant* rate of τ_k . Thus, the tax-inclusive cost of capital to local firms is $r + \tau_k$.

The dynamics of the model are determined largely by adjustment costs that firms must bear when they undertake local investment; in particular, these costs will preclude instantaneous adjustment of the local capital stock. Specifically, the cost of adjustment incurred by local firms is given by $c(i_t)k_t$, with $c' > 0 < c''$ where i_t is the rate of gross

investment within the locality at time t , i.e., the amount of expenditures on capital goods expressed as a proportion of the amount of capital in the locality, k_t . This adjustment cost is assumed to take the form of lost output and is thus expressed in units of numéraire. Note that since $c(\cdot)$ is homogeneous of degree zero in the level of investment and the total stock of capital, total adjustment costs are homogeneous of degree one in these variables. This assumption, and the assumption that adjustment costs are convex in the rate of investment, are standard ones in the investment literature. Assuming that capital depreciates at a constant exponential rate of δ , the evolution of the local capital stock takes the usual form:

$$\dot{k} = (i_t - \delta)k_t. \quad (A.1)$$

The cash flow of local firms at time t is the value of their output net of adjustment costs, less investment expenditures, less tax payments, less payments for local labor,

$$\pi_t = f(k_t) - c(i_t)k_t - \tau_k k_t - i_t k_t - w_t. \quad (A.2)$$

Assume that no agents face liquidity constraints or other capital market imperfections and that all agents plan over infinite horizons. Local residents are assumed to plan their lifetime private consumption streams subject to the constraint that the present value of lifetime consumption is equal to the present value of lifetime income net of any taxes or transfers, firms maximize the present value of profits net of taxes or subsidies, and the local government must satisfy a budget constraint that requires the present value of public expenditures to be equal to the present value of tax revenues. Under these assumptions, firms choose the paths of investment i_t and capital k_t to

$$\max \quad \Pi \equiv \int_0^{\infty} \pi_t e^{-rt} dt \quad (P)$$

subject to (1), with an initially-given stock of capital $k_0 = K_0$.

In addition to collecting revenues from the taxation of local capital, the local government may collect revenue from or provide subsidies to local residents in a lump-sum fashion and it can spend money on the provision of public goods that benefit local residents. Let T denote the present value of lump-sum taxes imposed on local residents; under the assumptions of the model, the precise time path of revenue flows from these taxes is unimportant. Assume that the level of provision of public goods is exogenously fixed and let \bar{G} denote the present value of public expenditures on public good provision; provided that public good provision levels are fixed, their time path is unimportant. Since the stock

of capital in the locality can vary over time, the amount of tax revenue collected from capital taxation can also vary, with $t_k k_t$ the amount of revenue collected at time t . The local government budget constraint requires that

$$\bar{G} = T + \int_0^\infty \tau_k k_t e^{-rt} dt. \quad (A.3)$$

Local residents derive utility from private consumption and from local public goods. The latter, however, are treated as exogenously fixed, and can be ignored in the remainder of the analysis. No restrictions are placed on the role of public goods in the preference structure of households. The preferences of households over private consumption streams can also be very general; essentially all that is required is that household intertemporal utility maximization exhausts the present-value lifetime budget constraint. This basic assumption implies that the welfare of local residents is an increasing function of lifetime wealth. As already noted, households are endowed with fixed supplies of labor, earning a gross return of $w_t = f(k_t) - k_t f'(k_t)$ in every period. Local residents may also be endowed with some stock of capital \bar{k} which earns a flow return of $r\bar{k}$ in every period, as well as some ownership shares in local and foreign firms. Let θ represent the local ownership share in local firms, with $0 \leq \theta \leq 1$, and let $\bar{\Pi}$ represent the present value of profits derived from ownership of firms outside of the locality. Under these assumptions, the present value of lifetime income for local residents is given by

$$Y = \int_0^\infty [f(k_t) - k_t f'(k_t)] e^{-rt} dt + \bar{k} + \theta \Pi + \bar{\Pi} - T. \quad (A.4)$$

Under the assumptions of the model, local tax policy affects the welfare of local residents only insofar as it affects Y .

