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Adjusting Fiscal Balances for Asset Price Cycles

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by Robert Price and Thai-Thanh Dang

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ABSTRACT/RÉSUMÉ

Adjusting fiscal balances for asset price cycles

This paper develops a method for adjusting structural budget balances for asset price cycles and presents estimates of structural budget balances corrected for house-price and equity-price cycles for OECD countries. The traditional cyclically adjusted budget balance indicator, which is the basis for measuring structural or underlying budget balances, does not adjust for the effects of cyclical fluctuations in asset prices. This implies that, by default, asset price related effects on revenues are included in the structural budget measure. That can be misleading for policy makers where asset price shifts prove to be temporary, leading to pro-cyclical fiscal action, especially where policy makers cut tax rates or increase spending in response to unexpected revenue buoyancy. The paper first presents econometric estimates of tax revenue elasticities measuring the response of the major tax categories to house-price and equity-price movements. It then uses these elasticities to adjust revenues for the effects of asset price cycles measured in terms of deviations from "fundamental" and smoothed asset prices. To the extent that asset price movements are independent of, and uncorrelated with, the output cycle, the adjustment can be added to the conventional structural balance to create an asset-adjusted structural balance. The analysis is retrospective, but an important consideration has been to improve the identification of cyclical revenue fluctuations as they occur, or as they are incorporated into fiscal projections, and to be able to recognise the source of revenue "surprises".

JEL classification codes: E32; E62; H2; H62
Keywords: budget balances; cyclical adjustment; tax elasticities; asset cycles; house prices; equity prices; capital taxes; automatic stabilisers.

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L'ajustement des soldes budgétaires en fonction des cycles de prix des actifs

Le présent document expose une méthode d'ajustement des soldes budgétaires structurels en fonction des cycles de prix des actifs et donne des estimations des soldes budgétaires structurels corrigés des fluctuations conjoncturelles des prix des logements et des prix des actions pour les pays de l'OCDE. L'indicateur traditionnel des soldes budgétaires corrigés des influences conjoncturelles, qui sert à mesurer les soldes structurels ou sous-jacents, ne s'ajuste pas en fonction des effets des fluctuations conjoncturelles des prix des actifs. Il en résulte que, par défaut, les effets des prix des actifs sur les recettes sont pris en compte dans la mesure du budget structurel. Cela peut induire en erreur les décideurs publics en cas de variations temporaires des prix des actifs, conduisant à une action budgétaire pro-cyclique, surtout lorsque des mesures d'allégement d'impôt ou d'augmentation de dépenses sont prises en présence d'une abondance inattendue de recettes. Ce document présente tout d'abord des estimations économétriques des élasticités des recettes fiscales mesurant la réaction des principales catégories d'impôt aux variations des prix des logements et des prix des actions. Ces élasticités sont ensuite utilisées pour ajuster les recettes en fonction des effets des cycles de prix des actifs mesurés en termes d'écarts par rapport aux prix « fondamentaux » ou lissés. Dans la mesure où les fluctuations des prix des actifs sont indépendantes du cycle de la production, ou sans lien avec ce dernier, l'ajustement peut être ajouté au solde structurel classique afin d'obtenir un solde structurel corrigé des fluctuations des prix des actifs. L'analyse est rétrospective, mais l'on s'est attaché tout particulièrement à mieux identifier les fluctuations conjoncturelles des recettes au fur et à mesure de leur survenue, ou de leur incorporation dans les projections budgétaires, et à parvenir à reconnaître l'origine de recettes « surprenantes ».

Classification JEL : E32 ; E62 ; H2 ; H62
Mots-clés : soldes budgétaires ; ajustement conjoncturel ; élasticités fiscales ; cycles des actifs ; prix des logements ; prix des actions ; impôts sur le capital ; stabilisateurs automatiques.

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ADJUSTING FISCAL BALANCES FOR ASSET PRICE CYCLES

Robert Price and Thai-Thanh Dang[1]

I. Why is a revised set of fiscal indicators needed?

This paper sets out a methodology for correcting fiscal balances for the effects of asset price cycles on tax receipts. The traditional cyclically adjusted budget balance indicator (CAB, referred to interchangeably below as the structural budget balance) corrects the actual balance for the effects of the business cycle on government receipts and transfers, measured in terms of the output gap (Girouard and André, 2005 and earlier references therein). Revenues are not adjusted for the effects of fluctuations in asset prices, which implies that, by default, such effects are included in the structural budget measure. This can be – and has been – misleading where asset price shifts prove to be temporary. Not only may structural balances, so defined, fail to give an early warning of fiscal loosening (Hughes Hallet *et al*., 2009), but they may also mislead as to the degree and direction of discretionary fiscal action: for example, the post-financial crisis deterioration in the structural budget balance is considerably larger than is implied by the stimulus packages or other well-identified discretionary measures. One of the main culprits is probably an under-adjustment of the endogenous budget deterioration related to relapses in equity and house prices.

The approach used here is to construct an asset-cycle adjustment process which is separate and additional to the existing output-cycle adjustment process. If asset price cycles were systematically related to output cycles, the cyclical component of budgetary changes due to asset price effects might be looked on as an additional element of built-in stability: higher revenues from asset prices could have a beneficial damping effect on activity if the asset price cycle is correlated with the business cycle. However, as will be seen below, there is only a partial correlation between output- and asset price cycles, the latter being affected by exogenous factors that may have no systematic output-stabilising effects. Asset price effects on revenues can thus not be added to orthodox built-in stabilisers to make a single composite element of automatic stabilisation.

While the research reported here is largely retrospective, an important consideration in the development of the apparatus for asset price adjustment has been to improve the identification of cyclical revenue fluctuations as they occur, or as they are incorporated into fiscal projections. Errors in estimating cyclically adjusted balances in EU countries have coincided with revenue "surprises" at cyclical peaks which are a reflection of forecasting inadequacies,[2] and there is an emerging literature on the misleading

1. This research was undertaken within the Public Economics Division and has benefited from the advice of Peter Hoeller and Paul van den Nord, as well as from comments given by interlocutors at the European Commission, which partly funded the research. The authors would also like to express their thanks for helpful comments made by Jorgen Elmeskov, Christophe André, Eckhard Wurzel, Douglas Sutherland, Oliver Roehn, Lukasz Rawdanowicz, Felix Huefner, Rauf Gonenc and Luke Willard. Susan Gascard provided excellent editorial support.

