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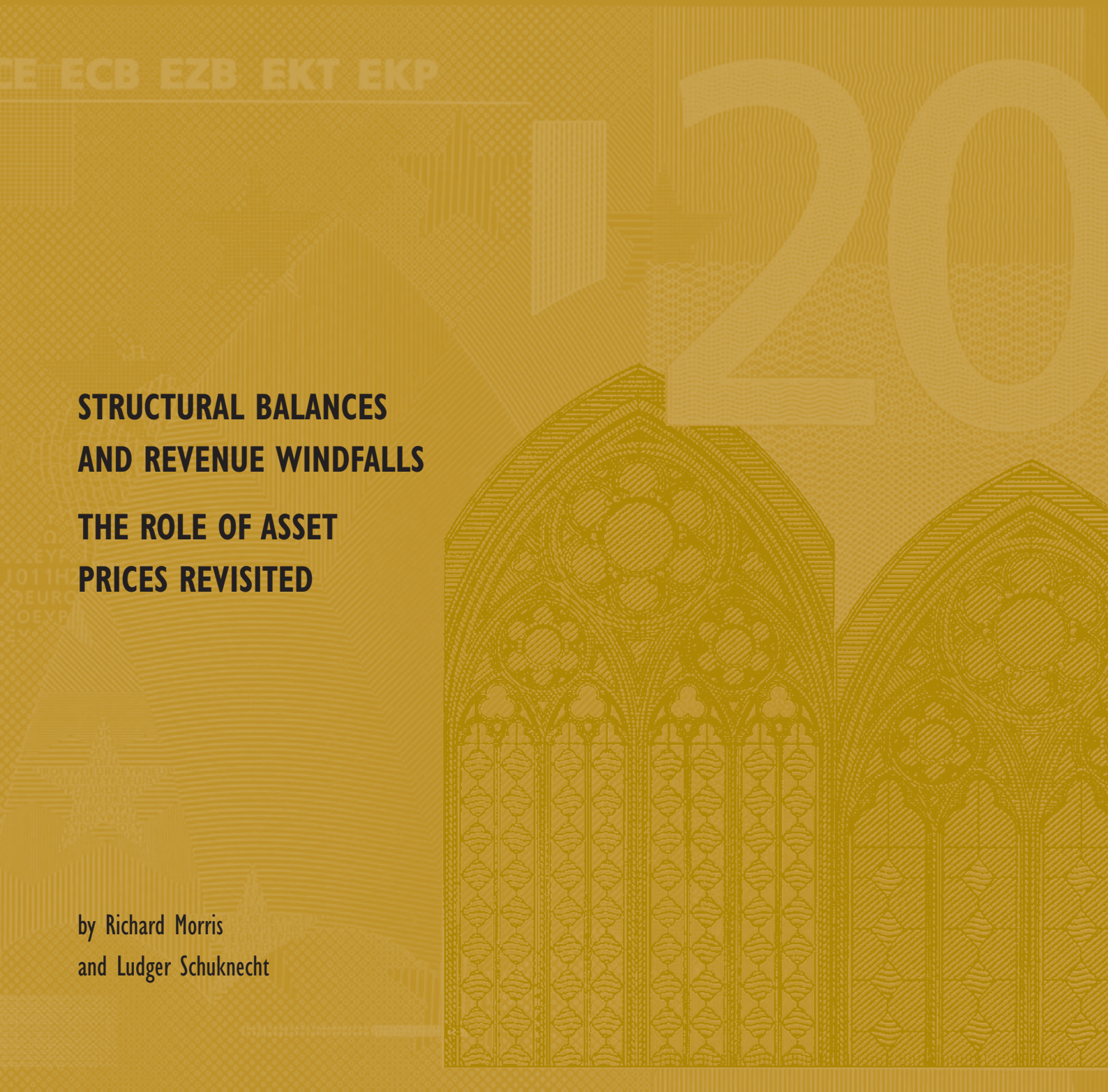

STRUCTURAL BALANCES AND REVENUE WINDFALLS

THE ROLE OF ASSET PRICES REVISITED

by Richard Morris

and Ludger Schuknecht

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Abstract

In this paper we revisit one of the "missing links" between budget balances and the economic cycle, namely the impact of asset prices on fiscal revenues. We estimate revenue elasticities with respect to equity and real estate price indices for 16 OECD countries, as well as for a synthetic euro area aggregate. For a sub-sample of euro area countries, we use these elasticities to investigate the impact of asset prices on budget balances and the assessment of the fiscal stance by adjusting existing estimates of cyclically adjusted balances for the asset price "cycle". The results support the view that asset price movements are a major factor behind unexplained changes in the cyclically adjusted balance, which, if not accounted for, can lead to erroneous conclusions regarding underlying fiscal developments.

JEL codes: H2, H6, E6, G1

Keywords: Fiscal policies, deficits, asset prices, tax revenues

Non-technical summary

The cyclical adjustment of fiscal balances has received increasing attention in the assessment and design of fiscal policy strategies in recent years. The use of cyclically adjusted balances (CABs) for fiscal analysis has, however, been plagued by significant measurement problems. In particular, the impact of the cycle on fiscal variables has proven to be unstable, especially on the revenue side. During upturns, unexpected windfall revenues have boosted not only nominal balances but also CABs; with the reverse occurring during downturns.

In this paper we revisit one of the missing links between fiscal balances and economic cycles by extending earlier work on the empirical relationship between asset prices and fiscal revenues. We estimate short- (and where relevant) long-term elasticities for four revenue categories (direct taxes on corporations, direct taxes on households, indirect taxes, and taxes on financial transactions) with respect to equity and residential property prices. This is done for 16 OECD countries, including 11 EU Member States, and for an aggregate of eight euro area countries (covering more than 90% of the euro area on the basis of GDP weights).

The empirical analysis points to significant and positive asset price effects for all four revenue categories for most countries in the sample. However, as one would expect given different tax systems, the estimates also confirm that asset price effects appear to vary in terms of their magnitude, in terms of which asset(s) have significant effects on which revenue category, and the nature (contemporaneous and/or lagged, short- and/or long-run) of the relationship. Movements of asset prices seem to be most relevant for transactions taxes and corporate taxes, while their effects on direct household taxes and indirect taxes tend to be smaller. However, given the greater importance of the latter two revenue categories, asset price movements seem capable of giving rise to notable budgetary effects from all four revenue sources. Typically elasticities with respect to real estate prices are larger that with respect to equity prices, but this does not necessarily imply that property prices exert a larger impact on the budget as this also depends on the size of movement of the asset prices (with equity prices tending to be more volatile).

Focusing on the subset of euro area countries, we use our estimates for asset price related tax elasticities to assess the impact of asset price movements on the budget balance and hence the assessment of underlying fiscal positions and the fiscal stance. We use a simple statistical technique to detrend asset price movements and thereby obtain an (unbiased) estimate of the contribution to fiscal revenues stemming from a stylised asset price "cycle". Focusing on the EMU period, these estimates suggest that for the "good times" of 1999-2000, the underlying fiscal position of many euro area countries was less favourable than suggested by standard estimates of the cyclically adjusted budget balance, while the converse was true during the "bad times" of 2001-2003. Our results suggest that taking into account the impact of asset price movements would give rise to an estimate of the euro area underlying fiscal position that is around ½ percent of GDP lower (higher) during the asset price upswing (downturn). More recently, in the context of the recovery in equity prices since 2003, there again seems to be a risk that the improvement of underlying fiscal positions is being over-estimated.

Our findings suggest that taking into account the influence of asset price movements could improve the fiscal monitoring and forecasting toolkit, either by helping to arrive at better estimates of the structural balance or interpreting unexplained movements of existing CAB estimates. In this context, the empirical analysis contained in this paper should be seen as indicative. More detailed analyses of the interactions between fiscal revenues and asset prices at the individual country level (e.g. taking into account tax systems and their changes) would clearly be necessary. More generally, our results support the view that caution is warranted in attributing unexplained improvements in the fiscal balance to structural factors, particularly at times when equity and/or real estate markets are buoyant.

I. Introduction

The cyclical adjustment of fiscal balances has received increasing attention in the assessment and design of fiscal policy strategies in recent years. Cyclically adjusted balances have also been incorporated into fiscal institutions in several countries, and especially in the EU's revised Stability and Growth Pact (SGP). Under the revised Pact, for example, consolidation requirements and medium-term budgetary objectives are expressed in terms of the "structural" budget balance (interpreted as the cyclically adjusted balance net of certain one-off and temporary measures) and structural consolidation efforts also determine the eligibility for escape clauses under the excessive deficit procedure.[4]

The use of CABs for fiscal analysis has, however, been plagued by significant measurement problems. The output gap (or trend growth) is very difficult to measure in real time. Moreover, and more relevantly for this study, the impact of the cycle on fiscal variables has proven to be unstable, especially on the revenue side. During upturns, unexpected windfall revenues boosted not only nominal balances but also CABs; with the reverse occurring during downturns.[5]

This study looks in depth at the issue of revenue surprises and unexplained movements of CABs. It argues that the underlying models for calculating CABs fail to adequately capture the underlying tax base and its relation to the economic cycle notably by missing the relationship between asset prices and fiscal revenues. The study thereby revisits one of the "missing links" in the study of the economic cycle and CABs. We do this in four ways. First, following Eschenbach and Schuknecht (2002) we estimate revenue elasticities for four tax categories (direct taxes on

[4] Several methods for estimating CABs have been developed in recent years, including by the European Commission, IMF, OECD and ESCB. The OECD's approach, which also forms the basis for the European Commission's approach, was first set out in van den Noord (2000) and was updated in Girouard and André (2005). The cyclical adjustment method used by the ESCB is explained in Bouthevillain et al. (2001). Broadly speaking, methodologies consist of two elements: firstly, an estimate of the cyclical position of the economy, based either on a derivation of the output gap or a detrending of output (or its relevant sub-components); and secondly, estimates of the reaction of fiscal variables to the economic cycle (i.e. tax and expenditure "elasticities"), using either econometric techniques or an analysis of fiscal institutions.

[5] Variations in revenues beyond what can be accounted for by policy measures or the real economic cycle can be described as resulting from variations in tax elasticities. In this context, the revised SGP calls for greater consolidation in "good times" and identifies good times as "periods where output exceeds its potential level, taking into account tax elasticities".

corporations, direct taxes on households, indirect taxes, and taxes on financial and capital transactions) in relation to the standard tax bases and two asset price indices (relating to equity and real estate prices). [6] This is done for a very up to date dataset (up to and including 2005) which allows us to capture asset price effects on fiscal revenues also over the recent housing boom and the full stock price roller coaster (that started with 1990s boom before the bust of the early 2000s and the recent resurgence) and for a wide range of industrialised countries (including most of the EU15, Japan and the US).

Second, in order to take into account the fact that asset price developments may impact on fiscal revenues with significant lags or have persistent effects, we go beyond earlier studies in seeking to take account of both short and longer term influences of asset prices on fiscal revenues.

Third, we include a novel focus on an aggregate that approximates the euro area (which is most relevant for the common monetary policy).

And fourth, zooming in on the euro area countries in our sample and on recent periods with major asset price swings, we use our estimates of asset price related revenue elasticities to assess the implications of asset price movements and related wealth effects on the assessment of the fiscal stance. Existing CAB approaches seek to net out the impact on the budget balance stemming from cyclical variations in output, but they generally ignore other potential cyclical influences on the budget balance, including those stemming from variations in asset prices. In other words, CABs take into account the fiscal effects of variations in output but ignore the effects of variations in wealth. We aim to show that taking into account the impact of asset price movements (in addition to the output gap) could have a significant bearing on the assessment of structural consolidation efforts in the context of the revised SGP.

The paper finds highly significant effects of asset prices on fiscal revenues for most countries and supports the hypotheses of potentially significant CAB mis-

[6] Earlier studies in this regard by Eschenbach and Schuknecht (2002 and 2004), Jaeger and Schuknecht (2004) and Girouard and Price (2004) have provided first estimates of asset price effects on fiscal revenues/balances for certain episodes.

estimations by existing methods. As to the structure of the paper, section two looks at accounting and institutional issues that explain the link between asset prices and fiscal balances. Section three explains the methodology and the data underlying our empirical analysis. Section four presents the results of this analysis. Section five then uses these results to examine the potential impact of asset prices on budget balances and underlying fiscal positions in the euro area. Section six concludes.