B. Comparative Dynamic Response to Tax Policy: Fundamental Analytics

The local tax on capital τ_k affects the equilibrium stock of capital invested in the locality. To understand this linkage, it is necessary to analyze the behavior of firms in greater detail. Specifically, forming the current-value Hamiltonian

$$H_t \equiv \pi_t + \lambda_t (i_t - \delta) k_t,$$

the necessary conditions for a solution to the profit-maximization problem (P) are

$$\frac{\partial H}{\partial i_t} = 0 \leftrightarrow \lambda_t = 1 + c'(i_t) \quad (A.5.1)$$

$$-\dot{\lambda} + r\lambda_t = \frac{\partial H}{\partial k_t} \leftrightarrow -\dot{\lambda} = (f'(k_t) - c(i_t) + (\lambda_t - 1)i_t - \tau_k) - \lambda_t(r + \delta). \quad (A.5.2)$$

By (A.5.1), the profit-maximizing rate of investment is determined implicitly as a function $i_t = \phi(\lambda_t)$ with $\phi'(\cdot) = c''(\cdot)^{-1} > 0$. Substituting into (A.5.2) and defining $\Psi(\lambda_t) \equiv c(\phi[\lambda_t]) - c'(\phi[\lambda_t])\phi(\lambda_t)$ yields

$$-\dot{\lambda} = f'(k_t) - \Psi(\lambda_t) - \tau_k - \lambda_t(r + \delta). \quad (\text{A.6})$$

Equations (A.1) and (A.6) define a dynamical system in the two variables k_t and λ_t . Letting λ_∞ , k_∞ , and i_∞ denote steady state values, (A.1) and (A.6) imply that

$$i_\infty \equiv \phi(\lambda_\infty) = \delta \quad (\text{A.7.1})$$

$$f'(k_\infty) = \Psi(\lambda_\infty) + \tau_k + \lambda_\infty(r + \delta) \quad (\text{A.7.2})$$

which uniquely determine the steady state of the system.

To see how the local capital stock depends on local taxation, first derive the variational equations

$$\frac{d\dot{k}}{d\tau_k} = (\phi(\lambda_t) - \delta) \frac{dk}{d\tau_k} + k_t \phi'(\lambda_t) \frac{d\lambda_t}{d\tau_k} \quad (\text{A.8.1})$$

$$\frac{d\dot{\lambda}}{d\tau_k} = -f''(k_t) \frac{dk}{d\tau_k} + (r + \delta + \Psi'(\lambda_t)) \frac{d\lambda_t}{d\tau_k} + 1 \quad (\text{A.8.2})$$

from (A.1) and (A.6). These equations, together with the boundary conditions $k_0 = K_0$ and $\lim_{t \rightarrow \infty} \lambda_t = \lambda_\infty = \phi^{-1}(\delta)$, provide two linear differential equations which can be solved for the functions $d\lambda_t/d\tau_k$ and $dk_t/d\tau_k$, i.e., for the comparative-dynamic response of the system to a change in the local rate of taxation on capital.²¹

In particular, assuming that the locality is initially in a steady-state equilibrium, (A.8) is a two-equation system with constant coefficients. To solve this system, it is convenient to reduce its dimensionality. Using (A.7.1) in (A.8.1) and noting that $\phi'(\lambda_\infty) = 1/c''(\delta)$, it follows that $d\dot{k}/d\tau_k = (k_\infty/c''(\delta)) d\lambda_t/d\tau_k$ which can be inverted to solve for

$$\frac{d\lambda_t}{d\tau_k} = \frac{c''(\delta)}{k_\infty} \frac{d\dot{k}_t}{d\tau_k} \quad (\text{A.9.1})$$

and hence

²¹ See Boadway (1979) for a comparative-dynamic tax analysis, in a closed-economy context, using similar techniques.

$$\frac{d\dot{\lambda}_t}{d\tau_k} = \frac{c''(\delta)}{k_\infty} \frac{d\ddot{k}_t}{d\tau_k}. \quad (\text{A.9.2})$$