2. Morris *et al*. (2009) show that such surprises have displayed a cyclical pattern (see also Joumard and André, 2008). The cyclicality effect is clearly more apparent than when comparing outcomes and targets based on stability programmes as in Barrios and Rizza (2008).

signals given to policy-makers by real time structural budget data.[3] In that light, the aim has been to construct a budget indicator which is capable of giving accurate signals going forward, while also being comparable across countries. This means avoiding a degree of institutional detail which would be impossibly elaborate and unwieldy for real-time analysis.

The structure of the paper is as follows. The next section describes the conceptual approach to specifying an asset price related cyclical adjustment model as an "add-on" to the existing cyclical adjustment model, together with the methodological choices behind the estimation of the tax elasticities needed to parameterise the model. Section III identifies the various taxes which respond to asset price movements and gauges their respective size, and hence their relative *a priori* importance, for asset-related revenue movements across OECD countries; it also describes the process by which tax data based on tax codes is reconciled with the SNA definitions of revenues used for economic analysis and forecasting. In section IV asset price elasticities are presented for four categories of taxes: direct taxes on households and corporations, indirect taxes and capital transfer taxes. Asset price cycles are discussed and estimated in section V, both in terms of "fundamental" asset prices and alternative measures based on asset price smoothing, with an assessment of how sensitive the asset-cycle adjustment process is to the specification of the cycle. In section VI, new structural budget balance estimates are derived, and compared with those of the current cyclical adjustment model. Revised discretionary policy indicators, based on the new structural budget balance estimates, are also presented. Section VII reviews issues that would occur if the adjustment were to be made in a forward-looking manner.

II. Methodological issues

Conceptual approach to asset-cycle adjustment

The existing cyclical adjustment process is designed to net out the effects of built-in stabilisers so as to arrive at a measure of structural budget balance, which can be used in first-difference form as a measure of discretionary budget change. Accordingly, current OECD and EC methodology defines the cyclically adjusted balance as a residual after netting out variations in revenues and spending as a result of deviations in actual output from potential (see Girouard and André (2005) for the most recent description). Formally, the cyclically adjusted component of the budget balance (CAB) is equal to:

$$CAB = \sum_{i=1}^{4} T_i \left(Y^*/Y\right)^{\varepsilon_{ti,\,y}} + CT - G\left(Y^*/Y\right)^{e_{u,\,y}} \qquad (1)$$

where: T_i is the actual tax revenue for the *i*th category of tax as defined in the national accounts (SNA); CT is net capital taxes and transfers; G is government expenditure; $\varepsilon_{ti,\,y}$ is the elasticity of the i^{th} tax category with respect to output and $e_{u,\,y}$ is the elasticity of government expenditure with respect to output. Y and Y* are the levels of actual and potential output. In practice, on the expenditure side unemployment benefits are taken as the only cyclically sensitive item. Following the SNA template, the model identifies four different types of taxes, each with different bases which respond to the output cycle: direct taxes on households, direct taxes on corporations, indirect taxes and social security contributions. The tax categories that comprise *CT*, the bases for which are capital transfers (inheritance and gift taxes), are not cyclically corrected, being assumed to be independent of the output cycle.

The way the elasticities are specified in the present CAB methodology means that asset price effects are excluded (Box 1). This means that, to the extent that taxes vary with asset prices, the CAB will vary automatically with the asset price cycle and become an unreliable indicator both of the underlying budget

3. See Hughes Hallet *et al.* (2009) for a résumé.

balance and of discretionary action – as evidenced in the recent post-financial crisis downturn when the non-cyclical deterioration in budget balances has often far exceeded the amounts involved in announced discretionary support measures. To correct for this automaticity, the current project is designed to incorporate a second cyclical adjustment relating to "asset price gaps", specified in a similar manner to the output gap adjustment:

$$CAB2 = CAB + \sum_{j=1}^{n}\sum_{k=1}^{2} T_j \left(\frac{A_k^*}{A}\right)^{\varepsilon_{j,k}} \qquad (2)$$

where *CAB2* is the budget balance adjusted for both output-gap and asset price gap effects, T_j is the j^{th} capital tax as defined in *OECD Revenue Statistics (RS)*, the precise categories of tax being defined below; A_k is the value of the k^{th} asset, of which there are two: residential property and equities; $\varepsilon_{j,k}$ is the elasticity of the capital tax with respect to the asset value(s) on which the capital tax is levied and A_k* is the trend (or equilibrium) value of the k^{th} asset *(A*/A* being analogous to the output gap). At a later point, the RS categories *(j)* are themselves aggregated to correspond to the national accounts categories *(i)*, as is described below and in the methodological annex.

Box 1. **Absence of asset and wealth effects in the current cyclical adjustment model**

Of the four different types of taxes distinguished in the cyclical adjustment process, three include elements which respond to asset prices as well as the output gap: direct taxes on households; direct taxes on corporations; and indirect taxes:

- The sensitivity of *personal direct taxes* to the cycle is derived from *a)* a tax receipts/tax base elasticity estimated directly from the tax/income distribution statistics, using cross-section wage data for a representative household as a benchmark, and *b)* a tax base/output elasticity modelled econometrically as *i)* the output elasticity of employment (Okun's Law) and *ii)* the sensitivity of the wage bill to employment (Phillips curve). The overall tax yield/output elasticity is thus unaffected by compositional changes in personal income and wealth arising from asset price movements.
- The *corporation tax*/tax base elasticity is defined as unity, the tax base being the gross operating surplus, which is in principle the reciprocal of the wage share of GDP. Again, no valuation or income effects from asset prices enter into the cyclical adjustment process.
- The *indirect tax*/tax base elasticity is taken as unity, the tax base being defined as personal consumption. The elasticity of consumption with respect to the output gap is modelled as a direct function of the output gap with no allowance made for compositional effects on the tax base which might arise as more cyclically elastic items are taxed at higher rates during upturns. However, since no controls for wealth have been used in the time-series elasticity estimation process, some indirect impact of asset prices on the tax base via wealth effects may be embedded in the elasticity estimate. As will be seen below, however, the correlation between asset price gaps and output gaps is very partial.

Approaches to asset-cycle smoothing

The asset prices and asset cycles normally identified as affecting capital tax receipts are house prices and share prices, which are the main determinants of capital gains tax (CGT) receipts. However, identifying the structural component of asset price effects on receipts is controversial and the difficulties of doing so account for the fact that national approaches to calculating an asset price corrected budget balance are usually based on *ad hoc* smoothing or exclusion processes (Box 2). It is particularly difficult to identify cyclical and structural elements of asset price changes going forward.

