Non-technical summary

In recent years, politicians like to ascribe lower growth rates of tax revenues to globalization and the consequences of tax competition. Less interest is paid to another possible explanation: Inflation rates have decreased markedly in industrial countries. The phenomenon of inflation – even of a moderate level - boosting tax revenues is well known under the term "fiscal drag". It is, however, important to differentiate between a real and a nominal type of fiscal drag Nominal fiscal drag can work the following way: With a progressive tax system and in the absence of perfect indexation, inflation shifts taxpayers into tax brackets with higher marginal tax rates. This so called "bracket creep" leads to rising tax income ratios. Since with positive nominal growth this relationship holds even in the absence of any real growth, the phenomenon can be called "nominal fiscal drag". The real type of fiscal drag does not depend on inflation. "Real fiscal drag" exists if the tax income ratio reacts positively to an increasing real income.

For economic thinking it is not very pleasant to accept the existence of nominal fiscal drag since it implies the existence of some form of money illusion in the political system. There is, however, pervasive evidence of empirical psychology for widely spread money illusion. Money illusion in the context of wages has a close relation to money illusion in the context of taxes. In the case of wages workers more likely accept a cut of real wages with nominal wage stability than with nominal reductions of wages. The case of taxes and voters has an equivalent psychological structure: Voters more likely accept an increasing real tax burden with a constant nominal net income than with a shrinking nominal net income.

The degree of money illusion might differ among countries, for different kinds of taxes and it will also depend on the extent of inflation. Fiscal exploitation of money illusion is easy if inflation automatically increases real tax revenues without further political actions required.

With this background it is the objective of this study to measure by the use of time series analysis the extent of both types of fiscal drag for different countries and different kinds of taxes. The time series approach is preferable to looking at the characteristics of a given tax system for a certain point in time. This static approach fails to take into account the fact that the tax system is endogenous itself and that changes of the system are probably driven also by the extent of inflation and real growth.

The study is based on OECD countries' experience since 1965. The results allow for a classification of countries which is helpful to identify cases that indeed might be confronted with a tighter fiscal constraint in the future due to the end of high inflation rates.

The results suggest that the decline of long run average inflation rates will make a fiscal difference for a majority of OECD countries. In these countries, tax revenues benefit from inflation. This overall nominal fiscal drag works mainly through personal income taxes and social security contributions. While the former does not come as a surprise due to well known bracket creeping effects the latter is a new insight. Although social security contributions do in many countries not grow automatically with inflation, it seems to be politically easier to increase contribution ceilings and rates in an inflationary environment. This hints at the relevance of money illusion in the context of taxation. Voters might be more willing to accept a growing real tax and social security burden if the net income does not decrease in nominal terms. In the countries where nominal fiscal drag exists it is persistent. Only in few cases (Belgium and Germany for individual income taxes) inflationary experience of the seventies has induced changes of the fiscal system in the direction of de facto indexation.

Finally, these results are related to present tax reforms. Recent reforms in the OECD tend to decrease income taxes and social security contributions at the cost of higher indirect taxation. Tax revenues thus are restructured away from types with a significant degree of both nominal and real fiscal drag towards types where fiscal drag hardly plays a role – be it of the nominal or real type. Therefore, taking low inflation rates and tax reforms together the presumption seems well founded that fiscal drag comes to an end.

After the Death of Inflation: Will Fiscal Drag Survive?

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Abstract

Declining inflation rates might have negative consequences for tax revenues. Phenomena like the inflationary bracket creep in a progressive income tax system do not work any longer. With this background the paper analyzes the extent of fiscal drag for OECD countries since 1965. Some considerations on the role of money illusion and indexation in this context lay the theoretical base followed by a descriptive view on the relation between inflation, growth and tax revenues in the past decades. A framework is presented that allows for the classification of fiscal structures with regard to the type of fiscal drag. The subsequent econometric analysis is performed for total and disaggregated government revenues. The results reveal that an end of inflation would have a negative impact on tax revenues for a number of OECD countries. The results also back theoretical considerations on inflation's impact on different kinds of taxes: This impact tends to be positive for individual income taxes and social security contributions, it is neutral or negative for corporate income, property and indirect taxation. The paper concludes that both declining inflation and recent trends in tax reforms can be expected to limit the potential for future fiscal drag.

JEL-Classifications: H 20, E 63

Keywords:
bracket creep, fiscal drag, indexation, inflation, money illusion, Olivera-Tanzi effect, taxes, Wagner's law

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1 Introduction

In recent years, politicians like to ascribe lower growth rates of tax revenues to globalization and the consequences of tax competition. Less interest is paid to another possible explanation: Inflation rates have decreased markedly in industrial countries. Countries with formerly high long-run average rates of inflation have succeeded in reducing them to levels close to zero. Although it might be premature to speak about the "death of inflation", it is hard to imagine for industrial countries a return of inflation rates close to the levels of the seventies in the foreseeable future. In Europe, traditional high inflation countries have entered EMU and are subject to a monetary regime that does not allow for an easy way back into inflation.

The achievement of low or even zero inflation rates can be relevant for the development of real government revenues. While the seigniorage dimension has attracted some attention particularly in the EMU context (for example GROS/VANDILLE, 1995), the impact of price stability on tax revenues has been neglected. Studies like JAKSCH (1990) or SADKA (1991) deal with cases of very high inflation. PERSSON/PERSSON/SVENSSON (1998) look into the Swedish case in one specific year (1994) and actually find a substantial impact of inflation on real tax revenues. However, a study is lacking that deals with the long-run consequences of disinflation for revenues in industrial countries as a whole.

The phenomenon of inflation – even of a moderate level - boosting tax revenues is well known under the term "fiscal drag". It is, however, important to differentiate between a real and a nominal type of fiscal drag (URSPRUNG AND WETTSTEIN, 1992). Nominal fiscal drag can work the following way: With a progressive tax system and in the absence of perfect indexation, inflation shifts taxpayers into tax brackets with higher marginal tax rates. This so called "bracket creep" leads to rising tax income ratios. Since with positive nominal growth this relationship holds even in the absence of any real growth the phenomenon can be called "nominal fiscal drag".

The real type of fiscal drag does not depend on inflation. "Real fiscal drag" exists if the tax income ratio reacts positively to an increasing real income. Perfect indexation of tax brackets will not neutralize this type. A perfectly indexed tax system that is nevertheless progressive in real terms leads to rising tax income ratios with positive real growth.

It will depend on the existence of both types of fiscal drag to what extent the era of low inflation will be a restriction for the revenue side of OECD budgets. If it turns out that indexation has spread widely since the inflationary expectations of the 1970s, the death of inflation would make no difference for government revenues. Revenue constraints would then depend on the existence of real fiscal drag and future real growth rates.

With this background it is the objective of this study to measure by the use of time series analysis the extent of both types of fiscal drag. The time series approach is preferable to looking at the characteristics of a given tax system for a certain point in time (as it was done for Sweden by PERSSON/PERSSON/SVENSSON, 1998). This static approach fails to take into account the fact that the tax system is endogenous itself and that changes of the system are probably driven also by the extent of inflation and real growth. There can be a substantial difference between the degree of *de lege* indexation and *de facto* indexation (PADOA SCHIOPPA KOSTORIS, 1993) where the latter takes into account discretionary changes of tax rules that happen in the political process as a reaction to inflation. The German case is an illustrative example. While any formal indexation is absent in the income tax system due to a negative view on indexation in the German legal system, there have been regular adjustments of tax brackets. The constitutional court, the Bundesverfassungsgericht, has played a crucial role for introducing partial indexation by forcing the tax legislator to make tax exempt the subsistence level which is calculated on a real basis. Thus in spite of the complete absence of any formal indexation in German tax tables, there exists today a considerable extent of de facto indexation

Similar considerations apply to real fiscal drag. There can be a substantial difference between the real income elasticity of tax revenues for any given tax table and the de facto elasticity which treats tax tables as endogenous and therefore takes into account their real growth driven adjustments.

