IMF Working Paper

WP/97/142

INTERNATIONAL MONETARY FUND

Research Department

Stylized Facts of Government Finance in the G-7

Prepared by Riccardo Fiorito[1]

Authorized for distribution by Donald Mathieson

October 1997

Abstract

The stylized facts of government finance in the Group of Seven (G-7) industrial countries show that revenues lag real GDP procyclically, while government spending in most cases fails to lead the economy procyclically. This finding is not confined to transfers but also applies to the wage component of government consumption as well as, in most cases, to government fixed investment. Government deficits are always countercyclical but there is little evidence that stabilization is equally successful in stimulating the economy before shocks materialize.

JEL Classification Numbers: E3, E6, H3, H6

Keywords: Stylized Facts, Business Cycle, Government Finance

Author's E-Mail Address: rfiorito@iol.it

---

[1]University of Siena and Ministero del Tesoro, Rome, Italy. This work was prepared while visiting the IMF Research Department whose hospitality I gratefully acknowledge. Cathy Wright was quite helpful in dealing with the OECD data and Manzoor Gill provided prompt research assistance. Opinions are strictly personal and do not involve any institution or person connected with this project.

CONTENTS

SUMMARY

This paper evaluates the cyclical features of government finance in the Group of Seven (G-7) industrial countries by applying the Kydland-Prescott (1990) methodology. Rather than adopting traditional indicators of fiscal stance, we separate discretionary fiscal policies from cyclical influences by using the phase and the sign of the comovements with real GDP. The greatest commonly available disaggregation is used to evaluate from quarterly OECD data (1970-95) whether expenditure or tax composition matters for macroeconomic performance.

Despite large national differences we find also common patterns that could be labeled as preliminary stylized facts of government finance: on the receipt side, transfers or revenues from the business sector are much more volatile than corresponding transfers or revenues from households. Receipts are procyclical and generally lag the economy. Household income taxes are procyclically lagging while business income taxes are more heterogeneous.

Taxation being more uniform, national patterns emerge mostly from the spending side: government outlays (and transfers, in particular) behave as lagging countercyclical stabilizers. Government spending leads the economy procyclically only for nonwage consumption (in Japan, Germany, France, and Italy) and--in Japan--for fixed investment also. Government deficits adjust quickly to the business cycle and are strongly countercyclical but there is little evidence that stabilization is equally successful in activating the economy before shocks materialize. Hence, the strong association between government balances and real GDP is only partially an economy policy success because stabilizing the economy via a countercyclical deficit can also indicate either an excessive sensitivity of government spending to the business cycle or the fact that government spending is mostly passive.

I. INTRODUCTION

Since the 1970s government expenditure and tax to GDP ratios have steadily risen in the G-7 instead of fluctuating around some constant value as implied either by fine tuning or tax smoothing. Expenditure components shifted in most cases from purchases to transfers and interest payments as a result of the extension of the welfare state in the 1970s and of the debt financing of budgetary deficits afterwards. Comparative data for unemployment are not better in those countries or areas where government size increased most (Table 2).

The corrections introduced in the last decade to manage government debt or to satisfy in Europe the common currency requirements reflected an attitude of fiscal and monetary discipline but generally ignored the composition of the government balance and its impact on the business cycle and growth. This paper abstains from growth considerations (Barro-Sala-I-Martin, 1992; Easterly-Rebelo, 1993) and focuses on the business cycle only by raising, in particular, two questions:

- how do fiscal variables respond to business cycles?

- how do discretionary fiscal variables affect business cycles?

Given the possibility that fiscal policies and budgetary institutions differ from country to country (von Hagen-Harden, 1994), only a comparative analysis can separate facts that are common to all countries from facts mainly reflecting local environments or shocks. Here, I shall try to analyze in a systematic and uniform way the cyclical properties of public finance data in the G-7. To do so I shall use quarterly and detrended OECD General Government data that are consistent with NIPA definitions. Further, I shall utilize data that are disaggregated as much as possible to evaluate whether differences in expenditure or tax composition matter for macroeconomic performance (Alesina-Perotti, 1995,1996).

Fiscal policies can admittedly affect or reflect business cycles. A possible way of addressing this issue is trying to separate discretionary from cyclically induced fiscal policies by choosing among existing measures of fiscal stance or by devising new ones (Blanchard, 1993). Alesina and Perotti (1995) suggest using cyclically adjusted primary balances to pick similar *episodes* from all countries rather than evaluating the *whole* fiscal history in each country. Yet, episodes are difficult to select and - unless they denote *regimes* lasting for long time - are by definition too few to provide a sufficient number of data points. Hence, in a regression context this inevitably leads to using unbalanced panel data samples and highly subjective criteria for inclusion.

The episode literature (Alesina-Perotti, 1995,1996; IMF, 1995; OECD, 1996d; McDermott-Wescott, 1996) led to important insights on the changing role of fiscal policy depending on the *size* of the debt or the persistence of the stabilization program (Giavazzi-Pagano, 1990, 1996). Yet, I believe that a systematic knowledge of *normal* government finance at business

cycle frequencies is a necessary preliminary unless one is looking for exceptions before recognizing what the standards are. The assumption is that the stylized facts methodology (Kydland and Prescott, 1990) can provide the benchmark information that is still missing for a systematic analysis of fiscal policies at cyclical frequencies.

In the stylized facts approach cyclical components are defined as deviations from a stochastic trend corresponding to the steady-state growth component. Contrary to Koopmans' criticism of the NBER approach, Kydland and Prescott assume that business cycle facts can be established without specifying a structural model. Theory is important in selecting the facts and in producing models that are consistent with them. Empirically, the stylized fact approach combines Lucas' (1977) theoretical definition of the business cycle with the Hodrick-Prescott (1980) filter that is used for extracting an unobserved growth component: hence, the amplitude and comovements of cycles are investigated by comparing volatility measures and the size of cross correlations between relevant macroeconomic variables and aggregate output at different leads and lags.[2]

The stylized facts approach can help in discriminating between automatic and discretionary fiscal policies: by analyzing the past, present and future comovements between any fiscal variable and real GDP, it is possible to assess which variables *follow* (built-in stabilizers) and which variables lead real GDP as discretionary interventions should.

An oversimplified scheme to interpret government behavior over the business cycle is represented in the following Table 1 where rows define procyclical (+) or countercyclical (-) comovements while columns define the leading or lagging phase with respect to real GDP.

A second advantage of the stylized facts methodology is that it can make operational the theoretical distinction between temporary and non-temporary effects of fiscal policy (Barro, 1981, 1989) without using the classical war/peace distinction that cannot be utilized for the postwar data of most G-7 countries.

The data sources utilized here are seasonally adjusted quarterly OECD data for the G-7 countries from 1970 to 1995. The chosen variables pertain to General Government level that consists of central and local government units together with social security funds (United Nations et al., 1993). The relevant variables are disaggregated receipts and disbursements such as direct taxes (business and household), indirect taxes, social security revenues on one side and government consumption (wage, nonwage), subsidies, transfers, interest spending and gross fixed investment on the other. All variables are cyclical deviations from a growth component obtained by applying the HP filter to quarterly General Government variables expressed in real terms. Details are available in the Data Appendix.

---

[2]This is shown in the stylized facts literature that includes, among the others, Backus-Kehoe (1992), Danthine-Donaldson (1993), Fiorito-Kollintzas (1994).

The plan of this paper is the following: in Section 2 I shall briefly describe major revenue and expenditure trends calculated as ratios to GDP. In Section 3 I shall explain the stylized fact methodology used in this paper. In Section 4 I shall report the univariate properties of each variable to assess differences in persistence and volatility. Comovements between government variables and real GDP are investigated in Section 5. Section 6 considers comovements between real GDP cycles and major General Government receipts as shares of GDP. These comovements approximate correlations between *tax rates* and the level of activity. In Section 7 I evaluate whether some revenues are mostly related to some specific outlay and whether some expenditures are a substitute or a complement for others. Section 8 concludes.

II. Recent Trends

Analyzing the business cycle stylized facts by construction leaves out of consideration the pertinent growth component. In our case this could imply a presumption that the *size* of government in each country is unimportant for evaluating the impact of fiscal policies. To avoid this interpretation and also to show how rapidly government size increased in the G-7, I shall briefly review the recent trends in public expenditure and taxation. For convenience, I shall divide the full sample into the following subperiods:

1970-75: labor and oil shocks
1976-80: responses to the oil shocks
1981-85: high interest rates
1986-90: high debt
1991-95: fiscal consolidation.

It is obvious that different labels can be used. What is important is to note that the same subperiod often includes both phases of recession and expansion so that average data are relatively independent of business cycles.

In the early 1970s the *size* of government, measured as the sum of total receipts and government outlays, ranged from about 40% (Japan) to about 80% of nominal GDP (Germany, France, UK). The oil shock was increasing government size (Roubini-Sachs, 1989) partly because of the cyclical government spending and partly because Keynesian stabilization policies were often adopted to face the largest supply shock occurring to the OECD economies.

In the 1991-95 period the government size reaches around 100% of nominal GPD in France, Italy and Germany and around 90% in Canada. The most spectacular increases occurred in Italy (36% points) and in France (23% points) though government size rose also outside of Europe: by about 20% points in Canada and in Japan so that Japan eventually reached the same government size as the US. The US and especially the UK are the only countries showing a small or a negligible government size increase.

Looking at the expenditure side, we recognize from Table 2 the same tendencies, i.e. that expenditure is increasing most in Italy and France, then in Canada and Japan. Again, this trend is smaller for Germany and negligible for the US and the UK. The revenue ratios soared following about the same ranking: Italy is the extreme case, then followed by Japan, France and Canada. The increases are smaller elsewhere and are generally concentrated in the last period. This is especially true for Germany which faced an abrupt unification shock after a decade of sound fiscal policy.

Changes in the *composition* of expenditures show (Table 5) that government consumption falls everywhere but in the UK. Yet G-7 countries differ in the relative weights given to wage (W) and nonwage (NW) government consumption (Table 3). Wage components are about 3/4 of total consumption for Japan, France and Italy though this figure tends to decline in Japan. In the US and in Canada the wage component is about 2/3 of total consumption while Germany and the UK are characterized by a larger portion of purchases which is stable for Germany and somewhat increasing for the UK.

The shrinking government consumption reflects a reduction of both the wage and nonwage component ratios to total expenditure (Table 5). Government employment shares of total employment (Table 3) are nearly constant in North America and in Japan while rising in continental Europe. Japan has the smallest employment share but also the highest wage component in government consumption. In Italy and France both employment and wage shares are high while in Germany both employment and non wage components are rising.

In general, purchases from the private sector were slightly reduced or maintained except for the UK where the nonwage component eventually equals the wage component. As a result, government consumption that is the General Government variable mostly related to the theoretical definition of public goods (Musgrave, 1959) is no longer the largest portion of public expenditure (Alesina and Perotti, 1995). Indeed, increases in *social security* and *interest payments* are the major changes in expenditure trends.

Actually, while in the 1970-75 period government consumption was the major expenditure everywhere but in France, at the end of the sample social security ranks first in four countries (Japan, France, UK and Italy) and second in the others.

The social security share increases in Canada, in the US and in the UK and more strikingly in Japan were ageing problems are impending. What is surprising is that the share of social security expenditure has not increased (Italy) or has only slightly increased (France) in those European countries where pensions are a major expenditure source, being mostly financed by compulsory social security rather than by private insurance schemes.

From the 1980s, interest payments rise everywhere because of governments' reluctance to accommodate inflation. With the only exception of the UK, this evidence appears also in Table 4 from the widening difference between total and primary ratios. Outside of Britain, the debt service increase is huge, especially in Italy and in Canada where eventually absorbs about 1/5 of the overall expenditure. Figures are smaller in Japan (1/10) but are still impressive.

Noting that the interest share on GDP is the product of the nominal interest cost and the Debt/GDP ratio, it is not surprising that we find in Table 5 a general tendency towards reducing the investment share. This tendency has been explicitly related by Tanzi and Lutz (1993) to the parallel increase in interest expenditure. While, in general, investment and interest rates should be negatively related, it is also plausible that investment shares fell because most governments were caught in the middle of two binding constraints: a stabilization target usually expressed for the budget deficit only and a political constraint against cuts in income-related expenditures. Hence, it is not surprising that investment expenditure could have been postponed in budgetary programs and then fatally reduced.

The main data on revenue composition (Table 4) show that the share of indirect taxes shrinks for all countries as one would expect from the historical pattern of fiscal systems (Stiglitz, 1988): indeed, taxes on commodities or custom duties are easier to collect and tend to fall when national economies become more integrated and the administrations are efficient enough to target less visible tax bases. Yet, in the G-7 the fall in indirect taxes is not compensated by a rise in income taxes, with the exception of Italy where the relevant ratios increased by 10% points with respect to GDP and by 14% points with respect to total receipts. Direct taxes are the major source of revenues in Canada, the US and Japan while in Europe social security revenues are larger in Germany and in France. Moreover, in Germany and especially in France income taxes are not a large GDP share so that consumption taxes are still an important receipt. What is noteworthy in Table 5 is that direct taxes and social security receipts move in *opposite* directions. This patterns holds for Italy too though with a reversed sign, Italy being the only G-7 country where social security' revenue decreases and income tax increases as a ratio to GDP.

Looking at the composition of income taxes, a major regularity is that households' burden ranges from 2/3 to 3/4 of total receipts, depending on the country and period: Japan is the country with the highest business income share, though following the general tendency towards reducing capital taxation.[3]

Social security contributions rise everywhere but in Italy. These revenues differ not only in the burden placed on the employers, employees and self-employed (OECD, 1996a) but also as a source for financing transfers: in continental Europe social security benefits (pensions and health care) mostly derive from flat-rate labor income taxation while in North America and especially in Canada financing from income taxes is considerably larger.[4]

As a result of the pattern of receipts and disbursements, general government balances deteriorate in the 1970s for most countries whereas in the early 1980s fiscal experiences seem to differ from country to country (Razin-Sadka, 1987): in some cases deficits are mainly the

---

[3]Actually, the shift from business to household taxation started in the UK and - since the early 1980s - spilled over from the US to Canada and Germany.

[4]Table 4 shows that social security revenues are much smaller in Canada than elsewhere as a ratio to both GDP and total receipts.

product of the debt financing of budget deficits. In other cases deficits reflect more or less temporary imbalances. Actually, when we look at primary balances only Italy, France and the US display deficits in the 1980s though differences in size and persistence are too large to be ignored.

III. METHODOLOGY

Business cycles cannot be observed before some detrending is adopted. The stylized facts literature is based on the Hodrick-Prescott filter (1980) that can be assimilated to a high- pass band filter eliminating frequencies lower than 8 years (King-Rebelo, 1993). In this section I shall not discuss the technical characteristics of the filter for which there is a literature partly addressing the properties of the HP filter and partly addressing the way in which the simulation of model economies can be affected (Singleton, 1988; Cogley, 1990; King-Rebelo, 1993; Canova, 1993; Harvey-Jaeger, 1993).