II. Fiscal revenues and asset prices: accounting and institutional issues

The conventional approach to fiscal monitoring, forecasting and cyclical adjustment focuses on a few main tax revenues and their respective bases. Disposable income determines private consumption which, in turn, underlies indirect taxes. Household income (from wages and salaries) determines household direct taxes. Corporate profits are the relevant base for direct taxes on corporations.

While our analysis also focuses on these tax categories, we extend the analysis of the respective tax bases to take account of the fact that the prices of key assets may also have an important impact on these revenues, in particular via wealth/capital gains taxes and wealth effects, as well as on other sources of revenue, notably turnover taxes.

Stocks and real estate wealth are particularly relevant for tax purposes as compared to other assets. These two asset classes account for a significant share of household and corporate wealth and, unlike bonds and cash, their value can change significantly over a relatively short period of time. In fact the emergence of major and persistent asset price booms and busts over the past two decades amidst strong growth of aggregate valuations (e.g. as share of GDP or household wealth) in industrialised countries make these assets particularly relevant for tax purposes (see also Jaeger and Schuknecht, 2004). ECB figures, for example, put average household wealth in real estate at over four and a half times disposable income.

The first tax category we look at is direct taxes on corporations. Real estate and equity prices impact on this category mainly through income/wealth taxes on

capital gains in corporate balance sheets. While there is probably no country that does not in some way tax such capital gains (at least through corporate taxes on profits realised from the sale of assets) the impact on revenue can differ enormously and depends on the tax institutions. Taxes may be collected when capital gains accrue or when they area realised. Losses can normally be deducted from gains up to a point but the limit differs across countries and losses may be carried forward for a limited or unlimited period of time. While we hence hypothesize a positive relationship between asset price changes and corporate tax revenues, the magnitude and time lag of the fiscal effects of asset price fluctuations is likely to differ significantly across countries.

The second category we examine is direct taxes on households. Wealth and capital gains taxes are the most important way to share into rising household wealth from stock and real estate markets. Again institutional details are extremely important. Some countries still apply wealth taxes (of say a fixed percentage of real estate or stock market wealth as an annual tax). Most countries tax only capital gains while some do not even do that or at least not under certain circumstances (for instance if stocks or a house have been owned for more than a certain period). In many countries, mortgage interest can be (fully or partly) deducted against income taxes so that rising house prices (and mortgages) might have a negative effect on taxes from this source.

Asset prices can also affect household direct taxes in a more indirect manner. If realised capital gains are taxed in corporations they may be taxed again at the household level. Small, unlisted companies may pay taxes on their capital gains if the building or stocks owned by the company are sold (revalued) and taxes are then paid on the personal account of the owner. In summary, we expect a positive effect of stock price changes on this tax category while the real estate price effect is generally expected to be positive but could be negative depending on the tax regime.

The third category is indirect taxes. Rising or (falling) wealth can impact on tax revenue through total consumption and its composition (see Altissimo et al (2005) for a survey of empirical estimates of propensities to consume out of housing and equity wealth). Asset prices should hence coincide with strong domestic demand that is “fiscally more friendly” than say export demand (which gives rise to little or no

indirect taxation). Market structures in real estate also matter: is the market liquid, can equity be easily withdrawn? Illiquid and inflexible markets are likely to lead to lower wealth effects on consumption. It is probably safe to argue that conspicuous consumption increases during booms and declines during busts in a more than proportionate manner (and Ferraris or perfumes are normally more highly taxed than bread and butter). Moreover, in some countries the payment of VAT on new dwellings creates a direct channel between the real estate market and indirect tax receipts. In summary, we also expect a positive relationship between indirect taxes and asset prices.

The fourth tax category we take into consideration is taxes on financial and capital transactions. While this is a relatively small revenue category its size can become important and, among those we examine, it is the tax category most directly related to movements in asset prices. Most countries tax real estate transactions and some also impose stamp duties on transactions in equity markets. Movements in real estate and equity prices are likely to constitute a good proxy of the tax base for this revenue category especially if boom periods are accompanied by higher turnover and (as is usually the case) if turnover tax rates are expressed as a percentage of the face value of the asset.

From an accounting perspective, one can express these effects in an equation of government tax revenue as follows:

$$R = t_y Y + t_c c_y Y + t_w .\ w + t_c c_w (1 - t_w).\ w + t_t \sigma w$$

Tax revenue (R) consists not only of taxes on income ($t_y Y$) and taxes on consumption out of income ($t_c c_y Y$), but also taxes on changes in wealth, i.e. capital gains ($t_w \Delta w$), taxes on consumption out of increased wealth ($t_c c_w (1-t_w) \Delta w$) and taxes on the transfer of wealth ($t_t \sigma_w$), where σ refers to market turnover.

Despite this seemingly simple intuitive and accounting relationship between asset prices and tax revenues, the above-mentioned institutional intricacies make these relationships much less tractable and to our mind largely turn them into an empirical question. This is subject of the next section.

III. The data and stylised facts

Our analysis covers 16 industrialised countries which were chosen in view of their relatively well developed asset markets and on the basis of data availability and consistency. These include eight euro area countries, including the big five: Germany, France, Italy, Spain and the Netherlands, as well as Belgium, Ireland and Finland. We also cover three non-euro area EU Member States: Denmark, Sweden and the United Kingdom, and in addition five non-EU OECD countries: the United States, Japan, Australia, Canada and Norway.

Data for the four tax categories were taken from the OECD Revenue Statistics database. Data for the relevant macroeconomic (standard) tax bases were taken primarily from the European Commission's AMECO database. For direct taxes on corporations we use gross operating surplus as the standard proxy for the tax base typically used for forecasting purposes, while for direct taxes on households the macroeconomic base we employ is compensation of employees. In the case of indirect taxes we choose disposable income rather than private consumption as the proxy for the standard tax base so that we can capture not only the direct impact of asset prices on indirect taxes but also indirect effects via changes in the propensity to consume out of income.

As mentioned above, the fiscally most relevant assets are equities and real estate. In principle, overall wealth held in property and in equity would be the most appropriate proxies for the asset-related tax bases. The problem is that such data is typically not available in sufficiently long time series for estimation purposes, and, in the case of data concerning housing wealth, is usually only available with a significant lag. We therefore opt instead for data on asset prices. These were provided by the Bank of International Settlements and consist, for each country in our sample, of indices for equity and residential property prices with broad coverage (see Borio et al (1994) for details).[7] Cross checking on the basis of available wealth data confirmed

[7] For direct taxes on corporations we also tried commercial property prices as an alternative variable to residential property prices, but in general the latter gave better results.

that the asset price indices are very good proxies for wealth held in housing and shares (see examples in Chart 1).

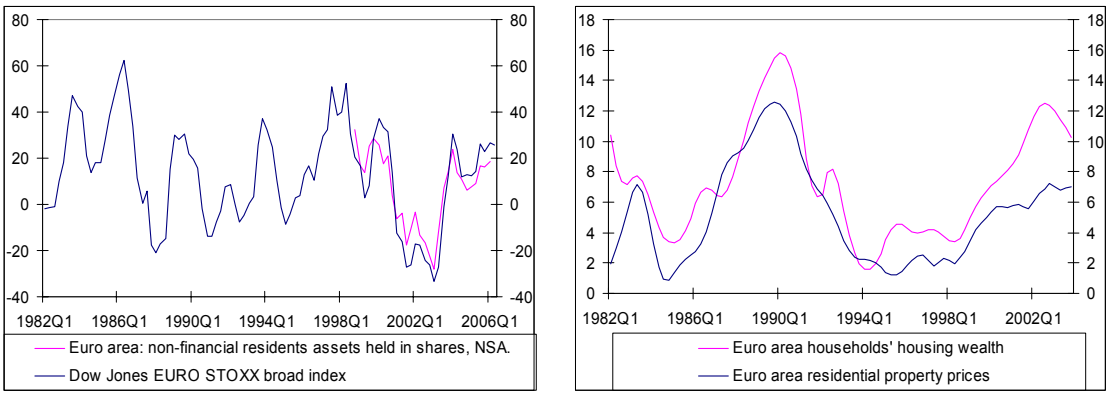
As the BIS asset price data are quarterly series (while the revenue data is only available at an annual frequency) we have taken the fourth quarter of each year so that the change in the index in a given year is approximated by the change in the index between the fourth quarter in that year and the fourth quarter of the previous year:

$$\Delta AP_t \quad AP(Q4)_t - AP(Q4)_{t-1}$$

On the basis of the available country data we have constructed a composite "euro area" data series. For the tax categories and their bases this has been done by simple aggregation of the data for the eight euro area Member States in our sample while the asset price indices have been aggregated using GDP weights for the relevant year (taken from the AMECO database). On the basis of these GDP weights our aggregate covers approximately 93% of the euro area.

Chart 1: Asset price indices and wealth data

Quarterly data. Annual percentage change



Sources: ECB, BIS.

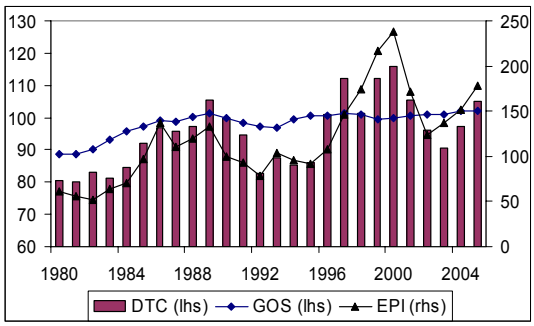
Before proceeding to the empirical analysis it is worth pointing out a few stylised facts that stem from a graphical analysis of the data. Chart 2 plots the four tax categories against their standard tax bases and the asset price indices for our synthetic "euro area" aggregate and for a few of the particularly "interesting" cases among our sample of individual countries. For illustrative purposes, all series are divided through by

nominal GDP and converted into indices with 1990 = 100. For the euro area, it can clearly be seen how the equity market booms and busts of the late 1980s / early 1990s and late 1990s / early 2000s were accompanied by a sharp rise and subsequent decline of corporate tax revenues as a percentage of GDP (panel a). This is also clearly the case for Germany (panel e). For taxes on financial and capital transactions (panel d), the data suggest a strong influence for both equity and real estate prices. For direct taxes on households (panel b) and for indirect taxes (panel c), the impact of asset prices appears more muted. Nonetheless, the charts still suggest that the asset price boom of the late 1990s / early 2000s may help to explain the rise and subsequent fall in receipts of these taxes as a proportion of GDP that cannot be explained by movements in the standard tax bases. For the United States, it can be seen that equity prices have been closely correlated with household income taxes (panel f), while the remaining examples (in panels g and h) clearly suggest a role for real estate prices in explaining direct taxes on households (in Japan) and indirect taxes (in the Netherlands).

