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Fiscal Restructuring in the Group of Seven
Major Industrial Countries in the 1990s: Macroeconomic Effects

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Abstract

This paper studies the fiscal restructuring of the first half of the 1990s in the major industrial countries. It presents and calibrates a simple model of the labor market and integrates it into a multi-country macroeconomic model that takes into account the effects of distortionary taxes. It then uses the resulting framework to simulate the effects of recent and prospective changes in fiscal policies in the group of seven major industrial countries. The analysis suggests that in the long run the impact on output is likely to be positive in those countries that relied relatively more on expenditure cuts or indirect tax increases (such as Canada, France, Japan, and the United Kingdom), while the effect of the fiscal restructuring on output is estimated to be negative in those countries that relied primarily on labor and capital taxes (Germany, Italy, and the United States).

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Summary

This paper studies the effects of the ongoing fiscal restructuring in the seven major industrial countries. It first presents and calibrates a simple model of the labor market that incorporates the effects of distortionary taxes and then integrates this framework into the IMF's multicountry model (MULTIMOD), which has been extended to account for the effects of various tax instruments. The resulting framework is then used to simulate recent and prospective changes in fiscal policies in this group of countries and to estimate the impact of these policies on output, employment, and other macroeconomic variables during the 1990s.

The main conclusions to be drawn from the study can be summarized as follows. First, for the group as a whole, the fiscal adjustments implemented during the early 1990s, as well as those expected to be implemented in the next few years, are estimated to lead to some loss of output and employment in the short run (relative to a baseline path of no fiscal restructuring). However, most of the short-run output losses would be recovered by the end of the 1990s, as the fiscal adjustment is expected to contribute to a shift of resources from public consumption to private investment by lowering debt-financing needs and thereby reducing the burden of distortionary taxes.

The simulations also show that the output cost of various fiscal instruments tends to vary over different horizons. Increases in indirect taxes and expenditure cuts are more costly instruments for deficit reduction in the short run in terms of output losses, but potentially beneficial instruments over longer horizons. Thus, those countries that relied relatively more on indirect taxes and expenditure cuts in their restructuring (such as Canada, France, Japan, and the United Kingdom) are estimated to eventually realize the greatest benefits from the adjustment. By contrast, countries that relied more heavily on tax increases on factor income (Germany, Italy, and the United States), while incurring smaller losses in the short run (relative to the size of their adjustment), are anticipated to incur output losses in the long run.



I. Introduction

In recent years the governments of the largest industrial countries have engaged in a massive effort to restructure and rationalize their expenditure and tax policies. Although many of the fiscal initiatives in the G-7 can be viewed as a response to the growth of public debt and deficits during the 1980s, the proximate cause of this effort has been different in each country. It has ranged from mobilizing domestic resources associated with German unification, to reducing the burden of public deficits on economic activity in the United States, Italy and Canada, and to altering the tax structure in a more revenue-neutral fashion over the medium term in Japan, France, and the United Kingdom. Many of these changes have had effects beyond domestic borders. For instance, the impact of German unification on international capital markets, despite tax increases of approximately six percent of GDP, contributed to the persistence of high interest rates in Europe and may have provided the impetus for fiscal restructuring in European countries. Arguably, the delay with which changes in fiscal policies were implemented in several European countries, despite the original goal of achieving the Maastricht targets by 1996, contributed to the ERM crisis of 1992-93. The ongoing U.S. deficit reduction plan, and the harmonization of indirect taxes associated with the creation of the single market in Europe, also represent policy shocks with potentially far-reaching implications for all industrial countries.

Notwithstanding the obvious importance of fiscal restructuring in the largest industrial countries, a comprehensive analysis of the effects of these policy changes and of their international implications has yet to be carried out. 1/ The present study intends to make a step in this direction. It first reviews the main policy changes which motivate the investigation. 2/ It then presents and calibrates a simple tax-augmented forward-looking model of the labor market and integrates this model into the IMF's macroeconomic model (MULTIMOD), augmented to include the effects of direct and indirect taxes on consumption and investment, and calibrated on the basis of the data framework developed by Razin and Sadka (1993) and Mendoza, Razin and Tesar (1993). The resulting model is then used to analyze the effects of changes in fiscal policies in the G-7 countries of the first half of the 1990s.

The study yields potentially useful insights in several directions. First, the tax-augmented framework provides a reasonable approximation to the theoretical effects of taxes on the largest industrial economies. The analysis follows the public economics literature in distinguishing between taxes on specific agents, (i.e., direct taxes on households and firms) and taxes on specific transactions (i.e., indirect taxes). Second, the simulations draw from changes in fiscal policies in the largest industrial countries, thereby providing an overview of a complex set of initiatives

1/ For a preliminary analysis of some of the issues explored in this paper see, however, McKibbin (1993a,b), and Mendoza and Tesar (1993).

2/ Since this paper was drafted, some of the fiscal policies planned in the G-7 countries from end-1994 and thereafter have been implemented, others have been modified, postponed, or abandoned, and yet others have been introduced. The analysis is based on information available as of the summer of 1994.

whose impact on the economies of the G-7 countries has not yet received a unified treatment. While the framework remains stylized, and several behavioral relationships are formulated in aggregate terms, the discipline imposed by the rational expectations structure and enforcing intertemporal budget constraints suggests that the study should capture the main impact of these policies.

The main conclusions to be drawn from this study can be summarized as follows. First, the fiscal adjustment undertaken in the G-7 countries during the 1990s is estimated to lead to some loss of output and employment in the short run (compared to a "no fiscal adjustment" baseline path), but to a broad recovery in the G-7 countries as a group during the second half of the 1990s. The short-run losses induced by the fiscal restructuring reflect the negative effects on aggregate demand of cuts in the G-7 countries' public deficits, and the dependence on greater distortionary taxes in most of these countries. These negative demand effects are not offset immediately by higher private demand because of the decline in net wealth of current generations, and are magnified by the presence of liquidity constraints on private spending. The recovery anticipated over the medium and long run in some of these countries reflects the shift of resources from public consumption to private investment and the anticipation of a reduced burden of taxation allowed by lower debt-financing needs. The simulations also show that the output cost of various fiscal instruments tend to vary over different horizons. Indirect tax increases and expenditure cuts, for instance, result in a loss of output over the short run, but are less distortionary instruments over long horizons, and therefore represent useful fiscal instruments to achieve debt reduction, as they shift resources from consumption to investment in the long run. Thus, countries that relied relatively more on indirect taxes and expenditure cuts in order to reduce their deficits (such as Canada, France, the United Kingdom, and--in a revenue-neutral fashion--Japan) are shown to reap the greatest benefits from the adjustment. Countries that relied more heavily on tax increases on factor income (Italy, Germany, and the United States), are projected to suffer more in the short run (relative to the size of the adjustment) and incur output losses even in the long run. Finally, our analysis points at significant international spillovers of the fiscal restructuring, particularly within Europe and largely reflecting the international spillovers associated with German policies since 1990.

II. Recent and Prospective Fiscal Changes in the G-7 Countries

1. Overview

After the widespread growth of public debt in the 1980s, the fiscal landscape of the G-7 countries at the beginning of the 1990s shows the prevalence of large fiscal imbalances. Table 1 summarizes the evolution of public debt during the 1980s in the G-7 countries, and shows that all these countries except Japan entered the 1990s with large structural (i.e., cyclically-adjusted) overall deficits, and four of them (the United States, Germany, the United Kingdom, and Italy) with structural primary deficits.

Table 1. Government Debt and Structural Budget Deficits in the 1980s
(In percent of GDP, General Government)

	Gross Debt 1980 (net debt)	Gross Debt 1985 (net debt)	Gross Debt 1990 (net debt)	Overall Structural Balance 1990	Primary Structural Balance 1990 ^{1/}
United States	39.6 (26.1)	51.3 (36.9)	59.6 (45.8)	-3.2	-1.1
Japan	51.9 (17.3)	68.7 (26.5)	69.8 (9.5)	2.3	3.2
Germany	31.8 (11.3)	41.7 (20.7)	39.6 (18.4)	-3.2	-1.1
France	37.2 (na)	45.4 (22.9)	46.9 (25.1)	-2.3	0.1
United Kingdom	41.8 (22.0)	51.2 (28.1)	34.6 (27.8)	-2.9	-0.5
Italy	58.9 (na)	84.0 (71.6)	104.8 (93.2)	-11.9	-1.8
Canada	44.6 (13.5)	64.9 (34.9)	72.3 (43.4)	-5.2	0.2

^{1/} Estimated from total balance and data on interest payments.

In response to domestic and external pressure for reducing these imbalances, several policy changes have occurred in the G-7 countries since 1990, with much of the restructuring effort projected over the next years. Both the United States and Italy, for instance, appear to have engaged in a credible plan of fiscal restructuring only since 1993. Similarly, after the changes in taxation implemented since the late 1980s in France, the United Kingdom, and Canada, these three countries are only expected to tackle the expenditure components of the budget in the next few years, while Japan is also expected to continue its shift toward greater reliance on indirect taxation in the near future. In a similar vein, further large tax increases are anticipated in Germany in the next few years, despite the sharp increase in tax pressure recorded since 1990.

A review of the key fiscal initiatives undertaken in the G-7 countries since 1990 is provided in this section. The discussion focusses on developments in four fiscal instruments: indirect taxes, labor and capital taxes, and government expenditure (inclusive of transfers). The discussion is summarized in Table 2, which reports yearly changes in average effective tax rates and cyclically-adjusted expenditure in the G-7 countries since 1990.