Box 2. **Approaches to adjusting the fiscal stance for asset price cycles**

The general approach to adjusting the fiscal stance for asset price cycles among OECD countries is to ignore it, reflecting, in some cases, the relative unimportance of asset-related taxes such as capital gains taxes and, elsewhere, the fact that the path of asset prices is unpredictable. Where, in a small minority of cases, an adjustment is made or has been proposed, the choice is between some sort of exclusion, smoothing or sensitivity analysis, with no examples of directly adjusting revenues for asset price movements.

Exclusion: In the *United States***,** the CBO calculates a "standardised" budget surplus or deficit that *excludes* the effects not only of cyclical fluctuations but also of factors that are clearly short-lived and that are unlikely to affect real income significantly in the short run. Those factors include swings in collections of capital gains taxes. Although such receipts move up and down as a result of business-cycle effects, those movements are not captured by the cyclical adjustment of revenues. Removing CGT receipts is seen as avoiding the misleading interpretation of fiscal stance indicators that can arise when a cut in the tax rate on capital gains temporarily encourages the realisation of taxable gains by enough to increase revenues.

Smoothing: Research at the *Australian Treasury* concluded that the economic cycle affects the fiscal position, but that there is no clear relationship between capital gains tax (CGT) revenue and nominal GDP. A possible approach would be to assume a structural level of CGT equivalent to its decade average as a share of GDP (0.9% of GDP), so that if actual CGT revenue exceeded the decade average, the excess would be taken off the budget balance to obtain the structural budget balance, and vice versa. However, currently no such adjustment is made.

Sensitivity analysis: Under the *Code for Fiscal Stability*, the *United Kingdom* government was required to publish estimates of fiscal aggregates adjusted for the effects of the economic cycle. In recent years asset prices have had strong effects on measures of the structural balance. Treasury analysis (Farrington *et al.,* 2008) concluded that it is highly challenging to assess accurately these potential adjustments: in particular, application of the results to the structural balance in real time would require a judgement regarding the extent to which divergences of asset prices from past averages might persist. However, while analysis is not used to adjust systematically HM Treasury's current methodology, one approach being considered is to conduct periodically additional sensitivity analysis of public finance projections with respect to asset price effects.

The simplest expedient would be to remove capital gains taxes to produce a "standardised" underlying balance, but this throws up a number of problems. First, it renders the *level* of the budget balance, so measured, meaningless. Second, asset price based fluctuations in government revenues do not just affect capital gains taxes: they affect VAT receipts (where house-building/purchasing is in the VAT base); transactions taxes (stamp duty, etc.); and inheritance taxes.[4] The exclusion method becomes less tractable when several tax bases are affected. Third, capital gains and other capital tax data are never available in real time, so adjustment is only feasible retrospectively, whereas errors in forecasting the CAB in EU countries have displayed a cyclical pattern (Morris *et al.*, 2008) and this implies that cyclically-corrected indicators may be misleading in assessing compliance with or breaches of budgetary rules and hence in determining appropriate fiscal policy responses. Being able to project capital tax revenues is thus important and requires a structural approach, which relates capital tax receipts to their respective drivers.[5] The analysis here thus breaks new ground insofar as it aims to augment the elasticities of taxes with respect to the business cycle – which is the bedrock of the current cyclical adjustment process – by elasticities relating tax receipts to asset prices.

That still leaves the problem of projecting asset price cycles and here the paper adopts a strategic rather than predictive approach. Since no single method of extrapolating "fundamental" asset prices can be reliable, the sensitivity of the asset price adjusted structural balance needs to be tested against a number of

4. See for example the *OECD Economic Survey of Ireland* (OECD, 2009) for an example of the range and extent of asset-related effects on revenues.

5. In the case of recent EU revenue forecasting errors, taxes on profits and capital income, as well as to a lesser extent VAT, are most involved, with property market developments a driver in some economies (Morris *et al.*, 2008).

benchmarks, based both on asset market fundamentals and an HP filter technique (section V). In the final analysis, however, the adoption of a particular benchmark is a political economy issue, which depends on the normative framework adopted for budget planning. A framework which emphasised the need for a cautious approach, where temporary revenues would be "firewalled" in some sort of a stabilisation fund, would discount short-term increases in asset prices more heavily than one which risked such increases leading to pro-cyclical spending or tax-giveaways.

Defining asset-related tax elasticities

For estimation purposes, for each tax category *i*, the existing cyclical adjustment procedure separates the elasticities $\varepsilon_{ti,\,y}$ into two components, $\varepsilon_{t,\,tb}$ and $\varepsilon_{tb,\,y}$:

$$T_i^* = T_i\,(Y^*/Y)^{\varepsilon_{t,\,tb}\,\varepsilon_{tb,\,y}} \tag{3}$$

where $\varepsilon_{t,\,tb}$ is the elasticity of a tax with respect to the tax base and $\varepsilon_{tb,\,y}$ is the elasticity of the tax base with respect to (the) output (gap). The tax yield/tax-base elasticities ($\varepsilon_{t,\,tb}$) are statutory elasticities, determined by the tax codes, as specified in national legislation, while the tax base elasticities are behavioural (being based, for example on variations of Phillips and Okun curves). This methodology is easiest to apply in the case of proportional taxes, where the tax yield/tax base elasticity will be unity and is thus rather easy to specify: in the existing cyclical adjustment model a unit elasticity has been applied to the sensitivity of corporation taxes, indirect taxes and social security contributions to their respective bases. Estimating the tax yield/tax base elasticity in multi-rate and progressive tax systems presents greater problems: in the existing cyclical adjustment system, personal income tax elasticities are estimated directly from tax/income distribution statistics (*i.e.* from cross-section data).

With respect to asset price (or transaction-) based tax elasticities, the starting point for the analysis was that the same methodology could, in principle, be applied to capital taxes, separating tax yield/asset price elasticities into tax rate and tax base components:

$$T_j^{**} = T_j\,(A_k^*/A_k)^{\varepsilon_{j,\,tbk}\,\varepsilon_{tbk,\,k}} \tag{4a}$$

where T_j^{**} is asset-cycle adjusted revenue for the j^{th} capital tax with respect to the k^{th} asset, *A*, on which it is levied; $\varepsilon_{j,\,tbk}$ is the elasticity of the tax with respect to the tax base applying to the k^{th} asset, and $\varepsilon_{tbk,\,k}$ is the elasticity of the tax base with respect to the asset value on which the capital tax is levied.