As Kydland and Prescott (1990) point out, the HP filter captures a growth component that is allowed to change slowly over time because this is the way in which business cycle scholars look at business cycle fluctuations. Actually, the *classical* business cycle approach (NBER) was directed to establishing a chronology for expansions and contractions without accounting for the underlying growth component. Conversely, modern business cycle analysis rests on *growth* cycles based on deviations from some trend, i.e. on statistically tractable covariance stationary data. There is no guarantee that the turning points found after detrending coincide with or are close to those established by the NBER chronology' which is the benchmark generally accepted by the public.

Among the main detrending procedures it is well known that unit root differencing produces cycles displaying little serial correlation (Nelson-Plosser, 1982), i.e. cycles that do not last long enough according to standard business cycle definitions. Conversely, deterministic trends produce business cycles lasting too long and turning points too different from those recognized by business cycle analysts (Canova, 1993). What makes the HP filter attractive is that business cycle have about the same length and the same chronology as in the NBER approach though allowing for a statistical treatment of cyclical components that are stationary, replicable and easy to calculate. Further, the HP filter is less judgemental than other UC methods and requires the same transformation for all variables. Finally, all the stylized facts literature is based on the HP filter and no preferable alternative has been presented.

Following the stylized facts stream I will report here measures of volatility, persistence and comovements by using the following characterization: let $Y(t)$ and $X_i(t+s)$ denote the cyclical components of the real GDP and of any other variable at time $t+s$, respectively. The strength of comovement is measured by the sample correlation coefficient $\varrho(t+s)$ where $s\in[-5,5]$ is an integer. When the peak correlation value occurs at the lag $s=0$ the comovement is considered synchronous; when this happens at the lag $s<0$ the comovement between X_i and Y will be considered leading for X_i while the comovement will be considered lagging for X_i when the peak value occurs at $s>0$.

Two further problems must be considered: the first deals with evaluating whether the reported coefficients are statistically different from zero and with adopting a criterion for defining strong or weak types of comovements. In our sample size, the cutoff point to decide whether two series are correlated at some lead/lag is $\rho^* = 0.19$ which is the required value to reject at the 5% level of significance the null hypothesis that the population correlation coefficient is zero. As in Fiorito and Kollintzas (1994) we denote here as 'weak' a sample correlation coefficient such that $\rho^* \leq |\rho(s)| \leq 0.5$ and as 'strong' a correlation coefficient such that $0.5 < |\rho(s)| < 1$.

The second point - not considered in previous stylized facts literature - is that the absolute values of two or more sample correlations can sometimes be too close to be statistically different. Thus, it might be difficult to characterize both the phase and the sign of related comovements. To do so I will use two criteria: the first one is based as in Kydland and Prescott (1990) on the choice of the highest sample correlation. I shall refer to this criterion as the "peak" criterion. The second criterion is based on the phase dominance that can be assessed by comparing the Ljung-Box statistics associated with all lags with the corresponding statistics for leads. Hence, the comovement between a pair of series will be defined as phase-leading if $LB^- > LB^+$ and as phase-lagging if $LB^+ > LB^-$ where:

$$LB^+ = n(n+2)\sum_{j=1}^{5} \rho_j^2/(n-j), \qquad LB^- = n(n+2)\sum_{j=-1}^{-5} \rho_j^2/(n-j),$$

where n is the number of the observations. In most cases the two criteria coincide in the sense that the peak correlation belongs to the same phase for which the LB statistics is higher so that labeling a comovement as leading or lagging cannot be controversial. Yet, sometimes, the two criteria differ, perhaps because reaction functions or automatic stabilizers might reverse the timing or the sign of comovements over the business cycle.

Once the second criterion is introduced we must define two different types of synchronous comovements: a *weak* synchronous comovement when the highest correlation occurs at $\rho(0)$ but there is also a dominating phase statistics for lead or lags and a *strong* synchronous comovement when LB^+ and LB^- are statistically equal. Providing a formal test of the difference between these two statistics is beyond our scope since the two correlation series are not independent. I suggest then discriminating between the two possibilities by comparing the p-values associated with each null, letting the reader deciding for himself from the reported Ljung-Box values.

IV. UNIVARIATE PROPERTIES

In presenting the stylized facts of government finance, I deem it useful to evaluate first the univariate properties of each variable since comovements can be negligible not simply because two detrended variables are statistically independent but also because one of them has virtually no cyclical pattern. Actually, some government variables can be acyclical for a variety of

reasons: one is that some revenues are not collected each quarter or else are collected only when some necessity materializes. A different reason for insufficient cyclicality is that government spending includes *collective goods* such as defense or general administration that should be provided regardless of the state of the economy.

The univariate properties I shall present here involve measures of unconditional volatility (standard errors of cyclical components) and measures of persistence based on the time required by each shock to decay. Persistence is measured at each lag by the corresponding sample autocorrelation and - as a whole - by a Ljung-Box statistics testing the null that detrended variables are a white noise process.

Blanchard and Watson (1986) suggested looking at the third and fourth moments of the distributions to assess whether fluctuations are symmetric and whether they are characterized by large infrequent shocks making the central part of the distribution thinner than implied by a normal curve. Conversely, fluctuations could be characterized by a larger concentration around the mean than implied by a normal curve: a fact that is reflected by a negative excess kurtosis signalling a sequence of many small shocks rather than the occurrence of few large *episodes.* To evaluate this I shall report for univariate data a Kurtosis (Ku) statistics calculated as in Kendall and Stuart (1958).

The cyclical behavior of real GDP is also reported as a benchmark and confirms previous findings that the overall business cycle is quite similar among the G-7 countries (Fiorito-Kollintzas, 1994). In particular, real GDP cycles are everywhere persistent and have a volatility which is intermediate between consumption (low) and investment (high). What is found here is that the same ranking holds for government consumption and investment as well.

Looking at *receipts* first, we see from Table 4 that revenues are always more volatile than GDP is. This is not surprising considering that revenues are the product of a tax base (consumption, labor income, property income) by a tax rate that has also some variability. This is especially true if taxes are not flat but are income-related since progressive taxes imply a positive covariance between the tax base and the tax rate[5].

In this respect, it is not surprising that *indirect taxes* are *less* volatile than income taxes and especially capital income taxes. Yet, indirect taxes are usually less persistent and *more* volatile than GDP, except for the US and Italy. In the remaining cases, we find a combination of weaker persistence and higher volatility compared to real GDP. This pattern is particularly striking for Japan whose revenue data show in the meantime a minimal business cycle propagation and the highest volatility in our sample.

---

[5]Inflation and hyperinflation should also imply some covariance between the tax base and the tax rate. Hyperinflation and collection lags have opposite implications (Tanzi-Oliveira effect) but they are admittedly more important for developing countries than for the G-7.

Compared to real GDP, *direct taxes* exhibit everywhere a much higher volatility and a smaller persistence. This does not hold for Italy where all revenue components display autocorrelations that closely resemble those found for real GDP.

As mentioned before, a tax base such as income is more volatile than consumption. Meanwhile, income tax brackets are generally more progressive than consumption tax brackets and this implies an additional source of volatility.

Capital revenues are very volatile because taxes on business income are generally levied infrequently or at irregular intervals. Moreover, capital income is *per se* difficult to measure not simply because is the most intangible tax base but also because fiscal laws rest on more or less comprehensive income definitions (Kay, 1990) that differ in each country and within the sample (Cnossen-Messere, 1990).

By splitting direct taxation into household and business components, we see that volatility is remarkably smaller for household taxation. However, taxes on households are also quite erratic, their volatility being two/three times larger than real GDP volatility. Direct taxation seems to differ from country to country. A possible common pattern is that deflated *business* income taxation has virtually no trend in Canada, US, Germany, and in the UK. Conversely, we found a small positive trend in Italy and France and a rising trend in Japan that becomes negative in the 1990s.

Thus, in Canada and in the US business income taxation is more persistent than household income taxation while in Japan the business component is not too different from a white noise process. In France both income tax categories are not statistically different from a white noise process whereas the business component has a very large excess kurtosis indicating the presence of large infrequent shocks. In Italy and in the UK there is more persistence for the household portion though the taxation of business income is much more volatile. In Germany the business component is just slightly more volatile but is more persistent than household' share as we also find in Canada and in the US. Thus, direct taxes display a variety of patterns reflecting both different weights of the household' and business components and large differences in tax policies and institutions.

Social security receipts are more persistent in Europe where are slightly more volatile than GDP. Outside of Europe, volatility is much higher in Canada and especially in Japan where, however, social security exhibits little serial correlation. In the US and in Canada there is some persistence that, however, seems again inversely - rather than directly - correlated to volatility. This feature holds for Italy and France as well.

When reporting statistics for *current receipts* we must consider that this variable almost coincides in the G-7 with total receipts (IMF, 1996). Aggregate revenues reflect then the main tendencies earlier described for components: in Japan revenues are not persistent and show a volatility that could reflect measurement errors. Italy's taxes are the most persistent and have about the same variability as real GDP. Taxes are also persistent in Germany, Canada, the UK

and the US where, however, we find evidence for large infrequent shocks mainly resulting from direct taxation.

A distinct feature of the US and of the UK economies is that tax autocorrelations decay slowly and monotonically for at least 4 quarters while in Italy and Canada autocorrelations decay earlier and reverse their signs. Finally, it is noteworthy that current receipts are generally less volatile than their components are: a fact suggesting that negative covariances occur, i.e. that there is a substitution between different ways of financing government expenditure. This issue will be analyzed later on.

Government final consumption is generally less volatile and less persistent than real GDP. This is reasonable if we recall that the provision of public goods should be independent of the business cycle. Yet, government consumption does not include only such public goods as defense, justice, etc. but accommodates also *merit* goods such as health or education that are typically supplied by private units (Musgrave, 1959) but that constitute a remarkable portion of government consumption (Klau-Saunders, 1985). Finally, government consumption also includes income maintenance programs that are intrinsically cyclical and purchases from private firms that should be equally - though differently - related to the business cycle (Barro, 1981, 1989).

The *wage component* of government consumption is more persistent than *purchases* everywhere but in Germany, presumably because the *nonwage* component, corresponding to the acquisition of inputs by private firms, is more occasional than the provision of final services.

Subsidies denote current unrequited transfers to firms and are equivalent to negative taxes on production. As it appears from Table 5, subsidies are a small fraction of total government expenditure, especially in the US. In Europe the share is larger but there is, however, a tendency towards reducing subsidies which can violate intra-EU trade or competition agreements. With the exception of Canada, subsidies are very volatile, being presumably decided on an occasional basis: this seems the case of Japan, Germany and especially France, where autocorrelations cannot be distinguished at the .05 confidence level from white noise. In the other cases subsidies are again volatile but are also cyclically persistent as one would expect from expenditure programs bound to last over time.

Transfers denote current transfers to households and include social security benefits, social assistance grants and transfers to the rest of the world. Social security benefits are the largest item though weights differ from country to country (OECD, 1996c): in Italy and Japan pensions are about 95% and 80% of the whole variable, respectively. The pension share is about the 70% in France and about 60% in the US and in Canada. In Germany and in the UK the pension share falls over time, at the end of the sample being about 50% in Germany and about 40% in the UK where social assistance grants rank first. Transfers to the rest of the world are negligible everywhere.

The composition of transfers should help to understand differences in persistence: indeed, pensions should be more persistent than welfare or assistance grants that - at least in principle - reflect more temporary disbursements. Actually, results conform only partially to this interpretation since the autocorrelation pattern for the UK is not different from countries where the pension share is higher, perhaps implying that welfare related spending can also last over time. Italy's results conform to the expectation while those for Japan seem again acyclical. All series are more volatile than GDP but less volatile than subsidies.

Compared to other current expenditures, *interest payments* are generally more volatile than consumption and transfers and less volatile than subsidies. Further, interest payments are generally more persistent in those countries such as Italy or Canada where the debt ratio to GDP is higher or where is rising as in the US (Table 5). This is not true for Japan where the increase in the debt/GDP ratio is impressive though slowing in the most recent period and is not true for France in which the ratio is relatively low though increasing in the last decade. In the case of France, it seems that debt service persistence should reflect mostly a rising cost of debt that we calculated in Table 5 by dividing the interest expenditure/GDP ratio by the relevant Debt/GDP ratio.

As an aggregate, *current expenditure* is not very volatile, presumably because the sum of government consumption and transfers ranges from about 2/3 (Japan) to about 9/10 of the total. While Japan's data reveal once again a thin cyclical pattern, in the other countries current expenditures are persistent. By looking at *government fixed investment* we see that data conform to cyclical requirements in all cases but Germany where autocorrelations are lower and volatility is high[6]. Cycles in government capital formation are volatile and persistent as expected. This holds also for Japan which is characterized by the largest government investment share among the G-7.

Total expenditure is much less volatile and has again a peculiar pattern in Japan where government consumption and fixed investment only are highly persistent and not contaminated by an excess of randomness. In general, total expenditures are just slightly more volatile than real GDP is and do not notably differ from *primary expenditure* patterns. The main implication of this result is that - at least in univariate terms - the distinction between total and primary expenditure does not seem too useful. Likewise, the two corresponding balances, i.e. *net government lending* and *primary balances,* do not differ either. Both variables are persistent, though to a lesser extent in Germany and France. The US balances reveal that a number of large infrequent shocks occurred.

---

[6]It should be pointed out (see Data Appendix) that Germany means here Unified Germany.

V. COMOVEMENTS

A. Receipts

Indirect tax comovements with real GDP can be better understood bearing in mind that the crucial tax base is private consumption, i.e. the least volatile private GDP component. If tax rates are constant as required by tax smoothing (Barro, 1979) these should be independent of any other variable, including current consumption. As a result, the combination of consumption smoothing and tax smoothing should imply a volatility that is smaller or not larger than the volatility of GDP, considering the fact that the tax base includes the nonwage component of government consumption (Mendoza-Razin-Tesar, 1993) which is always more volatile than GDP.

Further, lagging indirect taxes would suggest that consumption has an excess sensitivity to past income rather than behaving in a forward-looking way. Conversely, leading indirect taxes would presumably imply that real GDP is responsive to spending shocks. Our findings show that comovements are procyclical and in most cases synchronous while volatility is larger than for real GDP but in the US where comovements are leading. In all the other cases comovements are still procyclical but tend to be synchronous or lagging with the only exception of France. In Germany indirect taxes are procyclical and strongly correlated with real GDP.

Direct taxes comovements are quite heterogeneous, primarily because personal and business income taxes have in each country different weights and burdens. As mentioned before, the smaller business component is so volatile that it affects in most cases the sign or the phase of aggregate comovements. Yet, personal income taxes include also the profits of the unincorporated enterprises that should be especially important in Japan or Italy where about 1/3 of employment consists of self-employed workers running in most cases small or family-based business. Thus, there is an interaction between the income and the corporation tax that should be also recognized (Cnossen-Messere, 1990).

With the exceptions of Italy and the UK, the income taxes paid by *households* lag in all countries so that revenues follow real GDP procyclically as implied by an automatic stabilizer. Namely, revenues from households are procyclical in Canada, the US, Japan and Germany while are lagging and countercyclical in France only where, however, the correlation is weak. Conversely, in Italy and the UK comovements are negative and leading, as required by supply-side models where higher taxation anticipates falling output.