2. United States

Following the unsuccessful attempts to rein in the fiscal accounts during the late 1980s, the United States has recently engaged in a broad-based attempt to reduce its fiscal deficit, mainly by raising personal income taxes and by reducing discretionary outlays. 1/

The Budget Enforcement Act (BEA) of November 1990 was expected to move the federal balance to a modest surplus by 1994, mainly by cutting entitlements and other mandatory spending and increasing excise and income taxes. However, the projected improvement of the budget proved optimistic, largely because of the BEA's ineffectiveness in containing the growth of autonomous expenditures (notably those for Medicare and Medicaid), although the caps on discretionary spending were generally effective. A small temporary decline of the structural deficit was also recorded as the March 1992 change in the schedule of personal income taxes effectively shifted receipts from 1992 to 1993. Altogether, the structural primary federal deficit is estimated to have worsened by about 0.7 percent of GDP from 1990 to 1993.

The plan of deficit reduction approved in August 1993 includes tax increases, expected to yield a total of US\$250 billion over the fiscal years 1993-98 (or about 0.9 percent of GDP each year), inclusive of higher personal and income taxes (mainly on high-income earners, retroactive to January 1993), higher corporate taxes, and higher gasoline and other indirect taxes and user fees. Spending cuts should yield about

1/ We focus here on measures taken by the U.S. federal government.

Table 2. Summary of Fiscal Developments in the G-7 Countries

(In percent of GDP, general government)

	Period	Indirect Taxes	Labor Income Taxes	Capital Income Taxes	(Decline in) Transfers and Direct Expenditure	Change in the Primary Structural Balance
United States	1991	0.2	0.1	--	-0.2	0.1
	1992	--	-0.2*	--	-0.6	-0.8
	1993	--	0.2** + 0.1	0.1	-0.3	--
	1994-98	0.2	0.2	0.3	0.6	1.3
Japan	1991	--	--	--	--	--
	1992	--	--	--	-0.7*	-0.7
	1993	--	--	--	-0.5* -0.7*	-1.2
	1994	--	-0.9	-0.3	1.2** -0.7* -0.8*	-1.5
	1995-97	1.3	--	--	1.4** +0.8**	3.5
Germany	1991	0.4	1.1+0.6*	0.2+0.3*	-4.6	-2.0
	1992	0.1	1.3-0.6**	0.1-0.3**	1.5	2.1
	1993	0.4	0.1	--	0.9	1.4
	1994-96	0.3	1.7	0.3	1.1	3.4
France	1991	-0.4	0.4	0.2	--	0.2
	1992	-0.1	-0.1	-0.2	-0.6	-1.0
	1993	0.1	0.1	-0.2	0.1	0.1
	1994-97	--	-0.1	0.1	1.8	1.8
United Kingdom	1991	0.5	-0.2	-0.5	-0.2	-0.4
	1992	1.0	-0.2	-0.6	-0.7	-0.5
	1993	--	--	-0.1	-0.9	-1.0
	1994-96	1.1	0.8	0.1	1.0	3.0
Italy	1991	0.3+0.2*	0.2+0.2*	0.1	0.4+0.3*	1.7
	1992	-0.2** +0.1*	0.5-0.2** +0.3*	0.4-0.3** +0.3*	2.5	
	1993	-0.1** +0.1	-0.3** +1.1	-0.7** +0.9	-0.3** +0.4	1.1
	1994-96	0.1	-0.2	-0.7** +0.3	0.7	0.2
Canada	1991	0.6	0.2	-0.1	0.1	0.8
	1992	0.2	0.1	0.1	0.3	0.7
	1993	--	0.1	-0.1	0.1	0.1
	1994-98	-0.2	-0.1	-0.1	0.7	0.3

Notes: * indicates one-off measure; ** indicates the corresponding offsetting measure.

US\$ 200 billion in five years (or 0.6 percent of GDP each year), including both cuts in government consumption and in net transfers. The plan is front-loaded: roughly two-thirds of the deficit reduction should occur by end-1995. 1/

3. Japan

The success of the debt-control strategy implemented in Japan during the 1980s provided to the Japanese government some flexibility to adopt countercyclical measures during the early 1980s. Effort is ongoing, however, to reduce the burden of taxation on the working population through a gradual shift toward indirect taxation.

The first significant measures implemented in Japan during the 1990s occurred at the beginning of 1992, with the announcement a front-loading of public expenditure. 2/ This plan, however, had a limited impact, since it only affected the timing but not the size of expenditures. Another economic stimulus package, involving increased direct expenditure and enhanced loan programs, was announced in August 1992. Because the central government component of the package was not approved until December, however, much of the impact of the measures was carried over to 1993. In 1993, the government announced two more expenditure-based packages (in April and September), estimated to have temporarily worsened the structural balance by almost 2 percent of GDP in 1992 and 1993, with carry-over effects in 1994.

In February 1994, the government announced another fiscal stimulus package centered on an income tax cut of 1.2 percent of GDP and direct public expenditure increases of another 0.8 percent of GDP (in addition to other confidence-boosting measures with no direct impact on the fiscal balance). Initially, these measures were anticipated to elapse in 1995. Concern with the impact of aging on the fiscal burden of the work force, however, has made maintenance of the tax cut, offset by an increase in indirect taxes from 1997, the most likely outcome.

4. Germany

With a large deterioration in the fiscal position as a result of unification, a trend of increasing taxes has emerged in Germany: general government tax revenues have risen from 44 percent of GDP in 1990 to almost 48 percent of GDP in 1993, and are set to increase to about 50 percent by 1995. The share of public expenditure over GDP should also decline in the next few years.

The German structural deficit increased by about 2 percent of GDP in 1991, due to the sharp rise of transfers and expenditure to finance

1/ Estimated debt service savings for about US\$60 billion were also included in the plan, but were treated as endogenous in our simulations.

2/ Temporary corporate surcharges and higher indirect taxes in 1991 are estimated to have had negligible impact.

reconstruction of East Germany. The deficit increased despite significant cuts in transfers and direct expenditure and across-the-board tax increases in early 1991. These included: a rise in wage contribution rates (combined with a small decline of pension rates); a one-year 7.5 percent surcharge on income and corporation taxes; and an increase in the gasoline and other indirect taxes. In the event, higher than planned revenues were collected through these measures (due partly to high wage settlements during the year) and tax revenues increased by more than 2.5 percent of GDP.

Large cuts in expenditure were announced at the beginning of 1992. In addition to the carry-over effects of the 1991 tax increases, there were also significant increases in contribution rates to public health insurance funds, and small increases in indirect taxes (e.g., on tobacco). Partly due to high wage settlements in the public sector, these measures led to a further increase in tax revenues, despite the expiration of the 1991 income tax surcharge.

In 1993, the increase of the standard VAT rate and of contribution rates to a number of public health insurance funds led to a small increase in tax revenues. Limits on the real growth of public spending, adopted in July 1992, also contributed to improving the structural fiscal balance. In March 1993, a new "solidarity pact" involved the reimposition of the 7.5 percent tax surcharge on wage and corporate income from 1995 (expected to yield about 1 percent of GDP), the elimination of numerous tax preferences, an increase of the wealth tax, and further cuts in outlays. Prospective changes include a rise in the gasoline tax rate (about 0.3 percent of GDP), and higher labor income and consumption taxes, including higher pension contributions (for about 1 percent of GDP); and lower social security benefits (about 0.4 percent of GDP).

5. France

Reflecting a relatively stable budgetary position, fiscal policy in France has been implemented in recent years mainly by changing taxes in a revenue-neutral fashion. Prospective policies are expected to focus mainly on reducing the share of public expenditure over GDP.

Despite a worsening of the overall balance due to the economic slowdown of 1991, the structural balance improved modestly, mainly as a result of higher health insurance contributions. The effective replacement of some contributions to social security with the "contribution sociale généralisée" (CSG) shifted some burden from labor to corporate and personal business taxes. Lower VAT rates also led to a decline of indirect tax revenues (about 0.4 percent of GDP).

In 1992, discretionary increases in expenditure and lower tax proceeds (partly due to business and household tax reliefs, and partly to the carry-over of previous VAT cuts), were roughly equally responsible for the increase of the structural deficit. In 1993, savings in salaries and other administrative expenses were more than offset by discretionary increases in expenditure aimed at stimulating employment and support restructuring of

public enterprises. Some revenue measures were implemented to lower the tax burden on small and medium-sized firms, but were offset by the increase of the CSG rate and by a small increase in excise taxes.

The French government now plans some deficit-reducing measures. On the revenue side, a widening of tax brackets should reduce the effective tax rate by about 0.3 percent of GNP in 1994. However, this measure would merely neutralize the carry-over effect of the increase in the CSG rate in 1993. Contributions to the health care system are set to rise by some 0.1 percent of GDP, and certain fiscal advantages for financial instruments have been eliminated as of 1994. Reductions in employers' social security contributions have been planned, however, for low paid workers and new employees, and in other components of the wage tax wedge (for a total relief of about 0.3 percent of GDP). While revenue measures should be largely neutral on balance, net expenditure would decline significantly in the next few years, as cuts in real government spending by more than 1 percent are ongoing in 1994 (mainly in defense, capital outlays, and operating outlays), followed by constant real spending of the central government until 1997.

6. United Kingdom

After the personal and corporate tax cuts and expenditures increases of the early 1990s, fiscal policy appears to be shifting in the United Kingdom in the mid-1990s, as budget deficits are expected to be closed by expenditure-reducing measures and a further rise in indirect taxes.