In practice this approach proved impossible to apply. Based on the capital tax categories set out in the *OECD Revenue Statistics*, tax yields can be mapped to the various tax heads defined in national legislation (as described, for instance, in the *European Tax Handbook 2009*). However, the available data relate to tax receipts and no data exist on capital tax bases, either in time series or cross section form. Moreover, tax rates are usually so complex that tax bases cannot be inferred (as they could be for a unitary tax rate which would imply a unit tax elasticity with respect to the base). The estimation process used here thus relies on a reduced form approach, where tax yields from various capital tax heads are regressed directly on asset prices to give a composite elasticity ($\varepsilon_{t,\,a}$), adjusted revenue being derived as:

$$T_j^{**} = T_j\,(A_k^*/A_k)^{\varepsilon_{j,\,k}} \tag{4b}$$

where $\varepsilon_{j,k}$ is the elasticity of the tax yield with respect to the k^{th} asset price, which throughout the analysis is taken as a proxy for value.

Statistical procedures and econometric method

The basic statistical approach has been to estimate the capital tax elasticities directly from time-series data of the sub-categories identified in the *OECD Revenue Statistics:*

$$\boldsymbol{T_j = f\ (A_e, A_h, Z_j),} \tag{5}$$

where the regressions are in log form, A_e is the equity price index and A_h is the index of house prices and Z_j is a vector of relevant control variables, which would, ideally, include a discretionary policy indicator measuring policy-induced changes in revenues.

This approach holds for the majority of capital taxes, but has to be modified where capital tax receipts cannot be identified separately from other income- or profit-generated receipts, as is mostly the case with capital gains taxes, which are administered as part of the income or corporation tax systems and for which data only exist for a minority of countries (the United States, the United Kingdom, Ireland and Sweden) In that case, the asset-related tax elasticity is estimated via multivariate regression analysis, where a single aggregate tax category is defined and a vector of elasticities specified, with respect to the various bases on which the tax is levied:

$$\boldsymbol{T_x = f(TB_x, A_e, A_h,\ DISC_x, Z_x),} \tag{6}$$

where T_x is the x^{th} category of tax which includes both a non-capital and a (non-identified) capital tax component, TB_x is the non-capital tax base, $DISC_x$ is a control for discretionary tax changes in the non-capital component, and Z_x is a vector of other control variables. This estimation procedure has been applied to the Revenue Statistics (RS) categories of personal income and corporation tax.[6] Similarly, the elasticity of VAT receipts attributable to the house price cycle has to be estimated jointly with the other drivers of VAT receipts.[7]

Dealing with lags: an error-correction specification

Perhaps the greatest difficulty in dealing with capital taxes is that of lags between changes in the tax base and the relevant asset price indexes. Capital gains tax is particularly problematic, since it depends on the average holding period before gains are realised (as well as the trigger for realisation). However, the problem of lags between asset price changes, tax bases and receipts applies quite generally. Some experimentation was made with imposed lags, using difference equations to ensure stationarity, but this proved to be relatively *ad hoc*.

The analysis has thus been based on an error correction model, following the approach of Bruce *et al*. (2006) and Wolswijk (2007). This approach allows the estimation of short- and long-run elasticities for tax equations, the estimated lags being taken as reflecting both accrual/payment gaps and the behavioural responses of taxpayers (Box 3). In the case of responses to asset prices, the difference between short- and long-term elasticities and the speed of adjustment may be taken as reflecting a combination of behavioural responses on behalf of taxpayers with respect to capital gain realisations, loss carry-forward provisions and the accrual/assessment lags embedded in the tax base adjustment with respect to its equilibrium value.

6. In the process, the analysis generates alternative estimates for the tax-base/output-gap related elasticities embedded in the existing cyclical adjustment model. However, these new estimates have not been used to supersede the existing ones.

7. The analysis is based on *Revenue Statistics* categories at this stage, the definitions of income and expenditure being sub-components of the relevant national accounts aggregate. The capital gains tax/asset price elasticities generated thus need to be aggregated with the other capital tax/asset price elasticities to arrive at national accounts aggregate.

Box 3. **Rationale for distinguishing short and long-run tax elasticities**

Cyclical *versus* long-term tax relationships

Time series analysis allows a distinction to be made between short and long-term tax elasticities. Long-run elasticities are derived from level equations (in log form), but because many tax revenue series are non-stationary the resulting estimates are biased and the residual cannot simply be taken as reflecting short-term variability around the long-run trend. In order to remedy non-stationarity problems, the series can be transformed into first differences in logs, but this specification is also restrictive. It provides only a measure of short-run, "impact" tax elasticities and assuming these to be constant over time may be misleading. There may, for example, be compositional effects on the tax base when there is a short-term shift in consumption towards higher-taxed goods, driving up short-term tax elasticities relative to their long-run value.

In addition, in respect of tax series affected by asset prices, the tax base (or tax yield where the base is unobservable) may adjust only gradually to the asset price changes involved, for two reasons. First, while the SNA and *OECD Revenue Statistics* data, in principle record taxes on an accrual basis, *i.e.*, when the activities, transactions or other events occur which create the liabilities to pay taxes, in some cases (largely relating to income or capital gains taxes) the liability to pay can only be determined in a later accounting period than that which the income accrues. Some flexibility is thus permitted in the time at which such taxes are recorded (*UN 1993 SNA*). Second, the activities to which the tax bases relate are only indirectly related to the proxies (in this case aggregate asset price indicators) which are being monitored – especially in the case of realised capital gains.

Applying the error-correction model to tax equations

In order to take these cyclical and lagged tax responses into account, an approach based on an error-correction model has been used, allowing the estimation of short-run elasticities and a correction term which measures the deviation of tax receipts from their predicted long-run value in t-1 (or long-run growth rate). Tax equations, based on an error correction model take the following form:

$$\Delta lnT_i = c + \Sigma_j \alpha_j \Delta ln(X_j) + \lambda_i \left[ln(T_{i,t-1}) - \Sigma_j \beta_j ln(X_{j,t-1}) \right] + u$$

where α *and* β respectively measure short-run and long-run relationships between T and X and λ_i is the speed of adjustment from preceding predicted values of the i^{th} tax revenue component (the higher λ, the slower the adjustment so that λ represents the proportion of last year taxes which is corrected in the current period). In the context of multivariate analysis, X_j includes the asset based and related control variables. The estimate of β is derived by taking the coefficient of the variable X_j divided by λ_i.[1] See the methodological annex for further elaboration.