The *business* component leads procyclically for the US and Italy while it is synchronous or lagging elsewhere. Taxes on *business* income are always procyclical though widely different in phase and variability. In Canada and France comovements are weakly synchronous since there is a lagging phase dominance. In Germany comovements are strongly synchronous since the difference between the two LB statistics seems too small to indicate a phase dominance.

Comovements for aggregate *income taxes* are procyclical and generally lagging as expected: comovements are clearly lagging in Canada, Germany and Japan while in the US they are strong and (weakly) synchronous. France comovements are not significant as implicit in the low persistence of the direct tax variable that is almost six times more volatile than GDP. Italy and the UK have the most peculiar patterns: Italy is the only case where direct taxes are leading according to the peak criterion while in terms of phase the difference between the two LB statistics is too small to be informative.[7] In the UK too the timing of comovements is unclear because of the conflict between the phase and the peak criteria: as in the majority of cases, the highest correlation is lagging and countercyclical while the dominant phase is countercyclically leading. Finally, it should be noticed that the high variability of income taxes should reflect the progressivity of the tax that makes the covariance between the tax rate and base positive.

Compulsory *social security* contributions can be assimilated to a flat labor income tax levied on employers, employees and self-employed workers, though to a different extent in each country (OECD, 1996a).[8] The dependence on labor income and the flatness of the tax should explain why social contribution are generally less volatile than income taxes, though in Canada social contributions also are related to income tax. Actually, in the US, Germany, France, and Italy the volatility of social security contributions is about the same than volatility of real GDP, while in Canada, in the UK and especially in Japan the volatility is considerably higher. The comovements between social security contributions and GDP are generally lagging or synchronous in all countries but Italy, where we find as in the case of income taxes a positive leading peak that it is difficult to explain. Despite the phase uniformity among countries, there are also several differences, presumably reflecting heterogeneity in labor market institutions. Namely, the correlations for Japan, France, the UK and Canada are lagging but are statistically significant for Canada only. In the US and Germany comovements are stronger and procyclical and conform to the idea that labor share is procyclical. In the US, the peak correlation is lagging by one quarter and is consistent with our phase statistics. In Germany the peak correlation is synchronous though lags dominate. Hence, in both Germany and the US social security behaves as an automatic stabilizer dampening cycles not less than income taxes do and the more employment is cyclically responsive.

The comovements between real GDP and aggregate *current revenues* are more uniform than for the components: differences in volatility measure are not too large and display a cyclical

---

[7] An institutional explanation of the leading correlation in Italy could be that since 1977 income taxes exceeding a threshold level must be paid twice per year: in May, when they are based on past year's income and in November, when taxpayers anticipate next year's taxes based on the taxpayers' past income.

[8] The shares also reflect the proportion of self-employed which is higher in Japan, in Italy and, to a lesser extent, in France. Yet, in all these countries the self-employment share of contributions paid is notably smaller than its ratio to total employment. The remaining burden rests more on the employers in Italy, France and Canada (2/3-3/4) and somewhat less (5/10-6/10) elsewhere.

amplitude mildly exceeding that of GDP[9]. Moreover, all comovements are procyclical and synchronous or lagging in all cases but Italy where both income and social security taxes are leading. The stronger correlations are found in the US and in Germany, where the peak correlation is weakly synchronous since lags dominate. It seems then than in these two countries revenues can be successfully used to stabilize the economy given the readiness and the size of their cyclical response. Peak correlations are still strong and lagging by one quarter in Canada. Current revenues are weakly synchronous in France and are procyclically leading in Italy, where this aggregate variable reflects the comovements found for household income and social security receipts.

B. Disbursements

Although *government consumption* decreases everywhere as a share of public expenditure, comovements with real GDP are quite heterogeneous among the G-7 countries, confirming preliminary stylized fact evidence (Fiorito-Kollintzas, 1994). This evidence can be better understood by considering the separate behavior of *wage* and *nonwage* shares and, more generally, the composition of government consumption in the G-7 countries (OECD, 1996c).

As noted before, government consumption does not involve only *public* goods such as security, defense, legislation and alike but contains also *merit* goods (Musgrave, 1959) dispensed to individuals when unable to buy such private goods as - say - education or health. Barro (1981) suggests that government consumption is a substitute for private consumption so that rising government consumption by one unit does not rise by the same amount aggregate demand, the latter being increased only by $(1-\alpha)$, where α is the substitution parameter between private and government consumption. A related hypothesis is that α should be close to one for collective goods and smaller for individual goods yielding a smaller substitution since consumers must pay taxes to finance public services while still preferring to buy individual goods. The cyclical effects are quite complex because a rising share of merit goods should imply a higher level of aggregate demand that should be, however, balanced by higher interest rates. Further, if taxes are also increased, this should offset the labor supply boost that Hall (1980) and Barro (1981,1989) associate with transitory government purchases because of their effect on interest rates.

Even ignoring discussion on the long-run effects of government purchases (Barro, 1981; Ayagari-Christiano-Eichenbaum, 1992; Baxter-King, 1993), the cyclical implications of government consumption depend on many channels and parameters so that it is not surprising that in our results the common features for government consumption are few: in all countries but Germany the volatility is smaller relative to real GDP, a fact that should imply that public goods are still the largest component of government consumption. A related consequence is that the impact on private expenditure should be small so that even a demand-driven output should not react strongly to a government consumption shock in the short run.

---

[9] rv = relative variability between any cyclical component and GDP.

Another common feature is that the *nonwage* component of government consumption is much more volatile and always leads the economy procyclically. The volatility of the nonwage component is higher relative to GDP, presumably because purchases from the private sector reflect administrative decisions that are intermittent in nature. Yet, in our sample there is a polarization of results: in Japan, France, Italy, and Germany - where the correlation is particularly strong - purchases seem useful to activate the economy while in the US, in Canada and in the UK the nonwage share of government consumption leads countercyclically as when crowding out prevails. In all cases, however, government purchases do not stabilize the economy as most expenditures do but either increase or decrease the activity level after a few quarters.

Looking at the *wage component* of government consumption, it seems that automatic stabilization prevails since comovements are countercyclical and lagging in Canada, France and Japan. Yet, in Germany and the US comovements are strongly procyclical *and* lagging as if related expenditures could be afforded only when macroeconomic performance and government balances improve. Hence, according to our simplified scheme (Table 1) it seems that wage component is automatic while nonwage component is discretionary, though not necessarily productive. Finally, Italy and the UK are the only countries for which wage and nonwage components behave in about the same way though for Italy the leading procyclical correlation exceeds the cutoff point for purchase only while the UK is the only G-7 country in which both components are leading countercyclically.

Aggregate comovements between *final government consumption* and real GDP reflect mostly the broader wage component. Thus, in Italy government consumption leads real GDP procyclically. In Canada and in the UK government consumption is leading countercyclically, as if private consumption displacement coexisted with a negative supply effect induced by distortionary taxation and by higher interest rates. In the remaining cases, government consumption lags behind, suggesting that this variable too could be more cyclically induced than assumed by models imposing exogeneity and ignoring composition issues. In Germany and in the US government consumption lags procyclically real GDP as if purchases could be afforded in good rather than in bad times, following a pattern that fits investment or discretionary spending decisions more than provision of virtually acyclical public goods. Conversely, in Japan and in France government consumption lags real GDP countercyclically as if government consumption were acting as an automatic stabilizer.

As a result, the common patterns we find for government consumption are the low volatility of the aggregate and the leading phase of the nonwage component.

Subsidies also are quite different among the G-7, given the occasional nature of transfers to firms. Subsidies are leading countercyclically in Canada, France and the UK while they are countercyclically lagging in the US, i.e. acting as stabilizers that should be discretionary because of their extreme volatility. The only case in which subsidies are procyclical and weakly synchronous is Germany, where discretion complies in our interpretation with the

budgetary position[10]. Italy's pattern is difficult to recognize since there is a conflict between the leading procyclical phase and the negative lagging peak, though comparisons between the two LB statistics should favor the first interpretation.

Comovements between real GDP and *transfers* are very important in the light of the increasing weight of this variable that is not constituted by pensions only but also by welfare and social assistance grants. With the exception of Germany, transfers have a common pattern among the G-7 since are always countercyclically lagging. Correlations are strong in Canada, US, UK and Italy while are weak in France and Japan. These results confirm the idea that - regardless of the structure of government expenditure - transfers act everywhere as a timely cyclical stabilizer. As expected, volatility is generally not too high, since pensions are basically related to labor income which is typically smooth. Yet, transfers include grants and social assistance benefits that might impress an additional source of volatility whenever they reflect occasional spending.

As for other expenditures, Germany's pattern is different, transfers being lagging *and* procyclical. This patterns is clearly incompatible with automatic stabilization while conforming the intuition that more generous benefits require a less binding budget constraint and vice-versa.

Interest payments comovements are remarkably different in the G-7. Hence, the only common feature is a volatility that is two or three times larger than volatility of real GDP and that is mostly related to the interest rate component. In continental Europe debt service is countercyclically leading, though in France there is a synchronous correlation. In Japan too debt service is procyclically leading as if non-Ricardian consumers were perceiving interest payments as a part of their permanent disposable income. In Canada and in the UK interest payments lag real GDP procyclically while in the US they lag countercyclically providing some automatic stabilization that is atypical of this variable.

Current expenditure is more uniform and just slightly more volatile than GDP, with the exception of the US where it is even smoother. In most cases current expenditure is lagging countercyclically as one would expect from disbursements following business cycles in a relatively automatic way. This applies in particular to the US, Japan, France, Italy, and Germany where the peak correlation is synchronous while the overall phase shows that lags dominate. In the UK and in Canada current expenditure is countercyclically leading: this could imply that the cyclical effect of current expenditure could be contractionary or else that fiscal adjustment can be expansionary. Yet, this evidence is not too strong for the UK while is more ambiguous for Canada when we compare the peak with the phase criterion.

Government gross fixed investment comovements differ from country to country and generally do not fit textbook assumptions of a policy-controlled type of spending that should lead the economy procyclically by providing infrastructures and additional capacity. Actually,

---

[10]A possible label for the lagging procyclical cell in Table 1 could be "feasibility constraint".

the only country for which this scheme holds is Japan where government investment leads cycles in real GDP by one quarter. A different pattern is found in Canada and in the UK where government investment lags procyclically GDP cycles. Similarly to previous results, we interpret this procyclicality as resulting from the fact that public investments can be started when the economy expands and government balances improve. For the G-7 economies where basic infrastructures are already available, maintenance can be more important for business cycle analysis than starting new projects at distant time intervals and this could explain why relaxation of the government budget constraint should favor, in particular, investment expenditures that are otherwise bound to be postponed, neither being income-related nor rising automatically during recessions.

Stronger countercyclical behavior is found in the US data that report for the first time a capital account and hence investment data for General Government. The pattern is one of lagging countercyclical response to GDP fluctuation, where a longer lag seems to be the main difference with respect to typical current expenditures. Finally a synchronous negative comovement is found for France while leading negative comovements characterize the cyclical behavior in Germany and in Italy. A possible interpretation of such different results is that government investment while increasing capital accumulation can also crowd out private investment if total investment exceeds the level desired by private agents (Aschauer, 1989).

Total expenditure is just slightly more volatile than GDP with only two exceptions: in the US total expenditure is, like current expenditure, less volatile than real GDP while in Japan is more volatile because of the higher investment share. Comovements with real GDP are lagging and countercyclical in the US, France and Italy, confirming the view that public expenditure can work more as an automatic stabilizer than as an expansionary tool. Actually, the peak correlations occur only one quarter after business cycle materializes. In Germany the comovement is positive and weakly synchronous or else lagging if we consider the phase: as in other cases this result seems typical of a procyclical non-leading behavior of government expenditure in Germany that we take as an indicator of some feasibility constraint. Once more we find some similarity between Canada and the UK, for which total expenditure - like current expenditure - leads the economy countercyclically.

It is interesting to note that - unlike with our univariate results - total and primary expenditure comovements with GDP are not the same: actually, in most cases differences are minor, except for Italy and Japan where excluding interest payments affects cyclical behavior: Italy's primary expenditure is procyclically leading in peak terms as required by an activist fiscal policy. Yet, phase statistics show that negative lagging comovements slightly prevail as implied by a certain degree of automatism. In turn, Japan's primary expenditure is synchronous and procyclical but also not too significant. This is consistent with the fact that interest expenditure in Japan is procyclically leading, though it is difficult to rationalize. An intuitive explanation could be that when the debt/GDP ratio is small consumers may consider the debt service as a part of their permanent disposable income. Conversely, when the debt/GDP ratio is high, consumers perceive that higher future taxes will need to be raised (Sutherland, 1995). This interpretation is consistent with Italy's and Japan's data but does not fit Canada where the debt/GDP ratio is also high: indeed, excluding interest payments for Canada only implies a

phase shift, i.e. that expenditure follows real GDP countercyclically. In a sense, this implies that primary expenditure is a better stabilizer than total expenditure though it does not confirm the idea that primary expenditure is *per se* more *discretionary* than total expenditure.

C. Balances

This last issue can also be dealt with by comparing the cyclical behavior of *government net lending* with corresponding *primary balances.* What is amazing is the uniformity of comovements among the G-7 despite the differences we found by country and component. Further, we are unable to find any significant difference between the two balances which behave almost in the same way despite reported differences between total and primary expenditure comovements.

The most important result is that *net government lending* is procyclical, i.e. that the government deficit is countercyclical everywhere, though the size of correlation is smaller in Germany where expenditure is definitely procyclical. A second common result is that the countercyclical comovement is either synchronous or immediately lagging, with the only exception of Japan and the UK for which we find longer lags. Except for Germany and the UK, these correlations are strong. In no case government balance lead real GDP procyclically. The same conclusion holds for primary balances which closely replicate total balances in terms of volatility, size and timing of comovements. In general, government balances are volatile as typical of shock absorber variables but are not more volatile than several expenditure or receipt components.

The fact that the volatility of government balances is high but is not extremely high should exclude that government deficits operate as a buffer as inventory changes do in production-smoothing models. In the meantime, the cyclical dependence of government balances is too large to be ascribed to taxation only.

VI. Approximate Tax Rates

In this paragraph I shall present comovements between tax ratios to GDP and real GDP cycles to approximate comovements between tax rates and the appropriate tax base.[11] While this is certainly an oversimplification, it could be seen as a first step to ascertaining whether these approximate tax rates are smooth and independent of the business cycle as required by the optimal taxation literature (Atkinson, 1991; Barro, 1979; Lucas-Stokey, 1983).

---

[11]Fiorito and Padrini (1997) calculate for major OECD economies quarterly household, capital and labor tax rates. The methodology is based on but is not the same as that introduced by Mendoza-Razin-Tesar (1993) in their annual estimates.

A. Indirect Taxes

The ratio between indirect taxes and nominal GDP is a proxy of the consumption tax rate that is calculated by Mendoza-Razin-Tesar (1993) for a tax base that includes not only households' consumption but also the nonwage component of government consumption.