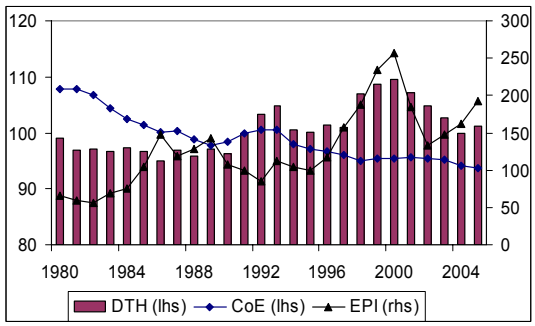
Chart 2: Tax categories, bases and asset prices indices

As a ratio to GDP. Indices 1990 = 100

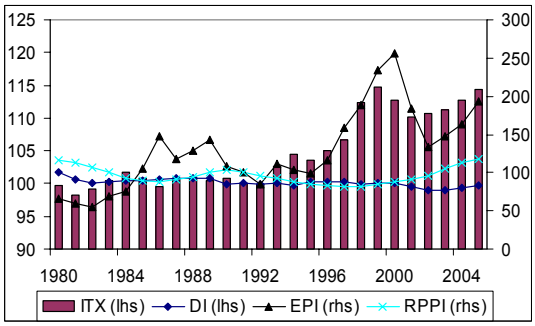
a) Euro area (direct taxes on corporations)



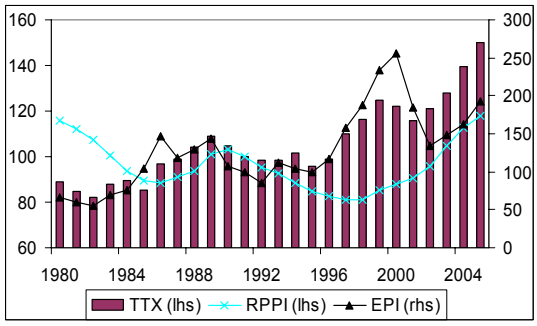
b) Euro area (direct taxes on households)



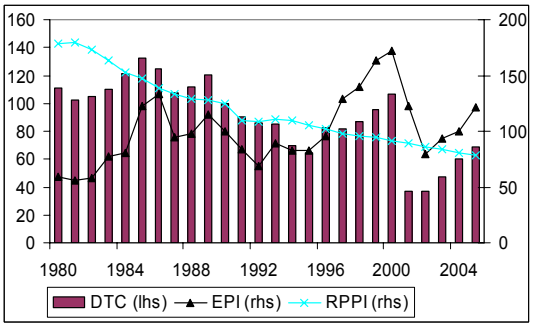
c) Euro area (indirect taxes)



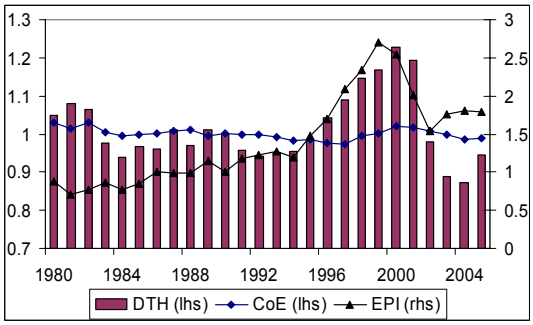
d) Euro area (taxes on financial transactions)



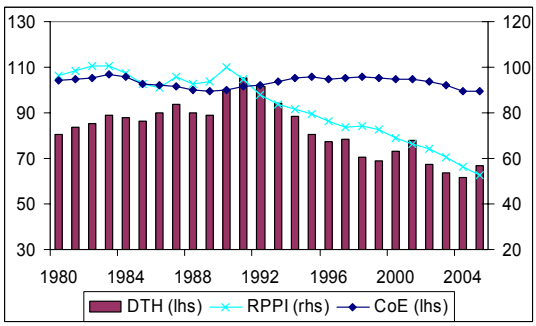
e) Germany (direct taxes on corporations)



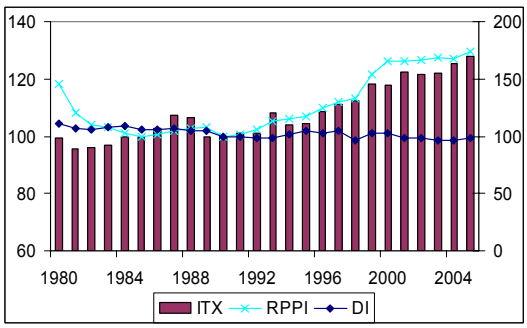
f) United States (direct taxes on households)



g) Japan (direct taxes on households)



h) Netherlands (indirect taxes)



Sources: OECD Revenue Statistics, European Commission (AMECO), BIS and own calculations

GOS = Gross operating surplus, CoE = Compensation of Employees, DI = Disposable Income, EPI = Equity Price Index, RPPI = Residential Property Price Index

IV: Regression analysis

A. Methodology

In order to test the significance of asset price movements on our tax variables we follow a standard approach for calculating revenue elasticities (see Bouthevillain et al (2001)). Two benchmark specifications are used and for each we estimate at least two models, one excluding and one including the asset price variables.

The first specification is a short run model in which we regress the tax categories on the explanatory variables in terms of first differences of the logarithm (approximating percentage growth rates). The basic model (including only the standard tax base) is specified as follows:

$$\text{(SR1)} \quad d\ln T_t = \alpha_1 + \alpha_2 d\ln B_t + \varepsilon_t$$

where T is the respective tax category, B is the standard tax base, and α_2 is the elasticity of the tax category with respect to its base. We then estimate the same equation including the asset price variables:

$$\text{(SR2)} \quad d\ln T_t = \alpha_0 + \alpha_1 d\ln B_t + \alpha_2 d\ln EPI_t + \alpha_3 d\ln RPPI_t + \varepsilon_t$$

where EPI is the equity price index, RPPI the residential property price index and α_3 α_4 are the respective elasticities. For each explanatory variable we test for significant elasticities with up to 2 lags and eliminate insignificant lags to arrive at the most parsimonious model. Given the relatively small data set (with typically only 25-35 observations), we first include our asset price variables individually and then only later include significant lags of both asset price variables to derive the "best model". Testing the significance of the two asset price variables first separately and then jointly also served as a check for multicollinearity, which in general did not prove to be a major problem.[8]

[8] Except in a small number of cases, coefficients and t statistics for the asset price variables remained robust when the other asset was concluded in the estimation. In most countries, movements of equity and property prices are not highly correlated (see table A1 in the appendix).

The above (short run) models provide us with estimates of short run elasticities for each tax category. However, there is a strong theoretical assumption that tax revenues and their tax bases are cointegrated. In this case, we should be able to estimate long run elasticities and also improve our estimates of short run elasticities by taking into account the long run cointegrating relationship. In most cases evidence for cointegration could be found either by Johansen cointegration tests or by testing for the stationarity of residuals from the long run relationship between the tax categories and their bases. In view of this we also estimated error correction models of the following form:

$$\text{(ECM1)}\quad d\ln T_t = \alpha_1 d\ln B_t - \lambda(\ln T_{t-1} - \beta_0 - \beta_1 \ln B_{t-1}) + \varepsilon_t$$

and including the asset price variables:

$$\text{(ECM2)}\quad \begin{aligned} & d\ln T_t = \alpha_1 d\ln B_t + \alpha_2 d\ln EPI_t + \alpha_3 d\ln RPPI_t \\ & - \lambda(\ln T_{t-1} - \beta_0 - \beta_1 \ln B_{t-1} - \beta_2 \ln EPI_{t-1} - \beta_3 \ln RPPI_{t-1}) + \varepsilon_t \end{aligned}$$

In this case α_1-α_3 represent the short-run elasticities and β_1-β_3 the long-run elasticities of our tax categories with respect to the respective tax base and asset price indices. λ is the error correction term which measures the percentage adjustment towards equilibrium each period in case tax revenues diverge from the levels predicted by the respective tax base. $\lambda\beta_0$ is the constant. Again, insignificant variables/lags are progressively removed from the model. In this way we can seek to detect and distinguish between both short run and long run influences of the asset price variables on tax revenues. For example, it may be that, in the long-run taxes are determined by their standard bases alone but in the short run one or other of the asset price variables exerts a significant influence. Another possibility is that asset price effects do not appear to be significant in the short run but that more persistent effects of the asset price variables enter into the long-run equilibrium relationship; or there may be both short and long-run effects. The error correction model variant provides a framework within which to reach some judgement on these issues.

All models were estimated using OLS and standard tests were performed to assess the quality of the estimations.[9] In a small number of cases, autoregressive terms were included to take account of autocorrelation in the residuals. In cases where asset price effects were found to be significant, their inclusion generally improved the quality of the model, which is what we would hope to find since we are essentially hypothesising that our basic model (with only the standard tax base as explanatory variable) is mis-specified.

While the asset price data generally extend back to 1970, in many cases we shorten the sample period to start in the mid 1970s or even as late as 1980. This was based on the observation that the inclusion of the (early) 1970s in the sample period often resulted in instability in the coefficients and corresponding t-statistics. This may be due to the impact on revenues of the first oil price shock and high and volatile inflation during this period in many countries, which is not controlled for in our estimations. For the sample periods chosen, the elasticities estimated appear to be reasonably stable, although for some countries and some tax categories recursive estimates point to some increase(decrease) of elasticities over the sample period.

We should also stress some more general caveats and limitations of our analysis. Firstly, the impact of discretionary tax changes and innovations to tax systems make it extremely difficult to estimate budget elasticities in a reliable way. This is why for forecasting purposes it is often preferred to derive tax elasticities on the basis of an institutional analysis of the tax system rather than econometric estimation, or even just to assume an elasticity of unity (see Bouthevillain et al (2001) and Girouard and André (2005)). Ideally, some estimate of the revenue impact of such changes should be netted out from the revenue series but such estimates are not readily available, at least not consistently over time and across countries. This omission is a source of potential biases in the estimates.[10] It should be borne in mind, however, that our aim in this study is not to arrive at precise estimates of elasticities for the standard tax bases, but rather to get some indication of the impact of asset price movements that could be taken into account when forecasting fiscal revenues and assessing underlying

[9] In particular: Durben-Watson first-order correlation tests, White Heteroskedasticity test, Breusch Godfrey second-order outocorrelation test and Jarque-Bera normality test.
[10] See Wolswijk (2007) for a discussion of this issue.

fiscal positions. In some cases where a significant tax reform is known to have been implemented in a given year or where there is an obvious break in the tax series the impact on the revenue elasticities can be checked and corrected for if necessary by the inclusion of dummy variables. In all but a small number of cases, however, the impact was found to be small or insignificant and the dummies could be excluded.

Secondly, our models implicitly assume that it is holdings of domestic shares and property that matter for fiscal revenues, whereas in practice residents will typically hold some of their equity (and in some cases real estate) wealth abroad. Our approach ignores the potential impact of such cross country capital gains/wealth effects. For the euro area countries in our sample we did try substituting the euro area and US equity price indices for the domestic price indices. As we would expect given the fact that the different equity markets are highly correlated (see table A1 in the appendix) these regressions tended to confirm the results of the regressions including the domestic equity price index (yielding the same or slightly weaker results). In some cases, however, the US equity price index was even more significant or led to the detection of significant effects that were not found when using the domestic share price index as an explanatory variable.

B. Results

Table 1 provides a condensed summary of our results while table 2 reports, for each country and each tax category, the main results of our preferred base model ("model 1") and, in case asset price effects were found to be significant, our preferred best model ("model 2") including the statistically significant asset price variable(s). For taxes on financial and capital transactions, our base model is identical to the "best" model as the asset price variables themselves are the proxy for the tax base. Tables A2a-d in the appendix provide a more detailed overview of the various models estimated, including details regarding lag structure and significance levels.

Table 1: Overview of regression results

		Short run relationship			Long run relationship			
		Standard Tax Base*	Equity Prices	Real Estate Prices	Standard Tax Base*	Equity Prices	Real Estate Prices	Adj R2
Direct Taxes on Corporations								
Significant effects**		11/17	9/17	8/17	15/17	9/17	3/17	
Average elasticity***	Model 1	1.77	-	-	1.24	-	-	0.30
	Model 2	1.33	0.34	0.73	0.79	0.31	1.06	0.51
Direct Taxes on Households								
Significant effects**		17/17	11/17	5/17	9/17	3/17	-	
Average elasticity***	Model 1	1.21	-	-	1.08	-	-	0.60
	Model 2	1.03	0.10	0.23	1.02	0.06	-	0.67
Indirect Taxes								
Significant effects**		17/17	6/17	9/17	10/17	-	2/17	
Average elasticity***	Model 1	0.95	-	-	1.05	-	-	0.61
	Model 2	0.91	0.10	0.25	0.97	-	0.30	0.70
Transactions taxes								
Significant effects**		-	9/14	13/14	-	3/14	6/14	
Average elasticity***		-	0.33	0.94	-	0.38	1.02	0.47

*Gross operating surplus for direct taxes on corporations, compensation of employees for direct taxes on households and disposable income for indirect taxes

** Ratio of countries in the sample for which the explanatory variable is found to be significant

*** Average only for countries where significant asset price effects are found. For long run elasticities, excludes countries where the macroeconomic tax base is omitted from the long run equation

Before discussing each tax category individually, there are a few observations that can be made that are generally applicable across tax categories. Firstly, irrespective of the tax category, we tend to find significant and positive asset prices effects for most countries. However, the impact varies in size, in terms of which asset price variable is important, and also in terms of the lag structure. Secondly, our estimates for the elasticity with respect to our proxies for the standard tax bases seem to be broadly consistent with what we would expect from theory and from previous studies. Thirdly, the elasticity with respect to the standard tax base tends (in most cases) to decline when asset price effects are included (and this applies to both short run and long run elasticities). This finding would be consistent with the hypothesis that these standard proxies capture a significant part of the respective tax base, but our asset price variables are a better proxy for at least some proportion of the actual tax base.