Interpretation of the error-correction term

The dynamic cyclical adjustment derived from the error correction model depends on the error-correction term acting on the difference between T_{t-1} and its predicted long-term value (the error-correction term, ECT). The ECT gives an estimate of the proportion of the pre-existing disequilibrium which is eliminated year-by-year, where a value of 1 indicates that 100% of the disequilibrium in period t-1 is eliminated in the current period. In a regression equation containing asset prices and control variables, it is possible for the controls to have a long-term relationship with tax yields while the long-term tax/asset price elasticity is insignificant. In the case where the short-term elasticity is significant, the long-term relationship with other fundamentals will still cause an adjustment back to equilibrium following a short-term asset price related shift in receipts.

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1. Wolswijk (2007) finds, in the case of the Netherlands, that differences between short- and long-term elasticities are especially marked for direct taxes. He also finds evidence of asymmetry in tax yield/tax base elasticities, the differences between short-and long-term elasticities being especially large when receipts are above their longer-run value, probably reflecting, in the case of corporation tax for example, reduced possibilities to offset past losses against tax. The analysis here does not investigate the issue of asymmetry in tax yield/asset price responses.

Reconciling capital tax elasticities with the national accounts format

Thus far, the analysis follows the *Revenue Statistics* format, but for economic analysis and forecasting purposes, the results have to be transferable to a national accounts framework. Their incorporation into this framework is, however, complex, since both income and expenditure taxes as defined in the national accounts incorporate taxes which are defined as capital taxes in the *Revenue Statistics* (Box 4). Thus, direct taxes on households include capital gains tax, taxes on immovable capital and wealth tax (capital gains tax being split between households and corporations). Indirect taxes include taxes on financial and other capital transactions. Only taxes on estates and inheritance (capital transfers) appear separately (in the capital tax category noted above) in the national accounts.

In aligning the asset (price)-related elasticities to the four major SNA categories – the form in which the results are presented below – the individual capital tax elasticities are aggregated according to their weight in total receipts. For example, if a national accounts tax head is composed of a proportion of receipts *w* deriving from non-asset-related sources and *1-w* from an asset-related source, the asset-related elasticity applying to that head would be $(1- w)\varepsilon_{j,k}$. More information on the weighting system, and the weights themselves, is given in the methodological annex.

Box 4. **Treatment of asset (price)-related taxes in the National Accounts**

In practice, capital-gains and capital taxes as defined in the *OECD Revenue Statistics* (RS) are distributed among current taxes (direct and indirect) and capital taxes in the 1993 Standardised National Accounts (SNA) (OECD, 2009 and UN, 1993) as follows:

National Accounts classification of taxes	Revenue Statistics asset-related tax components
Direct taxes: ***Current taxes on income and wealth*** (SNA D5)	
Current taxes on households	
Taxes on income and capital gains (SNA D51)	Taxes on income and capital gains (RS1100). – Capital gains taxes on individuals (RS1120) – Income tax on individuals (RS1110)
"Other current taxes" (SNA D59), which are comprised of taxes that are payable annually on property on net wealth	Recurrent taxes on immovable property (RS4100) and recurrent taxes on net wealth (RS4200).
Corporate taxes	Capital gains tax on corporations (RS1220)
Indirect taxes: ***Taxes on goods and services*** (SNA D21)	Taxes on financial and capital transactions (RS4400)
Capital taxes (SNA D91)	Estate, inheritance and gift taxes (RS4300)

Throughout the analysis, the emphasis has been on creating as much international standardisation as possible. However, while a data pooling approach might be considered appropriate in order to introduce a degree of international standardisation with respect to tax elasticities, specific country adjustments to the standard model have been required to account for cross-country institutional differences (which themselves vary over time). Estimations based on data pooling rather than country time series regressions may provide a misleading picture of asset-related tax sensitivities, unless pooling were to apply to institutionally similar groups of countries.

III. Tax treatment of asset-related activity in OECD economies

Capital gains taxes on households

Capital gains tax receipts are the most obviously sensitive to asset prices and have been recognised as distorting structural budget patterns in some OECD economies since the dot-com bubble (Girouard and Price, 2004). Tax treatment of capital gains varies significantly among OECD countries and also differs between movable and immovable property gains. The most common exception applies to capital gains on principal residences, which may either be exempt, subject to holding period restrictions or depend on reinvestment. Long-term (*i.e.* non-speculative) gains on equities are not taxed in about a third of economies and for these the amount of receipts from capital gains has been nil or negligible. For a significant number of countries where capital gains are taxed, they are not always reported separately, so the weight in total personal income tax receipts is not observable. For the minority of countries where capital gains tax data are available, the weight in total personal income taxes varies, from around 2% (two-decade average) for the United Kingdom, to 6% in Sweden, 8% in the United States and 14% in Ireland (over the 2000-07 period).

At the same time, any bias imparted by asset prices needs to be interpreted in the context of the deductibility of interest against tax. For individuals this normally applies, if at all, to the deductibility of mortgage interest payments. On the assumption that higher asset prices are accompanied by higher borrowing, systems which tax capital gains but that do not allow interest deductibility would be expected to have the highest income tax elasticity *vis-à-vis* asset prices. Conversely, systems which do not tax capital gains but allow interest deductibility would be expected to experience negative revenue buoyancy from asset price movements. Generalisations are difficult and different provisions may apply to immovable and movable property gains (as well as to domestic and foreign gains), but according to capital gains tax and deductibility criteria, OECD countries can be classified into four groups (Table 1):

- In one third of countries, capital gains are taxed and interest payments are not deductible (France, the United Kingdom, Japan and Canada among the major economies, together with Australia, Hungary, Korea, Mexico and Poland). In these economies (depending on the rates applied) the most marked impact of CGT on revenue buoyancy is to be expected.
- In just over a third of countries, among which is the United States, capital gains are taxed but interest payments on housing loans are deductible. The group also includes Ireland, Italy, Portugal and Spain. It also includes Switzerland and the Nordic countries, where deductibility of interest payments against capital income is an integral part of the neutrality of the system. Depending on CGT rates and the generosity of deductibility, the impact of asset price movements on income tax buoyancy could be reduced, negated or more than fully offset.
- In a minority of OECD countries, notably Austria, New Zealand, Turkey and (until 2009) Germany, capital gains are not taxed (though there have been moves to bring speculative gains into the tax net) and there is no interest deductibility. In these economies, the yield from capital gains can be taken, for all intents and purposes, as nil and no elasticity of income tax receipts with respect to asset prices is to be expected.
- For the small number of OECD economies which do not tax capital gains but allow interest deductibility, notably Belgium, Greece (until 2010), the Netherlands and the Czech Republic, negative buoyancy effects may be expected from asset price movements.