Thus it has to be emphasized that the focus of this study is on de facto characteristics of tax systems along the time dimension and not on de lege characteristics of a tax system for a given point in time. The study is based on OECD countries' experience since 1965. The results allow for a classification of countries which is helpful to identify cases that indeed might be confronted with a tighter fiscal constraint in the future due to the end of high inflation rates.

In the following section 2 theoretical considerations on the impact of inflation and growth on different kinds of taxes are presented. Section 3 presents some descriptive statistics both along the time and the cross section dimension. Subsequently, the analytical framework is introduced that allows for the measurement of the existence of both nominal and real fiscal drag (section 4). The econometric approach and the resulting tax profiles are presented in section 5. The final section 6 concludes.

2 Money Illusion and Fiscal Drag

For economic thinking it is not very pleasant to accept the existence of nominal fiscal drag since it implies the existence of some form of money illusion in the political system. If voters would think purely in real terms it is hard to see why politicians could use inflation to impose larger real tax burdens on citizens.

However, there is pervasive evidence of empirical psychology for widely spread money illusion. As SHAFIR ET AL. (1997) put it in their survey on money illusion: "people often think about economic transactions in both nominal and real terms, ... money illusion arises from an interaction between these representations, which results in a bias toward a nominal evaluation". The evidence on the existence of money illusion comes from different fields: In people's assessment of income, transactions, contracts and investments (SHAFIR ET AL., 1997). Money illusion stands also as a central explanation for the phenomenon of nominal downward wage rigidity: Workers and trade unions are more inclined to accept real wage cuts if nominal wages do not shrink (AKERLOF ET AL., 1996).

Money illusion in the context of wages has a close relation to money illusion in the context of taxes. In the case of wages workers more likely accept a cut of real wages with nominal wage stability than with nominal reductions of wages. The case of taxes and voters has an equivalent psychological structure: Voters more likely accept an increasing real tax burden with a constant nominal net income than with a shrinking nominal net income.

The degree of money illusion might differ among countries and it will also depend on the extent of inflation. With low inflation the nominal view leads to judgements that are also reasonable in real terms. Awareness for the importance of real economic considerations can be expected to increase with the inflation rate since people will start to notice that the nominal view is erroneous and leads to wrong decision in everyday life. In the tax context this feeds the expectation that nominal fiscal drag might work better in times of modest inflation rates whereas episodes of high inflation rates will make it harder to increase real taxes under the monetary veil.

The existence of money illusion in taxation will also depend on the type of tax and the type of taxpayer. So it might be less plausible to assume money illusion for companies whose managers are trained to think in economic terms than for private households with a probably lower degree of hard economic thinking.

Apart from that, different taxes offer different scopes for the fiscal exploitation of money illusion. Exploitation is easy if inflation automatically increases real tax revenues without further political actions required. This is the case for a progressive income tax with imperfect indexation of brackets. OATES (1988) subsumes such built-in tax increases which are less clearly perceived than legislated changes under the fiscal illusion heading. Thus, in the case of bracket creeping money illusion mixes with fiscal illusion and both create favorable conditions for a real budget expansion.

Conditions are less favorable if inflation works the opposite way. Inflation automatically reduces real revenues for taxes with a considerable lag between the taxable event and the moment it is actually paid. The negative effect of inflation for real revenues of a tax with a significant collection lag is familiar as the Olivera-Tanzi effect (OLIVERA, 1967 and TANZI, 1977). In industrial countries collection lags are probably relevant in the taxation of profits and property and less important in wage and indirect taxation or in regard to social security contributions which all are paid in a close timely context to the taxable event.

Concerning corporate taxation where the Olivera-Tanzi effect could have relevance it should, however, be mentioned that there are also inflation effects working into the opposite direction (SADKA, 1991). For example, nominal accounting procedures lead to an overstatement of real income if depreciation allowances are calculated on the basis of historic nominal costs. So the overall sign of the impact can not be decided by theoretical considerations alone.

If the Olivera-Tanzi effect dominates other effects, political passivity leads for corporate taxes to a reduction of the real tax burden. In this situation, the existence of money illusion works into the opposite direction compared to individual income taxes: inflation makes it even difficult to keep real tax payments constant because this would require a nominal increase of taxes.

Inflation can be expected to reduce the real turnout of property taxation since Olivera-Tanzi is relevant as well. This kind of taxation is often based on wealth measures of past periods or even on nominally defined tax bases like standard tax values for real estate (in Germany the *Einheitswert*). Here again, money illusion would lead to a decreasing real tax burden.

The highest degree of inflationary neutrality should be expected from proportional taxes without a significant collection lag. These conditions seem to be best fulfilled by transactions taxes like VAT. Abstracting from hyperinflationary situations, neither bracket creep nor collection lag effects are at work that could pave the way for an inflationary impact.

In regard to social security contribution which have an increasing importance for the revenue side of the public sector in OECD countries, the arguments are somewhat contradicting. On the one hand it can be argued that inflation should reduce the real level (ALESINA AND PEROTTI, 1995): Social security contributions often are paid as a flat rate of income up to a maximum value. Even if the latter is adjusted more or less regularly inflation would dampen revenues. On the other hand considerations of money illusion and income taxation apply similarly to social security contributions. If employees regard these contributions as income tax equivalents, the same logic applies: With inflation social security contributions can be increased in real terms without reducing nominal net income. So money illusion can help increasing the real turnout of this type of government revenues. Nevertheless a difference to income taxation remains. In most countries there is no automatism, real increases of social security contributions have to be realized by discretionary steps like increases of contribution rates or ceilings.

Real fiscal drag, i.e. the existence of a positive relation between tax revenues and real income on the macro level, can not be explained by money illusion. It is also difficult to explain long-run real fiscal drag on a macro level simply by the progression of a tax system. Under distributive objectives the real bracket creep has undesirable consequences (STEYN AND FOURIE, 1996): If real growth benefits all income classes it will tend to shift an ever larger share of taxpayers into the top range of marginal tax rates. In the end the progressive system would degenerate to a system of a flat proportional rate unable to achieve corrections of relative income distribution. Therefore, if voters and politicians like progression as an instrument to correct the relative income distribution it can be expected that in the political process tax brackets will be adjusted for real growth. If these adjustments occur on a regular basis, the tax ratio is not affected by real growth.

More adequate explanations for the existence of real fiscal drag obviously originate from arguments being discussed in the context of Wagner’s Law like median voter’s tax price and income elasticity of public good demand (for example: BLANKART, 1998, 143-172). Abstracting from other kinds of revenues the government budget constraint implies public expenditures to equal tax revenues. In this sense saying that real fiscal drag exists for total taxes is almost synonymous to the statement that Wagner's Law holds.[1] The empirical literature on the validity of Wagner's Law is already broad (for a recent survey see PEACOCK/SCOTT, 2000) and it is no direct objective of this study to further elaborate on this issue. For the study of nominal fiscal drag it is, however, necessary to have some understanding of the extent of real fiscal drag – the Wagnerian dimension – as a reference point. In order to know how inflation changes the growth of tax revenues one has to know what the underlying relation between taxes and real income is.