Noting (as is easily verified) that $\Psi'(\lambda_\infty) = -\delta$, substitution from (A.9) into (A.8.2) yields a second-order differential equation in $dk_t/d\tau_k$

$$d\frac{\ddot{k}_t}{d\tau_k} = r\frac{d\dot{k}_t}{d\tau_k} - \frac{k_\infty f''}{c''(\delta)} \frac{dk_t}{d\tau_k} + \frac{k_\infty}{c''(\delta)} \quad (\text{A.10})$$

with the boundary conditions $k_0 = K_0$ and $\lim_{t \rightarrow \infty} k_t = k_\infty$. The characteristic polynomial for this equation has two distinct real roots, one positive and one negative; one can verify that the solution to the equation is

$$\frac{dk_t}{d\tau_k} = \frac{1}{f''(k_\infty)} [1 - e^{-\rho t}] \quad (\text{A.11.1})$$

where $-\rho$ is the negative root of the characteristic polynomial associated with (A.10), given by

$$\rho = -\frac{r}{2} + \frac{\sqrt{r^2 - 4k_\infty f''(k_\infty)/c''(\delta)}}{2} > 0; \quad (\text{A.11.2})$$

the inequality in (A.12) follows because of the concavity of f and the convexity of c . From (A.11.1), it follows that

$$\frac{dk_t}{d\tau_k} < 0 \quad \text{for all } t > 0, \quad (\text{A.12})$$

that is, an increase in the local tax on capital reduces the capital stock at all subsequent times. Indeed, the reduction in the capital stock is monotonic, and the magnitude of ρ determines the rate at which the capital stock falls to its new, lower, steady-state value.

To facilitate the economic interpretation of (A.11), define $\kappa_t \equiv f'(k_t)/k_t dk_t/d\tau_k$, which is the percentage change in the stock of capital, at time t , that results from an increase in the rate of capital taxation by one percent of the gross rate of return (or marginal product) of capital. Furthermore, define

$$\epsilon \equiv \frac{f'(k_\infty)}{k_\infty f''(k_\infty)};$$

ϵ can be interpreted as the “elasticity of demand for capital,” i.e., it is the percentage change in k associated with a one percentage point increase in the marginal product of capital. If the production function is highly concave, the marginal productivity of capital schedule is very steep and ϵ is very small; in this case, we expect to see that tax policy has little effect on the equilibrium level of capital. Indeed, implicit differentiation of the

steady-state condition (A.7.2) shows that the proportionate change in the steady-state value of the capital stock is just equal to

$$\kappa_\infty \equiv \lim_{t \rightarrow \infty} \kappa_t = \epsilon.$$

In terms of this notation, (A.11) and (A.12) can be written as

$$\kappa_t = \kappa_\infty [1 - e^{-\rho t}] = \epsilon [1 - e^{-\rho t}] \quad (\text{A.13.1})$$

where now

$$\rho = -\frac{r}{2} + \frac{\sqrt{r^2 - 4f'(k_\infty)/\epsilon c''(\delta)}}{2}. \quad (\text{A.13.2})$$

Note from (A.13.2) that the rate of adjustment of the capital stock depends critically on $c''(\delta)$, that is, the second derivative of the adjustment cost function. If the adjustment cost function is only mildly convex, so that c'' is close to zero, then ρ is a large and the adjustment to the new steady state occurs very quickly. If c'' is large, however, ρ is small, and the adjustment to the steady state is slow.

The principal conclusions of this analysis can be summarized as follows:

Proposition 1: Starting from an initial steady-state equilibrium, a permanent unanticipated increase in the capital tax rate lowers the new steady-state equilibrium capital stock in proportion to the elasticity of demand for capital. The capital stock falls monotonically to its new steady-state value at a rate that depends positively on the convexity of the adjustment cost function. In particular, with linear adjustment costs, the adjustment is instantaneous.