Several modifications of the tax system were implemented in 1991. The statutory corporate tax rate was reduced, and corporate loss carry-over provisions were made more generous, leading to a fall of the average tax on capital income of about 0.5 percent of GDP in 1991. During the same year, the standard VAT rate was increased (partly to finance the reduction of the headline community charge--the "poll tax"), restrictions were imposed on mortgage interest relief, child and age related benefits were increased, and employers' National Insurance contributions were increased to cover employee benefits in kind. Partly on account of the structural increase in spending recorded over the year, the structural deficit of the general government is estimated to have increased during 1991 by some 0.4 percent of GDP.

In March 1992 the tax rate applied to the first £ 2,000 of income was lowered, at an estimated annual cost of £ 2.5 billion (with carry-over effects in 1993). Car taxes were reduced and transitional relief was given to businesses. Increases in expenditures (notably health, transport, and education), also contributed to raising the structural deficit in 1992, despite some carry-over effect of the 1991 VAT increase. In contrast, tax policies were largely neutral in 1993. However, further growth in real spending and some carry-over from previous tax measures contributed to a decline of the structural primary balance of about 1 percent of GDP.

Several revenue measures were announced in 1993, which became effective in 1994. These included: (a) the imposition of a VAT on domestic fuels at an 8 percent rate, rising to the standard U.K. rate (17.5 percent) in 1995,

and increases in other road fuel duties, insurance, and air passenger taxes, for a total tax yield of about 1 percent of GDP when fully implemented; (b) an increase in National Insurance contributions of about 0.3 percent of GDP, (c) a broadening of the personal income tax base, mainly through reduction of mortgage and married couples' allowances and measures to reduce tax avoidance, expected to yield about 0.7 percent of GDP; and (d) a small decline in business taxes (0.1 percent of GDP). Aggregate spending ceilings were also announced, and later tightened in the 1994/95 budget. Altogether, these measures are expected to improve by about 3 percent of GDP the structural budget balance by 1996.

7. Italy

Overall taxation has increased sharply in Italy in recent years, lifting the average Italian tax rate to among the highest in major industrial countries. Expenditure cuts have played a relatively minor role in the ongoing plan of fiscal stabilization, and only in 1993 has the government begun to rely primarily on permanent structural changes in order to stabilize the debt/GDP ratio.

The state budget laws for 1991 envisaged expenditure cuts of £ 20 trillion, based primarily on ceilings on discretionary outlays and broad-based revenue measures of £ 28 trillion, while the laws for 1992 emphasized revenue measures (especially capital taxes). In these two years, the primary structural deficit improved by more than 4 percent of GDP. However, many of the deficit reducing measures taken in these years were of a one-off nature, including temporary wage freezes, early retirement of public employees, special taxes on real estate and on bank deposits, front-loading of indirect taxes, and revenues from fiscal amnesty ("condono tributario").

Tax revenues increased by about 1 percent of GDP in 1993, mainly due to increases in direct taxes. Measures included limits to income tax allowances, the partial abolition of the indexation of tax brackets, and higher real estate and corporate property taxes. New expenditure cuts of about 0.4 percent of GDP were also implemented, including reduction of expenditure on pensions, health care, and public wages and investment. In contrast with the practice of previous years, most of the measures taken in 1993 were structural in nature.

No significant change in taxes is planned in the near future. Beginning in 1994, sales taxes and various excises have been raised, partly aimed at further harmonizing Italian tax rates with EC rates. However, the absence of new measures replacing previous one-off measures, and new initiatives aimed at reducing the tax burden on certain categories of taxpayers (such as higher tax rebates for principal residences, and extension of the tax indexing) are expected to lead to a decline of the direct tax rate. Over the next few years, however, a small improvement of the structural primary balance is likely to be realized, as a result of cuts in general government expenditure in public procurement and transfers, health care, and social security.

8. Canada

Following the completion of the comprehensive tax reform program undertaken in the 1980s and the introduction of a general sales tax in 1991, recent and prospective policy changes have focussed primarily on the expenditure component of the budget.

The Goods and Services Tax (GST) was introduced in January 1991. Despite the relatively modest revenue yield from the new tax, revenue from other indirect taxes increased, especially at the provincial level, thus raising overall indirect tax revenue by about 0.8 percent of GDP in 1991 and 1992. Subsequently, only minor structural changes have been made to the tax system. As required by the Expenditure Control Plan of 1990, on the other hand, across-the-board reductions in expenditures (including defense, structural operating budgets, and international assistance) contributed to significant declines in the structural deficit in 1991 and 1992.

In 1993 fiscal policy was relatively neutral, with allowances made at the federal level for investment tax credits in machinery and equipment, reductions in the federal corporate tax rate (in January 1993 and in January 1994), and increases in local personal income taxes aimed at reducing the Provinces' budget deficits.

The current Federal Government Expenditure Control Plan for the period until 1998 includes cuts in transfers for about 0.3 percent of GDP. Investment in regional development and other direct public spending should be also reduced by about 0.4 percent of GDP. No significant change in federal taxes is anticipated, except for a significant reduction in the tobacco tax.

III. Macroeconomic Effects of Tax Policies--An Analytic Framework

In order to explore the implications of the policy changes surveyed above on the economies of the G-7 countries, we present a macroeconomic framework that incorporates three categories of taxes: a tax on labor income, a tax on capital income, and a consumption tax. We formulate and calibrate a simple forward-looking labor market model and incorporate this into a broader macroeconomic framework (namely, the IMF's multi-country model MULTIMOD), further modified to account for the role of taxes on demand. The channels through which taxes affect economic behavior in our framework are discussed in this section, while details of the model

unrelated to taxes, and of the methodology related to the tax data, are left in the background. 1/

1. The labor market

Our simple labor market model involves three equations: a price-setting equation, a wage-setting equation, and an unemployment equation. In synthesis, the model allows cyclical labor demand and supply to determine the fluctuation of unemployment around its natural level, which is taken as largely exogenous and can be regarded as the long-run outcome of a search/bargain-based framework, such as that of Pissarides (1985). Short-run fluctuations of wages around their long-run trend are modelled in a traditional fashion, based on an expectation-augmented Phillips curve, inclusive of a real wage target effect.

a. The price-setting equation

Prices are assumed to be set at a constant mark-up over unit labor cost. We do not estimate the markup equation. There is a substantial amount of empirical evidence pointing at the unresponsiveness of markups to demand, and previous attempts aimed at identifying time-varying markups have proven unsuccessful. 2/ In logarithmic form, 3/ with q denoting the price of output, l^d work-hours employed, y output, and w unit wages, the fixed-markup equation is written in first difference form as

$$\Delta q = \Delta w + \Delta l^d - \Delta y. \quad (1)$$

Note that the output deflator q is defined as net of indirect taxes, while the nominal wage w is defined as gross of labor income taxes (including all components of the labor tax wedge).

1/ The overall model is outlined in the appendix and detailed in Masson, Symansky, and Meredith (1990). Details of the methodology used to construct the relevant tax series are provided in Mendoza, Razin and Tesar (1993) and Razin and Sadka (1993). In summary, that methodology consists of approximating the tax rates faced by representative agents by means of *average effective tax rates constructed from OECD national account data*. While perhaps not completely rigorous in its treatment of tax laws, particularly in its approximation of marginal tax rates by means of average rates, this methodology is shown in Mendoza, Razin and Tesar (1993) to be sufficiently robust in comparison to alternative treatments, yet sufficiently simple for modeling purposes and useful to bypass the complexity and cross-country diversity of actual tax laws.

2/ See, for instance, Masson, Symansky and Meredith (1990), and the survey by Blanchard and Fischer (1989, Ch. 9).

3/ Throughout the rest of the paper, lower case letters denote the logarithm of the corresponding upper case letters, and greek characters denote exogenous parameters.

b. The wage-setting equation

Following related approaches (see, for instance, Coe and Krueger (1990), and Nickell (1988) for a general discussion), we specify the short-term dynamics of the real wage around its exogenous long-run growth rate by combining (in log form) an expectations-augmented Phillips curve with a target real wage term:

$$\Delta w = \eta + E\Delta p_{t+1} - \alpha(u - u^*) - \phi((w-q) - (w-q)^*)_{t-1}, \quad (2)$$

where u and u^* denote the current and natural unemployment rates, p the consumption-based deflator, $(w-q)^*$ the target real product wage, and η captures other exogenous determinants of the long-run growth of real wages. All coefficients in equation (2) are expected to be positive: nominal wages should increase less than expected inflation when unemployment exceeds its natural rate or the real product wage exceeds its target level. 1/ For simplicity, we assume a Cobb-Douglas technology, which implies that competitive firms would target the real wage at a linear function of trend productivity: $(w-q)^* = (y-l)^t - \beta$ (the superscript t denotes a trend, and β is the capital share of income). With more general technologies, however, the target real wage would also be linked to trend labor productivity. The resulting wage equation is:

$$\Delta w = \omega + E\Delta p_{t+1} - \alpha(u - u^*) - \phi((w-q) - (y-l)^t)_{t-1}, \quad (3)$$

where ω collects all constant terms. In the long run, unemployment is at its natural rate (see the unemployment equation below) and the real wage grows with average productivity and other exogenous factors (all absorbed in the constant term).

c. The unemployment equation

With a Cobb-Douglas technology, and denoting (log) work-hours employed by l^d and capital by k (assumed fixed in the short run), changes in output can be mapped into changes in employed work-hours for each k . Defining potential output as, $\bar{y} \equiv (1-\beta)\bar{l}^d + \beta k$ the demand for work-hours from its "natural" level can be written as

$$l^d = \bar{l}^d + \frac{y - \bar{y}}{1 - \beta}. \quad (4)$$

Next, we specify the supply of labor (in number of individuals), n^s , as

$$n^s \equiv \bar{n}^s + \gamma[(w - t_L - p) - (w - t_L - p)_{t-1}^c], \quad (5)$$

1/ We did not place *a priori* restrictions on whether the wage term on the left-hand side of (2) should include or exclude labor income taxes. Presumably, firms bargain in terms of gross labor costs, while workers bargain in terms of net earnings. Equation (2) performed substantially better when specified in terms of gross labor cost, however. We have therefore adhered to this formulation.

where, \bar{n}^s is the long-run labor force, t_L is the tax rate on gross wages (including all components of the tax wedge on wages), and p is the consumer deflator (inclusive of indirect taxes). Thus, equation (5) describes the response of the supply of labor to the real de-trended *after tax* consumption wage. Consistent with most available evidence showing a small elasticity of long-run labor supply to labor income, the labor force is assumed to be inelastic in the long run. 1/ We allow for an impact of real after-tax wages on labor services in the short run, but, empirically, we found this effect to be small.