As required by tax smoothing, the ratio is not too volatile and is also less volatile than we found for the income tax rate. Yet, the pattern of comovements is not too uniform and can be roughly described in three ways: in Canada and in the UK this share is countercyclically leading as if increasing this ratio depressed the economy about one year later. Correlations for the UK are rather weak while they are significant for Canada. The most immediate channel for such a result is the indirect tax impact on prices countercyclically leading real GDP in the G-7. (Fiorito-Kollintzas, 1994). A second pattern, found for Germany and less clearly for France, implies that the indirect tax share leads real GDP procyclically. This result cannot be accommodated by the price/output relation because prices are countercyclical in Germany too so that a different mechanism should be at work. A possibility is that the consumption share is procyclical though this is not consistent with the fact that consumption fluctuates less than GDP.

Yet, taking into account that the relevant consumption variable includes in this case government purchases this conjecture still has some point because the nonwage component of government consumption is generally volatile and in Germany also strongly and procyclically leads real GDP.

A third pattern is that found for the US and Italy, for which indirect tax rates follow real GDP countercyclically. In this case too we have to speculate on consumption behavior, i.e. on the fact that consumption is less volatile than GDP so that tax rates should fall in expansions and rise in recessions. Finally, in Japan the indirect tax share seems to be acyclical while in France no simple interpretation fits the data.

B. Direct Taxes

Income tax rates are more volatile than corresponding data for consumption and social security revenues. Namely, tax rates on *household* income are more volatile than tax rates on *business* income which are fairly stable over the business cycle. Since taxes on business income are among the most erratic government finance variables, it appears that some tax smoothing occurs.

Except for Japan in which tax rates on business income fluctuate more than those for households, this is a general result or a candidate *stylized fact* to deal with. A possible explanation could be that business income tax rates are considered more distortionary than tax rates on household income because households are primarily consumers while firms are primarily producers and investors and it is well known that consumption is more stable than output and output is more stable than investment over the business cycle.

Another important common feature that we find for the G-7 is that the cyclical behavior of the household and business tax rates is quite different: household tax rates lead the economy countercyclically in a number of countries (Canada, Germany, Italy, and the UK) while are lagging procyclically in Japan and in the US and countercyclically in France. Conversely, business income tax rates are *always* procyclical, being synchronous or lagging in all cases but Italy.

The fact that only household rates lead real GDP countercyclically implies that supply-side policies should act on household income only while the historical evidence reported in Table 2 shows a pronounced falling trend in the business income tax share. A second point addresses the business sector results: it seems that in this case the tax share is a bad proxy of the actual tax rate so that the lagging cyclical comovements could be plainly accommodated by recognizing that profits are procyclical and more volatile than GDP. Hence, it should not be a surprise that taxes on business income are also procyclical and more or less synchronized with real GDP.

The aggregate income tax rate closely replicates the dominant household component so comovements are countercyclically leading for a majority of countries, while the US and Japan display a lagging and procyclical tax rate correlation with the overall business cycle.

The *social security contribution* share cannot be considered a good proxy of the labor tax rate because earnings are not included and social security revenue alone cannot provide a reliable proxy of the labor share. Yet, these comovements are still useful to show how social security revenues move over the business cycle.[12] Indeed, in all countries social security share is countercyclically leading or synchronous so that a rising share of social contributions should anticipate a fall in the activity level. Comovements for Canada are lagging and countercyclical, a fact that is puzzling but that can also be accounted for once we consider that social security includes in Canada payments for unemployment compensation (countercyclical) and exemptions for overtime income above the contribution ceiling (procyclical).

The social security share is the least volatile and this should not be surprising given the smoothness of the labor income.

VII. Substitutes and Complements

In this section each revenue and expenditure component is related to the other receipts and expenditures. The emphasis is no longer on the comovements between government finance and real GDP but on the way in which each component replaces or follows another revenue or disbursement. While the historically changing sectoral composition of government finance

---

[12]The reason why I did not use here the tax rates estimated in Fiorito and Padrini (1997) is that in the typical stylized fact approach real GDP – rather than a more appropriate tax base – is the reference variable for cyclical comovements.

seems more a structural than a cyclical issue (Table 2), there are also cyclical aspects that are involved: the first is that the automatic nature of many General Government variables may induce sectoral changes over the business cycles that are not entirely known to policy-makers. Changes in composition may also result from the fact that fiscal adjustment programs are usually expressed in terms of an aggregate target such as the share of government balance in the GDP: in this case targets could be reached by raising those revenues that are easier to collect or by cutting those expenditures for which the social or political pressure is less.

Cyclical comovements between receipts and spending and within each of the two groups can be misleading unless one considers that most of these variables are GDP-related and that revenues, in particular, are procyclical. Finally, cyclical comovements do not need to conform to long-run trends reflecting major changes in the composition of government finance.

Here, I shall present results for receipts first, then for expenditures and finally for revenue/expenditure correlations. For each country I shall report a matrix of correlation coefficients $\rho(I, j)$ where each element corresponds to the highest correlation between the selected pair of variables. Namely, the element $\rho(I, j) = \rho[x_i(t+s),x_j(t)]$ denotes the timing of the comovement been x_i and x_j which is reported in parentheses for the relevant lag $s \in [-5,5]$. To simplify the presentation, I shall not report all the distributions and those correlations that are smaller than our cutoff value. Finally, when peak correlation is uncertain I shall insert a question mark in the relevant cell.

Among receipts, correlations between indirect taxes (TIND) and income taxes (TY) are in most cases positive, presumably because both reflect positive comovements with real GDP. Usually, indirect taxes lead direct taxes because consumption can be immediately charged. Conversely, social security contributions lead indirect taxes though differently among countries. Comovements between indirect taxes and social security receipts are not too clear except for the fact that social security leads. The same phase can be found for the relationship between income taxes and social security contributions: in Germany, France and the UK the correlation is positive while in Canada and Japan it seems that some substitution occurs. In Italy there is no significant correlation between income taxes and social security revenues, though glancing at the data reported in Table 4 one may get the idea that structural relations are different.

The expenditure side displays a variety of patterns which are difficult to grasp without accounting for the hidden GDP variable. Yet, a few results seem common enough to be briefly reported. *Subsidies* always lead government consumption: procyclically in Canada, Japan, Germany, and the UK, countercyclically elsewhere. When *transfers* and *government consumption* are compared, transfers lead consumption everywhere but in Italy (synchronous) and Canada where the phase is reversed. In the US, Germany and the UK there is a negative correlation between these two variables (Alesina-Perotti, 1995) showing that higher transfers are cyclically followed by lower consumption spending. Conversely, the comovement is positive in Japan and France and still positive in Italy and Canada where phasing is different. The relation between government consumption and interest spending has no common pattern while the relation between government consumption and fixed investment is positive and

synchronous in a number of cases (US, Canada, UK) and is also positive for Germany where consumption leads. In the remaining cases there is at cyclical frequencies a substitution between investment and consumption: in France this happens with a leading consumption variable while in Japan and Italy a negative correlation is found for a leading investment variable.

The relation between *transfers* and *investment* shows a fairly common negative pattern either when transfers are leading (Canada, US, France) or when the opposite is found (Japan). In Germany and in Italy the peak correlation is positive, being synchronous in Germany and leading for investment in Italy.

Finally, the negative comovement between investment and interest spending suggested by Tanzi and Lutz (1993) has little support in our cyclical analysis, being presumably most relevant in the long run.

Comovements between major *revenues and expenditures* reflect also their respective relations to GDP. Taxes are usually procyclical while spending components often lag real GDP countercyclically so that the association between each receipt and disbursement is generally difficult to interpret.

Indirect taxes in four cases lead *transfers* negatively as if a substitution were involved. In the remaining cases, however, transfers lead indirect taxes positively as when a "spend and tax" policy prevails. Comparing indirect taxes with *subsidies* it appears that the latter are leading, a fact that is found also when different receipts are considered. Finally, no common pattern is found in the comovements between indirect taxes and *government consumption.*

Direct taxes lead government consumption procyclically, Japan being the only case where the relation is reversed in both phase and sign terms. It is interesting to note that comovements between direct taxes and *transfers* are still positive though in most cases transfers are leading: if these relations are genuine, one could be tempted to relate differences in phases to the fact that government consumption activates or stabilizes the economy after some financing is found. Conversely, as long as transfers stabilize spending only, an increased volume of taxation must follow to meet government balance requirements in the next period. Actually, transfers always lag real GDP countercyclically so that a lagging tax response to transfers should eventually amount to expanding government size only. The relationship between direct taxes and *interest payments* is insignificant in three cases (Canada, Japan, Germany) and always positive except in the US where interest spending leads. Similarly, the comovements between direct taxes and government investment are always positive though insignificant in Canada, the UK and Italy.

Social security contributions are strongly and positively correlated with contemporaneous government consumption in Germany while consumption is leading elsewhere. The same phase behavior is found in Canada, France and Italy for the transfer/social contribution relation since the spending variable leads the tax variable once more. Yet, this is not true for

Germany and Japan where comovements are synchronous as in the US in which, however, the dominant correlation is negative.

VIII. CONCLUSIONS

This paper evaluates the stylized facts of government finance by applying the Kydland-Prescott methodology to the G-7 countries. The comparative analysis aims at disentangling facts that are common to all countries from facts mainly reflecting local environments or shocks. The comparison is based on detrended General Government data that are compatible with NIPA definitions and that stem from the quarterly OECD database. The greatest commonly available disaggregation is used to evaluate whether differences in expenditure or tax composition matter for macroeconomic performance.

Rather than adopting traditional indicators of fiscal stance, we have tentatively separated discretionary fiscal policies from cyclical influences by using the phase of the comovements with real GDP. This study does not rest on the choice of *episodes* that are difficult to select but is based on a systematic scrutiny of *normal* government behavior over the business cycle. Implications for growth are not analyzed.

Differences in results are more numerous than similarities. Yet, there are also some patterns that seem common enough to be labeled as preliminary *stylized facts*:

1. Transfers or revenues from the business sector are much more volatile than corresponding transfers or revenues from households

2. Receipts are procyclical and generally lag the economy

3. Household income taxes are procyclically lagging while business income taxes are more heterogeneous

4. Taxation being more uniform, national patterns emerge mostly from the spending side.

5. Government outlays (and transfers, in particular) behave as lagging countercyclical stabilizers.

6. Government spending leads the economy procyclically only for nonwage consumption (Japan, Germany, France, Italy) and - in Japan - for fixed investment also

7. Government deficits adjust quickly to business cycle and are strongly countercyclical.

8. The cyclical behavior of primary deficit does not differ from overall balances.

9. Proxies for tax rates lead countercyclically the economy (households) while lagging procyclically (business)

10. Expenditures lead taxes in most cases

While it is difficult to provide a common theoretical framework for unifying all the reported facts, a few comments are in order: the first deals with the aggregate effect of the deficit that is not too informative unless one knows how the components behave. Actually, it is from component behavior that we can rationalize why Germany's correlation is comparatively smaller. Conversely, the weak correlation found for the UK is mainly a by-product of the fact that government spending often leads countercyclically the economy as when crowding out prevails.

The fact that spending can procyclically follow business cycles because of a binding budget constraint can help us to relax the initial assumption that discretionary policy is necessarily leading: discretion can also be used for postponing spending to a time in which government balances improve because the economy improves.

Finally, it should be recognized that the strong association between government balances and real GDP is only partially an economy policy success because stabilizing the economy *via* a countercyclical deficit can also indicate an excessive sensitivity of government spending to the business cycle: indeed, a stabilization effect that is too strong can even suggest that government spending does not activate the economy before shocks materialize.

Table 1. Government Comovements with Real GDP

	Revenues		Spending	
	Leading	Lagging	Leading	Lagging
+		Automatic Stabilization	Activism	
-	Recessionary, Distortionary		Crowding Out	Automatic Stabilization

Table 2. Government Expenditures, Receipts and Balances (in percent of GDP) 1/

	Expenditure		Receipts			Balances			
	Total	Prim.	Total	Dir.	Ind.	Total	Prim.	URATE	RRATE
Canada									
1970-75	35.2	31.5	35.4	14.3	13.2	0.2	3.9	6.0	-0.5
1976-80	38.1	33.4	35.7	14.0	12.0	-2.4	2.3	7.7	1.2
1981-85	44.0	36.6	38.5	14.6	12.6	-5.5	1.9	10.5	8.6
1986-90	43.9	35.2	40.2	16.1	13.0	-3.7	5.0	8.4	6.1
1991-95	48.5	39.1	42.4	16.7	13.9	-6.1	3.3	10.6	7.5
USA									
1970-75	30.4	29.3	29.2	13.65	8.9	-1.2	-0.1	5.9	-0.1
1976-80	30.6	29.5	29.7	14.1	7.9	-0.9	0.2	6.8	0.1
1981-85	32.7	31.0	29.7	13.1	7.9	-3.0	-1.2	8.3	7.6
1986-90	32.6	30.6	30.1	13.3	7.7	-2.5	-0.5	5.9	7.7
1991-95	33.6	31.5	30.5	13.2	8.2	-3.1	-1.0	6.6	4.7
Japan									
1970-75	22.3	21.4	22.4	9.2	6.9	0.1	1.0	1.4	-2.5
1976-80	29.7	27.4	25.3	9.6	7.0	-4.4	-2.1	2.1	3.2
1981-85	32.6	28.5	29.8	11.6	7.6	-2.8	1.3	2.5	5.6
1986-90	31.4	27.2	32.7	13.0	8.0	1.3	5.5	2.5	3.8
1991-95	32.6	28.9	32.8	12.1	7.8	0.2	3.9	2.6	4.2
Germany									
1970-75	42.0	40.9	41.0	11.7	13.1	-1.0	0.1	1.5	2.8
1976-80	47.5	45.8	44.7	12.9	13.0	-2.8	-1.0	3.6	3.1
1981-85	48.0	45.2	45.5	12.1	12.8	-2.5	0.3	7.0	5.4
1986-90	45.8	43.0	44.4	12.0	12.4	-1.4	1.4	7.2	4.4
1991-95	48.9	45.6	45.8	11.4	12.9	-3.1	0.1	8.4	4.2
France									
1970-75	39.3	38.3	39.4	6.9	14.5	0.1	1.1	2.9	-0.3
1976-80	44.6	43.3	43.7	8.0	14.7	-0.9	0.4	5.3	0.9
1981-85	50.9	48.5	48.2	8.9	14.4	-2.7	-0.3	8.7	6.6
1986-90	50.2	47.4	48.4	9.1	13.9	-1.8	1.0	9.8	6.3
1991-95	53.3	49.7	48.6	9.2	14.9	-4.7	-1.1	11.1	6.1
UK									
1970-75	39.3	35.5	38.0	14.0	14.3	-1.3	2.5	2.7	-2.5
1976-80	42.2	37.9	38.4	13.8	14.1	-3.8	0.5	4.8	-0.9
1981-85	44.5	39.6	41.5	14.3	16.3	-3.0	1.9	10.0	6.7
1986-90	39.6	35.7	39.0	13.5	15.7	-0.6	3.3	8.1	3.7
1991-95	42.7	39.6	36.9	12.4	14.6	-5.8	-2.7	9.1	5.8
Italy									
1970-75	36.8	34.4	28.9	5.5	9.2	-7.9	-5.5	4.3	-5.6
1976-80	41.0	36.2	31.5	8.2	8.5	-9.5	-4.7	5.3	-3.8
1981-85	48.4	41.1	36.9	12.1	8.8	-11.5	-4.2	7.6	5.3
1986-90	51.1	42.5	40.3	13.6	9.9	-10.8	-2.2	10.0	4.4
1991-95	54.5	43.4	44.9	15.1	11.5	-9.6	-1.5	10.2	6.4

Notes:

1/ "Prim." = Primary; "Dir" = Direct; "Ind." = Indirect; "URATE" = Unemployment Rate; "RRATE" = Real Interest Rate, measured as the long-run yield on government bonds minus realized inflation (GDP deflator) one-year ahead.