As far as direct taxes on corporations are concerned, we find significant asset price effects for all countries except Italy and Norway. For the majority of countries, equity prices are the main driving force, with (both short and long run) elasticities of around 0.3 being typical. In other words, a ten percent increase in equity prices normally implies

a 3% increase in corporate tax receipts. Elasticities for real estate are higher, typically around 0.7 in the short run. For several countries (Belgium, France, Denmark, Japan and the US, as well as the euro area aggregate) both equity and real estate prices are found to be significant. On average the adjusted R^2 increases from 0.30 to 0.50 when asset price variables are included in the estimates.

Particular caution is warranted, however, in interpreting these results as the estimations also show that gross operating surplus is a very poor proxy for the corporate tax base, especially in the short-run. In fact, for some countries gross operating surplus does not appear to provide any information for forecasting corporate tax receipts in the short run, while even in the long run there are cases (Belgium, Denmark, Canada) where equity and/or real estate prices seem to perform better as a proxy for the corporate tax base. In such cases, the relevance of the elasticities estimated is limited.[11]

One case worthy of special mention is Germany, which experienced a very sharp decline in corporate tax receipts in 2001 which coincided both with a significant corporate tax reform (which lowered corporate tax rates) and a sharp decline in the stock market. The (short-run) elasticity of 0.36 for German corporate tax receipts with respect to equity prices was estimated including a dummy for the 2001 tax reform. Excluding the dummy leads to a much higher estimate of this elasticity (see Table A2a in the appendix).

Turning to direct taxes on households, compensation of employees clearly provides a better proxy of the actual tax base and the influence of asset prices generally seems to be less significant than for corporate taxes. Nonetheless, we still find significant effects for 12 of the 16 countries in our sample, mainly for equity prices, with an average increase in the adjusted R^2 from 0.60 to 0.67 when asset prices are included as explanatory variables. In cases where significant effects are found, the elasticity with respect to equity prices is typically around 0.05 to 0.1, although for the

[11] We also tried including GDP as an alternative to gross operating surplus in the estimations, but this did not have any effect. In cases where gross operating surplus was insignificant the same was also true of GDP, which generally turned out to be a (slightly) poorer proxy for the corporate tax base. Also, the estimated elasticities of corporate taxes with respect to the asset price variables were unaffected by the inclusion of GDP.

United States it is as high as 0.27.[12] This finding seems to be consistent with existing literature pointing to a particularly high sensitivity of household income taxes to stock prices in recent years in the United States.[13] The elasticity of household direct taxes with respect to real estate is on average around 0.2. In three cases, including Germany and the euro area aggregate, equity prices enter into the long run equilibrium relationship, indicating that the effect of equity markets on direct tax revenues tends to be quite persistent over time.

The only country for which we found a significant negative relationship between real estate prices and direct taxes on households was Sweden. In some other cases, coefficients were negative for certain lags, but generally not significant (or robust across different specifications). The fact that we only find relative few examples of significant effects of real estate prices on household income taxes may be due to positive (capital gains) and negative (mortgage interest deductibility) effects offsetting each other.

As for indirect taxes, a similar picture emerges in terms of the extent to which disposable income explains tax receipts as well as the overall magnitude of asset price effects. The adjusted R^2 increases, on average, from 0.61 to 0.70 when the asset price variables are included in the estimates. Real estate prices seem to be the important variable in most countries, including several euro area countries, which is consistent with existing literature which suggests stronger wealth effects on consumption from the housing market, but much less so from the stock market (Case et al (2001), Catte et al (2004)). We do not, however, find a significant effect from real estate for the euro area aggregate.[14]

[12] This estimate was obtained including a dummy for 2002 when a sharp full in direct taxes on households coincided with both the equity market decline and a significant income tax cut.
[13] This is consistent with previous finding of significant variations in household capital gains in the US since the mid 1990s. For example, Girouard and Price (2004) report that household capital gains in the US doubled between 1995 and 200, reaching slightly over 1% of GDP before falling to around ½ per cent of GDP in 2003. In an investigation into the relationship between revenues and the stock market in the late 1990s and early 2000s, the Congressional Budget Office noted that, while some of the variation of tax-to-GDP ratio showed up as corporate income tax, even more was due to variation in individual income tax receipts.
[14] This is not so surprising given that we do not find any significant effect for real estate prices in France or Spain. Moreover, for those countries where significant effects are found, the lag structure varies, which may explain why such effects cannot be identified for the euro area aggregate. It should also be noted that estimated coefficients may overstate asset price induced wealth effects on consumption (and indirect taxes) if consumption/savings rate changes coincide with wealth changes but are due to other factors.

Regarding taxes on financial transactions, for all countries asset prices appear to be a major factor explaining variations in revenues with an average adjusted R^2 of almost 0.5. In over half of the cases, both equity and real estate play a significant role. Elasticities of turnover taxes with respect to equity prices are in the order of 0.3 (but reach as high as 0.6 in the UK) while elasticities with respect to real estate are typically between 0.5 and 1.

Overall, the results seem to confirm that asset prices exert a significant impact on our four tax categories in most countries. The results are generally consistent with those reported in Eschenbach and Schuknecht (2002). If anything, our results point to even stronger and more pervasive asset price effects than this earlier study, which would be consistent with the observation from the raw data that the influence of asset prices on fiscal revenues seems to have become more marked in recent years.

The extent to which including asset prices in our estimates helps to explain variations of tax receipts that are not explained by variations in the standard tax base can be illustrated by comparing the residuals from the "base" and "best" models. A couple of pertinent examples are shown in Chart 3. Firstly, regarding corporate taxes for the euro area, residual analysis shows that including equity prices helps to track revenue fluctuations considerably better throughout the sample period. It also helps to explain a large portion of the "boom-bust-boom" in corporate tax receipts since the late 1990s. Secondly, the case of direct taxes on households in the United States highlighted above is a particularly interesting one, where the impact of equity price movements on direct taxes on households seems to be particularly strong. Here we can see that the sharp fall and subsequent recovery of tax receipts since 2000 is only partly explained by the growth of compensation of employees, but is explained much more fully when we take into account the impact of equity prices.

Table 2: Summary of regression results

a) Direct taxes on corporations

	Short-term elasticities			Long-term elasticities			
	Gross Operating Surplus	Equity Price Index	Real Estate Price Index	Gross Operating Surplus	Equity Price Index	Residential Property Price Index	Adjusted R2
Belgium							
Model 1	1.08			1.58			0.06
Model 2		0.42			0.49	0.51	0.51
Finland							
Model 1	1.32			1.41			0.73
Model 2	1.50			0.75	0.44		0.81
France							
Model 1	1.97			1.29			0.31
Model 2	2.61		0.66	0.80	0.31		0.62
Germany							
Model 1				0.61			0.20
Model 2		0.36			0.44		0.53
Ireland							
Model 1				1.17			0.02
Model 2			0.62		1.19		0.17
Italy							
Model 1				1.00			0.35
Netherlands							
Model 1				1.00			0.17
Model 2				0.54	0.31		0.24
Spain							
Model 1	1.63			1.51			0.23
Model 2			0.61	0.91	0.29		0.43
"Euro area"							
Model 1				0.95			0.21
Model 2		0.20	0.44	0.74	0.18		0.47
Denmark							
Model 1				1.60			0.08
Model 2		0.31	1.27	0.40		1.41	0.65
Sweden							
Model 1	1.12			1.25			0.35
Model 2	0.74	0.39		1.24			0.51
United Kingdom							
Model 1	1.40			0.94			0.46
Model 2	1.09		0.60	0.95			0.53
Australia							
Model 1	1.14						0.18
Model 2	0.55	0.37					0.25
Cananda							
Model 1	1.90			1.20			0.64
Model 2	1.27	0.34			0.99		0.75
Japan							
Model 1	2.89			1.29			0.58
Model 2	1.08	0.37	0.48	0.56		0.70	0.82
Norway							
Model 1	3.20						0.79
United States							
Model 1	2.38			1.15			0.27
Model 2	1.79	0.26	1.16	0.98			0.40
Average*							
Model 1	1.77			1.24			0.30
Model 2	1.33	0.34	0.73	0.79	0.31	1.06	0.51

*Average only for countries where significant asset price effects are found. For long run elasticities, exludes countries where gross operating surplus is omitted from the long run equation.

Table 2: Summary of regression results

b) Direct taxes on households

	Short-run elasticities			Long-run elasticities			
	Compensation of Employees	Equity Price Index	Residential Property Price Index	Compensation of Employees	Equity Price Index	Residential Property Price Index	Adjusted R2
Belgium							
Model 1	1.17						0.59
Model 2	1.26	0.06					0.61
Finland							
Model 1	1.05			1.07			0.68
Model 2	0.75	0.05		0.98	0.04		0.71
France							
Model 1	1.32						0.80
*Model 2***	*1.31*	*0.05*					*0.83*
Germany							
Model 1	1.10			1.02			0.76
Model 2	0.94			0.88	0.09		0.81
Ireland							
Model 1	1.10						0.43
*Model 2***	*1.13*	*0.17*					*0.50*
Italy							
Model 1	1.56						0.81
Model 2	1.52		0.05				0.83
Netherlands							
Model 1	1.20			0.73			0.25
Spain							
Model 1	1.61			1.09			0.58
Model 2	1.00		0.34	1.01			0.65
"Euro area"							
Model 1	1.11			1.16			0.69
Model 2a	1.18	0.04		1.07	0.06		0.71
*Model 2b***	*1.01*	*0.07*		*0.92*	*0.13*		*0.80*
Denmark							
Model 1	1.33						0.51
Sweden							
Model 1	1.11			1.01			0.53
Model 2	1.21	0.07	-0.21	1.03			0.64
United Kingdom							
Model 1	1.16			0.98			0.67
Model 2	0.88	0.07	0.15	0.99			0.73
Australia							
Model 1	1.24			1.14			0.56
Model 2	1.07	0.09		1.12			0.60
Canada							
Model 1	1.00			1.18			0.49
Model 2	0.96	0.10		1.11			0.58
Japan							
Model 1	1.23						0.44
Model 2	0.67	0.16	0.39				0.66
Norway							
Model 1	0.83						0.40
Model 2	0.60		0.22				0.49
United States							
Model 1	1.56						0.62
Model 2	0.93	0.27					0.71
Average*							
Model 1	1.21			1.08			0.60
Model 2	1.03	0.10	0.23	1.02	0.06		0.67