It is obvious that both types of fiscal drag are of a very different quality. While the nominal type has to do with a lack of economic rationality in the form of money illusion that is in danger to be abused by politicians, the real type can possibly be ascribed to voters' preferences. This difference is important for normative conclusions: From an economic point of view the existence of nominal fiscal drag will arouse more criticism than the existence of real fiscal drag. For the latter the normative conclusion crucially depends on the individual judgement concerning the optimal size of government.

3 Descriptive Analysis

Annual data on tax revenues used in this study originate from OECD Revenue Statistics. Data on GDP and the GDP deflator originate from the OECD Fiscal Positions and Business Cycle database. The following kinds of taxes are analyzed (in brackets line code of OECD Revenue Statistics):

- total tax revenues including social security contributions,
- taxes on income, profits and capital gains (1000), also subgroups individuals (1100) and corporate (1200),
- social security contributions (2000),
- taxes on property (4000),

[1] It is no perfect synonym since Wagner's law refers to a relation between the expenditure income ratio and per capita income.

- taxes on goods and services (5000).

24 OECD countries are included in the analysis (though not in every analytical step due to missing values): Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Spain (ESP), Finland (FIN), France (FRA), Great Britain (GBR), Germany (GER), Greece (GRC), Ireland (IRE), Italy (ITA), Japan (JPN), Luxembourg (LUX), Netherlands (NLD), Norway (NOR), New Zealand (NZL), Portugal (PRT), Sweden (SWE), Switzerland (SWI), Turkey (TUR) and the United States (USA).

Tables 1 and 2 offer a first descriptive view of the data both in a time and a cross section perspective. The time dimension (Table 1) shows different developments for different kinds of taxation. The overall increase of taxes can not easily be explained by inflation. Although the inflationary seventies were characterized by a substantial increase of taxes the same is true for the second half of the low inflation sixties. The picture would, however be compatible, with the existence of a combined real and nominal fiscal drag. In this sense, high real growth could explain the increase of tax levels in the sixties while the significant increase of inflation might have done the job in the two following decades.

Differences between types of taxes partially correspond to the above considerations: Almost two third of the increase in the individual income tax ratio over the whole period took place in the inflationary decade 1970-1980 – a clear indication for the absence of perfect indexation provisions and the effectiveness of nominal fiscal drag in a progressive income tax system. Inflation did not boost revenues from corporate income, goods and services or property taxes: these tax ratios did hardly move or even declined in the seventies. Social security contributions show a behavior quite similar to that of individual income taxation: inflation in the seventies was paralleled by a marked increase which constitutes almost half of the increase in social security contributions over the whole period 1965-1996.

Table 2 reveals some cross section characteristics for OECD countries. For that purpose, countries are separated into two groups - countries below and above the median inflation rate and the median real growth rate, respectively. With nominal (real) fiscal drag, high inflation (growth) countries should be characterized by larger tax increases than low inflation (growth) countries. The ANOVA test for differences in the mean shows significant differences along the inflation dimension. Increases of the overall tax rate was more than 4 percentage points larger in high inflation countries than in low inflation countries clearly indicating nominal fiscal drag in the cross section perspective. Statistically significant (on the basis of at least 10% significance level) are also the differences for income taxes and – unexpectedly – taxes on goods and services. Differences for the growth dimension are not significant with the exception of corporate income tax where high growth countries show larger increases of tax income ratios.

While these results indicate that inflation may indeed be relevant for real tax levels, the descriptive aggregate view conceals substantial differences between countries and does not allow for a proper distinction between real and nominal fiscal drag.

Table 1: OECD inflation, real growth and the change of tax ratios in different periods (standard deviation in brackets)

	average annual inflation (GDP deflator)	average annual real growth (GDP)	average change of tax-GDP-ratio						
			total taxes incl. social security	total income taxes	income taxes individuals	income taxes corporate	property taxes	taxes goods and services	social security contributions
1965-1970	0.0430 (0.0022)	0.0465 (0.0088)	0.0326 (0.0226)	0.0169 (0.0151)	0.0151 (0.0162)	0.0018 (0.007)	0.0000 (0.0021)	0.0062 (0.0108)	0.0093 (0.0081)
1970-1980	0.1010 (0.0214)	0.0373 (0.0145)	0.0461 (0.0312)	0.0237 (0.0214)	0.0233 (0.0218)	0.0008 (0.0118)	-0.0028 (0.0055)	0.0005 (0.0116)	0.0234 (0.0187)
1980-1990	0.0856 (0.0222)	0.0279 (0.0099)	0.0319 (0.0306)	0.0090 (0.0212)	0.0015 (0.0194)	0.0027 (0.0090)	0.0029 (0.0060)	0.0094 (0.0173)	0.0094 (0.0069)
1990-1996	0.0563 (0.0079)	0.0246 (0.0074)	0.0128 (0.0235)	0.0007 (0.0157)	-0.0032 (0.0133)	0.0031 (0.0077)	0.0008 (0.0043)	0.0044 (0.0108)	0.0064 (0.0099)
total period (1965-1996)	0.0774 (0.0281)	0.0334 (0.0137)	0.1234 (0.0451)	0.0503 (0.0371)	0.0368 (0.0362)	0.0084 (0.0137)	0.0009 (0.0088)	0.0205 (0.0238)	0.0486 (0.0266)

non weighted means

Table 2: Changes of tax ratios in high and low inflation / real growth countries

change of tax-GDP-ratio 1965-1996	mean of high inflation countries	mean of low inflation countries	significance ANOVA (P-value)	mean of high growth countries	mean of low growth countries	singificance ANOVA (P-value)
total taxes incl. social security	0.1522	0.1094	0.0256	0.1377	0.1226	0.4559
total income taxes	0.0680	0.0401	0.0845	0.0585	0.0487	0.5563
income taxes individuals	0.0537	0.0317	0.1862	0.0421	0.0414	0.9660
income taxes corporate	0.0095	0.0078	0.7839	0.0142	0.0039	0.0775
property taxes	-0.0025	0.0031	0.1496	0.0016	-0.0007	0.5560
taxes goods and services	0.0342	0.0090	0.0114	0.0273	0.0154	0.2618
social security contributions	0.0528	0.0605	0.5375	0.0496	0.0634	0.2701

"high" and "low" stands for above and below median, non weighted means.

4 The Classification Approach

For the further analysis the following framework is used inspired loosely by a similar classification in PADOA SCHIOPPA KOSTORIS (1993). Equation (1) serves to define the concepts of real and nominal fiscal drag and to relate this differentiation to indexation.

The logic of these definitions is the following: The first consideration is of a real nature and is based on the question how a real expansion of income affects the tax ratio in the absence of any inflation. The second consideration is of a nominal nature and is based on the question how a nominal expansion of income affects the tax ratio in the absence of any real growth.

$$(1)\ \frac{T}{Y} = a\,\frac{Y^{b}}{P^{g}}$$

Real fiscal drag (*real fiscal anti-drag*) can be defined as a case where the tax income ratio reacts positively (negatively) to an increase of the nominal income holding the price level constant, i.e. $b>0$ $(b<0)$. Real fiscal drag is absent with $b=0$. It might be tempting to use the terminology progression (regression) for this differentiation. As explained above, however, there is no self-evident relationship between static progression and real fiscal drag in the time dimension since the tax system's degree of progression is endogenously decided in the course of time and influenced by real growth and inflation. Therefore it seems preferable to avoid this misleading terminology.