Table 3. Government Consumption: Employment and Wage Shares 1/

	Canada		USA		Japan		Germany		France		UK		Italy	
	N	W	N	W	N	W	N	W	N	W	N	W	N	W
1970-75	.20	.70	.16	.63	.08	.81	.12	.56	.19	.74	.19	.61	.14	.75
1976-80	.20	.69	. 16	.63	.09	.83	.14	.54	.20	.76	.21	.60	.15	.75
1981-85	.21	.66	.16	.61	.09	.79	.15	.54	.22	.75	.22	.58	.16	.74
1986-90	.20	.65	.15	.61	.08	.78	.15	.53	.23	.74	.20	.58	.17	.72
1991-95	.21	.65	.16	.63	.08	.76	.16	.53	.24	.73	.17	.51	.18	.72

Notes:
1/ N = government employment as a percentage of total employment; W = wage component as a percentage of government consumption; Japan: 1991-94.

Table 4. Components (%) of Total Receipts 1/

	Direct Taxes			Indirect Taxes	Social Security
	T	B	H		
Canada					
1970-75	40.4	11.0	29.4	37.3	8.3
1976-80	39.2	10.0	29.2	33.6	10.0
1981-85	37.9	8.5	29.4	32.6	10.7
1986-90	39.9	7.1	32.8	32.4	11.4
1991-95	39.4	5.3	34.1	32.8	12.8
USA					
1970-75	46.4	11.5	34.9	30.4	23.1
1976-80	47.3	11.6	35.7	26.4	26.3
1981-85	44.1	7.7	36.4	26.7	29.2
1986-90	44.2	8.5	35.7	25.6	30.1
1991-95	43.2	8.4	34.8	26.8	29.9
Japan					
1970-75	41.0	19.5	21.5	31.1	22.0
1976-80	37.8	16.6	21.2	27.7	27.3
1981-85	38.9	16.4	22.5	25.4	26.9
1986-90	39.7	17.8	21.9	24.5	26.0
1991-95	36.7	13.7	23.0	23.9	28.3
Germany					
1970-75	28.5	12.0	16.5	31.9	34.6
1976-80	28.8	11.4	17.4	29.0	37.3
1981-85	26.7	8.7	18.0	28.2	38.5
1986-90	27.1	8.6	18.5	27.9	39.0
1991-95	24.8	6.7	18.1	28.2	40.9
France					
1970-75	17.6	5.9	11.7	36.8	37.9
1976-80	18.2	5.1	13.1	32.5	41.7
1981-85	18.5	4.9	13.6	30.6	42.6
1986-90	18.7	5.8	12.9	29.7	43.1
1991-95	19.1	4.7	14.4	28.6	43.6
UK					
1970-75	36.8	6.3	30.5	37.7	14.4
1976-80	35.8	4.6	31.2	36.8	16.2
1981-85	34.5	8.1	26.4	39.3	16.0
1986-90	34.5	7.5	27.0	40.2	16.8
1991-95	33.5	4.9	28.6	39.5	17.0
Italy					
1970-75	19.0	3.8	15.2	31.7	41.3
1976-80	26.0	4.3	21.7	27.2	40.3
1981-85	32.9	5.0	27.9	23.9	36.8
1986-90	33.8	7.0	26.8	24.6	34.7
1991-94	33.5	7.2	26.3	25.6	33.6

Notes:
1/ T = Total; B = Business; H = Households.

Table 5. Components (%) of General Government Expenditure 1/

	Consumption			Subs	SocSec	Intst	Inv	Debt/GDP	Cost of Debt
	Total	W	NW						
Canada									
1970-75	52.7	36.7	16.0	3.7	26.0	10.6	10.2	47.9	7.8
1976-80	50.8	34.9	15.9	5.2	26.9	12.3	7.6	44.0	10.7
1981-85	46.1	30.6	15.5	5.8	27.0	16.8	6.1	55.1	13.4
1986-90	44.2	28.7	15.5	4.3	28.4	19.8	5.4	70.0	12.4
1991-95	42.9	28.1	14.8	3.4	31.9	19.4	4.8	90.3	10.4
USA									
1970-75	59.6	37.6	22.0	1.5	31.0	3.5	12.5	43.2	2.5
1976-80	55.8	35.2	20.6	1.6	35.6	3.7	11.0	39.6	2.8
1981-85	53.1	32.4	20.7	1.9	36.3	5.3	10.3	42.9	4.0
1986-90	52.7	32.3	20.4	1.6	35.2	6.0	10.8	52.9	3.7
1991-95	49.0	31.1	17.9	1.1	40.1	6.3	9.6	64.8	3.3
Japan									
1970-75	38.1	30.8	7.3	5.6	24.9	3.8	23.5	16.7	5.1
1976-80	33.1	27.4	5.7	4.6	31.4	7.6	19.7	40.5	5.7
1981-85	30.2	23.8	6.4	4.1	33.5	12.6	16.6	64.2	6.4
1986-90	29.5	23.1	6.4	3.1	35.9	13.3	15.8	72.1	5.8
1991-94	28.5	21.7	6.8	2.3	35.5	11.5	18.1	73.5	5.1
Germany									
1970-75	42.6	23.9	18.7	4.5	34.7	2.6	10.0	19.8	5.6
1976-80	41.8	23.1	18.7	4.5	36.3	3.6	7.2	29.9	5.8
1981-85	42.3	22.8	19.5	4.1	35.8	5.9	5.6	40.3	7.0
1986-90	42.2	22.4	19.8	4.7	35.5	6.1	5.2	43.6	6.4
1991-95	40.4	21.6	18.8	4.3	35.8	6.7	5.4	51.1	6.4
France									
1970-75	38.7	28.7	10.0	4.4	39.3	2.4	8.8	45.8	2.0
1976-80	39.2	39.9	9.3	4.4	40.9	2.9	7.2	34.1	3.8
1981-85	38.0	28.6	9.4	4.5	42.0	4.7	6.0	35.1	6.9
1986-90	36.7	27.3	9.4	3.8	42.7	5.6	6.3	40.3	6.9
1991-95	36.0	26.4	9.6	3.0	42.9	6.7	6.3	50.3	7.1
UK									
1970-75	49.2	30.0	19.2	6.0	21.5	9.6	12.0	71.9	5.3
1976-80	49.5	29.6	19.9	5.8	23.9	10.3	7.3	58.3	7.5
1981-85	49.1	28.6	20.5	4.9	28.1	11.0	4.2	53.4	9.1
1986-90	51.3	29.7	21.6	3.3	28.8	9.9	4.7	42.6	9.2
1991-95	51.1	26.1	25.1	2.5	31.3	7.3	4.5	43.8	7.2
Italy									
1970-75	39.4	29.5	9.9	6.0	35.6	6.4	8.5	52.7	4.5
1976-80	34.6	25.9	8.7	7.1	34.8	11.7	7.5	59.9	8.0
1981-85	33.4	24.7	8.7	6.1	34.4	15.2	7.6	72.2	10.2
1986-90	32.8	23.6	9.2	5.1	34.3	16.8	6.7	94.8	9.1
1991-94	32.0	22.9	9.1	4.1	35.1	20.4	5.2	112.3	9.9

Notes:

1/ W = Wage Component; NW = Nonwage Component. Consumption components for the UK are available until 1994; Subs = Subsidies; SocSec = Social Security; Intst = Interest Payments; Inv = Gross Fixed Investment. Debt is obtained from OECD, *Economic Outlook*, various issues. The debt series (gross financial liabilities) for Italy and the UK have a break: in both cases I used the old series for the 1991-95 period.

Table 6. Phases and Strength of Comovements

	Leading	Lagging	Synchronous		
			Weak		Strong
Peak	$\rho(s)$, $s<0$	$\rho(s)$, $s>0$		$\rho(0)$	
Overall Phase	$LB^- > LB^+$	$LB^+ > LB^-$	$\lvert LB^- - LB^+ \rvert \neq 0$,	$\rho(0)$,	$\lvert LB^- - LB^+ \rvert = 0$

Table 7. Univariate Properties of Cyclical Components 1/

ρ(k)	1	2	3	4	8	12	LB (26)	Ku	Vol.
Real GDP									
Canada	.86	.65	.45	.25	-.21	-.34	278.7	.43	1.65
USA	.86	.68	.47	.26	-.37	-.45	354.6	.18	1.76
Japan	.82	.67	.50	.26	-.32	-.31	281.7	1.67	1.46
Germany	.84	.65	.45	.24	-.36	-.35	319.8	1.59	1.93
France	.83	.64	.40	.19	-.21	-.29	279.3	-.55	1.08
UK	.83	.67	.52	.32	-.30	-.45	354.6	.02	1.82
Italy	.84	.57	.25	-0.03	-.26	0.0	203.8	.65	1.61
A. Receipts									
Indirect Taxes (tind)									
Canada	.64	.28	.03	-.09	-.10	-.13	97.3	3.41	3.67
USA	.78	.55	.28	-.03	-.42	-.07	239.3	.04	1.78
Japan	.25	.23	.17	.19	-.23	-.27	61.7	0.0	4.49
Germany	.69	.61	.45	.24	-.24	-.40	298.6	.19	2.97
France	.55	.34	.14	-.09	-.26	.01	127.8	.14	2.51
UK	.63	.50	.33	.26	.02	-.28	289.7	-.27	3.36
Italy	.86	.54	.16	-.17	-.32	.06	238.6	3.51	3.83
Direct Taxes (ty)									
Canada	.37	.17	.15	.10	-.14	-.20	64.1	1.90	3.91
USA	.60	.45	.23	.14	-.18	-.33	153.3	7.32	4.61
Japan	.14	.29	.25	.23	-.32	-.37	87.3	1.67	7.37
Germany	.58	.31	.10	-.17	-.35	.09	145.8	3.94	4.93
France	.01	.08	-.12	-.04	-.13	.09	41.4	4.16	6.17
UK	.47	.30	.30	.29	-.23	-.29	155.8	.20	6.15
Italy	.86	.59	.26	-.02	-.21	-.27	183.5	.55	3.51
Direct Taxes: Households (tyh)									
Canada	.22	.10	.15	.02	-.20	-.18	50.4	1.74	4.62
USA	.53	.39	.18	.02	-.09	-.30	106.8	9.29	4.55
Japan	.28	.49	.13	.28	-.29	-.31	117.0	1.32	7.14
Germany	.40	.24	-.08	-.17	-.22	.05	82.6	-1.22	5.57
France	.24	.05	.02	.01	-.08	-.09	27.9	-.28	5.84
UK	.52	.34	.33	.37	-.21	-.37	195.8	.22	5.73
Italy	.66	.39	.18	-.07	-.14	-.08	117.2	-.12	4.26
Direct Taxes: Business (tyb)									
Canada	.71	.49	.37	.18	-.39	-.42	282.3	-.71	9.37
USA	.66	.43	.31	.19	-.24	-.23	169.2	1.56	10.20
Japan	-.02	.08	.26	.09	-.33	-.22	39.2	1.76	11.91
Germany	.67	.46	.28	.03	-.36	-.10	155.0	-.28	7.4
France	.08	.10	.08	-.06	-.17	-.08	31.7	12.5	16.27
UK	.33	.30	.23	.02	-.25	-.12	77.7	-.60	20.94
Italy	.49	.13	-.12	-.36	-.17	.29	98.4	.76	14.71

Table 7. Univariate Properties of Cyclical Components 1/

ρ(k)	1	2	3	4	8	12	LB (26)	Ku	Vol.
Social Security Receipts (ssrg)									
Canada	.51	.25	.16	-.02	.04	-.29	95.6	1.02	4.30
USA	.59	.33	.22	.30	-.17	-.03	160.8	1.54	2.33
Japan	-.19	-.16	.23	.01	-.24	-.20	53.9	4.62	6.52
Germany	.74	.45	.23	.09	-.36	-.21	175.2	2.62	2.38
France	.68	.38	.22	.08	-.31	-.11	123.0	.25	1.28
UK	.64	.48	.31	.27	-.14	-.29	248.1	.22	3.35
Italy	.80	.48	.15	-.11	-.41	.22	275.9	-.49	1.68
Current Receipts (yrg)									
Canada	.52	.21	.02	-.10	-.12	-.03	65.3	1.10	2.25
USA	.70	.51	.27	.14	-.32	-.31	172.2	4.06	2.62
Japan	.06	.19	.24	.22	-.32	-.43	87.0	.92	4.03
Germany	.71	.49	.27	.03	-.31	-.15	170.0	.19	2.64
France	.31	.14	-.07	-.02	-.20	.06	63.5	2.33	1.68
UK	.61	.41	.35	.26	-.31	-.32	206.2	-.14	2.83
Italy	.77	.39	.02	-.22	.01	-.02	135.3	3.07	1.79
B. Disbursements									
Government Consumption (cg)									
Canada	.51	.25	.18	.25	-.10	-.18	127.4	-.28	1.24
USA	.61	.31	.24	.14	-.25	-.02	139.4	1.29	.79
Japan	.51	.21	-.03	-.26	-.13	-.04	69.9	5.69	1.35
Germany	.80	.61	.42	.24	-.48	-.41	354.6	3.07	2.57
France	.73	.45	.18	0.0	-.35	-.18	212.6	1.05	.81
UK	.55	.43	.24	-.02	-.37	-.01	123.5	.84	1.02
Italy	.75	.50	.32	.16	-.24	-.31	175.0	1.04	.63
Government Consumption: Wages (cgw)									
Canada	.63	.24	.07	-.07	-.17	-.21	115.3	.45	1.33
USA	.87	.70	.54	.35	-.13	-.42	333.6	1.67	.77
Japan	.89	.61	.26	-.05	-.29	-.06	257.4	4.49	.95
Germany	.71	.52	.32	.14	-.29	-.33	211.6	5.03	2.20
France	.95	.82	.65	.45	-.19	-.38	479.4	-.29	.52
UK	.91	.71	.46	.20	-.34	-.24	250.2	2.12	1.74
Italy	.83	.56	.24	-.04	-.25	-.09	157.9	.68	.46
Government Consumption: Non-Wages (cgnw)									
Canada	.32	.01	.07	.19	-.14	-.19	61.5	.05	3.53
USA	.57	.25	.17	.06	-.34	-.07	137.5	.89	2.21
Japan	.29	.05	-.14	-.31	-.04	-.07	36.4	6.62	7.97
Germany	.81	.62	.43	.24	-.53	-.43	389.5	2.09	3.46
France	.65	.36	.14	.02	-.13	-.06	97.4	2.89	3.45
UK	.44	.36	.22	.03	-.11	-.09	85.6	.88	2.56
Italy	.74	.40	.13	-.05	-.19	-.16	114.3	.62	2.28