Table 1. **Tax treatment of capital gains and interest deductibility for individuals**

2010, Resident taxpayer

	Residential property		Shares	Rate and regime	Mortgage interest deductibility
	Principal residence	Other			
Australia	Exempt	Investment property and second homes taxable	Taxable. Indexation or halving of capital gain allowed for disposals 1 year+	Marginal income tax rate	Not deductible
Austria	Not included in taxable income, except speculative gains = disposal within 1 year for shares and 10 years for immovable property		Not taxable ex. speculative gains	Normally zero/ half of effective income tax rate on speculative gains	Not deductible
Belgium	Not taxable except on sale of undeveloped immovable property within 8 years and developed immovable property within 5 years		Not taxable except speculative transactions	Normally zero; 33% on speculative transactions; 16.5% on short-term immovable property gains	Deductible up to € 2 770 for first ten years and € 2 080 thereafter
Canada	Exempt	Taxable	Taxable	50% of realised gains taxed at income tax rate	Not deductible
Czech Republic	Exempt after 2 years	Taxable as capital income	Not taxable	Income tax: flat rate	Deductible up to ceiling
Denmark	Exempt	Taxable as capital income	Taxed as income from shares	28/43/45% above ceiling	Deductible from capital income
Finland	Exempt after 2 years	Taxable as income from capital		Flat rate tax of 28%	Deductible from capital income
France	Exempt	Diminishing rate: exempt after 16 years	Taxable as professional income	Immovable property taxed at flat 16%; shares at 18%	Not deductible
Germany	Not taxable until 2010, ex speculative gains: 1 year for shares and 10 years for immovable property			Normally zero; speculative gains taxed at income tax rates	Not deductible
Greece	Not taxable	Exempt prior to 1/1/2010		Zero until 2010 = flat rate 10% on shares; 5-20% on buildings	Credit of 20%; fully deductible until 2000
Hungary	Not taxed after 5 years	Taxable	Taxable	Flat rate 25%	Not deductible
Iceland	Exempt if owned two years or reinvested	Taxable	Taxable	18% in 2010; 10% prior to June 2009	Interest compensation payment
Ireland	Exempt	Taxable	Taxable	Flat rate of 20% until 2008; 25% since April 2009	Credit of 15%; formerly relief at 20% of standard rate
Italy	Exempt	Taxed as miscellaneous income if not held for five years	49.72% subject to tax	Miscellaneous income subject to progressive income tax rates 23%-43%	Credit of 19% up to a maximum of € 760
Japan	Taxable	Taxable	Withholding tax of 1.05% or tax assessment on 26% of proceeds	Short-term property gains 39%; long term (5yrs) 20%; shares 10%	Not deductible
Korea	Exempt	Taxable, with no holding period exemption	Exempt	Included in taxable income	Not deductible
Luxembourg	Exempt	Taxable as miscellaneous income; speculative gains as ordinary income		Maximum rate of 19.475%;	
Mexico	Exempt if occupied two years before sale	Taxable adjusted for inflation	Exempt when securities are classified as available to the general public	Subject to income tax rates	Not deductible

Table 1. **Tax treatment of capital gains and interest deductibility for individuals** (continued)

	Residential property		Shares	Rate and regime	Mortgage interest deductibility
	Principal residence	Other			
Netherlands	Not taxable			Zero	All interest payments deductible for 30 years
New Zealand	Not taxable			Not taxed	Not deductible
Norway	Exempt	Taxable	Taxable	Included in taxable income	Deductible
Poland	Exempt after 5 years		Taxable	Flat rate 19%	Not deductible ex for loans 2003 to 2006
Portugal	Exempt if proceeds reinvested; 50% of gains taxed otherwise		Taxable	10% unless the taxpayer opts for its inclusion in his taxable income	30% deductible up to a ceiling
Slovak Republic	Exempt after 2 years	Exempt after 5 years	Exempt up to a ceiling	Flat rate 19%	Not deductible
Spain	Exempt	Gain adjusted for inflation	Treated as ordinary income	Income tax at rates of 24-43%	15% up to a ceiling
Sweden	Tax deferrable if new permanent residence purchased	22/30ths taxable	Included in income from capital	Flat rate tax on capital income: 30%	Deductible from capital income
Switzerland	Subject to a real estate gains tax declining with period of ownership		Exempt except for professional share dealing	Cantons set their own tax rates	Deductible with limits
Turkey	Not taxable	Taxable but exempt after 5 years	Taxable but exemption for shares in resident companies held for 3-12 months	Income tax rates: 15-35% with inflation adjustment	Not deductible
United Kingdom	Exempt	Taxable	Taxable	Marginal income tax rate before 2008/9; now a flat rate of 18%.	Not deductible ex. against rental income
United States	Exempt if owned for 2 years or occupied for 2 years in preceding 5	Taxable	Taxable	Short-term gains taxed at income tax rate; long-term gains (more than a year) 5-15% until 2010.	$1 million ceiling for principal & secondary residences

Source: *European Tax Handbook 2009*; *The International Comparative Legal Guide to Real Estate 2010;* national tax sources.

Corporate capital gains taxes

Part of the surge in OECD-area tax revenues during the pre-financial crisis period was due to unusually high corporation tax receipts, related not just to strong profit performance in the financial-, energy- and housing-related sectors, but also to an unexpectedly high elasticity of corporation tax receipts with respect to the gross operating surplus (Joumard and André, 2008). This pro-cyclical elasticity behaviour could have been related to the loss carry-back and carry-forward provisions incorporated into national tax codes, which may lead to a diminishing carry-forward of tax losses during booms, and to the tax treatment of capital gains (Table 2).

Corporate tax systems generally treat realised capital gains as part of ordinary profit, but, as is the case with personal income taxes, the effects of asset prices on corporation tax receipts are likely to vary considerably because of institutional differences between tax systems. A third of OECD countries exempt gains on share disposals in one form or another (Belgium, Denmark, Germany, Greece, Hungary, Luxembourg, the Netherlands, New Zealand, Norway, Portugal). Residential property prices may also be expected to impact on the corporate profit tax base, depending on the strength of house prices movements, since corporate profits will have been directly affected by increases in the value of the land and property portfolio of the construction and real estate sectors. Moreover, the property assets of commercial enterprises in general may also have been affected to the extent that commercial-property and house prices move in tandem.