Nominal fiscal drag (*nominal fiscal anti-drag*) is given if a purely nominal expansion of income – Y and P grow in the same proportion – induces a rising (decreasing) tax income ratio. Nominal fiscal drag (nominal fiscal anti-drag) is thus associated with $b > g$ ($b < g$). Nominal fiscal drag is absent with $b = g$. Thus, the non-existence of nominal fiscal drag implies the function determining the tax ratio to be homogeneous of degree zero in nominal income and the price level.

With the help of these definitions the classification scheme results from the combinations of possible real and nominal fiscal drag types. For this classification the log-linear transformation (2) of equation (1) is used which is also a convenient starting point for the empirical analysis.

$$(2)\ \log(\frac{T}{Y}) = \log a + b \log\frac{Y}{P} + J \log P \qquad \text{with } J = b\text{-}g$$

Table 3: Classification Scheme

		nominal fiscal drag		
		absent	negative	positive
real fiscal drag	absent	AA: b=0, J=0	AN: b=0, J<0	AP: b=0, J>0
	negative	NA: b<0, J=0	NN: b<0, J<0	NP: b<0, J>0
	positive	PA: b>0, J=0	PN: b>0, J<0	PP: b>0, J>0

The concept of indexation can now be related to this classification. *Perfect indexation* of a tax is given when inflation does not have any impact on the way real income affects the tax level (J=0, i.e. cases AA, NA and PA). All other cases are characterized by imperfect indexation. Here, however, a further differentiation is necessary depending on whether imperfect indexation leads to nominal fiscal drag of the same or the opposite sign as real fiscal drag.

Incomplete indexation is given whenever a purely nominal expansion of income has an effect of the same sign as the effect resulting from a purely real expansion. In a system of real fiscal drag this means $b > g$ (case PP). In a system of real fiscal anti-drag this means $b < g$ (case NN). In both cases, de jure or de facto indexation procedures work that offer a partial compensation for the inflationary element of nominal growth in the determination of the real tax burden.

Over-indexation is given whenever adjustments of taxes for inflation do not only neutralize effects of a merely nominal income expansion but even have an overcompensating character. In this situation a purely nominal income expansion has an effect on taxes with the opposite sign to the effect resulting from a purely real expansion. Within a structure characterized by real fiscal drag this means $g > b$ (case PN). With a structure characterized by real fiscal anti-drag over-indexation implies $g < b$ (case NP) .

Cases AN and AP do not fit easily into this indexation context. Both cases are characterized by the fact that a merely nominal expansion of income has an effect on the tax income ratio while a real expansion has not. These cases are logically different from the preceding cases. While in the above cases the inflationary impact is associated with an underlying effect from a real income expansion that feeds into the nominal sphere, this real effect is absent here.

5 Resulting Tax and Country Profiles

A straightforward way to classify countries within the framework of Table 3 is to estimate equation (2)' with u_t as the random disturbance term for each kind of tax and for each country.

$$(2)' \quad \log\left(\frac{T_t}{Y_t}\right) = \log a + b \log \frac{Y_t}{P_t} + J \log P_t + u_t$$

There are, however, two main econometric complications that have to be taken account of. First, there might be a simultaneity problem as the tax ratio can have an impact on the explanatory variable since the tax burden is likely to be a determinant for real income and might also affect the price level. The use of instrumental variables is the standard way to deal with this difficulty.

Second, similar to the empirical approaches testing Wagner's Law (HAYO, 1996) there is the danger of spurious regression since the variables are likely to be integrated. Indeed standard unit root tests (Augmented Dickey Fuller, not reported) indicate the existence of unit roots. The criticism for this kind of test is well known. A low power implies that often the null hypothesis of a unit root can not be rejected even if the time series is stationary. Nevertheless, without further justification it would not be legitimate to estimate equation (2) in levels. This justification could be derived from evidence for the existence of a cointegration relation. Since in the case of more than two variables the Engle-Granger approach is not appropriate, the Johansen test for cointegration is applied.

The Johansen procedure (appendix A.1) clearly rejects the null hypothesis of the existence of none or only one cointegrating relationship among the three variables. In a majority of cases the procedure also rejects the null of the existence of at most two cointegrating equations and thus hints on the existence of three cointegrating equations. This outcome where the number of cointegrating equations is equal to the number of variables indicates that the included time series are stationary. It obviously stands in contrast to the results of the unit root tests. In regard of the low power of the latter the Johansen result can be regarded to dominate the results from the Dickey Fuller tests.

Thus, equation (2) is estimated in levels. In the instrument variables estimation the Newey-West covariance matrix is used which gives consistent estimates in the presence of both heteroskedasticity and autocorrelation. A time trend is included in the estimation of (2) in order to allow for long-run changes in the tax structure. Lagged values of the explanatory variables are used as instruments.

In the appendix (A.2) the estimated coefficients are reported. Estimations are based on annual data for 1965-1996. On the basis of at least a 5% level of significance all available country tax combinations are classified according to the scheme of Table 1. Tables 4-10 summarizes the resulting profiles.

Judging on the basis of total government revenues, OECD countries can be divided into two groups. Due to perfect de facto indexation inflation does not seem to have an impact on tax ratios in 10 countries, whereas in a majority of 13 countries the analysis indicates a positive nominal fiscal drag. Apart from the case of Canada inflation never has a negative impact on the aggregate revenue level. 6 countries are of the super-neutral type in the sense that neither inflation nor real growth have a measurable impact on revenues in relation to income.

Disaggregating government revenues reveals clear differences among types of taxation along both the nominal and the real dimension. Turning to the nominal dimension, inflation tends to have effects that confirms the empirical relevance of the above theoretical considerations.

Inflation is of significant importance in the case of income taxes. For income taxation, there is as expected a difference in sign between individual taxation and corporate taxation. For individual income taxes government revenues – with the exception of Canada – are not hurt by inflation. On the contrary, OECD countries are split even into one group with no inflationary impact and another group with positive nominal fiscal drag. In contrast to that, corporate taxation is characterized by a significant group of 7 countries with a negative impact of inflation on the tax level. In these countries inflation seems to be helpful for companies to reduce tax burden. Thus Olivera-Tanzi like effects seem to dominate effects with the opposite sign.

The insights from the descriptive analysis are also confirmed in regard to social security contributions which show very much the same profile as income taxes on individuals, i.e. in a large group of countries inflation helps to increase the real burden. Property taxes similar to direct corporate taxes show for a non negligible group of countries a negative impact of inflation on revenues and are largely neutral otherwise. Taxes on good and services are the most neutral type of tax in the sense that here the largest groups exist where any nominal fiscal drag is absent.

Having a short look on the real dimension it turns out that from the perspective of a revenue seeking government real growth is not helpful to increase corporate income taxes, property taxes and taxes on goods and services. On the contrary, for these revenue categories tax income ratios tend to decline with real growth in a number of countries. For taxes on goods and services this negative impact could possibly be explained by the fact that growth typically is accompanied by shrinking shares of aggregate consumption in GDP. In contrast to that, social security contributions and individual income taxes offer the widest scope for rising tax ratios under the condition of positive real growth.