Table 7. Univariate Properties of Cyclical Components 1/

ρ(k)	1	2	3	4	8	12	LB (26)	Ku	Vol.
Subsidies (sub)									
Canada	.68	.49	.34	.13	-.41	-.33	262.1	.65	1.53
USA	.67	.39	.10	-.14	-.26	-.04	170.4	1.07	13.70
Japan	-.33	0.0	-.09	.09	-.26	-.10	43.6	5.07	20.06
Germany	.22	.20	.07	.05	-.34	-.17	53.6	1.48	9.10
France	.21	.10	.02	.25	-.05	-.11	34.2	2.16	8.17
UK	.70	.57	.39	.14	-.35	-.39	266.0	2.20	12.35
Italy	.85	.50	.06	-.30	-.25	.14	233.1	.60	5.62
Transfers (sspg)									
Canada	.66	.53	.36	.21	-.14	-.32	225.6	-.67	3.01
USA	.61	.44	.25	.11	-.19	-.31	134.7	2.42	2.86
Japan	.01	.24	.15	.03	-.07	-.22	34.1	1.30	3.46
Germany	.75	.49	.32	.16	-.38	-.35	240.8	.41	2.67
France	.61	.35	.14	-.18	-.26	-.09	127.0	1.63	1.43
UK	.68	.47	.35	.12	-.19	-.23	161.7	-.37	3.10
Italy	.85	.51	.11	-.23	-.22	.06	196.0	-.61	2.23
Interest Payments (ypepg)									
Canada	.69	.48	.20	.04	-.48	-.09	193.9	-.91	3.42
USA	.72	.46	.28	.09	-.35	-.08	161.4	.17	5.75
Japan	.43	.50	.03	.01	-.30	0.0	93.3	1.34	5.51
Germany	.31	.12	.39	.20	-.37	-.29	105.1	1.68	6.27
France	.89	.63	.31	.04	-.18	-.35	255.6	1.19	6.90
UK	.35	.54	.12	.17	-.14	-.18	64.4	.63	6.09
Italy	.86	.61	.32	.07	-.20	-.20	255.9	.03	4.05
Current Expenditure (ypg)									
Canada	.73	.51	.39	.22	-.20	-.28	281.7	-.20	1.83
USA	.71	.48	.29	.08	-.21	-.30	210.4	.39	1.18
Japan	.04	.13	.17	.04	-.25	-.20	39.3	2.79	2.10
Germany	.81	.62	.39	.21	-.36	-.35	263.0	2.42	2.25
France	.68	.49	.34	.21	-.16	-.19	202.6	.06	1.29
UK	.57	.44	.31	.20	-.09	-.37	188.4	.57	2.08
Italy	.74	.47	.19	-.10	-.28	.10	155.6	-.39	2.01
Gross Fixed Investment (ig)									
Canada	.75	.45	.16	-.09	-.48	.01	205.5	-.77	3.18
USA	.62	.38	.25	.24	-.40	-.40	239.9	.39	3.86
Japan	.72	.50	.30	.14	-.41	-.29	210.1	1.34	5.51
Germany	.43	.28	.18	.21	-.25	-.38	133.1	.38	6.30
France	.81	.64	.42	.19	-.44	-.20	357.5	.31	3.39
UK	.62	.34	.13	.02	-.25	-.08	115.5	1.81	8.18
Italy	.92	.74	.51	.30	-.25	-.61	478.6	-.34	3.65

Table 7. Univariate Properties of Cyclical Components 1/

ρ(k)	1	2	3	4	8	12	LB (26)	Ku	Vol.
Total Expenditure (tg)									
Canada	.76	.53	.38	.21	-.20	-.26	285.1	-.39	1.99
USA	.68	.45	.27	.04	-.23	-.25	203.0	.22	1.22
Japan	-.22	-.02	.05	.10	-.35	-.25	82.1	1.33	3.30
Germany	.42	.32	.24	.33	-.13	-.32	130.1	2.81	3.16
France	.67	.51	.33	.24	-.19	-.18	237.3	.34	1.35
UK	.59	.47	.33	.19	-.13	-.28	162.9	.41	2.38
Italy	.82	.49	.08	-.28	-.38	.42	354.3	-.08	2.13
Primary Expenditure (pg)									
Canada	.77	.56	.41	.24	-.16	-.30	313.2	-.67	2.30
USA	.67	.44	.25	0.0	-.25	-.21	186.7	.16	1.30
Japan	-.22	-.01	.06	.11	-.34	-.31	77.9	1.40	3.60
Germany	.40	.31	.23	.32	-.11	-.16	123.9	3.27	3.27
France	.61	.46	.28	.22	-.18	-.14	202.4	.32	1.30
UK	.57	.51	.32	.22	-.12	-.28	177.7	.21	2.58
Italy	.84	.50	.09	-.28	-.39	.39	352.5	.01	2.19
C. Balances 2/									
Net Government Lending (nlg)									
Canada	.69	.45	.28	.11	-.07	-.31	212.3	.57	3.32
USA	.77	.58	.34	.15	-.31	-.36	222.3	4.10	3.29
Japan	.87	.65	.36	.05	-.38	0.0	234.4	.42	2.50
Germany	.37	.16	.09	.18	-.28	-.35	79.7	.92	3.10
France	.48	.33	.09	.02	-.25	.06	97.6	1.92	2.14
UK	.54	.41	.35	.23	-.11	-.20	179.6	-.31	3.12
Italy	.87	.52	.08	-.32	-.48	.51	552.5	3.27	2.59
Primary Balance (pnlg)									
Canada	.72	.49	.32	.14	-.09	-.32	229.0	.13	3.66
USA	.76	.57	.32	.12	-.32	-.32	206.7	4.13	3.36
Japan	.86	.65	.34	.03	-.40	.02	230.0	.13	2.56
Germany	.35	.14	.09	.19	-.13	.02	76.2	1.15	3.21
France	.43	.29	.06	.02	-.26	.07	87.0	1.77	2.06
UK	.58	.46	.36	.24	-.12	-.21	197.3	-.20	3.42
Italy	.86	.52	.08	-.31	-.45	.45	513.9	2.23	2.77

Notes:
1/ ρ(k) = autocorrelation at lag k; Ku = Kurtosis; Vol = Volatility (standard deviation of the cyclical component * 100).
2/ Since net government lending (NLG) and primary balances (pnlg = NLG + YPEPG) contain negative values, I applied the HP filter to the log of the ratio between total revenues and total (primary) expenditures.

Table 8. Comovements – Receipts

Cross Correlations of Real GDP with Real X_{t+j}

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Indirect Taxes														
Canada	2.21	-.29	-.25	-.14	.03	.27	.44	.45	.37	.26	.17	.09	40.5	250.7
USA	1.01	.10	.23	.39	.50	.51	.46	.27	.07	-.14	-.27	-.37	77.8	33.4
Japan	3.05	.04	.11	.16	.32	.40	.47	.48	.42	.35	.24	.16	31.5	64.6
Germany	1.53	.09	.25	.43	.63	.71	.77	.67	.55	.38	.19	.05	123.7	100.2
France	2.32	.18	.27	.43	.51	.52	.52	.35	.19	0.0	-.15	-.24	89.2	25.7
UK	1.84	-.08	.10	.16	.25	.34	.44	.39	.42	.40	.34	.28	24.0	74.5
Italy	2.34	-.13	-.06	.06	.22	.37	.44	.41	.26	.04	-.18	-.34	21.5	40.7
Direct Taxes														
Canada	2.36	-.21	-.20	-.17	-.02	.18	.31	.34	.38	.40	.38	.41	16.3	80.3
USA	2.62	-.05	.09	.20	.40	.56	.72	.68	.58	.47	.33	.21	56.4	128.0
Japan	5.05	-.15	-.06	-.02	.10	.19	.27	.44	.48	.54	.50	.51	7.6	129.1
Germany	2.55	-.28	-.23	-.09	.11	.33	.52	.59	.57	.45	.30	.11	28.5	162.8
France	5.69	-.10	-.12	-.05	-.06	.12	.17	.03	.07	.04	-.01	-.09	5.2	1.8
UK	3.38	-.24	-.28	-.32	-.23	-.14	-.02	.03	.05	.18	.22	.34	33.9	22.2
Italy	2.19	.28	.24	.15	.04	-.06	-.15	-.23	-.24	-.19	-.09	.05	17.5	16.0
Direct Taxes: Households														
Canada	2.79	-.20	-.26	-.33	-.22	-.06	.04	.11	.21	.27	.26	.34	29.6	34.4
USA	2.59	-.18	-.08	-.01	.18	.34	.49	.56	.55	.50	.40	.31	20.4	122.4
Japan	4.90	-.16	-.04	.10	.22	.37	.40	.58	.54	.57	.42	.35	23.6	130.2
Germany	2.79	-.36	-.31	-.21	-.04	.19	.43	.49	.46	.42	.34	.18	34.0	83.4
France	5.39	-.07	-.10	-.07	-.05	-.13	-.18	-.27	-.25	-.18	-.09	-.07	4.2	19.5
UK	3.15	-.25	-.33	-.43	-.35	-.28	-.20	-.11	-.10	-.03	.07	.24	59.7	9.6
Italy	2.65	-.12	-.21	-.16	-.07	.03	.11	.13	.13	.10	.06	.07	9.5	5.5
Direct Taxes: Business														
Canada	5.67	0.0	.13	.31	.43	.52	.59	.50	.39	.33	.27	.17	62.1	67.2
USA	5.79	.34	.39	.38	.43	.37	.31	.09	-.02	-.15	-.12	-.14	80.0	7.0
Japan	8.17	-.09	-.06	-.09	-.01	0.0	.10	.20	.27	.33	.38	.43	2.0	58.8
Germany	3.85	-.22	-.15	.04	.16	.19	.39	.26	.12	0.0	-.09	-.22	14.4	15.2
France	14.99	-.03	-.01	.04	.16	.28	.37	.27	.30	.18	.01	-.11	11.7	22.2
UK	11.51	-.06	-.01	.07	.13	.20	.30	.29	.31	.44	.34	.31	7.3	64.5
Italy	9.15	.47	.52	.35	.10	-.15	-.35	-.46	-.47	-.35	-.18	-.03	69.2	61.4

Table 8. Comovements – Receipts

Cross Correlations of Real GDP with Real $X_{t\pm j}$

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Social Security Revenues														
Canada	2.60	-.06	-.13	-.11	-.12	-.12	-.08	-.09	-.20	-.24	-.24	-.26	6.6	25.7
USA	1.33	-.25	-.12	.03	.24	.48	.67	.68	.63	.55	.40	.18	39.3	145.3
Japan	4.47	0.0	.01	.07	.02	-.10	-.10	-.05	-.15	-.13	-.12	.03	1.5	6.2
Germany	1.23	-.31	-.13	.05	.21	.43	.68	.66	.55	.41	.28	.19	37.9	110.8
France	1.18	-.03	-.07	-.08	-.02	.03	.13	.15	.15	.16	.15	.11	1.6	11.2
UK	1.84	.08	.03	.02	.04	.06	.08	.06	-.02	-.08	-.08	-.13	1.4	3.8
Italy	1.05	-.06	.11	.18	.19	.14	.06	.01	-.01	0.0	.03	.11	10.8	1.5
Current Revenues														
Canada	1.36	-.29	-.28	-.19	.01	.30	.53	.54	.48	.39	.30	.25	31.4	90.7
USA	1.49	-.08	.08	.23	.46	.65	.82	.76	.63	.49	.32	.16	75.4	145.7
Japan	2.77	-.08	.02	.07	.21	.23	.31	.46	.42	.43	.37	.41	11.5	91.9
Germany	1.37	-.22	-.07	.13	.35	.58	.80	.78	.70	.52	.33	.15	57.8	161.4
France	1.55	-.09	-.09	.04	.19	.27	.36	.21	.19	.10	.05	-.04	13.7	10.3
UK	1.55	-.31	-.29	-.29	-.15	0.0	.16	.21	.25	.33	.35	.40	30.8	54.6
Italy	1.11	0.0	.11	.18	.23	.26	.23	.17	.09	0.0	-.07	-.07	17.1	4.8

Table 9. Comovements – Disbursements

Cross Correlations of Real GDP with Real $X_{t\pm j}$

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Government Consumption														
Canada	.75	-.33	-.33	-.35	-.36	-.37	-.31	-.25	-.22	-.07	.04	.16	65.8	15.9
USA	.45	-.04	-.06	-.12	-.17	-.18	-.11	-.02	.07	.20	.34	.40	8.8	35.1
Japan	.93	.10	.14	.11	.06	.04	.03	-.17	-.27	-.41	-.48	-.44	5.1	74.0
Germany	1.33	-.36	-.17	-.01	.15	.38	.65	.67	.65	.59	.52	.41	35.2	179.4
France	.75	.29	.27	.20	.11	0.0	-.08	-.25	-.34	-.37	-.26	-.15	23.0	44.7
UK	.56	-.39	-.35	-.36	-.27	-.19	-.11	-.11	-.04	0.0	.02	.21	56.7	6.5
Italy	.39	.42	.37	.29	.24	.15	.04	.01	-.08	-.13	-.13	-.09	49.6	5.3
Government Consumption: Wages														
Canada	.81	0.0	-.04	-.10	-.14	-.17	-.28	-.41	-.47	-.43	-.28	-.06	6.5	70.6
USA	.44	-.22	-.10	.02	.11	.19	.27	.35	.43	.52	.58	.63	11.5	142.3
Japan	.65	.08	.05	.04	.02	-.03	-.11	-.23	-.38	-.52	-.62	-.63	1.3	133.2
Germany	1.14	-.18	-.01	.14	.29	.50	.72	.63	.55	.43	.34	.25	41.5	113.2
France	.48	.05	-.01	-.09	-.18	-.26	-.35	-.44	-.51	-.55	-.55	-.54	11.9	147.6
UK	.95	-.20	-.24	-.27	-.28	-.26	-.22	-.16	-.10	-.03	.05	.17	33.7	7.0
Italy	.29	.09	.12	.15	.18	.19	.17	.15	.09	.01	-.08	-.17	12.0	7.1
Government Consumption: Nonwages														
Canada	2.13	-.33	-.31	-.28	-.26	-.24	-.10	.04	.11	.25	.24	.21	44.7	19.7
USA	1.26	.11	0.0	-.15	-.28	-.34	-.33	-.29	-.25	-.20	-.10	-.07	24.4	22.0
Japan	5.46	.19	.28	.27	.20	.18	.20	-.03	-.09	-.19	-.25	-.15	27.5	13.8
Germany	1.79	.22	.41	.52	.64	.74	.73	.47	.29	.15	.02	-.17	157.1	39.1
France	3.18	.35	.38	.34	.28	.18	.11	-.07	-.15	-.17	-.07	.03	54.0	6.9
UK	1.41	-.33	-.26	-.26	-.16	-.08	-.02	-.04	.02	.03	.02	.17	29.3	3.6
Italy	1.42	.41	.34	.24	.16	.05	-.05	-.10	-.14	-.14	-.07	.03	38.8	5.9
Subsidies														
Canada	9.22	-.12	-.18	-.19	-.23	-.25	-.16	-.09	-.09	-.03	.04	.06	21.1	2.5
USA	7.79	.41	.44	.39	.24	.01	-.18	-.31	-.41	-.46	-.45	-.40	62.8	92.0
Japan	13.76	-.01	-.01	-.01	-.05	-.08	-.09	.05	-.04	.06	.10	.15	0.9	4.1
Germany	4.70	.05	.15	.30	.38	.39	.42	.32	.23	.12	-.01	-.10	44.4	19.5
France	7.53	-.30	-.28	-.28	-.28	-.24	-.26	-.22	-.21	-.13	-.06	-.05	41.7	12.3
UK	6.78	-.36	-.38	-.45	-.38	-.34	-.25	-.07	.06	.18	.29	.33	80.5	25.7
Italy	3.50	.55	.36	.09	-.20	-.43	-.55	-.56	-.45	-.27	-.08	.08	71.0	62.4