*Average only for countries where significant positive effects are found

** Regression including the United States Equity Price index rather than the domestic equity price index.

Table 2: Summary of regression results

c) Indirect taxes

	Short-run elasticities			Long-run elasticities			
	Disposable Income	Equity Price Index	Residential Property Price Index	Disposable Income	Equity Price Index	Residential Property Price Index	Adjusted R2
Belgium							
Model 1	0.85			1.07			0.48
Model 2	0.67		0.17	0.79		0.24	0.57
Finland							
Model 1	0.63			0.95			0.74
Model 2	0.29		0.25	0.60		0.35	0.82
France							
Model 1	1.12			1.03			0.80
Germany							
Model 1	0.86			1.02			0.71
Model 2	0.72		0.36	1.10			0.77
Ireland							
Model 1	1.29						0.50
Model 2	1.06		0.19				0.52
Italy							
Model 1	1.26						0.80
Model 2	1.03	0.04	0.18				0.84
Netherlands							
Model 1	0.98						0.46
Model 2	0.55		0.28				0.66
Spain							
Model 1	0.73			1.14			0.45
Model 2	1.19	0.16		1.20			0.63
"Euro area"							
Model 1	0.86						0.71
Denmark							
Model 1	1.06			1.03			0.69
Model 2	0.72		0.23	0.94			0.78
Sweden							
Model 1	0.95			1.11			0.54
United Kingdom							
Model 1	1.24						0.68
Model 2	1.32	0.06					0.74
Australia							
Model 1	1.21			1.11			0.74
Model 2	1.36	0.05		1.12			0.78
Canada							
Model 1	0.92						0.47
Model 2	0.89	0.14	0.26				0.63
Japan							
Model 1	0.68			1.02			0.70
Model 2	0.43	0.08		1.02			0.75
Norway							
Model 1	0.96						0.52
Model 2	0.81		0.19				0.58
United States							
Model 1	0.95			0.98			0.76
Average*							
Model 1	0.95			1.05			0.61
Model 2	0.91	0.10	0.25	0.97		0.30	0.70

*Average only for countries where significant effects are found

Table 2: Summary of regression results

d) Taxes on financial and capital transactions

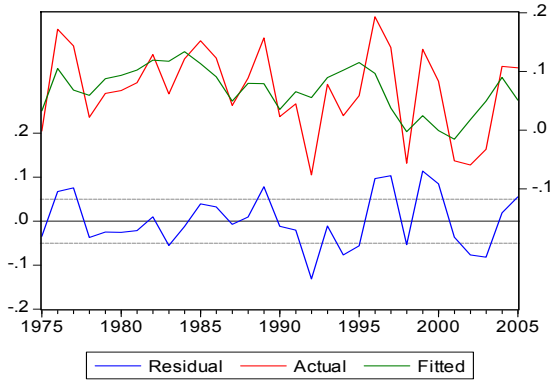
	Sample period	Short-run elasticities		Long-run elasticities		Error Correction Term	Adjusted R2
		Equity Price Index	Real Estate Price Index	Equity Price Index	Real Estate Price Index		
Belgium	1975-2005	0.38	0.95				0.71
Finland	1975-2005		1.08				0.44
France	1975-2005	0.11	0.90				0.37
Germany	1975-2005	0.29		0.47	0.91	0.63	0.40
Ireland	1980-2005	0.41	1.13				0.50
Italy	1978-2005		0.74		0.84	0.19	0.55
Netherlands	1972-2005	0.15	0.60	0.43	0.79	0.42	0.66
Spain	1975-2005		0.51				0.29
"Euro area"	1975-2005	0.16	0.52	0.24	0.90	0.23	0.44
Denmark	1975-2005		1.09		0.95	0.34	0.37
Sweden	1972-2005	0.38	2.28				0.50
UK	1978-2005	0.61	0.68				0.32
Australia	1975-2005	0.47	0.83				0.42
Norway	1980-2005		0.90		1.70	0.63	0.59
Average*		0.33	0.94	0.38	1.02	0.41	0.47

*Average only for countries where significant effects are found

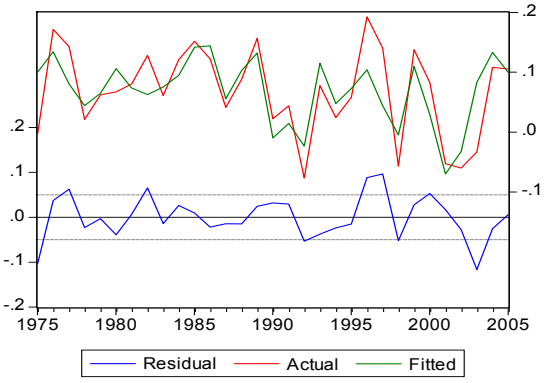
Chart 3: Residuals from selected models

Euro area: direct taxes on corporations

Model 1 (base model)

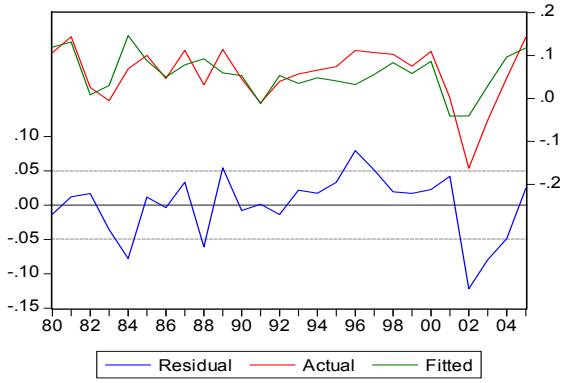


Model 2 (including asset price variables)

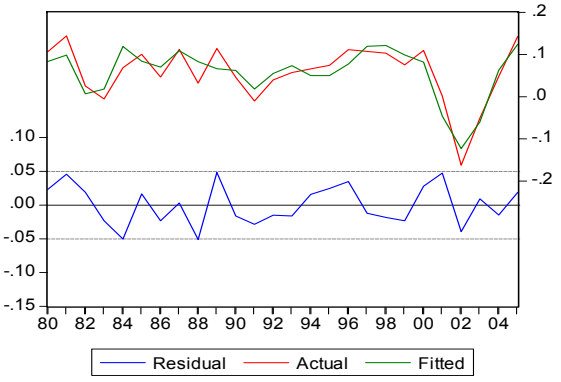


United States: direct taxes on households:

Model 1 (base model)



*Model 2 (including asset price variables)**



** Model excluding dummy for 2002 (see appendix table A2b)*

V: Assessing the impact of asset prices on (structural) budget balances

A. Asset price related budget sensitivities

Having estimated elasticities for the four tax categories with respect to the asset price variables, we would now like to come to some form of tentative assessment as to the impact of asset price movements on the budget balance. As a first indication, we calculate budget sensitivities for a certain increase in asset prices. This can be done by multiplying the revenue to GDP ratio in the previous period by the corresponding elasticity and the percentage change in the relevant asset price variable

Table 3 shows the budgetary effect of asset price changes for each tax category and for each euro area country in our sample assuming a 10 percent increase in both equity and real estate prices. Overall, a ten percent increase in asset prices seems to add, on average, around half a percent of GDP to fiscal revenues, although the budgetary impact for our euro area aggregate is estimated to be smaller (at around one quarter of a percent of GDP). This (apparent) discrepancy results largely from the fact that the impact of real estate price increases on indirect tax receipts is found to be significant in a number of euro area countries, but not for the euro area aggregate. For a given price increase, the impact on the budget stemming from real estate prices tends to be larger, in particular due to the impact on transaction taxes and (in some countries) on indirect taxes. As has already been noted, however, this does not necessarily mean that real estate prices have a larger effect overall since equity markets tend to be more volatile. In many countries equity prices increased two-, three- or even four-fold between the mid 1990s and the peak of the stock market boom in 2000, and our estimates suggest that the effect of such an increase in some countries could add as much as 3% or more of GDP to revenues.

Table 3: Asset price related budget sensitivities

Increase in revenue (in % of GDP) given a 10% increase in equity and real estate prices

	direct taxes on corporations		direct taxes on households		indirect taxes		taxes on financial transactions		Total		Total
	EPI	RPPI	EPI	RPPI	EPI	RPPI	EPI	RPPI	EPI	RPPI	
Belgium	0.14	0.18	0.08			0.22	0.04	0.09	0.26	0.49	0.75
Finland	0.17		0.07			0.35		0.03	0.24	0.38	0.62
France	0.07	0.16	0.04				0.01	0.05	0.12	0.21	0.33
Germany	0.03		0.08			0.42	0.01	0.02	0.12	0.44	0.57
Ireland		0.03	0.14			0.25	0.05	0.15	0.20	0.43	0.62
Italy				0.05	0.06	0.25		0.09	0.06	0.39	0.45
Netherlands	0.10					0.35	0.04	0.07	0.14	0.41	0.55
Spain	0.09	0.19		0.24	0.19			0.08	0.28	0.51	0.79
Weighted Average [1]	**0.05**	**0.07**	**0.04**	**0.04**	**0.03**	**0.22**	**0.01**	**0.06**	**0.14**	**0.39**	**0.53**
"Euro area"	**0.04**	**0.10**	**0.06**				**0.02**	**0.06**	**0.12**	**0.16**	**0.28**

Sources: European Commission (AMECO) and own calculations. [1] Using GDP weights

B. Impact of asset prices on the underlying fiscal stance

Asset price related budget sensitivities provides us with an estimate of how much movements in asset prices add to (or subtract from) fiscal revenues. But in order to assess the implications of asset price movements for the underlying fiscal position, we need to develop a view as to the proportion of these revenues that is structural and the proportion that is cyclical/transitory (i.e. the excess (or shortfall) in revenues stemming from asset price over (or under) valuation. We need some measure of the extent to which asset prices are diverging from their equilibrium values. Unfortunately, the measurement of the asset price gap is as at least as problematic if not more so that the measurement of the output gap and a proper treatment of this problem would go well beyond the scope of this paper. We get around this issue by separating the asset price series into trend and cyclical components using a Hodrick-Prescott filter.[15] This at least gives us an unbiased view as to whether asset prices are above or below trend.[16] In this way, we calculated a cyclical component of the budget balance related to our asset price "cycle" (CC^{AP}) that may serve as a useful first approximation as follows:

[15] Alternatively we could have filtered the proportion of revenues associated with asset price movements, which should, however, give the same results. Girouard and Price (2004) apply a similar approach using and an HP filter to separate capital gains tax revenues into trend and cycle components which are then used to calculate cyclically adjusted balances net of capital gains stemming from the asset price cycle.

[16] Moreover, since using an HP filter implies that during an asset price boom the estimated trend growth of asset prices will rise, this at least partly takes into account the argument that asset price booms may reflect structural factors (e.g. increased productivity, lower and more stable inflation etc).

$$CC_t^{AP} = \sum \left(\frac{T^i}{GDP} \right)_{t-1} \bullet \varepsilon^{ij} \bullet (AP_t^j - AP_t^{jTR})$$

where T^i/GDP is the ratio-to-GDP of tax category i, ε^{ij} is the elasticity of tax category i to asset price j and AP^j - AP^{jTR} is the deviation of the asset price j from its trend value.

Table 4: Estimated impact of asset price "cycle" on the budget balance

(as a percentage of GDP)

a) "Cyclical component" related to asset prices

									Euro area	
	Belgium	Germany	Spain	France	Ireland	Italy	Neth'nds	Finland	[1]	[2]
1999	0.63	0.57	0.41	0.33	0.82	-0.24	0.88	-0.22	0.34	0.35
2000	0.44	0.73	0.13	0.47	0.80	0.06	1.35	2.16	0.52	0.54
2001	-0.29	0.08	-0.60	-0.06	-0.15	-0.18	0.53	3.55	-0.03	0.01
2002	-0.78	-0.42	-0.97	-0.46	-0.54	-0.16	-0.17	0.30	-0.35	-0.43
2003	-0.53	-0.27	-0.37	-0.16	-0.14	0.07	-0.26	-0.47	-0.18	-0.20
2004	0.26	-0.26	0.32	0.07	0.10	0.27	-0.37	-0.41	-0.01	0.00
2005	0.46	-0.01	1.07	0.25	0.26	0.16	-0.12	-0.34	0.21	0.22

b) Change in the "cyclical component" related to asset prices

	Belgium	Germany	Spain	France	Ireland	Italy	Neth'nds	Finland	Euro area	
									[1]	[2]
1999	-0.12	0.34	0.30	0.44	0.48	0.15	0.80	0.44	0.33	0.34
2000	-0.14	0.15	-0.29	0.14	0.06	0.29	0.50	2.33	0.19	0.19
2001	-0.71	-0.66	-0.73	-0.52	-0.89	-0.23	-0.75	1.12	-0.53	-0.53
2002	-0.52	-0.49	-0.44	-0.41	-0.41	0.00	-0.69	-2.25	-0.33	-0.42
2003	0.21	0.14	0.59	0.23	0.31	0.23	-0.12	-0.75	0.15	0.20
2004	0.76	0.02	0.67	0.21	0.25	0.20	-0.15	-0.03	0.16	0.20
2005	0.21	0.25	0.77	0.18	0.16	-0.09	0.27	0.07	0.22	0.23

[1] Estimated
[2] Weighted average of country estimations

The calculations for the euro area countries in our sample for the period 1999-2005 are shown in table 4. Although one should keep in mind the caveats so as not to gain a false sense of precision, the results are rather telling. They suggest that in 1999 and 2000, the impact of asset prices on the budget balance was positive and increasing in most euro area countries. For the euro area, our estimates point to a component of the budget balance related to the asset price "cycle" of slightly above 0.5% of GDP in 2000, while the effects on the budgets of Germany, the Netherlands and Finland are notably larger than this.[17] In 2001 and 2002, the impact of asset prices then turned

[17] The impact is particularly high in Finland in 2000 and indeed in that year the budget balance jumped from below 2% of GDP to almost 7% of GDP.

negative. The estimates for the euro area point to the budget balance deteriorating by almost 1% of GDP more between 2000 and 2002 than would have been the case in the absence of asset price effects. From 2003 onwards, asset price increases have again started to have a positive effect on budget balances in most countries.