Table 4: Classification for total taxes including social security

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	FIN,GBR,KOR, LUX,TUR,USA	-	AUT,ESP,FRA,GER,GRC,IRE, JPN	13
	negative	-	-	ITA,SWI	2
	positive	DNK,NOR,NZL, PRT	CAN	AUS,BEL,NLD,SWE	9
	sum	10	1	13	24

Table 5: Classification for total income taxes

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	AUT,GBR,GRC, JPN,KOR,LUX, NOR,PRT,TUR, USA	-	GER,IRE,ITA	13
	negative	-	-	ESP,SWI	2
	positive	DNK,FIN,NLD, NZL,SWE	CAN	AUS,BEL,FRA	9
	sum	15	1	8	24

Table 6: Classification for income taxes individuals

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	FRA,GBR,JPN, KOR,LUX,TUR, USA	-	AUT,ESP,GER, IRE	11
	negative	-	-	SWI	1
	positive	DNK,FIN,NLD, NOR	CAN	AUS,BEL,GRC,ITA,NZL,SWE	11
	sum	11	1	11	23

Table 7: Classification for income taxes corporate

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	DNK,FIN,GBR, GRC,JPN,LUX, NLD,NOR	AUS,AUT, IRE,USA	SWI	13
	negative	ESP,GER,SWE	NZL,TUR	ITA	6
	positive	BEL,FRA,KOR	CAN	-	4
	sum	14	7	2	23

Table 8: Classification for social security contributions

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	CAN,DNK,KOR,LUX,NOR,TUR,USA	-	GBR,GER,IRE,NLD	11
	negative	-	-	AUT,JPN,SWI	3
	positive	FIN,ITA,PRT,SWE	-	BEL,ESP,FRA,GRC	8
	sum	11	0	11	22

Table 9: Classification for property taxes

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	AUT,BEL,DNK,FIN,GBR,JPN,KOR,LUX,SWI,TUR	ESP,GER,IRE,USA	NZL	15
	negative	NLD,NOR,PRT,SWE	AUS,CAN,GRC,ITA	FRA	9
	positive	-	-	-	0
	sum	14	8	2	24

Table 10: Classification for taxes on goods and services

		nominal fiscal drag			
		absent	negative	positive	sum
real fiscal drag	absent	AUT,BEL,CAN,DNK,FIN,FRA,GER,GRC,JPN,LUX,NLD,NOR,SWI	USA	KOR,PRT,SWE	17
	negative	ESP,GBR,IRE,ITA,NZL	-	AUS	6
	positive	-	-	TUR	1
	sum	18	1	5	24

It is possible that the degree of indexation changes in the course of time. As suggested by the theoretical considerations above an experience of high inflation may increase awareness for real consequences of inflation in the fiscal system and thus lead to de facto indexation. The case of Turkey with an average inflation rate of 30 percent illustrates this view, since nominal fiscal drag is largely absent for Turkey.

In the seventies, inflation rates in OECD countries on average more than doubled in comparison to the second half of the sixties (see Table 1). This new experience might have induced changes of the de jure indexation procedures or at least the de facto indexation behavior. Being made more alert by an inflationary decade voters might have forced politicians to correct more frequently for the consequences of phenomena like bracket creep. CUSUM tests indicate for a number of cases the possibility of structural breaks in equation (2) around 1980 (not reported). On that basis, a Chow test was applied to test for a structural break in 1980. In the majority of cases structural stability of equation (2) over the whole period can not be rejected with a significance level of at least 5% (see Appendix A.3). Among the cases with a structural break there is no general tendency in regard to nominal fiscal drag. There are only very few cases where inflation of the 70s seems to have induced a change of fiscal structures towards indexation: For individual income taxation, Belgium and Germany are the only cases, where a positive nominal fiscal drag before 1980 was neutralized afterwards by de facto indexation. If one further takes into account that a number of the detected structural breaks occur without inducing a change in classification, the conclusion seems to be justified that the structure as described in the Tables 4-10 is largely stable in qualitative terms.

6 Conclusion

These results suggest that the death of inflation or – to put it more modest – a decline of long run average inflation rates will make a fiscal difference for a majority of OECD countries. In these countries, tax revenues benefit from inflation. This overall nominal fiscal drag works mainly through personal income taxes and social security contributions. While the former does not come as a surprise due to well known bracket creeping effects the latter is a new insight. Although social security contributions do in many countries not grow automatically with inflation, it seems to be politically easier to increase contribution ceilings and rates in an inflationary environment. This hints at the relevance of money illusion in the context of taxation. Voters might be more willing to accept a growing real tax and social security burden if the net income does not decrease in nominal terms. In the countries where nominal fiscal drag exists it is persistent. Only in few cases (Belgium and Germany for individual income taxes) inflationary experience of the seventies has induced changes of the fiscal system in the direction of de facto indexation.

Nominal fiscal drag is largely absent for corporate and property taxes. There are, on the contrary, significant groups of countries where nominal fiscal drag is negative. For corporate taxation this indicates that in a couple of countries negative effects of inflation on the real turnout like the Olivera-

Tanzi effect dominate positive effects, for example the one resulting from nominally defined depreciation allowances. For most countries indirect taxation revenues are not affected by inflation.

Real fiscal drag is less frequent than nominal fiscal drag. Where present it works mainly through individual income taxation and social security contributions. Thus in principle, real fiscal drag would have a chance to continue in these countries also in times of price level stability.

This outlook changes if these findings are related to present tax reforms. Recent reforms in the OECD tend to decrease income taxes and social security contributions at the cost of higher indirect taxation. Tax revenues thus are restructured away from types with a significant degree of both nominal and real fiscal drag towards types where fiscal drag hardly plays a role – be it of the nominal or real type.

Therefore, taking low inflation rates and tax reforms together the presumption seems well founded that fiscal drag comes to an end. This can also be stated in the context of Wagner's Law: Government expenditures can only grow as far as additional revenues can be raised. Assuming that other sources like deficit finance or privatization proceeds are exhausted in most countries, taxes are crucial. This study indicates increasing marginal political costs of tax financing a rise of public expenditures. For a given income elasticity of the demand for public goods this tends to restrict the scope for a future Wagnerian expansion.