Denoting the log of actual and "normal" per-worker work-hours by h and \bar{h} , respectively, and using (4), (5), and $l^d = n^d h$, we can write unemployment as a function of h as

$$u \equiv n^s - n^d = u^* + \gamma[(w - t_L - p) - (w - t_L - p)^c] - \frac{y - \bar{y}}{1 - \beta} + (h - \bar{h}), \quad (6)$$

where $u^* \equiv \bar{n}^s - \bar{n}^d$ is the long run ("natural") rate of unemployment. To incorporate the effects of hiring and firing costs on the short-run behavior of employment, we now assume u to be determined as a weighted average of its *desired* rate (i.e., its value when $h = \bar{h}$) and its last observed realization, u_{-1} . This yields the unemployment equation:

$$u = \rho u_{-1} + (1 - \rho) \left[u^* + \gamma[(w - t_L - p) - (w - t_L - p)^c] - \frac{y - \bar{y}}{1 - \beta} \right]. \quad (7)$$

With this specification, a larger value of ρ implies that temporary fluctuations of output are achieved mainly by changing average per-worker work-hours. The unemployment rate is sluggish and responds to output over the medium term, as per-worker work-hours return to their normal level. In steady state, the output gap is zero, real wages increase along their trend, work-hours equal their normal level, and unemployment is at its natural rate.

Finally, the labor market model is closed by considering the links between the natural rate of unemployment, u^* , and taxes. Our specification, discussed below, is a simple one: it recognizes explicitly the link between the natural rate of unemployment and labor taxes, which is well documented empirically and well supported theoretically; but it leaves the effects of other tax instruments (for which supportive empirical evidence is lacking or negative, and theoretical predictions are ambiguous) in the background, by *lumping these effects into a constant shift term*. Specifically, we posit a linear relationship between natural unemployment and the labor tax rate,

$$u^* = \zeta + \kappa t_L, \quad (8)$$

1/ The relative inelasticity of the labor supply of men is rather uncontroversial. More uncertainty surrounds estimates of the elasticity of the female labor supply. See Pencavel (1986) and Killingsworth and Heckman (1986) for surveys of the literature.

and calibrate the coefficient κ based on available empirical evidence. The term ζ , which incorporates the effects of non-labor taxes and other exogenous determinants of steady-state unemployment, is estimated jointly with the model's other coefficients by allowing for a structural change at mid-sample. Since the steady-state labor supply is inelastic, changes in u^* reflect the disincentives placed by labor taxes on long-run labor demand through the interaction of wage bargaining and search effort.

Equation (8) is broadly consistent with a variety of models of long-run unemployment, such as that of Pissarides (1985). In that model, a fixed supply of workers trades off the benefits of being employed against the costs of job search, and the risk of not finding employment upon separation. Firms' and workers' bargaining determines both the steady-state unemployment rate and the real wage, as a function of parameters that include labor taxes and non-labor income. Search effort being elastic, exogenous changes that increase workers' bargaining strength would increase real wages and unemployment; conversely for changes that increase firms' strength. For instance, since unemployment benefits are generally untaxed and often unrelated to wages, higher labor income taxes raise the ratio of the income of the unemployed to that of the employed, and similarly for higher employers' per-worker taxes. This higher labor tax wedge is partly borne by firms, thus leading to higher equilibrium real wage and higher unemployment.

In principle, indirect taxes may also affect firms' and workers' bargaining incentives. However, changes in consumption taxes leave the replacement ratio unchanged, thus leading to unchanged long-run unemployment in a wide class of models (see Johnson and Layard (1986) and Bean (1994) for comprehensive discussions). The effect of capital taxes is also theoretically ambiguous: they reduce profits (leading firms to bargain for lower wages and hire less labor), but induce firms to substitute workers for capital (thus acting in the opposite direction). The total effect on unemployment is likely to be small. Indeed, there is hardly any empirical evidence that taxes other than labor taxes may effect the natural rate of unemployment. 1/

1/ The prior that indirect and capital income taxes should have little impact on long-run unemployment may explain the paucity of empirical studies exploring the effect of these taxes on unemployment. Where such effect was explored, little evidence was found. See, for instance, Layard and Nickell (1986), Johnson and Layard (1986), and Coe (1990).

The labor market model described above is summarized by equations (1), (3), (7), and (8). 1/ After substituting (8) for u^* into (3) and (7), these two equations were estimated by Three-Stage-Least-Squares (with instrumental variables for the forward-looking term) individually for each country, using annual data from 1968-91. The results are reported in Table 3. Clearly, given the limited number of degrees of freedom, it is best to regard the estimation as no more than an educated calibration of the model. Nevertheless, Table 3 presents rather plausible results, the coefficients being estimated with the predicted sign with acceptable significance. 2/

2. Taxation, consumption, and investment

Besides affecting the supply-side of the economy through real wages and employment, taxes also affect consumption and investment, the dynamics of government debt, and various national income and price identities. These channels are outlined in the rest of this section, beginning with a brief description of the impact of indirect taxes on aggregate price deflators. An overview of MULTIMOD is provided in the Appendix, while a complete discussion of the model and of its econometric aspects is available in Masson, Symansky, and Meredith (1990).

a. Indirect taxes and the consumer price index

In theory, a VAT should be levied on the full value of goods sold by firms, giving credit for the cost of intermediate inputs. In practice, value added taxes are implemented subject to two common exceptions. First, capital goods (whose services are treated as intermediate goods) and government purchases, are generally exempted from the tax base. Second, most countries levy indirect taxes according to the destination principle, thus imposing the VAT on all goods destined for final domestic consumption, regardless of their country of origin; thus, exports are exempted from home country's VAT, while imports are subject to the tax. These common exceptions make the destination-based VAT essentially equivalent to a consumption tax, a practice that we follow here. Thus, the consumption

1/ The coefficient κ in (8) was calibrated based on previous empirical cross-country studies of the natural rate of unemployment, including Adams and Coe (1990), Coe and Krueger (1990), and Coe (1990). In these studies, the elasticity of the natural rate of unemployment to the labor tax wedge was estimated from 1.6 to 1.8. Accordingly, the value of κ was computed for each country using data on average tax and unemployment rates, \bar{t} and \bar{u} , and $\frac{\partial u^*}{\partial t} \frac{\bar{t}}{\bar{u}} = \kappa \frac{\bar{t}}{\bar{u}} = 1.7$. The resulting values of κ are reported in Table 3.

2/ Insignificant slope coefficients were set at zero. A mid-sample structural break was allowed for the coefficients ζ and ω . Given the lack of sufficient data on taxes, the Italian model was not estimated, and the Italian coefficients were set at the average of the German, French, and U.K. estimates. See Table 6 for further details of the estimation.

Table 3. Estimates of the Labor Market Model

Country	γ	α	ϕ	ρ	ζ_1	ζ_2	ω_1	ω_2	κ	adj.r ² eq.1	adj.r ² eq.2	h eq.1	DW eq.2
United States	--	.39 (.10)	.56 (.12)	.51 (.03)	-.02 (.01)	-.03 (.01)	.03 (.01)	.02 (.01)	.40	.90	.62	1.39	1.20
Germany	.17 (.08)	.77 (.23)	.17 (.05)	.73 (.04)	-.05 (.01)	-.00 (.01)	.04 (.01)	-.00 (.02)	.23	.97	.74	1.34	1.91
France	.11 (.04)	1.33 (.26)	.14 (.04)	.71 (.03)	-.06 (.01)	-.02 (.01)	.00 (.02)	-.05 (.02)	.28	.98	.86	-0.12	1.86
Italy	.20	.91	.16	.72	--	--	--	--	.49	--	--	--	--
Canada	.50 (.16)	.55 (.13)	--	.57 (.04)	-.02 (.01)	-.02 (.01)	-.04 (.02)	-.06 (.02)	.63	.96	.71	0.44	
Japan	--	5.18 (1.70)	.10 (.05)	.93 (.01)	-.00 (.01)	-.01 (.01)	-.02 (.04)	-.03 (.04)	.16	.93	.70	1.13	1.32
United Kingdom	.33 (.14)	.64 (.29)	--	.73 (.06)	-.04 (.03)	-.01 (.01)	-.03 (.03)	-.04 (.02)	.42	.97	.43	0.32	1.40

Source: Annual Data from 1968 to 1991. Standard errors in parentheses. The U.K. equations, and the unemployment equations for the United States, Canada, and Japan, were corrected for first order serial correlation. A mid-sample break-point was allowed for ζ and ω .

deflator P is defined as a function of the domestic and foreign producer prices Q and Q^f as

$$P = (1+t_c)[(1-m)Q + mXQ^f] , \quad (9)$$

where t_c is the VAT rate, m is the (endogenous) share of imported goods in domestic consumption (constrained to be the same for all the components of absorption), X is the exchange rate (defined as the domestic price foreign currency), and f denotes foreign variables. 1/

b. Households' wealth and firms' capital

The long-run model of consumption used in our framework is based on the work of Blanchard (1985), extended by allowing for short-run liquidity effects. In the long run, households maximize the discounted utility of current and future consumption, subject to the constraint that the present value of consumption does not exceed wealth. In the short run, some consumers are assumed to be liquidity-constrained, thus leading to the inclusion of a linear term linking changes in consumption to changes in disposable income. In steady state, consumption and disposable income grow at the same rate, and consumption is fixed as a constant share of wealth.