These estimates suggest that ignoring the impact of asset prices movements on fiscal revenues could have considerable implications for assessing the level and change of the structural budget balance. This is especially the case if asset price movements are driven by factors beyond developments in the real economy. Indeed, the correlations between our asset price "cycles" obtained using the HP filtering technique and official estimates of the output gap are rather small (see table A3 in the appendix). In periods when asset markets are performing well but GDP growth is below trend (as was the case in the euro area in 2005), existing estimates of the change in the CAB are likely to be particularly misleading.

In order to gauge the potential implication of asset price effects for assessing compliance with consolidation requirements in the context of fiscal rules that emphasise CABs, such as the revised SGP, table 5 shows how estimates of the structural balance could differ if such effects were taken into account in addition to the changes in the output gap. Panel a) reports changes in the CAB as contained in the AMECO database at the time of the European Commission's autumn 2006 forecasts. Panel b) reports the same numbers after netting out our estimates for the impact of asset price movements.[18] According to the official CAB estimates, the euro area fiscal stance was tightening by half a percentage point of GDP in 1999. Our estimates suggest, however, that most of this improvement could be attributed to rising asset prices (1999 being a boom year for euro area equity markets). By contrast, in 2001, according to the official CAB estimates the euro area fiscal position deteriorated by 0.7% of GDP, but after taking account of the sharp decline in equity markets in that year, only a small amount of this deterioration seems to have been structural. Rather, according to our estimates, the loosening of the fiscal stance occurred already in 2000.

[18] Of course, this is only a rough approximation in which it is assumed that the impact of asset prices on the budget balance is in addition to and independent of fluctuations of the output gap. The regression analysis in the previous section suggest that this is largely true, but not entirely so (i.e. estimated elasticities of taxes with respect to their standard tax bases are affected and in general tend to be slightly smaller following the inclusion of asset price variables in the estimations).

Turning to more recent years, which have witnessed a recovery in equity markets (as well as a continued strong growth of property prices in many countries), the results point to a risk of overestimating the improvement in underlying fiscal positions. According to the unadjusted CAB estimates, the fiscal position of the euro area improved by almost 1% of GDP in the 2003-2005 period, but after adjusting for asset price effects, the estimate is reduced to just 0.4% of GDP. For 2005 the estimate of the impact of asset price movements on the euro area budget balance of around 0.2% of GDP may go some way towards helping to explain the "surprise" improvement in that year (when the actual budget balance turned out to be around 0.3/0.4% of GDP better than forecast by most international institutions as late as in the autumn of the same year).

Table 5: Impact of asset prices on structural budget balances

(as a percetange of GDP)

a) Change in cyclically adjusted balance

	Belgium	Germany	Spain	France	Ireland	Italy	Neth'nds	Finland	**Euro area**
1999	-0.38	0.54	1.18	0.36	-0.79	0.83	0.47	0.05	0.51
2000	-0.19	-0.54	-0.29	-0.50	1.17	-1.27	0.46	4.74	-0.42
2001	0.98	-1.58	0.46	0.07	-3.12	-1.23	-1.00	-1.28	-0.70
2002	-0.08	-0.24	0.68	-1.06	-1.06	0.71	-0.49	0.01	-0.12
2003	0.55	0.28	0.62	-0.50	1.60	-0.08	-0.21	-0.83	0.03
2004	-0.52	0.13	0.14	0.45	1.75	0.15	1.24	-0.32	0.23
2005	-1.70	0.65	1.47	1.16	-0.15	-0.04	1.72	0.45	0.67

b) Change in cyclically adjusted balance net of asset price effects

	Belgium	Germany	Spain	France	Ireland	Italy	Neth'nds	Finland	**Euro area**	
									[1]	**[2]**
1999	-0.25	0.20	0.88	-0.09	-1.28	0.68	-0.33	-0.38	0.18	0.20
2000	-0.05	-0.70	0.00	-0.64	1.11	-1.56	-0.04	2.41	-0.62	-0.61
2001	1.69	-0.92	1.19	0.59	-2.23	-1.00	-0.25	-2.40	-0.17	-0.27
2002	0.43	0.26	1.12	-0.66	-0.65	0.71	0.19	2.25	0.21	0.26
2003	0.35	0.14	0.03	-0.73	1.29	-0.31	-0.08	-0.08	-0.12	-0.15
2004	-1.27	0.11	-0.53	0.23	1.50	-0.05	1.38	-0.30	0.07	0.08
2005	-1.91	0.40	0.70	0.98	-0.31	0.05	1.45	0.38	0.44	0.47

Sources: European Commission autumn 2006 forecasts and own calculations.
[1] Estimated
[2] Weighted average of country estimations

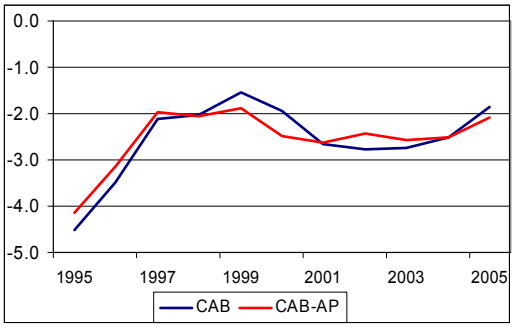
In general, netting out the impact of the asset price "cycle" seems to reduce variations of the structural balance. While for some countries (including France and Italy), the impact is quite muted, it is more substantial for Germany and for the euro

area - see panels a) and b) of Chart 4. In Spain, the (nominal and cyclically adjusted) budget balance has been improving for several years, but the estimates suggest that after taking into account asset price changes, the fiscal stance has been neutral rather than tightening in recent years. In the case of the Netherlands, the estimates suggest that almost all of the improvement in the CAB in 1999/2000 and its subsequent deterioration in 2002/2003 could be explained by the asset price "cycle", while the more recent consolidation of public finances is confirmed as being largely structural.[19]

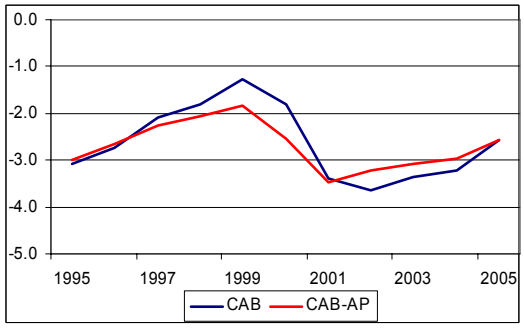
Chart 4: Cyclically adjusted balances (with and without asset price effects)

(as a percentage of GDP)

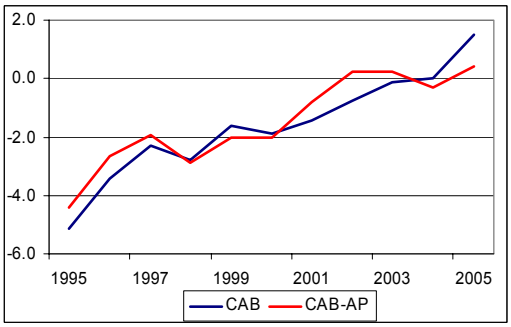
a) Euro area



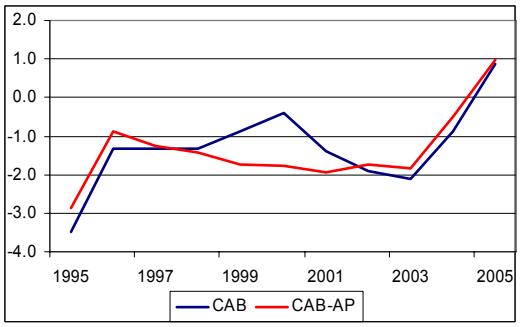
b) Germany



c) Spain



d) The Netherlands



CAB = Cyclically adjusted balance as estimated by the European Commission (autumn 2006).
CAB-AP = CAB adjusted for the asset price "cycle"

[19]It should be borne in mind, however, that the HP filer method used to separate the cyclical and trend components of asset price movements suffers from the well known end point problem, implying a likely underestimation of deviations from trend at the end of the sample period.

C. A word on forecasting revenue windfalls

The focus in this section has been on using our estimates of tax elasticities with respect to asset prices to draw conclusions regarding the underlying budgetary position and fiscal stance in the recent past. Such estimates could, however, also improve the toolkit for forecasting purposes, at least in the short term. In particular, towards the end of the year, information regarding asset price movements in that year (and/or in the previous year if there are lagged effects) could, in principle, be used as an input to improve projections for fiscal revenues, or at least to assess the likelihood of revenue windfalls / shortfalls in the current year. For example, for the euro area, by November 2006 the Dow Jones EURO STOXX broad index had already increased by around 15% since the beginning of the year (and by 20% compared to the previous November). Meanwhile, the latest (2006Q2) estimate for the annual growth of the euro area residential property price indicator was 6.8% (see ECB Monthly Bulletin, December 2006). According to the elasticities we calculated in section IV, this would point to a boost to revenues from asset price movements in the euro area in 2006 of approximately 0.2% of GDP. Depending on the extent to which such revenue windfalls are already accounted for in the fiscal projections (e.g. in the European Commission's autumn 2006 forecasts), this suggests either a likelihood of a further positive revenue surprise in 2006, or that the projected small improvement of the euro area cyclically adjusted budget balance in 2006 may be related primarily to the asset price "cycle" rather than to a structural improvement of the public finances.

VI: Conclusions

In this paper we have revisited one of the missing links between fiscal balances and economic cycles by extending earlier work on the empirical relationship between asset prices and fiscal revenues. We estimated short- (and where relevant) long-term elasticities for four revenue categories (direct taxes on corporations, direct taxes on households, indirect taxes, and taxes on financial transactions) with respect to equity and residential property prices. This was done for 16 OECD countries, including 11 EU Member States, and for an aggregate of eight euro area countries (covering more than 90% of the euro area on the basis of GDP weights).

The empirical analysis points to significant and positive asset price effects for all four revenue categories for most countries in the sample. However, as one would expect given different tax systems, the estimates also confirm that asset price effects appear to vary in terms of their magnitude, in terms of which asset(s) have significant effects on which revenue category, and the nature (contemporaneous and/or lagged, short- and/or long-run) of the relationship. The impact of asset prices seems to be strongest on transactions taxes and on corporate taxes, while the effects on direct household taxes and indirect taxes tend to be smaller. However, given the greater importance of the latter two revenue categories, asset price effects on all four categories seem capable of giving rise to notable budgetary effects. Typically elasticities with respect to real estate prices are larger that with respect to equity prices, but this does not necessarily imply that property prices exert a larger impact on the budget as this also depends on the size of asset price movements (with equity prices tending to be more volatile).