Table 2. **Tax treatment of corporate capital gains and losses**

	Capital gains	Loss carry-forward provisions	Regime and tax rate
Australia	All realised gains resulting from a capital gains tax "event" taxable	No carry-back; indefinite carry-forward	Corporation tax (CT) rate 30%
Austria	Sale or disposition of shares and business property	No carry back; indefinite carry-forward	Flat rate 25%
Belgium	Sale of business assets taxable as ordinary income; share disposals exempt	No carry-back; indefinite carry-forward	Nil/33%
Canada	All realised capital gains taxable	Carry-back 3 years; carry-forward 7 years	CT rate 22.12%
Czech Republic	All gains generally included in ordinary income	No carry-back; 5 year carry-forward	CT rate of 20%
Denmark	All disposals of immovable property taxable ; disposals of shares after 3 years exempt	No carry-back; indefinite carry-forward against a similar type of gain	CT rate 25%
Finland	All capital gains taxed as ordinary income	No carry-back; carry-forward 3 years for business assets, 5 years for shares against similar types of gain	CT rate 26%
France	Taxed as ordinary income; SMEs exempt.	3-year carry-back; indefinite carry-forward	CT rate 33 1/3%; sale of shares in listed real estate companies = 19%
Germany	Taxed as ordinary income; share disposals exempt	Carry-back 1 year; unlimited carry-forward	CT rate 15%
Greece	Taxed as ordinary income; shares exempt if acquired before 1/1/2010	No carry-back; Carry-forward 5 years	CT rate 25% reducing to 20% by 2014
Hungary	Taxed as ordinary income; 50% of gains on shares exempt	No carry-back; Indefinite carry-forward	CT rate 16%
Iceland	Profits derived from sales of assets taxed as ordinary income	No carry-back; 10-year carry-forward	CT rate 18%
Ireland	Gains realised by resident companies subject to CT; gains on disposal of substantial shareholding exempt	Indefinite carry-forward	CT rate 12.5%
Italy	Gains on business assets taxed; gains on alienation of shares exempt for 95% of amount.	Carry-forward 5 years	CT rate 27.5%
Japan	Treated as ordinary income	Carry-back 1 year; carry-forward 7 years	CT rate 30%
Korea	Included in ordinary income	No carry-back; carry-forward 5 years	CT rate 10-20%
Luxembourg	Capital gains from sale of shares exempt	Indefinite carry-forward	CT rate 21%
Mexico	Taxed as ordinary income, after indexation	No carry-back; 10-year carry-forward	CT rate 30%
Netherlands	Included in ordinary income when realised; share disposals mainly exempt	Losses can be deducted as soon as expected	CT rates progressive: 20/23/25.5%
New Zealand	Capital gains not taxed	No carry-back; indefinite carry-forward	Nil
Norway	Gains from property and bonds taxed; gains from share disposals not taxed since 2004	No carry-back; carry-forward 10 years	CT rate 28%
Poland	Fixed assets and intangibles counted as ordinary income	Carry forward 5 years	CT rate 19%
Portugal	Gains on disposal of assets; 50% relief on share disposals	Carry-forward 6 years	CT rate 25% + 1.5% municipal surcharge
Slovak Republic	Included in ordinary income	Carry forward 5 years	CT rate 19%
Spain	Gains on disposal of assets treated as ordinary income	Carry-forward 15 years	CT rate 30%
Sweden	Capital gains counted as business income; sales of immovable property and share disposals taxed.	Losses may be off-set against gains on similar types of assets	CT rate 26.3%
Switzerland	Taxed as ordinary income	No carry-back; carry-forward 7 years	CT rates 14-30%
Turkey	Included in ordinary income, subject to inflation accounting	No carry-back; carry-forward 5 years	CT rate 20%
United Kingdom	All capital gains except for intra-group disposals and reorganisations of share capital	Net capital losses may be carried forward indefinitely	CT rate 28%
United States	Taxed as ordinary income	Carry-back 2 years; carry-forward 20 years	Federal 15-35%; States: 0 to 10%, deductible in computing Federal taxable income

Source: *European Tax Handbook* (2009); national tax sources.

Taxes on capital, transfers and transactions

Capital taxes are not currently included in the cyclical adjustment process. According to *OECD Revenue Statistics* (RS) definitions, there are four major heads:

- *Taxes on immovable property* (RS4100).
- *Recurrent wealth taxes* (RS4200).
- *Capital transfer taxes (estate, inheritance and gift taxes)* (RS4300).
- *Capital transactions taxes (including stamp duties)* (RS4400).

As noted, these taxes are distributed among the different SNA tax aggregates. The following tables describe the major features linking such taxes to asset prices, together with their revenue weight in the relevant SNA tax head, both being determining factors of aggregate asset price/tax sensitivity.

Taxes on immovable property and wealth

The extent to which OECD countries depend on the taxation of immovable property varies considerably as does the tax base (Table 3). Generally, such taxes are levied at state or municipal level and can vary to the extent that rating decisions are devolved. Most countries use a form of valuation assessment, rather than market values *per se*, with varying periodicity. A minority use a base linked to area. Apart from these, the presumption is that these taxes will generally respond to asset cycles in a way which relates quite closely to the valuation system set out in the tax code, while also, more generally, responding to fluctuations in house building. As for wealth taxes, these are imposed in only a few countries, a number having abolished them in the period under review: namely, Austria, Belgium, Denmark, Finland, Spain and Sweden (Table 3). The revenues in this category would be expected to react importantly, but with a lag to asset price developments (equities and housing).

Financial and capital transactions taxes

Capital transactions taxes are widespread (Table 4) and apply to the passing of title to property from one person (or entity) to another.[8] The most remunerative tax and the one most likely to respond to asset price cycles is that based on immovable property transfers. The rates on personal property transfers vary substantially among OECD economies and are usually *ad valorem*, but can also be graduated, implying a progressivity which makes them highly responsive to house price movements (*e.g.* the United Kingdom and Ireland). The effect on tax receipts will be a function of both house price movements and activity, which will vary cyclically with housing construction booms.

Taxation of financial market transactions is also subject to marked international variation, and can be on a lump sum or *ad valorem* basis. In the latter case, it is to be expected that such taxes, where they are imposed, will respond to equity price cycles, because both the value and number of transactions vary cyclically. The other element of capital transactions tax, which relates to the duties imposed on registering legal documents, leases, etc. is less likely to show any asset-related effects, except insofar as mortgages and insurance track asset price movements. Taking capital transactions taxes in total, their weight in aggregate tax receipts is around 1¾ on average, being below ½% in one third of OECD economies and above 3% only in Spain, Ireland, Australia and Korea, which has an unusually high dependence on such taxes.