The main difference between this study and most empirical applications of Blanchard's model lies in our inclusion of taxes in the definition of income and wealth. Since this inclusion leaves the behavioral specification of consumption unchanged, we omit the specifics of the consumption function, and discuss only the definition of wealth and disposable income. 2/

Total real private wealth is the sum of real human and capital wealth, real money balances, and real domestic and foreign bonds:

$$W = \frac{V^H + V^K + M + B + X \cdot B^f}{P} . \quad (10)$$

Nominal human wealth, V^H , equals the discounted stream of after-tax labor income, $(1-t_L)W \cdot L$, and transfers from the government, T_G^H . The discount rate includes the exogenous growth rate of population, n , and the after-tax interest rate applicable to savings (the nominal riskless rate of interest, i , plus a premium γ for credit risk on personal income and the probability of death of a household). 3/ In recursive form, nominal human wealth is

$$V^H = \frac{V_{+1}^H}{1+n+(i+\gamma)(1-t_k)} + (1-t_L)W \cdot L + T_G^H . \quad (11)$$

1/ In the long run, Q/XQ^f converges to the equilibrium real exchange rate, which is determined endogenously consistent with the model's assumption of imperfect substitutability among different countries' exports.

2/ See Masson, Symansky, and Meredith (1990) for details of the consumption function underlying this model.

3/ In our simulations, we set the rate of growth of the labor force, n , at 0.015, and the premium γ at 0.05.

After log-linearizing the consumer price deflator, π_p , real human wealth is defined as

$$\frac{V^H}{P} = \frac{V_{+1}^H / P_{+1}}{1+n+(i+\gamma)(1-t_k)-\pi_p} + \frac{(1-t_L)W \cdot L + T_G^H}{P}. \quad (12)$$

Note that households' labor income is taxed at the labor income rate t_L , whereas interest income is taxed at the capital income rate t_k . We also ignore the tax-induced spread between lending and borrowing rates (taxes are deducted from households' interest income, but, with few exceptions, tax credit is not given for households' interest payments). This spread would induce a kinked budget constraint on consumers' decisions, so that the relevant interest rate would depend on whether households are net lenders or net borrowers. 1/ On average, however, households hold net claims on the government and corporate sectors. Ignoring aggregation biases for simplicity, the interest rate relevant for consumption is the net-of-tax rate.

Capital wealth is also defined in present value terms. Earnings from physical capital (net of depreciation at the rate δ) are subject to the tax rate t_k , but also include a tax credit on interest paid, proportional to the fraction of debt-financing in firms' capital, d_k . 2/ The discount rate includes the endogenous rate of growth of physical capital, and an exogenous premium ν above the risk-free rate of interest (reflecting both default risk and a premium against undiversifiable corporate risk). 3/ The definition of real capital wealth that is relevant for consumption decision is obtained by deflating nominal capital wealth by the consumption deflator,

$$\frac{V^K}{P} = \frac{V_{+1}^K / P_{+1}}{\frac{K}{K_{-1}} + (i+\nu)(1-t_k \cdot d_k) - \pi_p} + \frac{(1-t_k)[Q(Y-\delta \cdot K_{-1}) - W \cdot L] + T_G^K}{P}, \quad (13)$$

where T_G^K denotes transfers from the government to firms.

A larger share d_k of firms' debt-financing weakens the direct effect of capital income taxes on capital wealth. If $d_k=1$, taxes on capital income have no direct effect on capital wealth: the income effect of a tax change is offset by the substitution effect through the discount rate. 4/ 5/

1/ See Sandmo (1985) for further discussion.

2/ Masson, Symansky, and Meredith (1990) estimate an average share of debt in total financing for industrial countries' corporations of about 0.55, which we use as our estimate of d_k .

3/ In our simulations, the steady-state growth rate of capital was set at 0.015 and the premium ν so as to ensure that capital wealth equals the stock of capital in steady state.

4/ This is essentially a partial equilibrium result, however, that rests on a computation of wealth based on a fixed income stream and fixed interest rates. Depending on the use of tax earnings by the government, income and interest rates will adjust until demand and supply of goods on the world market are equated in each period.

Finally, in our model taxes affect consumption through liquidity effects on disposable income (see Masson, Symansky, and Meredith (1990) for details). Disposable income is defined as the sum of post-tax labor and capital income plus transfers from the government:

$$P \cdot Y^D = (1 - t_L) W \cdot L + (1 - t_K) \left[(Y - (\delta + (i + v) d_K) K_{-1}) Q - W \cdot L + B_{-1} i + X B_{-1}^f i^f \right] + T_G^H + T_G^K. \quad (14)$$

Equations (9)-(14) capture the effects of taxes on consumption in our model. Essentially, taxes reduce disposable wealth and income, thus stimulating both a short-run and long-run fall of consumption. Taxes on capital income also result in a substitution of consumption for saving.

Investment is modeled as in Tobin (1969), extended by allowing for adjustment costs. In the long run firms trade off the market value of a unit of existing capital with its replacement cost. In the short run investment is determined by an error-correction model that reflects the costs of adjusting capital to its desired level (see Masson, Symansky, and Meredith (1990) for details). The inclusion of taxes does not affect these links, but only the definition of firms' value. Similar to the case of households' capital wealth, firms' wealth is given by the discounted stream of capital earnings. Nominal capital wealth, however, is deflated by the output price Q :

$$\frac{V^K}{Q} = \frac{V_{+1}^K / Q_{+1}}{\frac{K}{K_1} + (i + v) (1 - t_K d_K) - \pi_Q} + \frac{(1 - t_K) [Q(Y - \delta \cdot K_{-1}) - W \cdot L] + T_G^K}{Q}, \quad (15)$$

where π_Q is the rate of producer price inflation. With this specification, capital taxes affect investment through the market value of capital. If firms are not fully debt-financed, higher taxes reduce the real market value of capital, V_K/Q , and thus firms' incentives to invest. 1/

c. Government budget identity

Net tax revenues are defined by the sum of labor taxes, capital taxes, and sales taxes, minus transfers from the government to the private sector. In our model these transfers play the role of residual flows used to satisfy

5/ (...continued)

5/ Note that since the rules for deductibility of interest expenses differ at the household and firm level, there would be an incentive for households to report consumer credit and other personal interest expenses as business expenses. Tax evasion and the details of income tax reporting remain beyond our stylized framework, however, we assume the tax authorities to be able to assure tax segmentation between the household and business sectors.

1/ See Samuelson (1970) and Stiglitz (1973) for a discussion of the irrelevance of corporate taxes on firms' value when firms are completely debt-financed.

the intertemporal budget constraint of the government. Defining net tax revenues as

$$T = \frac{t_c P}{1+t_c} C + t_L W \cdot L + t_k [(Y - (\delta + (i+v) d_k) K_{-1}) Q - W \cdot L + B_{-1} i + X B_{-1}^f i^f] - T_G^H - T_G^K, \quad (16)$$

the dynamics of government debt are determined by

$$B = (1+i) B_{-1} + G - T, \quad (17)$$

where G is the nominal value of government spending on both domestic and imported goods. 1/

In summary, taxes enter our framework through the labor market, households' and firms' wealth, the wedge between consumer and producer prices, and, naturally, government debt. In general, our model's predictions on the long-run response of macroeconomic variables to changes in various taxes are similar to those of intertemporal neoclassical models. For instance, the model is consistent with several equivalence relationships among fiscal instruments, including the equivalence between VAT and a uniform tax on income (wages plus capital income attributable to initial wealth, excluding double taxation of saving). 2/ Many of the sharp stylized predictions of theoretical public finance models are weakened, however, by the model's allowance for several market imperfections and short-run rigidities. Households' finite expected lifetime and liquidity effects, for instance, imply that our model does not exhibit full Ricardian equivalence: changes in taxes (even if non-distortionary) affect aggregate demand. Furthermore, changes in public debt have different effects depending on the instrument eventually used by the government to meet its intertemporal budget constraint. For instance, if debt-service savings are rebated to the private sector by lowering distortionary taxes or by increasing transfers at least partially to firms (as assumed in our simulations), then deficit reductions induce a shift from (government) consumption to (private) investment, thus raising output in the long run.

Search costs and strategic labor market behavior also lead to permanent effects of tax changes. Some of these effects are captured in our framework, where higher labor taxes raise the natural rate of unemployment. Higher capital taxes would benefit current consumption at the expense of future consumption, leading to a steady-state with lower capital, consumption, and income. In our framework, capital taxes also depress investment directly, since firms are not fully debt-financed. Finally, although in the long run indirect taxes affect neither labor supply nor the work-search trade-off, slow adjustment of nominal wages and short-run

1/ Interest income is assumed to be taxed according to the residence principle. Foreign assets are therefore taxed at the domestic rate.