Focusing on the subset of euro area countries, we use our estimates for asset price related tax elasticities to assess the impact of asset price movements on the budget balance and hence the assessment of underlying fiscal positions and the fiscal stance. Focusing on the EMU period, our estimates suggest that for 1999-2000, the underlying fiscal position of many euro area countries was less favourable than suggested by standard estimates of the cyclically adjusted budget balance, while the converse was true during 2001-2003. Our results suggest that taking into account the impact of asset price movements would give rise to an estimate of the euro area underlying fiscal position that is around ½ percent of GDP lower (higher) during the asset price upswing (downturn). More recently, in the context of the recovery in equity prices since 2003, there again seems to be a risk that the improvement of underlying fiscal positions is being over-estimated.

Our findings suggest that taking into account the influence of asset price movements could improve the fiscal monitoring and forecasting toolkit, either by helping to arrive at better estimates of the structural balance or interpreting unexplained movements of existing CAB estimates. In this context, the empirical analysis contained in this paper should be seen as indicative. More detailed analyses

of the interactions between fiscal revenues and asset prices at the individual country level (e.g. taking into account tax systems and their changes) would clearly be needed. More generally, our results support the view that caution is warranted in attributing unexplained improvements in the fiscal balance to structural factors, particularly at times when equity and/or real estate markets are buoyant.

Appendix

Table A1: Correlations among the asset price variables

	EPI/RPPI	EPI/EPI(EA)	EPI/EPI(US)
Belgium	-0.17	**0.78**	**0.58**
Finland	**0.41**	**0.61**	0.34
France	-0.13	**0.91**	**0.65**
Germany	-0.24	**0.87**	**0.62**
Ireland	-0.04	**0.64**	**0.52**
Italy	-0.10	**0.72**	**0.44**
Netherlands	0.06	**0.83**	**0.66**
Spain	-0.08	**0.77**	**0.43**
Euro area	-0.36	-	**0.65**
Denmark	**0.41**	**0.58**	**0.45**
Sweden	-0.15	**0.70**	**0.49**
United Kingdom	-0.08	0.39	**0.60**
Australia	-0.13	**0.67**	**0.64**
Canada	0.09	**0.64**	**0.66**
Japan	0.14	**0.52**	**0.40**
Norway	0.07	**0.52**	0.32
United States	-0.23	**0.65**	-
Average[1]	-0.03	**0.67**	**0.53**

[1] Excluding euro area
EPI = Equity Price Index, RPPI = Residential Property Price Index, EPI(EA/US) = Euro area/ United States Equity Price Index..
NB: Correlations above 0.4 shown in bold

Table A2: Detailed overview of econometric models and results

a) Direct taxes on corporations

		Short Run Elasticities[1]												Long term elasticities			Error Correction Term	Adjusted R2
		Gross Operating Surplus (GOS)				Equity Price Index (EPI)				Residential Property Price index (RPPI)				GOS	EPI	RPPI		
	Lag	0	-1	-2	Σ	0	-1	-2	Σ	0	-1	-2	Σ					
	Sample period																	
Belgium	1975-2005																	
SR1																		-
SR2						0.38***			**0.38**									0.46
ECM1		1.08*			**1.08**									1.58***			0.14*	0.06
ECM2						0.42***			**0.42**						0.49***	0.51***	0.35***	0.51
Finland	1970-2005																	
SR1	d(93) d(95)			1.22***	**1.22**													0.70
SR2	""			1.65***	**1.65**		0.27***		**0.27**									0.77
ECM1	""			1.32*	**1.32**									1.41***			0.24***	0.73
ECM2	""			1.50***	**1.50**									0.75***	0.44***		0.33***	0.81
France	1975-2005																	
SR1		1.07***			**1.07**													0.12
SR2		0.87**			**0.87**		0.29***		**0.29**									0.37
SR3		0.96**			**0.96**					0.54*			**0.54**					0.16
ECM1		1.97***			**1.97**									1.29***			038***	0.31
ECM2		2.61***			**2.61**					0.66***			**0.66**	0.80***	0.31***		0.71***	0.62
Germany	1975-2005																	
SR1																		0.00
SR2						0.58***			**0.58**									0.24
ECM1														0.34***			0.49***	0.20
ECM2						0.76***			**0.76**						0.36***		0.65***	0.53
SR1	d(01)																	0.76
SR2	""					0.23***			**0.23**									0.79
ECM1	""													0.61***			0.20**	0.79
ECM2	""					0.36***			**0.36**						0.44***		0.31***	0.86
Ireland	1978-2005																	
SR1																		0.00
SR2											0.70**		**0.70**					0.12
ECM1														1.17**			0.06	0.02
ECM2											0.81**		**0.81**	1.29***			0.21	0.11
ECM3											0.62**		**0.62**		1.19***		0.11**	0.17
Italy	1978-2005																	
SR1			1.53***		**1.53**													0.31
SR2																		-
ECM1														1.00***			0.38**	0.35
ECM2																		-
Netherlands	1975-2005																	
SR1																		-
SR2								0.14*	**0.14**									0.06
ECM1														1.00***			0.27***	0.17
ECM2														0.54***	0.31***		0.56***	0.24
Spain	1980-2005																	
SR1			1.20**		**1.20**													0.08
SR2a			1.09**		**1.09**			0.20**	**0.20**									0.18
SR2b			0.83**		**0.83**					0.50*			**0.50**					0.14
ECM1			1.63**		**1.63**									1.51***			0.36***	0.23
ECM2										0.61**			**0.61**	0.91***	0.29**		0.58***	0.43
"Euro area"	1975-2005																	
SR1		0.74**			**0.74**													0.07
SR2		0.77***			**0.77**	0.17***			**0.17**									0.28
ECM1														0.95**			0.42***	0.21
ECM2						0.20***			**0.20**	0.44*			**0.44**	0.74***	0.18***		0.70***	0.47
Denmark	1977-2005																	
SR1																		-
SR2							0.41***		**0.41**	1.15***			**1.15**					0.39
ECM1														1.60***			0.30**	0.08
ECM2							0.31***		**0.31**	1.27***			**1.27**	0.40**		1.41***	0.71***	0.65
Sweden	1972-2005																	
SR1			1.26**		**1.26**													0.10
SR2			0.96**		**0.96**		0.37**		**0.37**									0.23
ECM1			1.12**		**1.12**									1.25***			0.66***	0.35
ECM2			0.74*		**0.74**		0.39***		**0.39**					1.24***			0.69***	0.51
UK	1978-2005																	
SR1	AR1	1.16*	0.92*		**2.08**													0.48
SR2	""	1.15**			**1.15**						0.81***		**0.81**					0.58
ECM1			1.40**		**1.40**									0.94***			0.21**	0.46
ECM2			1.09*		**1.09**						0.60**		**0.60**	0.95***			0.23**	0.53
Australia	1975-2005																	
SR1		0.61***	0.53***		**1.14**													0.18
SR2		0.55*			**0.55**	0.15*	0.22***		**0.37**									0.25
ECM1		1.22***	0.80***		**2.02**									1.69***			0.12	0.36
ECM2		1.18***	0.75**		**1.93**										0.50***	0.91***	0.28*	0.37
Canada	1975-2005																	
SR1		1.47***			**1.47**													0.46
SR2		1.01***			**1.01**	0.30**			**0.30**									0.58
ECM1		1.90***			**1.90**									1.20***			0.24***	0.64
ECM2		1.27***			**1.27**	0.34***			**0.34**						0.99***		0.31***	0.75
Japan	1973-2005																	
SR1		1.44***	0.67**		**2.11**													0.50
SR2		0.76***			**0.76**		0.18***	0.21***	**0.39**		0.37*		**0.37**					0.70
ECM1		1.55***	1.34***		**2.89**									1.29***			0.21***	0.58
ECM2		1.08***			**1.08**		0.16***	0.21***	**0.37**		0.48**		**0.48**	0.56**		0.70**	0.32***	0.82
Norway	1976-2005																	
SR1		3.20***			**3.20**													0.79
SR2																		-
ECM1		3.20***			**3.20**									1.46***			0.16**	0.81
ECM2																		-
US	1975-2005																	
SR1		1.37**			**1.37**													0.11
SR2		1.14*			**1.14**		0.25**		**0.25**	0.97*								0.21
ECM1		2.38***			**2.38**									1.15***			0.24**	0.27
ECM2		1.79**			**1.79**		0.26**		**0.26**	1.16**				0.98***			0.33**	0.40

[1] *, **, *** significant at the 10%, 5% and 1% levels respectively. [2] d(-) = dummy corresponding to year in brackets. AR(-) = autoreggresive term with lag in brackets.

Table A2: Detailed overview of econometric models and results

b) Direct taxes on households

		Short term elasticities[1]												Long term elasticities				
		Compensation of Employees (CoE)				Equity price index (EPI)				Residential Property Price index (RPPI)				CoE	EPI	REPI	EC Term	Adjusted R2
	Lag	0	-1	-2	Σ	0	-1	-2	Σ	0	-1	-2	Σ					
	Sample period / dummies																	
Belgium	1975-2005																	
SR1			1.17***		**1.17**													0.59
SR2			1.26***		**1.26**	0.06*			**0.06**									0.61
ECM1																		-
ECM2																		-
Finland	1972-2005																	
SR1		1.09***			**1.09**													0.60
SR2		1.03***			**1.03**		0.05*		**0.05**									0.62
ECM1		1.05***			**1.05**									1.07***			0.50***	0.68
ECM2		0.75***			**0.75**		0.05*		**0.05**					0.98***	0.04**		0.61***	0.71
France (d98)	1975-2005																	
SR1		1.32***			**1.32**													0.80
SR2 [2]		1.31***			**1.31**		0.05**		**0.05****									0.83
ECM1		1.43***			**1.43**									1.43***			0.26***	0.81
ECM2 [2]		1.57***			**1.57**		0.09**		**0.09****					1.01***	0.30***		0.22***	0.86
Germany	1975-2005																	
SR1		1.18***			**1.18**													0.73
SR2		1.12***			**1.12**			0.05**	**0.05**									0.76
ECM1		1.10***			**1.10**									1.02***			0.39**	0.76
ECM2		0.94***			**0.94**									0.88***	0.09**		0.66***	0.81
Ireland	1978-2005																	
SR1			1.10***		**1.10**													0.43
SR2 [2]			1.13***		**1.13**		0.17***		**0.17**									0.50
ECM1																		-
ECM2																		-
Italy	1978-2005																	
SR1		0.56*	1.00***		**1.56**													0.81
SR2		0.53**	0.99***		**1.52**					0.25**	-0.20**		**0.05**					0.83
ECM1			0.77**		**0.77**									1.15***			0.30*	0.83
ECM2			0.66**		**0.66**					0.17**			**0.17**	1.05***			0.20	0.85
Netherlands	1975-2005																	
SR1		1.43***			**1.43**													0.24
SR2																		-
ECM1		1.20***			**1.20**									0.73***			0.16*	0.25
ECM2																		-
Spain	1980-2005																	
SR1			2.12***		**2.12**													0.51
SR2																		-
ECM1			1.61***		**1.61**									1.09***			0.19***	0.58
ECM2			1.00**		**1.00**						0.34**		**0.34**	1.01***			0.21***	0.65
"Euro area"	1980-2005																	
SR1		1.16***			**1.16**													0.66
SR2a		1.21***			**1.21**	0.04**			**0.04**									0.69
SR2b [2]		1.14***			**1.14**	0.07***	0.05*		**0.12**									0.76
ECM1		1.11***			**1.11**									1.16***			0.32**	0.69
ECM2a		1.18***			**1.18**	0.04**			**0.04**					1.07***	0.06*		0.39**	0.71
ECM2b [2]		1.01***			**1.01**	0.07**			**0.04**					0.92***	0.13***		0.62***	0.8
Denmark	1970-2005																	
SR1		1.33***			**1.33**													0.51
SR2																		-
ECM1																		-
ECM2																		-
Sweden	1971-2005																	
SR1		1.03***			**1.03**													0.49
SR2		1.19***			**1.19**	0.07**			**0.07**			-0.25**	**-0.25**					0.62
ECM1		1.11***			**1.11**									1.01***			0.26**	0.53
ECM2		1.21***			**1.21**	0.07**			**0.07**			-0.21**	**-0.21**	1.00***			0.20*	0.64
UK	1980-2005																	
SR1		1.16***			**1.16**													0.59
SR2		0.89***			**0.89**		0.09**		**0.09**			0.12*	**0.12**					0.65
ECM1		1.16***			**1.16**									0.98***			0.48***	0.67
ECM2		0.88***			**0.88**		0.07*		**0.07**			0.15**	**0.15**	0.99***			0.47***	0.73
Australia	1975-2005																	
SR1		1.46***			**1.46**													0.49
SR2																		
ECM1		1.24***			**1.24**									1.14***			0.35***	0.56
ECM2		1.07***			**1.07**		0.09**		**0.09**					1.12***			0.36***	0.60
Canada	1975-2005																	
SR1		1.00***			**1.00**													0.49
SR2		0.96***			**0.96**		0.10***		**0.10**									0.58
ECM1		0.94***			**0.94**									1.18***			0.20**	0.53
ECM2		0.80***			**0.80**		0.09**							1.11***			0.14*	0.58
Japan	1970-2005																	
SR1		1.23***			**1.23**													0.56
SR2a		0.90***			**0.90**		0.15***	0.10**	**0.25**									0.64
SR2b		0.67***			**0.67**					0.61***			**0.61**					0.68
SR2c		0.67***			**0.67**		0.09*	0.07*	**0.16**	0.39**			**0.39**					0.66
ECM1		1.63***			**1.63**									1.45***			0.13*	0.53
ECM2a		1.42***			**1.42**		0.15***	0.10*	**0.25**					1.54***			0.14*	0.65
ECM2b		1.46***			**1.46**					0.72***			**0.72**	1.61***			0.19**	0.69
Norway	1976-2005																	
SR1		0.83***			**0.83**													0.40
SR2		0.60***			**0.60**							0.22**	**0.22**					0.49
ECM1		0.70***			**0.70**									1.02***			0.23**	0.45
ECM2		0.41*			**0.41**							0.20**	**0.20**	0.94***			0.14	0.51
US	1980-2005																	
SR1		2.18***			**2.18**													0.48
SR2		1.03**			**1.03**	0.14**	0.24***	0.12**	**0.50**									0.67
ECM1		2.50***			**2.50**									1.17***			0.20*	0.44
ECM2		1.28**			**1.28**	0.10**	0.22***	0.17***	**0.49**					1.11***			0.25***	0.74
SR1	d(02)	1.56***			**1.56**													0.62
SR2	""	0.93**			**0.93**		0.18***	0.09**	**0.27**									0.71
ECM1	""	2.01***			**2.01**									1.48**			0.08	0.63
ECM2	""	1.23**			**1.23**		0.17***	0.15***	**0.32**					1.12***			0.21**	0.76