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Appendix A. 1: Johansen Cointegration Test

The Johansen procedure was applied to the three variables $\log(\frac{T}{Y})$, $\log \frac{Y}{P}$ and $\log P$, assuming an intercept and trend in the cointegrating equation. On the basis of the Akaike statistic 5 lags were included in the procedure. In the table, X**(*) means that the null of at most X cointegrating equations is rejected with a significance level of 1% (5%).

	total taxes incl. social security	**total income taxes**	**income taxes individuals**	**income taxes corporate**	**property taxes**	**taxes goods and services**	**social security contributions**
Australia	2**	2**	2*	2*	1**	2**	-
Austria	2*	2**	2*	2**	2**	2**	1**
Belgium	2*	2*	2*	2*	2*	2**	1**
Canada	2*	1**	1**	2*	1**	1**	2*
Denmark	2**	2*	2*	1**	1**	2**	2**
Spain	2**	2**	1**	2*	1**	2*	2*
Finland	2**	1*	1**	1**	2*	1**	2*
France	2**	2*	2*	2*	1**	2*	2**
Great Britain	2**	2**	2**	2*	2*	1**	1**
Germany	2*	2*	2*	1**	1**	2**	2**
Greece	1**	1**	1**	1**	2**	1**	2*
Ireland	1**	2*	2*	1*	2*	1**	2**
Italy	2**	2**	2**	1**	1**	2**	2*
Japan	1**	1**	1**	1**	2*	2*	1**
Luxembourg	2**	2*	2**	1**	1**	2**	2**
Netherlands	2*	2**	2*	2**	2*	2*	1**
Norway	2*	1*	1**	1*	2**	2*	2*
New Zealand	2**	2**	2**	1**	2**	2**	-
Portugal	1**	2*	N.V.	N.V.	1**	2**	2*
Sweden	1**	1**	NONE**	2**	2*	2**	2*
Switzerland	2*	2*	2**	2**	2*	1**	2**
Turkey	1**	1**	1**	1**	1**	1**	1**
USA	2**	2**	2**	2*	2*	2**	2*

Appendix A. 2: Coefficients for b and J

in the estimation of $log(\frac{T_t}{Y_t}) = log a + b\ log \frac{Y_t}{P_t} + J\ log P_t + d\ t + u_t$ (annual data 1965-1996, for Korea 1972-1996, instrumental variable estimation with lagged explanatory variables as instruments, Newey-West covariance matrix, t-values in brackets, ***/**/* indicate significance level of 1/5/10%)

	total taxes incl. social security		**total income taxes**		**income taxes individual**	
Country	β	ϑ	β	ϑ	β	ϑ
Australia (AUS)	0.49366 *** (3.181477)	0.205900 *** (4.705975)	1.270029 *** (4.528389)	0.257175 *** (4.194302)	1.694365 *** (6.018918)	0.587180 *** (7.113008)
Austria (AUT)	-0.26518 (-0.420453)	0.311281 *** (6.764861)	0.338334 * (1.757920)	0.251076 * (2.029829)	0.364262 (1.665140)	0.795715 *** (5.703695)
Belgium (BEL)	0.465460 *** (3.351416)	0.532972 *** (5.608684)	1.569152 *** (7.027271)	1.137628 *** (4.946048)	1.604179 *** (4.797697)	1.476237 *** (6.199386)
Canada (CAN)	0.754912*** (3.520082)	-0.332064*** (-3.790354)	1.959391*** (5.743846)	-0.763211*** (-5.949034)	2.315451*** (4.019889)	-0.742848*** (-3.360920)
Denmark (DEN)	2.467312 *** (8.558929)	-0.055963 (-0.820312)	4.909805 *** (4.598182)	-0.256248 (-1.332402)	5.759941 *** (4.986424)	-0.342991 -1.264323
Spain (ESP)	-0.069340 (-0.480632)	0.2890.31 *** (3.729330)	-0.568035 *** (-2.956171)	0.471878 *** (3.698758)	-0.037627 (-0.125608)	0.768155 *** (8.712683)
Finland (FIN)	0.928380 (1.529562)	-0.281468 (-1.249791)	2.039842 ** (2.079914)	-0.476849 (-1.369659)	2.595766 ** (2.484302)	-0.518473 (-1.372035)
France (FRA)	-0.119923 (-1.872209)	0.245997 *** (7.811419)	0.663196 *** (5.632626)	0.182913 *** (2.636685)	0.438863 (1.662268)	0.164861 (1.204336)
Great Britain (GBR)	-0.148525 (-0.147403)	0.104167 (1.567132)	2.865308 (1.179036)	0.229696 (-1.418927)	4.757949 (1.565735)	0.246814 (0.904697)
Germany (GER)	0.124016 (1.367951)	0.566397 *** (8.150686)	-0.600008 (-1.597396)	1.137230 *** (4.325558)	0.180378 (0.437896)	1.312362 *** (6.318988)
Greece (GRC)	0.497694 * (1.934284)	0.339380 ** (2.387900)	0.921637 * (1.765267)	0.150727 (0.616548)	2.752298 *** (2.900742)	1.092294 ** (2.302562)
Ireland (IRE)	-0.271839 (-1.326707)	0.165613 *** (3.645594)	0.369938 (1.074747)	0.316960 *** (9.495072)	0.425965 (0.766083)	0.598624 *** (9.020218
Italy (ITA)	-0.801759 *** (-3.899398)	0.178468 *** (3.749385)	0.080546 (0.393247)	0.717753 *** (10.02505)	0.651153 *** (3.798405)	0.747762 *** (11.44608)
Japan (JPN)	-0.071908 (-0.420663)	0.302299 ** (2.570684)	0.264276 (0.847998)	0.354473 (1.339342)	0.278230 (0.963839)	0.394570 (1.631450)
Korea (KOR)	2.498054 (1.222398)	0.252212 (1.332754)	4.337575 * (1.850693)	0.160469 (0.598774)	5.858221 * (1.993738)	0.397259 (1.179955)
Luxembourg (LUX)	3.964662 (0.970680)	4.047559 (1.290312)	4.394980 (1.122522)	4.733778 (1.580844)	5.764515 (0.859970)	5.965752 (1.161533)
Netherlands (NLD)	0.383734 *** (2.913205)	0.301577 *** (5.191925)	1.470449 *** (3.390393)	-0.046698 (-0.246868)	1.769521 *** (3.169091)	0.002232 (0.008488)
Norway (NOR)	2.483913 ** (2.708939)	-0.238297 (-0.823249)	1.920249 * (2.005115)	0.078130 (0.383569)	2.646801 ** (2.091032)	-0.817341 * (-1.722611)
New Zealand (NZL)	0.862947 ** (2.695611)	0.165423 * (2.004123)	2.456639 *** (3.468348)	0.225081 * (1.828895)	4.651071 *** (3.323843)	0.557222 ** (2.556391)
Portugal (PRT)	0.521283 ** (2.604417)	0.101419 (1.475376)	-0.552963 (-1.082048)	0.214702 (1.585599)	-	-
Sweden (SWE)	1.314512 *** (4.844797)	0.351770 *** (3.728392)	0.841203 *** (4.042965)	0.120243 (1.223156)	1.320803 *** (5.308052)	0.216223 ** (2.244298)
Schwitzerland (SWI)	-0.877682 *** (-2.999086)	1.243696 *** (6.284769)	-0.834294 *** (-2.778916)	1.815061 *** (7.883643)	-1.177999 *** (-3.104035)	1.965849 *** (7.383898)
Turkey (TUR)	2.424120 * (2.024876)	0.043471 (0.690189)	3.478003 (1.183755)	-0.200187 (-1.322737)	4.869057 (1.268662)	-0.1202772 (-0.628463)
United States (USA)	2.671841 * (1.747516)	-0.089376 (-0.486396)	3.705861 (1.545695)	-0.097387 (-0.317210)	6.384834 * (1.944876)	0.313416 (0.668903)