2/ See Chapter 4 in Frenkel, Razin and Sadka (1993) for a discussion of equivalence relations in taxation.

valuation effects lead to lower demand and output in response to higher indirect taxes.

We can illustrate the impact of changes in fiscal policy in our framework by simulating a standard change in U.S. taxes and expenditure. We consider permanent unanticipated increases of 2 percent of GDP in labor, capital, and indirect taxes, and a cut in government expenditure of the same size. As in the rest of this paper, we characterize the behavior of the government in the long run by assuming that the fiscal changes last for ten years, after which transfers to the private sector are increased so as to eliminate the surplus (also gradually over ten years). Reflecting the decline in the debt stock achieved during the high-surplus phase, the new steady state of the economy is characterized by a lower debt/GDP and lower primary surplus/GDP ratios. The lower surplus (which corresponds to debt-service savings) is assumed to be rebated to households and firms in proportion to their income shares. The model is obviously flexible in dealing with alternative assumptions on the long-run behavior of the government.

Table 4 summarizes the results of these experiments. All the fiscal instruments discussed above contribute to an impact decline in output (largely reflecting the reduced consumption by liquidity constrained agents), but the magnitude and persistence of their effects differ significantly in each case. In particular, increases in indirect taxes are inflationary and contractionary in the short run, although their effect tapers out quickly, and output increases above its baseline by the end of the decade. Expenditure cuts have similar--yet larger and quicker--effects. In both cases, the medium-to-long run effects reflect the reallocation of resources from consumption to investment, which results from the assumption that part of the (net) revenues are rebated to firms (effectively, as investment subsidies). Increases in capital and labor taxes have similar qualitative effects on output, although their quantitative effects are significantly different. With sluggish unemployment, the negative effects of increases in labor taxes on employment (and income) emerge, in this example, at roughly the same rate of decay of the negative liquidity effects. Thus, output and inflation display a relative flat response over time. Higher capital taxes lead to more complicated dynamics: negative liquidity effects dominate on impact. Subsequently, the decline in the discount rate induced by the higher capital tax rate raises consumers' wealth and consumption, thus providing scope for a small temporary recovery. As the pre-tax interest rate rises over the medium run, so as to equalize the after-tax rate to the effective rate of time preference, then consumption, investment, and income decline. It is apparent, from these scenarios that the effects of a fiscal retrenchment crucially depend on the fiscal instruments used to achieve it: if distortionary means are primarily used in order to reduce the deficit (as in several of the countries in our sample) significant output losses can be incurred at all horizons.

Table 4. Sample of Fiscal Shocks 1/
(U.S. model; deviations from baseline)

	1991	1992	1993	1994	1995	1996	2000	Long run
Wage Tax								
Real GDP	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.6
GDP deflator	0.0	0.1	0.1	0.1	0.1	0.1	-0.0	-0.0
Capital Tax								
Real GDP	-1.6	-1.5	-0.8	-0.6	-0.7	-1.0	-2.2	-4.0
GDP deflator	-1.2	-1.4	-0.9	-0.2	0.3	0.6	1.6	3.6
VAT								
Real GDP	-0.6	-0.7	-0.5	-0.3	-0.1	0.0	0.3	0.7
GDP deflator	0.8	0.2	-0.2	-0.4	-0.5	-0.5	-0.8	-0.9
Expenditures								
Real GDP	-1.5	-0.5	0.0	0.3	0.4	0.5	0.4	0.8
GDP deflator	-1.2	-1.4	-1.3	-1.1	-1.0	-0.9	-0.9	-0.7

1/ The figures measure percentage deviations between the simulated and baseline paths. The baseline is constructed using historical data until 1993 and World Economic Outlook projections thereafter.

IV. Macroeconomic Effects of Fiscal Restructuring in the G-7 Countries

In this section we assess the macroeconomic effects of the fiscal policies examined in Section 2 and summarized in Table 2, by integrating the behavioral equations presented in the previous section into the IMF's macroeconomic model (MULTIMOD).

Several methodological considerations should be noted at the outset. First, our stylized treatment of taxation and the allowance for only four fiscal categories (indirect taxes, labor and capital taxes, and net direct expenditure) require discretion in translating observed changes in statutory taxes into their theoretical counterparts. In our simulations, all changes in VAT, excise taxes, and user fees, were classified as changes in indirect taxes; changes in social security and pension contributions and in all components of the labor tax wedge (whether paid by firms or by workers) were classified as changes in labor taxes; changes in corporate taxes, taxes on bank deposits and real estate, dividend and interest income taxes, and investment taxes (or incentives), were classified as changes in capital taxes; two-thirds of changes in personal income taxes were attributed to labor taxes (reflecting the average share of labor income in industrial countries) and the rest to capital taxes. The resulting estimates of the year-on-year changes in the tax/GDP shares are reported in the first three columns of Table 2. Changes in primary structural fiscal balances were obtained by subtracting interest payments on public debt from estimates of cyclically-adjusted overall balances (obtained from the IMF's World Economic Outlook database) and are shown in the last column. Estimates of structural changes in net expenditure (reported in the fourth column of Table 2) were then obtained residually, by subtracting estimated changes in structural revenues from estimated changes in structural primary balances, and were then treated as exogenous changes in government expenditure on goods and services. ^{1/} After converting the tax revenue data into changes in tax rates, these shocks were introduced sequentially in the model, with each shock treated as history in subsequent years.

Second, it was necessary to distinguish between temporary and permanent and between anticipated and unanticipated policy changes. We chose to view all policies as permanent and unanticipated, absent clear reasons to do otherwise. Specifically, four sets of measures were treated as temporary, and were linked to anticipated offsetting measures of an equal amount: the Japanese stimulus packages of 1992-94; the German income tax surcharge of 1991-92; the U.S. rescheduling of personal income taxes of 1992; and some of Italy's fiscal measures from 1991 to 1993, such as taxes on bank deposits, temporary wage freezes, front-loading of tax revenues, and fiscal amnesty, which were also classified as temporary, reflecting their one-off nature. The Japanese VAT increase of 1997 was treated as known as of 1994.

^{1/} Our simulations do not distinguish between discretionary and autonomous changes in structural revenues and outlays, but only between cyclical and structural changes (the former being endogenous to the model, the latter being exogenous).

Finally, as changes in fiscal policy in the period 1990-97 overlapped with changes in monetary policy and other exogenous shocks (including German unification, the ERM crisis, NAFTA, etc.), our simulations need not be descriptive of the actual behavior of the G-7 economies over the sample. For instance, our simulations assume exogenous monetary aggregates to remain at their baseline values, and no change in labor market and structural policies, except for those incorporated in Table 2. Different assumptions on the response of monetary policy to unanticipated shocks might affect the simulated behavior of output in the short run, but their effects over longer horizons would have been small. 1/

The results of the simulations are presented in Tables 5 and 6 for five indicators: output, investment, consumption, the rate of unemployment, and prices. Table 5 presents the results of a simulation in which all the G-7 countries implement simultaneously the fiscal changes described in Table 2. To gauge the spillover effects of these policy shifts, Table 6 presents the results of a simulation in which all countries *except the home country* undertake the same policy shifts.

The results from Table 5 indicate that the impact of fiscal policies in the G-7 countries from 1990-97 was mixed, largely depending on the direction and type of fiscal instrument used. In general, with the exception of Germany and, to a lesser extent, Italy and Canada, the overall impact of the adjustment is estimated to be modest: deviations of income from its no-adjustment baseline are estimated, in most cases, to be no greater than two percent. The short-run response of output and demand, primarily reflecting liquidity effects, conforms to common wisdom on the impact of fiscal policies: contractionary in response to expenditure cuts and tax increases, and vice versa. The mid-1990s, which is the period with the largest degree of fiscal tightening, generally exhibits the largest output losses. By the late 1990s and in the long run, each country's results tend to reflect the contribution of its particular mix of fiscal instruments to shifting resources from (government) consumption to (private) investment. In general, the fiscal restructuring is estimated to produce the largest gains in the medium-to-long run in those countries that relied more heavily on expenditure cuts and indirect tax increases in their fiscal restructuring (e.g., France, Japan, the United Kingdom, and Canada). Countries that either increased expenditures or relied on capital and labor taxes (Italy, Germany, and the United States) are projected to exhibit output losses

1/ Also to be noted is the assumption on target debt/GDP ratios which-- as previously discussed--is allowed to converge to a new lower level beginning in the year 2000. This effectively allows all savings to be rebated to labor and capital in proportion to their income shares (effectively as consumption and investment incentives). Different assumptions on the allocation of debt-service savings in the steady state produced only small differences with respect to those reported in the subsequent tables over the medium run, although there were some differences for steady-state solutions. Details of alternative scenarios are available from the authors.