C. The Welfare Analysis of Fiscal Policy with Imperfect Capital Mobility

Having characterized the comparative-dynamic effects of local capital taxes on the evolution of the capital stock, it is now possible to consider the welfare implications of capital taxation. In particular, it is of greatest interest to examine the effect of changes in τ_k on the welfare of local residents, as represented by their lifetime wealth Y . For brevity, it is convenient here to restrict attention to the case where local firms are owned entirely by non-residents, i.e., $\theta = 0$. Substituting from (A.3) into (A.4), one obtains

$$\begin{aligned} \frac{dY}{d\tau_k} &= \int_0^\infty \left[-k_\infty f''(k_\infty) \frac{dk_t}{d\tau_k} + \tau_k \frac{dk_t}{d\tau_k} + k_\infty \right] e^{-rt} dt \\ &= \int_0^\infty \left[k_\infty e^{-\rho t} + \tau_k \frac{dk_t}{d\tau_k} \right] e^{-rt} dt \end{aligned} \quad (\text{A.14})$$

where the second equality follows from (A.11.1).

To interpret (A.14), consider first the case where $\tau_k = 0$, i.e., the locality initially raises no taxes from capital. In this case, the second term in the integrand of (A.14) vanishes, and it is clear that $dY/d\tau_k > 0$, that is, it is optimal for the locality to impose a positive tax on capital. The gain from doing so, however, depends on the value of the speed of adjustment of the capital stock; the larger the value of ρ , the smaller the gain from taxing capital. Indeed, in the extreme case of linear adjustment costs, adjustment is instantaneous, and the gain from local taxation of capital vanishes.

In view of (A.12), it is obvious that local welfare is maximized by choosing a positive rate of taxation τ_k^* on local capital such that $dY/d\tau_k = 0$. In fact, one can solve for the rate of capital taxation, expressed as a proportion of the gross return on capital, as

$$\frac{\tau_k}{f'(k_\infty)} = \frac{-1}{\epsilon\rho}, \quad (\text{A.15})$$

an inverse-elasticity type of formula in which the rate of adjustment of the capital stock, ρ , again figures prominently.

Proposition 2: The optimal steady-state rate of taxation of local capital is inversely proportional to the speed with which the local capital stock adjusts in response to changes in the local rate of return on capital. In particular, if adjustment is instantaneous, the optimal local tax rate is zero.

This proposition is helpful in the proper interpretation of previous results from atemporal models which abstract from the dynamics of adjustment. When adjustment costs are negligible, there are no quasi-rents to extract from the owners of local capital, and no incentive for local governments, acting in the interests of their residents, to impose fiscal burdens on this capital. However, if it is costly to adjust the local capital stock, the owners of this capital, when net fiscal burdens are imposed on them, will not find it in their interest to reduce the capital stock immediately to a level at which it again earns a competitive net rate of return. Rather, they will allow the capital stock to fall gradually until it reaches its new steady-state value. During this transition, the net rate of return is below the level that can be obtained on external markets, and the local capital tax thus transfers quasi-rents from capital owners to local residents. Thus, a small open locality, whose policies have no perceptible effect on the net rate of return to capital on external markets, can achieve some redistribution at the expense of the owners of *imperfectly* mobile resources even though, in the long run, the net rate of return on local capital must

return to that which can be obtained on external markets. The redistributive impact of the local capital tax, however, is dependent on the amount of quasi-rents available to be captured, which depends on the costs of adjustment. Previous literature, which abstracts from adjustment costs, in effect assumes that the capital stock is able to adjust to changes in local fiscal policies without delay.

While it is true that a locality's residents can benefit from taxing imperfectly-mobile capital, the reduction in the stock of local capital does inevitably reduce the productivity of local labor, and the steady-state level of wage income is reduced by the taxation of mobile capital. Taxing imperfectly-mobile capital thus involves an intertemporal tradeoff for local residents: they can enjoy the benefits of reduced taxes for local public services, but gradually their wage income erodes, ultimately by an amount greater than the tax savings that they obtain by taxing capital. The preceding analysis has shown that the taxation of local capital is in their interest *in present value terms*, when discounted at the market rate of return. However, if the effects of local policy are discounted at a lower rate, this intertemporal tradeoff becomes less favorable. Indeed, if they are not discounted at all, so that policies are judged only by their long-run effects, the local capital tax is actually harmful to local residents and should be avoided. This is another way to interpret the findings of previous analyses: by ignoring the transitional dynamics of adjustment to local policies, they have in effect focused on the long-run impacts of fiscal policy and, in doing so, have concluded that localities, acting in the interests of their residents, will not attempt to impose fiscal burdens on mobile factors of production.