Continuation Appendix A.2

	income taxes corporate		social security contributions		property taxes	
Country	*b*	*J*	*b*	*J*	*b*	*J*
Australia (AUS)	0.226095 (0.413388)	-0.855228 *** (-4.910308)	-	-	-1.285057 *** (-5.164773)	-0.375452 ** (-2.068910)
Austria (AUT)	-0.365311 (-0.835621)	-0.949149 *** (-3.584585)	-0.414542 ** (-2.197411)	0.767531 *** (5.588007)	-0.785169 (-1.536993)	0.963713 (1.540847)
Belgium (BEL)	1.860873 *** (4.612239)	-0.499871 (-1.347291)	0.490445 *** (3.480134)	0.360563 *** (3.016568)	-0.569563 (-1.523674)	-0.662330 (-1.319908)
Canada (CAN)	2.016032*** (3.000747)	-1.168417*** (-2.877951)	0.975576 (1.228259)	-0.321829 (-1.106836)	-1.114430*** (-4.263438)	-0.305511** (-2.081475)
Denmark (DEN)	-3.882182 * (-1.761491)	0.776730 (1.110203)	-15.50301 * (-1.856744)	0.853875 (0.596911)	1.631452 * (1.747364)	0.171446 (0.968301)
Spain (ESP)	-1.390801 ** (-2.455057)	-0.222590 (-0.536458)	2.158519 *** (5.764577)	0.533501 *** (4.180892)	0.127310 (0.558508)	-0.614659 *** (-3.308556)
Finland (FIN)	-1.694963 (-1.666565)	-0.348952 (-0.945672)	3.915605 *** (3.039915)	-0.9843392 * (-1.709166)	-2.133942 (-1.401422)	0.763445 (1.135812)
France (FRA)	1.106687 ** (2.340218)	0.356804 * (1.908969)	0.302589 ** (2.524881)	0.370991 *** (7.851602)	-2.558208 *** (-7.019720)	0.474336 *** (3.064627)
Great Britain (GBR)	-0.860463 (-0.129631)	0.312309 (0.771242)	0.377637 (0.172905)	0.245624 ** (2.446232)	-6.711560 (-1.602908)	-0.221376 (-0.741702)
Germany (GER)	-5.021791 *** (-4.820208)	0.503155 (0.507889)	0.300053 * (1.953642)	1.044192 *** (10.51090)	-0.256479 (-0.801853)	-0.648802 *** (-0.648802)
Greece (GRC)	-0.372298 (-0.434673)	-0.633076 (-1.304701)	1.385372 ** (2.158012)	0.774455 ** (2.338638)	-3.818798 ** (-2.559669)	-2.222625 *** (-2.948279)
Ireland (IRE)	1.926972 * (1.922532)	-0.948808 *** (-6.252414)	1.400079 * (1.958474)	0.716567 *** (8.670327)	-0.696851 (-0.907953)	-0.975281 *** (-10.03250)
Italy (ITA)	-1.221070 ** (-2.326550)	0.685297 *** (4.603165)	0.475902 ** (2.456731)	-0.058407 (-1.218915)	-4.606191 *** (-4.621288)	-0.749536 *** (-3.048953)
Japan (JPN)	0.210293 (0.479187)	0.362720 (1.058297)	-0.235841 *** (-4.552354)	0.592294 *** (13.82676)	-0.145745 (-0.498449)	0.236562 (1.177829)
Korea (KOR)	5.176028 ** (2.224395)	0.565456 * (2.038600)	14.76737 (1.490130)	-0.013572) (-0.013853)	3.405870 (0.802236)	-0.203226 (-0.702110)
Luxembourg (LUX)	2.014241 (0.436392)	2.663370 (0.694520)	6.765803 (1.055523)	6.186346 (1.240126)	-2.897054 (-1.062478)	-2.163297 (-1.025952)
Netherlands (NLD)	0.347281 (0.736580)	-0.135954 (-0.906645)	-0.005210 (0.012598)	0.740203 *** (5.809170)	-1.476733 ** (-2.179621)	0.256865 (1.019131
Norway (NOR)	0.325249 (0.061671)	3.038115 * (1.983903)	6.281869 * (1.957199)	-0.947545 (-0.832791)	-3.647412 *** (-3.247939)	0.497506 (1.156326)
New Zealand (NZL)	-3.531800 ** (-2.139448)	-1.086581 *** (-3.345921)	-	-	0.698862 * (1.739946)	0.367897 *** (4.191153)
Portugal (PRT)	-	-	1.841350 *** (3.812946)	-0.018301 (-0.139217)	-4.993529 *** (-3.745661)	-0.675298 (-1.104518)
Sweden (SWE)	-3.687685 *** (-5.189841)	-0.573939 (-0.955602)	3.798354 *** (3.410102)	0.787380 (1.647050)	-6.076669 *** (-2.972296)	1.239533 (0.954090)
Schwitzerland (SWI)	0.947692 (1.544183)	1.054414 ** (2.463079)	-1.288445 *** (2.771270)	2.049300 *** (6.743951)	-0.745265 (-1.262567)	0.409943 (1.198104)
Turkey (TUR)	-10.21442 ** (-2.056865)	-0.408654 ** (-2.362794)	-6.053573 (-1.313171)	-0.248502 (-1.382020)	5.602037 (1.233214)	0.105818 (0.443612)
United States (USA)	-0.590890 (-0.109983)	-1.676010 *** (-4.048101)	6.962519 * (1.752606)	0.647508 * (1.756394)	1.081440 (0.633890)	-1.011554 *** (-7.302943)

Continuation Appendix A. 2

	taxes on goods and services	
Country	*b*	*J*
Australia (AUS)	-0.709552 ** (-2.202432)	0.299505 *** (2.953646)
Austria (AUT)	-0.099930 (-0.447648)	0.178654 (0.974033)
Belgium (BEL)	-0.457201 * (-1.921505)	-0.039394 (-0.374419)
Canada (CAN)	0.179514 (0.747003)	0.164301 (1.084643)
Denmark (DEN)	0.823554 (0.750942)	0.161945 (1.306287)
Spain (ESP)	-2.537477 *** (-4.628817)	-0.117713 (-0.345667)
Finland (FIN)	-0.594214 (-1.177228)	0.201016 (1.212335)
France (FRA)	-0.249220 (-1.694702)	0.098553 * (0.056521)
Great Britain (GBR)	-4.802921 ** (2.221145)	-0.253739 (-1.000302)
Germany (GER)	0.733932 * (1.931849)	-0.336679 (-1.424832)
Greece (GRC)	0.194179 (0.512095)	0.356131 * (1.801883)
Ireland (IRE)	-0.607940 *** (-2.798768)	0.142508 * (1.938220)
Italy (ITA)	-2.059882 *** (-4.791339)	0.000452 (0.003941)
Japan (JPN)	-0.425598 * (-1.753160)	-0.078412 (0.131152)
Korea (KOR)	0.175078 (0.168803)	0.400976 *** (3.473467)
Luxembourg (LUX)	0.606097 (0.181826)	1.133347 (0.431443)
Netherlands (NLD)	0.126473 (0.751672)	0.085787 (1.442603)
Norway (NOR)	1.900697 * (2.013310)	-0.303338 (-1.014273)
New Zealand (NZL)	-2.412219 *** (-3.086062)	0.024915 (0.168597)
Portugal (PRT)	0.271436 (1.511263)	0.184318 ** (2.710813)
Sweden (SWE)	-0.062820 (-0.147361)	0.369749 ** (2.096690)
Schwitzerland (SWI)	-0.562491 (-1.581736)	-0.132279 (-0.811922)
Turkey (TUR)	3.176363 *** (2.963492)	0.249756 *** (4.624966)
United States (USA)	-0.715178 (-0.915910)	-0.216095 *** (-3.958878)