[1] *, **, *** significant at the 10%, 5% and 1% levels respectively. [2] d(-) = dummy corresponding to year in brackets. AR(-) = autoreggresive term with lag in brackets.
[2] Regressing including United States Equity Price Index

Table A2: Detailed overview of econometric models and results

c) Indirect taxes

		Short term elasticities[1]												Long term elasticities				
		Disposable Income (DI)				Equity Price Index (EPI)				Residential Property Price index (RPPI)				DI	EPI	RPPI	EC term	Adjusted R2
	Lag	0	-1	-2	Σ	0	-1	-2	Σ	0	-1	-2	Σ					
	Sample period																	
Belgium	1971-2005																	
SR1		0.69***			**0.69**													0.43
SR2		0.57***			**0.57**					0.17**			**0.17**					0.48
ECM1		0.85***			**0.85**									1.07***			0.17**	0.48
ECM2		0.67***			**0.67**					0.17**			**0.07**	0.79***		0.24**	0.32***	0.57
Finland	1971-2005																	
SR1		0.74***	0.23*		**0.97**													0.69
SR2		0.50***	0.24**		**0.74**					0.18***			**0.18**					0.74
ECM1		0.63***			**0.63**									0.95***			0.19**	0.74
ECM2		0.29**			**0.29**					0.25***			**0.25**	0.60***		0.35*	0.17**	0.82
France	1971-2005																	
SR1		0.98***			**0.98**													0.77
SR2																		
ECM1		1.12***			**1.12**									1.03***			0.37***	0.80
ECM2																		
Germany	1971-2005																	
SR1		0.84***			**0.84**													0.68
SR2		0.67***			**0.67**					0.29***			**0.29**					0.73
ECM1		0.86***			**0.86**									1.02***			0.17**	0.71
ECM2		0.72***			**0.72**					0.36***			**0.36**	1.10***			0.14**	0.77
Ireland	1980-2005																	
SR1		1.29***			**1.29**													0.50
SR2		1.06***			**1.06**							0.19*	**0.19**					0.52
ECM1		0.94***			**0.94**									0.97***			0.69***	0.65
ECM2																		
Italy	1980-2005																	
SR1	d98	1.26***			**1.26**													0.80
SR2	""	1.03***			**1.13**			0.04*	**0.04**			0.18**	**0.18**					0.84
ECM1	""	1.55***			**1.55**									1.44***			0.26***	0.84
ECM2	""	1.36***			**1.36**			0.04**	**0.04**			0.18***	**0.18**	1.45***			0.27***	0.89
Netherlands	1971-2005																	
SR1		0.55**	0.43**		**0.98**													0.46
SR2		0.55***			**0.55**					0.28***			**0.28**					0.66
ECM1		0.72***	0.50**		**1.22**									1.22***			0.20*	0.57
ECM2										0.33***				0.77***		0.29***	0.30***	0.74
Spain	1975-2005																	
SR1	AR1	0.88***			**0.90**													0.42
SR2	AR1	1.00***			**1.00**		0.06*	.	**0.06**									0.45
ECM1		0.73***			**0.73**									1.14***			0.16**	0.45
ECM2		1.19***			**1.19**	0.06***	0.10***		**0.16**					1.20***			0.34***	0.63
"Euro area"	1975-2005																	
SR1		0.86***			**0.86**													0.71
SR2																		-
ECM1		0.74***			**0.74**									1.03***			0.13*	0.72
ECM2																		-
Denmark	1971-2005																	
SR1		1.29***			**1.29**													0.67
SR2		1.10***			**1.10**						0.21***		**0.21**					0.74
ECM1		1.06***			**1.06**									1.03***			0.21**	0.69
ECM2		0.72***			**0.72**						0.23***		**0.23**	0.94***			0.16**	0.78
Sweden	1971-2005																	
SR1		0.81***	0.55***		**1.36**													0.41
SR2																		-
ECM1		0.95***			**0.95**									1.11***			0.39***	0.54
ECM2																		-
United Kingdom	1975-2005																	
SR1		0.81***	0.43**		**1.24**													0.68
SR2		0.86***	0.46**		**1.32**			0.06***	**0.06**									0.74
ECM1														0.88***			0.36***	0.69
ECM2		0.81***	0.42*		**1.23**			0.07***	**0.07**					1.04***			0.2*	0.76
Australia	1971-2005																	
SR1		1.16***			**1.16**													0.72
SR2		1.21***			**1.21**	0.04*			**0.04**									0.75
ECM1		1.21***			**1.21**									1.11***			0.22	0.74
ECM2		1.36***			**1.36**	0.05**			**0.05**					1.12***			0.26***	0.78
Canada	1971-2005																	
SR1		0.92***			**0.92**													0.47
SR2		0.63***			**0.63**		0.06**	0.07**	**0.13**		0.26**		**0.26**					0.58
ECM1		0.59**			**0.59**									0.99***			0.28**	0.52
ECM2a		0.65**			**0.65**			0.05*	**0.05**					0.99***			0.25**	0.54
ECM2b		0.44**			**0.44**									0.40**	0.17**	0.52*	0.42***	0.63
Japan	1971-2005																	
SR1		0.88***			**0.88**													0.63
SR2		0.74***			**0.74**		0.08***		**0.08**									0.69
ECM1		0.65***			**0.65**									1.01***			0.21**	0.70
ECM2		0.43**			**0.43**		0.08***		**0.08**					1.02***			0.24***	0.75
Norway	1971-2005																	
SR1		0.58***	0.38***		**0.96**													0.52
SR2		0.51***	0.30**		**0.81**					0.19**			**0.19**					0.58
ECM1																		-
ECM2																		-
US	1980-2005																	
SR1		1.16***			**1.16**													0.66
SR2		1.05***			**1.05**							0.32***	**0.32**					0.75
ECM1		0.95***			**0.95**									0.98***			0.43***	0.76
ECM2																		-

[1] *, **, *** significant at the 10%, 5% and 1% levels respectively. [2] d(-) = dummy corresponding to year in brackets. AR(-) = autoreggresive term with lag in brackets.

Table A2: Detailed overview of econometric models and results

d) Taxes on financial and capital transactions

		Short-run elasticities								Long-run			
		Equity Price Index (EPI)				Residential Property Price index (RPPI)				EPI	RPPI	Error correction	Adjusted R2
	Lag	0	-1	-2	Σ	0	-1	-2	Σ				
	Sample period												
Belgium	1975-2005												
SR		0.23***	0.36***	-0.11*	**0.48**	0.95***			**0.95**				0.71
Finland	1975-2005												
SR	AR1					0.64***	0.44*		**1.08**				0.44
France	1975-2005												
SR		0.11**			**0.11**	0.90***			**0.90**				0.37
ECM		0.10**			**0.10**	0.63***			**0.63**		0.99***	0.16**	0.43
Germany	1975-2005												
SR		0.19**	0.15*	-0.18**	**0.16**								0.24
ECM		0.29***			**0.29**					0.47***	0.91***	0.63***	0.40
Ireland	1980-2005												
SR	AR1	0.19**	0.22**		**0.41**	1.13***			**1.13**				0.50
Italy	1978-2005												
SR						0.51***			**0.51**				0.24
ECM						0.23*			**0.23**		0.84***	0.19**	0.55
Netherlands	1972-2005												
SR			0.16***		**0.16**	0.94***			**0.94**				0.62
ECM		0.15**			**0.15**	0.60***			**0.60**	0.43***	0.79***	0.42***	0.66
Spain	1975-2005												
SR						0.51***			**0.51**				0.28
"Euro area"	1975-2005												
SR		0.13***			**0.13**	0.64***			**0.64**				0.26
ECM		0.15***			**0.15**	0.49**			**0.49**	0.27**	0.78**	0.18**	0.42
Denmark	1975-2005												
SR						1.46***			**1.46**				
ECM						1.09***			**1.09**		0.95***	0.34**	0.37
Sweden	1972-2005												
SR	AR1	0.38***			**0.38**	2.28***			**2.28**				0.50
United Kingdom	1978-2005												
SR		0.61**			**0.61**	1.48***	-0.80**		**0.68**				0.32
Australia	1975-2005												
SR		0.47***			**0.47**	0.83***			**0.83**				0.42
ECM		0.49***			**0.49**	0.53***			**0.53**	1.21***		0.39**	0.51
Norway	1980-2005												
SR	AR1					1.25***			**1.25**				0.35
ECM						0.90***			**0.90**		1.70***	0.63***	0.59

[1] *, **, *** significant at the 10%, 5% and 1% levels respectively.

Table A3: Correlation between output gap and "asset price gaps"

	Output Gap / Equity Price Gap	Output Gap / Real Estate Price Gap	Equity Price Gap / Real Estate Price
Belgium	0.27	-0.19	-0.36
Finland	**0.64**	**0.73**	**0.59**
France	**0.43**	0.18	-0.09
Germany	-0.09	0.23	-0.44
Ireland	0.35	0.26	0.08
Italy	0.17	0.00	-0.05
Netherlands	0.26	0.31	0.09
Spain	**0.59**	**0.53**	0.09
Euro area	0.24	0.37	-0.42

Correlations above 0.4 shown in bold

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