Table 9. Comovements – Disbursements

Cross Correlations of Real GDP with Real $X_{t\pm j}$

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Transfers														
Canada	1.82	.19	.09	-.01	-.21	-.43	-.58	-.69	-.66	-.58	-.43	-.38	29.4	171.0
USA	1.62	.01	-.05	-.13	-.28	-.38	-.52	-.61	-.60	-.54	-.43	-.27	26.5	139.0
Japan	2.37	-.05	-.10	-.06	-.11	-.22	-.31	-.31	-.30	-.32	-.24	-.09	7.7	37.4
Germany	1.38	-.21	-.11	-.07	0.0	.12	.25	.21	.22	.23	.25	.26	8.6	30.9
France	1.32	.07	.05	-.01	-.09	-.19	-.25	-.39	-.37	-.27	-.15	.01	5.6	42.0
UK	1.70	.32	.22	.16	0.0	-.17	-.31	-.50	-.63	-.64	.57	.51	22.1	178.5
Italy	1.39	.15	.15	.09	-.04	-.21	-.40	-.50	-.48	-.31	-.03	.28	10.4	68.0
Interest Payments														
Canada	2.07	-.29	-.26	-.17	-.12	.02	.18	.34	.36	.28	.22	.14	21.3	42.3
USA	3.27	-.19	-.21	-.17	-.12	-.09	.02	.04	-.03	-.15	-.22	-.31	14.8	18.8
Japan	2.61	0.0	.15	.34	.40	.45	.36	.27	.09	-.07	-.24	-.38	52.2	31.3
Germany	3.24	-.27	-.26	-.19	-.17	-.12	.04	.08	.09	.16	.17	.14	24.3	9.6
France	6.36	-.14	-.22	-.33	-.45	-.56	-.62	-.56	-.41	-.20	.01	.17	76.0	58.6
UK	3.35	.01	.07	.09	.16	.23	.30	.35	.34	.29	.30	.16	9.8	47.1
Italy	2.52	-.21	-.28	-.35	-.40	-.42	-.39	-.33	-.20	-.05	.11	.27	61.6	24.0
Current Expenditures														
Canada	1.11	-.08	-.17	-.27	-.44	-.53	-.52	-.51	-.48	-.37	-.25	-.16	62.1	77.1
USA	.67	.02	-.04	-.14	-.30	-.42	-.51	-.58	-.57	-.50	-.36	-.21	30.3	118.0
Japan	1.45	-.02	-.02	-.01	-.14	-.24	-.28	-.26	-.32	-.29	-.16	.02	8.1	29.4
Germany	1.16	-.22	-.06	.13	.32	.42	-.53	.46	.42	.37	.31	.25	38.0	74.0
France	1.19	-.16	-.22	-.28	-.30	-.38	-.41	-.47	-.43	-.30	-.10	.11	42.5	56.4
UK	1.14	-.16	-.22	-.31	-.31	-.30	-.28	-.24	-.23	.19	-.07	.03	38.4	16.6
Italy	1.25	.20	.13	.05	-.07	-.23	-.38	-.41	-.32	-.15	.07	.31	12.3	40.8
Gross Fixed Investment														
Canada	1.92	-.40	-.37	-.27	-.21	-.15	-.10	.05	.07	.18	.26	.29	48.0	20.9
USA	2.27	-.42	-.46	-.45	-.37	-.22	-.01	.20	.38	.49	.53	.52	82.0	102.3
Japan	3.78	.34	.43	.48	.43	.40	.37	.10	-.04	-.16	-.22	-.24	92.5	15.7
Germany	3.25	-.24	-.19	-.13	.03	.20	.47	.47	.51	.50	.45	.37	16.2	116.4
France	3.12	-.11	-.07	-.03	-.01	0.0	.01	-.07	-.10	-.12	-.08	.04	1.9	4.1
UK	4.49	-.27	-.26	-.25	-.21	-.17	-.10	-.05	-.04	-.05	-.03	-.03	31.1	0.9
Italy	2.27	-.42	-.46	-.45	-.37	-.22	-.01	.20	.38	.49	.53	.52	82.0	102.3

Table 9. Comovements – Disbursements

Cross Correlations of Real GDP with Real $X_{t\pm j}$

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Total Expenditure														
Canada	1.20	-.08	-.19	-.30	-.46	-.55	-.55	-.53	-.48	-.36	-.23	-.12	69.6	76.2
USA	.69	-.01	-.08	-.17	-.28	-.36	-.40	-.47	-.46	-.38	-.22	-.06	26.7	68.8
Japan	2.26	.02	.11	.12	.21	.11	.10	.16	.04	.02	-.02	.11	8.7	4.2
Germany	1.63	-.17	-.04	.15	.28	.38	.47	.37	.42	.34	.28	.19	30.4	59.5
France	1.25	-.13	-.21	-.26	-.27	-.33	-.35	-.42	-.39	-.30	-.12	.09	34.2	47.6
UK	1.31	-.34	-.39	-.43	-.37	-.31	-.23	-.17	-.13	-.08	.03	.11	76.0	7.0
Italy	1.33	.39	.33	.15	-.09	-.33	-.50	-.52	-.37	-.11	.20	.49	42.2	73.1
Primary Expenditures														
Canada	1.39	0.0	-.12	-.25	-.43	-.57	-.62	-.65	-.62	-.49	-.34	-.20	63.2	129.8
USA	.74	.03	-.04	-.13	-.26	-.34	-.41	-.48	-.46	-.36	-.19	-.02	21.8	65.7
Japan	2.47	.02	.10	.09	.19	.09	.08	.15	.04	.03	-.01	.12	6.4	4.1
Germany	1.69	-.14	-.01	.17	.32	.41	.47	.37	.42	.33	.26	.17	33.8	57.2
France	1.20	-.10	-.17	-.22	-.21	-.26	-.28	-.37	-.36	-.29	-.13	.06	21.5	40.3
UK	1.42	-.35	-.41	-.45	-.40	-.36	-.29	-.23	-.20	-.13	-.02	.08	84.7	12.9
Italy	1.36	.48	.44	.27	.02	-.22	-.42	-.47	-.35	-.10	.19	.46	57.9	63.3

Table 10. Cross Correlations of Real GDP with Real $X_{t\pm j}$

	RV	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Net Government Lending														
Canada	3.32	-.15	-.07	.05	.28	.53	.68	.68	.61	.38	.30	.24	42.3	135.7
USA	3.29	-.06	.09	.25	.47	.65	.80	.78	.67	.53	.34	.15	77.2	159.9
Japan	2.50	-.14	-.10	-.04	.07	.22	.37	.52	.63	.66	.63	.52	9.1	186.5
Germany	3.10	-.02	-.02	-.03	.01	.11	.20	.28	.16	.09	0.0	-.06	1.4	12.7
France	2.14	.02	.06	.20	.32	.42	.50	.43	.40	.27	.11	-.09	35.0	47.3
UK	3.12	-.02	.04	.07	.17	.15	.24	.33	.32	.36	.29	.28	9.5	54.2
Italy	2.59	-.32	-.20	0.0	.24	.45	.57	.54	.37	.09	-.22	-.45	41.4	71.7
Primary Balance														
Canada	3.66	-.18	-.10	.04	.28	.54	.71	.75	.68	.55	.40	.28	44.7	168.2
USA	3.36	-.08	.08	.23	.45	.64	.80	.78	.67	.52	.33	.13	73.5	156.9
Japan	2.57	-.14	-.10	-.02	.08	.24	.37	.51	.61	.64	.60	.47	9.8	171.0
Germany	3.21	-.04	-.05	-.06	-.03	.07	.17	.26	.15	.09	.01	-.05	1.4	10.6
France	2.06	-.01	.03	.17	.29	.38	.47	.40	.38	.27	.12	-.07	28.2	43.5
UK	3.42	.01	.07	.10	.18	.27	.36	.35	.35	.37	.31	.27	13.2	60.3
Italy	2.77	-.37	-.28	-.09	.13	.34	.48	.48	.33	.08	-.20	-.41	38.1	57.8

Table 11. Shares

Cross Correlations of Real GDP with $(X/GDP)_{t+j}$ Shares

	Mean	SD	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Indirect Taxes															
Canada	12.9	.39	-.31	-.37	-.39	-.34	-.19	-.10	-.02	-.02	-.03	-.01	0.0	59.0	0.2
USA	8.1	.14	-.02	-.11	-.15	-.25	-.40	-.55	-.57	-.56	-.54	.31	.31	27.6	131.3
Japan	7.4	.29	.09	.07	.02	.12	.13	.09	.16	.12	.08	.05	.05	4.7	5.4
Germany	12.8	.23	.08	.13	.21	.33	.26	.15	.14	.13	.06	-.03	-.04	27.2	4.6
France	14.4	.29	.10	.10	.20	.21	.13	.08	0.0	-.06	-.14	-.19	-.21	13.2	10.9
UK	15.0	.45	-.16	-.07	-.13	-.11	-.09	-.09	-.05	.05	.09	.13	.12	7.4	5.0
Italy	9.4	.30	-.03	-.05	-.07	-.07	-.06	-.05	.01	.01	-.05	-.16	-.23	1.7	8.4
Direct Taxes															
Canada	15.1	.56	-.28	-.33	-.39	-.32	-.20	-.12	-.02	.11	.22	.29	.39	52.3	33.0
USA	13.4	.46	-.09	-.01	.02	.18	.31	.45	.46	.43	.40	.32	.26	14.8	78.9
Japan	11.0	.70	-.13	-.09	-.09	-.01	.05	.10	.30	.37	.47	.46	.52	3.9	98.4
Germany	12.1	.49	-.34	-.37	-.31	-.16	0.0	.15	.31	.37	.32	.23	-.10	41.6	43.1
France	8.3	.47	-.11	-.16	-.13	-.06	-.03	-.03	-.13	-.05	-.04	-.04	-.10	6.4	3.3
UK	13.7	.87	-.28	-.37	-.46	-.41	-.37	-.32	-.22	-.15	.01	.11	.27	79.5	17.3
Italy	10.2	.39	.17	.07	-.08	-.25	-.40	-.49	-.44	-.31	-.13	.05	.22	27.3	37.8
Direct Taxes: Households															
Canada	11.9	.57	-.24	-.36	-.49	-.46	-.37	-.31	-.19	-.02	.10	.17	.30	84.6	18.0
USA	10.6	.41	-.25	-.23	-.24	-.11	-.01	.10	.24	.33	.38	.36	.35	20.6	61.9
Japan	6.2	.39	-.17	-.08	0.0	.10	.23	.22	.43	.43	.49	.38	.37	10.2	92.6
Germany	7.4	.32	-.45	-.48	-.44	-.33	-.13	.08	.22	.27	.31	.32	.21	83.0	40.2
France	5.9	.34	-.10	-.16	-.17	-.19	-.27	-.36	-.40	-.35	-.23	-.10	-.05	18.6	37.4
UK	11.2	.74	-.26	-.38	-.52	-.50	-.49	-.48	-.36	-.30	-.20	-.05	.15	105.7	30.4
Italy	8.3	.35	-.11	-.24	-.29	-.32	-.32	-.29	-.19	-.05	.05	.14	.23	37.6	11.8
Direct Taxes: Business															
Canada	3.2	.28	-.04	.06	.21	.29	.35	.40	.33	.26	.24	.24	.17	28.3	34.8
USA	2.9	.24	.25	.38	.45	.55	.63	.71	.49	.28	.13	.01	-.09	121.7	37.1
Japan	4.8	.53	-.05	-.05	-.12	-.08	-.10	-.03	.08	.17	.26	.33	.41	3.8	40.8
Germany	4.1	.28	-.09	-.11	-.06	.03	.08	.14	.22	.24	.15	.09	.03	3.4	15.0
France	2.4	.34	-.05	-.05	-.01	.10	.23	.32	.22	.28	.18	.05	-.07	7.2	18.4
UK	2.5	.46	-.11	-.09	-.03	.03	.09	.18	.15	.19	.34	.29	.26	3.3	35.8
Italy	1.9	.24	.42	.46	.30	.07	-.17	-.37	-.44	-.43	-.29	-.13	.02	54.7	50.0

Table 11. Shares

Cross Correlations of Real GDP with $(X/GDP)_{t\pm j}$ Shares

	Mean	SD	X_{t-5}	X_{t-4}	X_{t-3}	X_{t-2}	X_{t-1}	X_t	X_{t+1}	X_{t+2}	X_{t+3}	X_{t+4}	X_{t+5}	LB^-	LB^+
Social Security Receipts															
Canada	4.1	.18	-.05	-.19	-.26	-.34	-.41	-.44	-.43	-.46	-.44	-.38	-.34	42.3	93.0
USA	8.1	.13	-.37	-.41	-.43	-.38	-.26	-.14	.01	.13	.24	.26	.19	77.1	20.0
Japan	7.2	.47	-.04	-.05	-.05	-.09	-.19	-.25	-.15	-.19	-.18	-.13	.06	5.4	11.4
Germany	16.5	.30	-.46	-.43	-.43	-.43	-.33	-.18	-.02	.03	.05	.11	.21	96.0	6.8
France	18.8	.28	-.07	-.21	-.36	-.47	-.55	-.57	-.43	-.29	-.12	.01	.10	75.4	31.4
UK	6.2	.22	0.0	-.13	-.23	-.29	-.36	-.43	-.36	-.37	-.35	-.26	-.22	30.9	55.5
Italy	13.2	.30	.11	.08	-.06	-.27	-.49	-.66	-.58	-.40	-.17	.04	.25	35.0	61.8