Appendix A. 3: Two period classifications for cases with significant Chow breakpoint test at 1980

On the basis of a 5% significance level for Chow test. Details of estimation as described in Appendix A. 2.

total taxes incl. social security						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Belgium	-0.066578 (-0.387899)	0.215817** (2.631719)	AP	-1.200954** (-2.697691)	-0.000988 (-0.008996)	NA
Germany	-0.295463 (-0.752338)	0.079059 (0.164156)	AA	0.076711 (0.852577)	0.569544** (2.186127)	AP
Ireland	-1.577657*** (3.184458)	-0.43312*** (-4.721303)	NN	0.494052 (0.574530)	0.694856 (1.755438)	AA
Luxembourg	-1.436626*** (-3.970098)	1.110026 (1.275777)	NA	0.447496 (0.300586)	0.573269 (0.00387)	AA
total income taxes						
Country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Belgium	0.562066* (2.010124)	0.479643 ** (2.943222)	AP	-3.530485** (-2.178537)	-0.744772 * (-1.861805)	NA
Great Britain	-8.380625*** (-4.039344)	-1.254279*** (-5.290697)	NN	-1.490345 (-0.643694)	O.968453 (1.508503)	AA
Germany	-0.933071 (-0.876014)	0.312004 (0.240632)	AA	-0.124735 (-0.374053)	-1.635565** (-2.210264)	AN
Ireland	-2.417815* (-1.951435)	-0.119482 (-1.052475)	AA	-0.216736 (-0.163475)	0.102884 (0.169044)	AA
Luxembourg	-0.678656 (-1.129970)	0.417590 (0.456372)	AA	0.815381 (0.426789)	1.101374 (0.750334)	AA
New Zealand	2.808750 (0.344106)	0.738629 (0.496985)	AA	-0.003183 (-0.007525)	-0.110631 (-1.293641)	AA
Turkey	0.696300 (0.974128)	0.033115 (0.632706)	AA	8.709768 (0.195095)	0.990217 (0.310870)	AA
income taxes individual						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Belgium	0.194591 (0.578679)	0.584465*** (3.461517)	AP	-2.003873 (-1.339374)	-0.378720 (-1.270793)	AA
Great Britain	-11.78130*** (-3.457054)	-1.303702*** (-3.133163)	NN	1.475917 (0.886410)	-0.208473 (-0.408125)	AA
Germany	0.882558 (0.730450)	2.039490** (2.300170)	AP	0.136917 (0.579895)	-0.767255 (-1.014061)	AA
Ireland	-3.504644** (-2.301375)	-0.171966 (-1.112923)	NA	-1.567793 (-1.254194)	-0.161783 (-0.298909)	AA
Japan	0.195438 (0.172567)	-1.485816 (-0.440034)	AA	1.362828 (1.467056)	3.137019*** (4.235799)	AP
Luxembourg	-1.247978 (-1.593056)	2.086672 (1.064965)	AA	-0.462365 (-0.348441)	0.119253 (0.111813)	AA
New Zealand	4.731300 (0.332177)	1.076162 (0.425047)	AA	0.379122 (1.083764)	0.018010 (0.334576)	AA

income taxes corporate						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Spain	-1.573498 (-0.729635)	-1.097868 (-1.276096)	AA	3.364387** (2.329376)	2.069538*** (4.352118)	PP
Ireland	0.226899 (0.117883)	-0.170539 (-0.351928)	AA	6.627627 (1.167881)	1.005853 (0.384605)	AA
Luxembourg	0.481418 (0.267650)	-2.293549 (-1.090429)	AA	2.577415 (0.928052)	2.528703 (1.221216)	AA
New Zealand	-3.891298 (-0.274744)	-1.085279 (-0.430493)	AA	-1.102448 (-0.482310)	-0.669857 (-1.434391)	AA
USA	-1.152365 (-0.137534)	1.681479* (2.017006)	AA	5.837469 (1.336252)	-5.284833***	AN
social security contributions						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Belgium	1.194672*** (5.582283)	0.713771*** (5.788007)	PP	0.267163 (0.310586)	1.150700*** (6.384464)	AP
Germany	0.676402 (1.093503)	1.184863** (2.745626)	AP	-0.041322 (-0.400305)	0.942014*** (3.016546)	AP
Ireland	1.232042 (-0569445)	-0.365879) (-1.122847)	AA	0.889632 (0.630887)	0.957704 (1.490768)	AA
Luxembourg	-2.362292*** (-5.078366)	2.014734** (2.224343)	NP	-0.425459 (-0.475818)	-0.446573 (-0.653617)	AA
Netherlands	2.078667* (1.923509)	1.380180 (1.034222)	AA	-3.572602* (-1.955364)	-0.616988 (-0.270507)	AA
property taxes						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Australia	-0.996414 (-0.661514)	-0.565027 (-0.810621)	AA	-2.732828 (-0.188789)	0.534457 (1.191565)	AA
Belgium	-3.795946*** (-5.947375)	-1.284106** (-2.885600)	NN	-2.271602 (-0.444068)	-0.298427 (-0.185938)	AA
Germany	-2.422171* (-1.919301)	-2.125669* (-2.035771)	AA	-0.255116 (-0.807244)	-0.122411 (-0.179798)	AA
Italy	-5.918703 (-0.819974)	-0.738198 (-0.583446)	AA	-4.118626 (-0.642216)	-2.245472*** (-5.137953)	AN
Portugal	2.925957* (1.884026)	-0.601286 (-1.759835)	AA	3.017410* (1.998917)	-0.019598 (-0.058773)	AA
Sweden	1.303772 (0.413553)	0.668352 (0.474884)	AA	-13.52834 (-0.496999)	8.685219 (1.055194)	AA
Turkey	0.811733 (0.181242)	-0.403192) (-1.611131)	AA	-4.200051 (-0.100105)	0.390011 (0.133705)	AA
taxes on goods and services						
country	1965-1979			1980-1996		
	b	*J*	classification	*b*	*J*	classification
Austria	0.617224*** (3.780100)	0.042925 (0.364490)	PA	-2.755639 (-1.527278)	-0.569464 (-0.324753)	AA
Great Britain	0.736293 (0.404740)	-0.076601 (-0.625081)	AA	3.905170 (-1.098418)	0.991630 (1.055503)	AA
Germany	0.072851 (0.153146)	-1.008283*** (-3.233456)	AN	0.514130 (1.444611)	2.629037*** (3.386466)	AP
Ireland	-0.624961 (-0.744147)	-0.578095*** (-4.414430)	AN	0.697978 (1.175911)	0.929820*** (3.421550)	AP

Italy	1.340953 (0.560257)	0.138877 (0.377381)	AA	4.415966 (1.324269)	-0.091628 (-0.293877)	AA
Luxembourg	-1.566508* (-2.056692)	1.988119 (1.499835)	AA	-0.174988 (-0.083796)	0.240905 (0.148484)	AA
New Zealand	-0.555131 (-0.298492)	-0.027631 (-0.075000)	AA	-1.640747** (-2.555228)	0.531006*** (4.364527)	NP
Sweden	-3.804322*** (-3.390653)	-1.865355*** (-3.690440)	NN	0.117506 (0.063591)	1.093071** (2.516222)	AP
Switzerland	-0.073428 (-0.687147)	-0.678884*** (-5.770417)	AN	-1.134202 (-0.679593)	-1.517343 (-1.699048)	AA