Table 5. Fiscal Restructuring in the G-7 Countries: Simulation Results 1/
(deviations from baseline)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Long-run
United States											
Real GDP	0.2	0.5	0.3	-0.9	-0.8	-0.5	-0.4	-0.3	-0.4	-0.4	-0.6
Investment	-0.6	-1.2	-1.5	-1.3	-0.8	-0.5	-0.5	-0.9	-1.3	-1.6	-1.8
Consumption	-0.1	-0.1	-0.6	-1.5	-1.1	-0.6	-0.2	0.1	0.3	0.3	-0.1
Unemployment	-0.2	-0.5	-0.5	0.4	0.7	0.7	0.5	0.5	0.4	0.4	0.3
GDP deflator	0.4	0.7	0.8	0.1	-0.3	-0.3	-0.2	-0.1	0.1	0.1	-0.4
Japan											
Real GDP	0.1	0.5	1.0	1.0	-1.0	-0.6	-0.5	0.1	0.5	0.7	0.7
Investment	-0.2	-1.4	-3.4	-3.0	-0.9	0.1	1.1	2.3	2.9	2.9	2.7
Consumption	-0.0	0.2	0.2	0.2	-0.8	-0.6	-1.1	-0.8	-0.4	-0.1	0.2
Unemployment	-0.0	-0.1	-0.2	-0.4	-0.2	-0.2	-0.1	-0.1	-0.2	-0.3	-0.3
GDP deflator	0.2	1.3	2.7	1.9	0.5	0.9	0.5	-0.2	-0.6	-0.6	-0.4
Germany											
Real GDP	1.0	-0.5	-1.2	-3.3	-2.9	-2.3	-1.8	-1.3	-1.0	-0.9	-1.0
Investment	-1.6	-3.7	-5.4	-5.4	-4.5	-3.5	-2.7	-2.2	-1.9	-1.8	-1.4
Consumption	-0.1	-1.1	-2.3	-4.9	-5.3	-5.5	-5.5	-5.5	-5.4	-5.4	-4.4
Unemployment	-0.4	-0.1	0.3	1.4	2.1	2.4	2.3	2.1	1.9	1.6	1.4
GDP deflator	1.4	1.8	2.2	1.6	1.2	0.9	0.6	0.4	0.2	0.1	0.4
France											
Real GDP	0.2	0.3	0.0	-1.4	-0.6	0.0	0.3	0.5	0.4	0.3	0.5
Investment	-0.8	-1.0	-0.6	1.3	3.0	3.5	3.3	2.7	2.0	1.4	2.2
Consumption	-0.1	0.1	-0.2	-1.0	-0.4	0.3	0.8	1.2	1.4	1.4	1.4
Unemployment	-0.1	-0.2	-0.1	0.5	0.6	0.5	0.3	0.1	0.0	0.0	0.1
GDP deflator	0.2	0.5	0.6	-0.7	-1.2	-1.3	-1.1	-0.9	-0.7	-0.5	-0.4
United Kingdom											
Real GDP	0.5	0.4	0.6	-1.7	-1.8	-1.6	-1.2	-0.7	-0.1	0.5	1.6
Investment	-0.4	-0.5	-0.8	-1.1	-0.3	1.4	3.3	5.1	6.7	8.0	9.3
Consumption	0.2	-0.6	-1.5	-4.6	-5.8	-6.7	-7.2	-7.5	-7.6	-7.5	-5.5
Unemployment	-0.2	-0.5	-0.6	0.1	0.7	1.1	1.3	1.2	1.0	0.6	0.1
GDP deflator	0.8	1.5	1.7	1.6	1.2	0.6	-0.2	-1.0	-1.8	-2.5	-3.0
Italy											
Real GDP	-0.1	-1.0	-1.6	-2.5	-1.7	-1.1	-0.7	-0.6	-0.7	-0.9	-1.6
Investment	-0.8	-2.1	-4.5	-3.9	-1.6	-1.0	-1.2	-2.0	-3.4	-4.5	-3.5
Consumption	-0.7	-2.0	-2.8	-2.9	-2.1	-1.2	-0.2	0.6	1.0	1.2	0.4
Unemployment	0.0	0.4	0.9	1.7	1.9	1.8	1.6	1.4	1.2	1.2	1.3
GDP deflator	0.4	0.0	0.1	-1.2	-1.9	-2.2	-2.1	-1.7	-1.2	-0.7	-1.0
Canada											
Real GDP	0.0	-0.3	-0.6	-1.4	-0.9	-0.5	-0.2	-0.0	0.0	0.0	0.5
Investment	-0.9	-2.7	-3.3	-1.0	1.2	1.9	2.2	2.1	1.9	1.8	4.5
Consumption	-0.4	-1.1	-1.9	-2.6	-2.5	-2.3	-1.9	-1.7	-1.5	-1.5	-0.9
Unemployment	-0.2	-0.1	0.2	1.0	1.2	0.9	0.7	0.4	0.3	0.3	0.3
GDP deflator	0.8	1.2	1.3	0.1	-0.3	-0.5	-0.6	-0.6	-0.5	-0.5	-0.9

1/ The figures measure percentage deviations between the simulated and baseline paths. The baseline is constructed using historical data until 1993 and World Economic Outlook projections thereafter.

Table 6. Spillover Effects of Fiscal Restructuring in the G-7 Countries ^{1/}
(deviations from baseline)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Long-Run
United States											
Real GDP	0.2	0.0	0.1	-0.1	0.0	0.2	0.2	0.2	0.1	0.1	-0.1
Investment	-0.4	-0.4	-0.1	0.6	1.1	1.2	1.1	0.8	0.5	0.3	-0.0
Consumption	0.0	-0.2	-0.2	-0.2	0.2	0.6	0.9	1.1	1.2	1.2	0.7
Unemployment	-0.1	-0.1	-0.1	-0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.0	0.0
GDP deflator	0.2	0.2	0.0	-0.3	-0.5	-0.5	-0.4	-0.3	-0.2	-0.1	0.1
Japan											
Real GDP	0.1	0.0	-0.0	-0.3	-0.1	-0.0	0.1	0.1	0.2	0.1	0.1
Investment	-0.2	-0.4	-0.5	0.2	0.7	0.7	0.6	0.5	0.4	0.2	0.2
Consumption	-0.0	-0.1	-0.2	-0.3	-0.1	0.1	0.3	0.4	0.4	0.4	0.3
Unemployment	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	-0.0
GDP deflator	0.2	0.2	0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	0.0
Germany											
Real GDP	-0.0	0.2	0.2	-0.4	-0.1	0.1	0.1	0.1	0.0	-0.1	-0.0
Investment	0.1	-0.2	-0.8	0.3	1.4	1.5	1.2	0.8	0.4	0.1	0.3
Consumption	-0.0	0.0	-0.1	-0.3	0.2	0.6	1.0	1.2	1.3	1.2	0.8
Unemployment	0.0	-0.1	-0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0
GDP deflator	-0.0	0.1	0.2	-0.3	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.1
France											
Real GDP	0.3	0.0	0.1	-0.1	0.2	0.3	0.3	0.3	0.1	0.0	0.2
Investment	-0.5	-0.3	0.6	1.4	1.8	1.7	1.1	0.6	0.1	0.0	0.4
Consumption	-0.1	-0.3	-0.4	-0.3	0.1	0.5	0.8	0.9	0.8	0.7	0.5
Unemployment	-0.1	-0.1	-0.1	-0.0	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.0
GDP deflator	0.1	-0.1	-0.3	-0.7	-0.7	-0.6	-0.3	-0.1	-0.0	-0.0	-0.0
United Kingdom											
Real GDP	0.2	-0.3	-0.4	-0.3	0.1	0.4	0.6	0.6	0.4	0.1	0.3
Investment	-1.0	-1.8	-1.9	0.6	2.6	2.8	2.3	1.5	0.6	-0.1	0.9
Consumption	0.0	-0.7	-1.3	-1.3	-0.7	-0.0	0.5	0.9	1.1	1.0	1.0
Unemployment	-0.1	-0.0	0.1	0.2	0.1	-0.0	-0.2	-0.3	-0.3	-0.2	-0.0
GDP deflator	0.5	0.3	0.1	-0.4	-0.6	-0.6	-0.4	-0.1	0.1	0.3	-0.1
Italy											
Real GDP	0.4	0.0	-0.2	-0.8	-0.2	0.1	0.3	0.3	0.2	0.1	-0.1
Investment	-0.8	-1.8	-2.0	0.3	2.3	2.6	2.1	1.3	0.4	-0.4	-0.2
Consumption	-0.0	-0.5	-0.7	-0.8	-0.2	0.5	1.1	1.7	2.0	2.0	1.2
Unemployment	-0.2	-0.2	-0.1	0.2	0.3	0.2	0.1	-0.0	-0.0	-0.0	0.0
GDP deflator	0.5	0.5	0.4	-0.6	-1.0	-1.0	-0.9	-0.5	-0.1	0.3	0.4
Canada											
Real GDP	0.3	0.3	0.1	-0.6	-0.3	-0.0	0.0	0.1	-0.0	-0.1	0.1
Investment	-0.5	-1.5	-1.7	-0.1	1.2	1.3	1.0	0.5	-0.0	-0.4	0.8
Consumption	0.0	-0.2	-0.6	-1.0	-0.7	-0.3	-0.0	0.2	0.2	0.0	-0.2
Unemployment	-0.3	-0.4	-0.4	0.2	0.4	0.3	0.2	0.1	0.1	0.1	0.0
GDP deflator	0.4	0.6	0.7	-0.1	-0.2	-0.2	0.0	0.2	0.4	0.6	0.3

^{1/} The figures measure percentage deviations between the simulated and baseline paths. The baseline is constructed using historical data until 1993 and World Economic Outlook projections thereafter.

through the end of the decade and in the long run. In synthesis, our simulations suggest that despite the large overall adjustment in several of the G-7 countries, the growth potential of the adjustment was often offset by reliance on distortionary taxation in order to reduce the deficits. A larger shift of resources from consumption to investment (and therefore, greater output gains) would have been achieved if the same overall adjustment had been implemented with greater reliance on expenditure cuts and indirect taxes.