Table 12. Revenue/Expenditure Correlations

	TIND	TY	SSRG	CG	SUB	SSPG	YPEPG	IG
Canada	1.00	.29 (-1)	—	.32 (-5)	—	-.27 (0)	—	-.28 (+5)
		1.00	-.36 (+3)	.32 (-5)	.25 (-3)	-.43 (+4)	—	—
			1.00	.28 (+3)	.33 (+4)	.31 (+3)	-.26 (+2)	.19 (+4)
				1.00	.40 (+4)	.48 (-3)	—	.33 (0)
					1.00	.22 (-3)	-.45 (+2)	.27 (-2)
						1.00	-.22 (-1)	-.31 (-4)
							1.00	.39 (+2)
								1.00
USA	1.00	.36 (-2)	.54 (-3)	-.29 (+1)	.42 (+3)	.34 (-5)	-.38 (-1)	-.21 (+1)
		1.00	.52 (0)	.23 (-5)	.40 (+4)	-.56 (-1)	-.26 (+5)	.26 (0)
			1.00	.43 (-5)	-.47 (-1)	-.45 (0)	-.31 (-5)	.27 (-5)
				1.00	-.42 (+5)	-.24 (+5)	??	.30 (+1)
					1.00	.37 (+2)	-.32 (+2)	-.21 (0)
						1.00	.21 (-5)	-.31 (-5)
							1.00	—
								1.00
Japan	1.00	.42 (0)	-.23 (+2)	-.34 (-3)	-.20 (+5)	-.29 (-1)	-.42 (-4)	.44 (+3)
		1.00	-.23 (+3)	-.34 (+1)	-.23 (+5)	-.25 (+2)	??	.45 (+5)
			1.00	-.30 (+4)	??	.57 (0)	-.26 (+3)	-.33 (+4)
				1.00	.19 (+4)	.34 (+2)	-.41 (+5)	-.38 (+5)
					1.00	—	—	-.21 (0)
						1.00	-.35 (+3)	-.24 (+5)
							1.00	.27 (+1)
								1.00
Germany	1.00	.44 (-2)	.40 (-2)	.50 (-2)	.44 (0)	—	-.20 (+2)	.41 (-2)
		1.00	.47 (+1)	.35 (0)	.42 (+3)	—	—	.32 (0)
			1.00	.83 (0)	.26 (+1)	.60 (0)	.38 (0)	.54 (0)
				1.00	.29 (+2)	.72 (0)	.32 (-4)	.64 (0)
					1.00	-.24 (+3)	-.20 (+3)	.32 (-5)
						1.00	.28 (-4)	.44 (0)
							1.00	-.19 (-4)
								1.00

Table 12. Revenue/Expenditure Correlations

	TIND	TY	SSRG	CG	SUB	SSPG	YPEPG	IG
France	1.00	-.31 (+3)	—	-.37 (-5)	-.26 (+2)	-.54 (-4)	-.61 (-1)	-.26 (+5)
		1.00	.20 (+4)	-.24 (0)	—	??	.30 (-5)	.22 (+5)
			1.00	—	—	.25 (+5)	.23 (+5)	.36 (+3)
				1.00	-.20 (-1)	.51 (+1)	-.39 (-3)	-.22 (-5)
					1.00	—	.27 (-2)	—
						1.00	.52 (+1)	-.36 (-5)
							1.00	.25 (+5)
								1.00
UK	1.00	-.29 (+3)	-.27 (+5)	-.27 (+5)	-.17 (+3)	-.43 (-2)	.26 (-4)	-.40 (+1)
		1.00	.41 (+1)	.24 (-2)	.35 (+4)	-.36 (+2)	.40 (+2)	—
			1.00	.21 (+2)	.31 (+5)	-.33 (-3)	.32 (0)	—
				1.00	.33 (+4)	-.20 (+5)	-.24 (0)	.27 (0)
					1.00	—	.20 (-1)	.25 (+1)
						1.00	—	—
							1.00	—
								1.00
Italy	1.00	.42 (0)	-.55 (-3)	—	.48 (+5)	.37 (+5)	—	-.26 (+2)
		1.00	—	—	.27 (+2)	.46 (0)	.30 (0)	—
			1.00	—	-.31 (-3)	.30 (+1)	.34 (0)	.25 (+2)
				1.00	-.19 (-5)	.27 (0)	-.30 (-4)	-.35 (+2)
					1.00	.24 (-2)	.26 (+1)	-.37 (-3)
						1.00	.42 (0)	.50 (+4)
							1.00	.61 (+4)
								1.00

APPENDIX I: DATA SOURCES AND DEFINITIONS

Quarterly data for General Government in the G-7 countries stem from the OECD database and are seasonally adjusted. Data range from 1970:1 to 1995:4 for all countries but Italy and Japan for which some series stop earlier (1970:1-1994:4). Data for Germany refer to the unified country, before and after 1990.

The following definitions apply to all countries, though there are in some cases minor differences reflecting availability of data or definitions. For the US the last NIPA revision is utilized so as current and capital accounts are disentangled.

Receipts

YRG = Current Receipts

$$YRG = TY + TIND + SSRG + TRRG + YPERG$$

$$TY = THB + THH$$

where:

TY = Direct Taxes
TYB = Direct Taxes (Business)
TYH = Direct Taxes (Households)

TIND = Indirect Taxes
SSRG = Social Security payments received by Government
TRRG = Current Transfers received by Government
YPERG = Property and entrepreneurial income

and where TRRG is not available for the US.

Disbursements

Total expenditure (TG) includes current expenditure (YPG) and capital account expenditure (KG):

$$TG = YPG + KG$$

$$YPG = CG + TSUB + SSPG + TRPG + YPEPG$$

where:

CG = CGW + CGNW
CG = Government Consumption
CGW = Government Consumption (Wages)
CGNW = Government Consumption (Nonwages)

TSUB = Subsidies
SSPG = Social Security Benefits
TRPG = Other Current Transfers
YPEPG = Net Interest Payments

KG = IG + KTRRG,

where IG and KTRRG denote government investment and net capital transfers respectively.

For France and Italy the consumption variable is given by
CGAA = CGW + CGNW, where CGAA is General Goverment Consumption while CG includes private non-profit institution consumption. For Canada and the US, TRPG is not available as a separate item.

Net capital transfers (KTRRG) are not available for the US. For Canada, Japan, France, and the UK the capital account balance includes expenditures other than fixed investment (RESTG). This is a minor item except for Japan where RESTG denotes net purchases of land that we excluded, however, from our measure of the capital account.

Balances

General Government Net Lending (NLG) is defined as:

NLG = SAVGG - IG + KTRRG,

where SAVGG denotes gross savings and equals the current balance definition:

SAVG = YRG - YPG

i.e. the sum of net savings (SAVG) and consumption of fixed government capital (CFKG):

SAVGG = SAVG + CFKG.

For France and the UK the depreciation variable (CFKG) is not available and therefore gross savings only are reported.

Deflation

In the OECD database - as in the original domestic sources - some variables such as government consumption (CGV) and government fixed investment (IGV) are already available in volume. I constructed real counterparts of revenues by deflating the indirect taxes by the consumption deflator and by deflating all the other variables by the GDP deflator. As far as expenditure is concerned, capital account has been deflated by the government investment deflator. Remaining variables other than transfers have been deflated by the GDP deflator, while real transfers have been obtained by the consumption deflator.

REFERENCES

Alesina, A. and R. Perotti (1995),"Fiscal Expansions and Adjustment in OECD Countries," *Economic Policy*, 21, 207-48.

——, (1996), "Fiscal Adjustment in OECD Countries: Composition and Macroeconomic Effects," IMF Working Paper 96/70.

Aschauer, D.A. (1988),"The Equilibrium Approach to Fiscal Policy," *Journal of Money Credit and Banking*, 20, 41-62.

——, (1989),"Is Public Expenditure Productive?" *Journal of Monetary Economics*, 23, 177-200.

——, "Does Public Crowd Out Private Capital?" *Journal of Monetary Economics*, 24, 171-88.

Atkinson, A.B.(ed.) (1991), *Modern Public Finance,* 2 vols., Elgar, Aldershot.

Auerbach, A.J. and L.J. Kotlikoff (1987), *Dynamic Fiscal Policy*, (Cambridge: Cambridge University Press).

Ayagari, S.R., L.J. Christiano, and M. Eichenbaum (1992), "The Output, Employment, and Interest Rate Effects of Government Consumption," *Journal of Monetary Economics*, 30, 73-86.

Barro, R.J. (1979),"On the Determination of Public Debt", *Journal of Political Economy*, 940-71.

——, (1981), "Output Effects of Government Purchases," *Journal of Political Economy*, 89, 1086-1121.

——, (1989), "The Neoclassical Approach to Fiscal Policy," in R.J. Barro (ed.), *Modern Business Cycle Theory* (Cambridge: Harvard University Press), 178-235.

——, and X. Sala-I-Martin (1992), "Public Finance in Models of Economic Growth," *Review of Economic Studies*, 4, 645-61.

Baxter, M. and R.G. King (1993), "Fiscal Policy in General Equilibrium," *American Economic Review*, 83, 315-34.

Blanchard O.J. (1993), "Suggestions for a New Set of Fiscal Indicators," in H. Verbon and F. van Winder (eds.), *The Political Economy of Government Debt* (Amsterdam: Elsevier Science Publishers), 307-25.

——, and M.W. Watson (1986), "Are Business Cycles All Alike?" in R.J. Gordon (ed.), *The American Business Cycle: Continuity and Change*, The University of Chicago Press, 123-82.

Canova, F. (1993), "Detrending and Business Cycle Facts," CEPR Discussion Paper No. 782.

Cnossen, S. and K. Messere (1990), "Personal Income Tax Reforms in OECD Member Countries," in S. Cnossen and R.M. Bird (eds.), *The Personal Income Tax: Phoenix from the Ashes?* (Amsterdam: North-Holland).

Cogley, T. (1990), "Spurious Business Cycle Phenomena in HP Filtered Time Series," University of Washington, mimeo.

Danthine, J.P. and J. Donaldson (1993), "Methodological and Empirical Issues in Real Business Cycle Theory," *European Economic Review*, 37, 1-35.

Easterly, W. and S. Rebelo (1993), "Fiscal Policy and Economic Growth," *Journal of Monetary Economics*, 417-58.

Feldstein, M.(1982), "Government Deficits and Aggregate Demand," *Journal of Monetary Economics*, 9, 1-20.

——, (1995), "The Effects of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act," *Journal of Political Economy*, 551-72.

Fiorito, R. and T. Kollintzas (1994), "Stylized Facts of Business Cycles in the G-7 from a Real Business Cycles Perspective," *European Economic Review*, 38, 235-69.

Fiorito, R. and F. Padrini (1997), "Distortionary Taxation and Unemployment," EUI Working Paper, Florence.

Frenkel, J.A. and A. Razin (1987), *Fiscal Policy and the World Economy: An Intertemporal Approach*, (Cambridge: The MIT Press).

Giavazzi. F. and M. Pagano (1990), "Can Severe Fiscal Contractions Be Expansionary? Tales of Two Small European Countries," *NBER Macroeconomics Annual*, 75-116.

——, (1996), "Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience," *Swedish Economic Policy Review*, May.

Hall, R.E. (1980), "Labor Supply and Aggregate Fluctuations," *Carnegie-Rochester Series on Public Policy*, 12, 7-33.

Hodrick, R. and E.C. Prescott (1980), "Post-War U.S. Business Cycle: An Empirical Investigation," Carnegie-Mellon University Discussion Paper No. 451.

IMF (1995), *Economic Outlook*, May, Washington D.C.

——, (1996), *Government Finance Statistics Yearbook*, Washington D.C.

Kay, J.A. (1990), "Tax Policy: a Survey," *Economic Journal*, 18-75.

Kendall, M.G. and A. Stuart (1958), *The Advanced Theory of Statistics*, Vol.2, (New York: Hapfner).

King, R.G. and S. Rebelo (1993), "Low Frequency Filtering and Real Business Cycles," *Journal of Economic Dynamics and Control*, 17, 207-31.

Kydland, F. and E.C. Prescott, "Business Cycles: Real Facts and a Monetary Myth," *Federal Reserve Bank of Minneapolis Quarterly Review*, 14, 3-18.

Lucas, R.E. Jr. (1977), "Understanding Business Cycles," in K. Brunner and L.H. Meltzer (eds.), *Stabilization of the Domestic and International Economy*, Carnegie-Rochester Conference Series on Public Policy, 5, 7-29.

Lucas, R.E. and N.L. Stokey (1983), "Optimal Fiscal and Monetary Policy in an Economy without Capital," *Journal of Monetary Economics*, 12, 55-93.

Masson, P. and M. Mussa (1995), "Long-Term Tendencies in Budget Deficits and Debt," IMF Working Paper No. 95/128.

McDermott, C. John and R.F. Wescott (1996), "An Empirical Analysis of Fiscal Adjustment," *International Monetary Fund Staff Papers*, Vol. 43, No. 4 (December).

McGrattan, E.(1994), "The Macroeconomic Effects of Distortionary Taxation," *Journal of Monetary Economics*, 33, 573-601.

Mendoza, E.G., A. Razin, and L.L. Tesar (1993), "An International Comparison of Tax Systems in Industrial Countries," *IMF Staff Studies for the World Economic Outlook*, 86-105.

Musgrave, R.A. (1959), *The Theory of Public Finance*, (New York: McGraw-Hill).

Nelson, C. and C. Plosser (1982), "Trends and Random Walks in Macroeconomic Time Series," *Journal of Monetary Economics*, 10, 139-62.

OECD (1995), *Taxation, Employment and Unemployment*, Paris.

——, (1996a), *Revenue Statistics 1965-1995*, Paris.

——, (1996b), *National Accounts 1960-95 vol 1*, Paris.

——, (1996c), *National Accounts 1982-94 vol.2 Detailed Tables*, Paris.

——, (1996d), *Economic Outlook*, June, Paris.

Roubini, N. and J. Sachs (1989), "Fiscal Policy," *Economic Policy*, April, 100-32.

Saunders, P. and F. Klau (1985), *The Role of Public Sector*, OECD Economic Studies (Paris: OECD).

Stiglitz, J.E. (1988), *Economics of the Public Sector*, (New York: Norton, 2nd edition).

Sutherland, A. (1995), "Fiscal Crisis and Aggregate Demand: Can High Public Debt Reverse the Effects of Fiscal Policy?" CEPR, Working Paper No. 1246.

Tanzi, V. and M.S. Lutz (1993), "Interest Rates and Government Debt: Are the Linkages Global Rather Than National?" in H. Verbon and F. van Winder (eds.), *The Political Economy of Government Debt* (Amsterdam: Elsevier Science Publishers), 233-54.

Tanzi, V. and L. Schuknecht (1995), "The Growth of Government and the Reform of the State in Industrial Countries," IMF Working Paper No. 95/130.

United Nations et al.(1993), *System of National Accounts 1993*, New York.

von Hagen, J. and I. Harden (1994), "National Budget Processes and Fiscal Performance," *European Economy*, 3, 311-418.