In comparing individual countries, the large output and employment costs associated with the policies implemented in Germany since 1990 are apparent, especially those linked to the large adjustment over the 1994-96 period. These costs reflect not only the size of the German adjustment since unification in 1990, but also the particular mix of policies implemented in this country, with its heavy reliance on labor taxes. Private consumption in Germany is estimated to remain below its no-adjustment baseline throughout the rest of the decade; investment would begin to recover around 1996, but would remain below its baseline throughout the sample. The policies of the early 1990s (mainly the large increase in indirect taxes) are also estimated to lead to some increase in inflation, which, however, is projected to fall around 1994.

The policies undertaken in France are estimated to produce more favorable effects. Besides engaging in an adjustment of significantly smaller magnitude than Germany, France is expected to rely to a greater extent on expenditure cuts as an ingredient of its restructuring, while simultaneously reducing indirect and capital taxes. The changes in French fiscal policies are estimated to lead to a mild contraction of demand and income between 1994 and 1995. The recovery, however, is projected to be rather rapid, and output would return above its baseline earlier than in all of France's G-7 partners.

In the United Kingdom, after the expansion induced by the large cuts in capital taxes in 1991 and 1992, the impact of expenditure cuts and the inflationary effects of higher indirect taxes underlie the subsequent decline in demand, income, and employment. Greater reliance on low-distortion instruments, however, is projected to pay off in the second-half of the 1990s, when the United Kingdom is expected to enjoy lower inflation, higher output growth, and lower unemployment (with respect to baseline), than all of its G-7 partners.

The temporary nature of many of the measures implemented in Italy in the early 1990s tends to dampen the effects of its policies relative to the size of the adjustment. Large increases in income taxes contribute to keep output below its no-adjustment baseline throughout the sample, although (as it will be discussed later) a sizable portion of the mid-1990s' contraction can be attributed to slow demand from Italy's partners. Consumption is expected to recover somewhat in the second half of the 1990s, but investment and unemployment would remain depressed.

The policy changes implemented outside Europe are generally smaller, and so are their effects. In both the United States and Japan, the output effects of the fiscal changes are estimated to remain in the order of one percent (as a deviation from the baseline). The small short-run effects of the Japanese fiscal stimulus packages reflect mainly the temporary nature of these policy changes during the 1992-94 period. The expiration of the stimulus packages in 1995 and the VAT increase of 1997 are projected to lead to a small contraction in the mid-1990s, but the planned shift from income taxes to nondistortionary taxes is projected to lead to some output gains by the end of the decade. In the United States, the small effects of the deficit-reduction package reflect the mixture of across-the-board (growth-reducing) tax increases and (growth-promoting) expenditure cuts. The strongest effects are anticipated at the peak of the deficit reduction initiative (in 1994-95), but output would remain somewhat depressed thereafter with respect to baseline. Finally, the Canadian case is noteworthy for the significant changes in prices and real activity associated with a relatively small adjustment package. After a contraction recorded through 1997, the relatively low distortionary impact of the Canadian package is estimated to lead to a recovery of output and employment before the end of the decade. In fact, as discussed below, both the contraction of the early 1990s, and the recovery of the late 1990s, would have been larger, absent the positive spillovers in 1990-91 and the negative spillovers at the end of the decade from fiscal initiatives in the other G-7 countries, particularly in the United States.

Table 6 provides information on the importance of international spillover effects. These effects are determined by allowing all countries except the home country to engage in the policies presented in Table 2. ^{1/} Not surprisingly, the United States, Japan, and Germany are estimated to experience smaller spillover effects from policies undertaken by their partners. The short-run spillover effects from partner countries' policies on Canada (primarily emanating from the United States), and on Italy (primarily from Germany) are estimated to be significant, reflecting the high openness of these two economies. For instance, about one-third of the shortfall of Italian and Canadian output with respect to their no-adjustment baseline in 1994 can be attributed to international spillovers. More generally, Table 6 highlights the mutually-reinforcing impact of the fiscal policies undertaken in the first-half of the 1990s in each of the G-7 countries. Closer examination of the channels through which the spillover effects are realized reveals a broad decline of imports (with respect to baseline) as the main channel of transmission. Reflecting the overall modest (and mixed, in sign) impact of the adjustment around the end of the decade, spillover effects are negligible around the year 2000 and in the long run.

^{1/} Accordingly, the difference between Table 5 and Table 6 provides an estimate of the effects of the domestic adjustment alone.

V. Concluding Remarks

Structural changes in fiscal policies have been on the forefront of the policy debate in the G-7 countries since the beginning of the 1990s. Despite the interest exhibited in institutional and academic circles in these policy changes, a unified analysis of their macroeconomic effects has, to date, not yet been conducted. In this paper we have tried to partially fill this void and analyzed recent and prospective changes in fiscal policies in the largest industrial countries, based on a detailed description of the specific policies implemented (and projected) in the G-7 countries, and of these countries' macroeconomic structure and cross-country linkages.

The study yields insights in several directions. First, the simulations confirm that over horizons that are of interest for policy considerations, the qualitative effects of fiscal policies predicted by standard textbook neoclassical models with flexible prices and factor adjustment may differ significantly from those displayed in actual economies. With a realistic degree of stickiness in prices and wages, for instance, higher indirect taxes may lead to significant output costs even though such taxes may be neutral in the long run. In addition, the short-run effects of factor taxes may significantly underestimate their long-run effects in an economy with a realistic degree of sluggishness in factor employment. The diversity of the effects of individual fiscal instruments suggests that the specific channels through which deficit reductions are achieved may be more important than the overall size of the reduction.

The simulations point at a broadly contractionary impact of the policies implemented over the first half of the 1990s (with respect to a no-adjustment baseline), although some of the countries that we investigate would reap benefits from their adjustment by the end of the decade. The simulations also suggest that greater reliance on indirect taxes and expenditure cuts and less reliance on factor income taxes might have made the short-term costs of debt-reduction more severe, but would have led to quicker recovery and greater benefits from resource reallocation in the long run.

Finally, although our framework does account for several features often ignored in macroeconomic models for policy simulation, and is calibrated to reflect important features of the G-7 economies, many of its behavioral relationships are formulated in aggregate terms and reflect shortcuts taken to capture the effects of taxes on key behavioral relationships. Clearly, while the rational expectations nature of our framework makes it less vulnerable to standard Lucas-type criticism of macroeconomic models, few of our behavioral relationships can be presumed to be fully robust to large policy shifts. It would be desirable, for instance, to include a more structural and forward-looking approach to the labor market than that considered here, including a better characterization of the impact of taxes on the natural rate of unemployment, and of the impact of specific expenditures (such as unemployment compensation) whose effect is analogous to that of distortionary taxes. The distinction between taxation of

internationally mobile and immobile factors, and explicit treatment of tariffs (which are ignored in the present study) can also have important implications for the analysis.

Outline of MULTIMOD

This section provides a brief description of the prototypical industrial country model in MULTIMOD. A complete description of the model, including its theoretical underpinnings and estimation details, can be found in Masson, Symansky, and Meredith (1990). 1/

MULTIMOD can be described as a dynamic multi-country Mundell-Fleming model with rational expectations, designed to analyze the effects of economic policies and other exogenous changes on the economies of the industrial and developing countries (the latter treated as a group). MULTIMOD treats explicitly cross-country linkages, mainly through changes in traded goods' prices and volumes, exchange rates, and interest rates (all of which are endogenous in the model). Scope for policy arises in the model mainly from the allowance for sluggish price adjustment, liquidity constraints, and various market imperfections and distortions (such as credit constraints for low-income countries and distortionary taxes). The version of the model used in our study links econometric models for each of the G-7 countries to an aggregate model for the other industrial countries and to an aggregate model of the developing countries, estimated from annual data from 1965-91, largely with pooled time series/cross-sectional techniques (the labor market model is estimated by Three Stage Least Squares individually in each country). Effective tax rates based on OECD national account data were obtained following the methodology described in Mendoza, Razin, and Tesar (1993).

The model does not provide unconditional forecasts, but rather analyzes the effects of exogenous and policy changes around a baseline forecast. The baseline forecast is based on country-specific information provided by country economists at the IMF on a six-month frequency as part of the World Economic Outlook project. The baseline used in this paper is based on historical data through 1993 and projected data through 1997. After 1997, each country is assumed to move slowly toward a steady state, which is reached by the year 2010 and is defined by conditions that include the equality of each country's real growth rate and interest rate, and zero primary fiscal and trade balances.

Private consumption and investment are derived in the model from intertemporal utility and profit maximization. The relevant definitions of households' and firms' wealth are provided in the text. Sluggish adjustment of consumption and investment are introduced by allowing for liquidity effects in consumption and for adjustment costs in investment. Exports and imports of manufacturing depend on relative prices and economic activity at home and abroad, as in a model of imperfectly substitutable goods. Export prices follow the price of domestic output in the long run, but respond to price movements in export markets in the short run. Import prices are defined as weighted averages of partner countries' export prices.

1/ Details of the model, including a description of the variables, estimation, and of the model code, are available upon request.

Industrial countries' production and export of oil is exogenous, with net exports from developing countries treated as residuals to clear the world market. Non-oil primary commodities (treated as a homogeneous composite good) are produced by the developing countries at market-clearing prices. Demand for primary commodities is sluggish in the short run, but fully responds to relative prices in the long run.

Government spending and tax rates are treated as exogenous. Short-run deficits are financed through endogenous changes in public debt, and the government's intertemporal budget constraint is enforced by adjusting transfers to the private sector. The target supply of base money is exogenous in free-floating exchange rate countries, but is endogenous in countries that target their exchange rate (so as to maintain a constant open interest premium). Financial assets of the industrial countries are assumed to be perfect substitutes, with long-term interest rates specified as a moving average of current and expected future short-term rates.

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