8. This kind of tax is typically imposed where there is a legal requirement for registration of the transfer, such as transfers of real estate, shares or bonds and can often be called a registration duty. It may also be called a stamp tax, which may also refer to taxes on legal documents, including mortgage and insurance contracts, apart from property and share transfers.

Table 3. **Taxes on immovable property and net wealth**

	Taxes on immovable property, RS4100		Net wealth RS4200	
	Base for assessment	Weight in total tax revenues %[1]	Tax imposed (Y) or not (N)	Weight in total tax revenues %[1]
Australia	Land tax is levied on the total unimproved value of the land at a specified date	4.6	N	0.0
Austria	Standard assessed value	0.6	N since 1994	0.3
Belgium	No real estate tax on household	0.0	N since 2008	0.1
Canada	Assessed value of property (variable, local government)	8.4	N	0.0
Czech Republic	Ground floor area	0.5	N	0.0
Denmark	Municipal: value of land and buildings; national: assessed value	2.2	N since 1997	0.1
Finland	Taxable value	0.8	N since 1/1/06	0.1
France	Property and dwelling taxes; 80% of notional rental value	4.4	Y	0.4
Germany	Fiscal value	1.1	N since 1998	0.5
Greece	Assessed value	0.4	N	0.1
Hungary	Maximum 3% of fair market value	0.6	N	0.0
Iceland	Officially assessed value	3.7	N since 2006	1.2
Ireland	Rateable value of non-residential occupation fixed annually	2.2	N	0.0
Italy	Not levied on primary residences	1.6	N	0.2
Japan	Assessed value used for inheritance tax, which is 80% of the market value	7.1	N	0.0
Korea	Progressive; assessed house price	2.9	N	0.0
Luxembourg	Unit value determined by Valuation Law	0.3	N since 2006	5.6
Mexico	Cadastral value (assessed value) of the real estate, varying by state	0.9	N	0.0
Netherlands	Taxable base established by public valuation	1.7	N since 2001	0.3
New Zealand	Rateable value of properties.	5.3	N	0.0
Norway	Assessed value of immovable property = 20-50% of fair market value	0.6	Y: up to 0.7% municipal & 0.4% national	1.3
Poland	Floor or land area	3.6	N	0.0
Portugal	Updated when property is sold	1.3	N	0.0
Slovak Republic	Floor area	1.3	N	0.0
Spain	Cadastral value adjusted every 8 years by reference to market value	1.8	N since 1/1/08	0.5
Sweden	Fee based on assessed value	1.9	N since 2007	0.4
Switzerland	Y at cantonal level	0.6	Y at cantonal level	4.5
Turkey	Value of land and buildings; deductible against Corporation Tax	0.7	N	0.0
United Kingdom	Rateable value re-assessed every 5 years, currently based on market rents of April 2003	8.9	N	0.0
United States	Market value of the property, or a percentage of it, determined by local assessor (state-administered)	10.2	N	0.0

1. Period average.
Source: National tax sources.

Table 4. **Capital transaction taxes**

	Transaction taxes (RS4400)				Weight in total tax revenues %[3]
	Transfer tax		Other documentary taxes[2]	Insurance premium tax	
	Residential property	Shares[1]			
	Tax imposed (Y) or not (N)				
Australia	N federal; Y state (up to 4-6.7%)	N federal; Y some states (0.6%)	Y	7½ - 11%[4]	4.4
Austria	Y (Land transfer tax 3.5%)	N	Y (0.8-2%)	11%	0.6
Belgium	Y (10-12.5%)	Y	Y (fixed/1%)	9¼%	1.9
Canada	N	N	N	10%	0.2
Czech Republic	Y (3%)	N	N	N	0.7
Denmark	N (Registration fee 0.6%)	N	Y (mortgage fee 1.5%)	14%	0.6
Finland	Y (4%)	N on publicly listed securities	Y (1.6% on financial transactions)	22%	1.0
France	Y (5.09%)	Y (3% up to max of € 5 000)	N	7-30%	1.0
Germany	Y (3-4.5%)	N	N ex minor fees	19%	1.3
Greece	Y (1%)	Y (0.15%)	Y (2.4-3.5%)	20%	2.8
Hungary	Y (2-4%)	N	Y	N prior to 2010	1.2
Iceland	N	N	Y (0.25-2%)	0.06% of sum insured	1.6
Ireland	Y (7-9%)	Y (1%)	Y	2%	3.5
Italy	Y (Registration tax 7%)	Y flat rate since 2007	N	21¼ %	2.4
Japan	Y: Acquisition 4%; registration tax 2%	Y	Y	N[5]	2.1
Korea	Y: Acquisition 2%; registration tax 3%	Y (0.15 - 0.5%)	Y	N	8.5
Luxembourg	Y: 6% +1% registration tax	N	Y	4%	2.1
Mexico	Y (2-3.3%)	N	Y		0.5
Netherlands	Y (6%)	N	N	7½%	1.7
New Zealand	N since 1999	N	N	N ex offshore[4]	0.5
Norway	Y: stamp duty 2½%	N	Y	N	0.3
Poland	Y (new property excepted)	Y	Y	N	0.0
Portugal	Y (up to 6%)	N	Y	9%	1.7
Slovak Rep.	N (abolished 2005)	N	N	N	0.2
Spain	Y (6-7% if not subject to VAT)	N	Y	6%	3.3
Sweden	Y: 1.5-3%	N (abolished 1991)	Y (0.4-1% mortgages	N	0.7
Switzerland	N federal; Y at cantonal level	Y Federal transfer duty 0.15-0.3%	Y on share issuance	N	2.8
Turkey	N except registration fee	N	Y Banking and insurance transaction tax 1-5%		2.6
United Kingdom	Y (up to 4%)	Y (0.5%)	Y	5%	1.7
United States	N federal; realty transfer taxes levied in 38 states	N federal; stock transfer taxes levied in some states	N ex. state-level stamp taxes	N	0.0

1. May not apply to shares in real estate companies.
2. Stamp duties on loan, lease, financial agreements etc.
3. Period average.
4. GST is charged on insurance premiums.
5. Premiums subject to enterprise tax.

Source: European Tax Handbook; The International Comparative Legal Guide to Real Estate 2010; *The International Comparative Legal Guide to Corporate Tax 2010* and national sources.

Estate, inheritance and gift taxes

Estate, inheritance and gift taxes are applied rather widely, though not universally (Table 5). They would be expected to respond to asset price movements with a relatively short lag (and may even be contemporaneous) where valuation and payment occur in real time, as would be the case with bequests of shares. Immovable property may be valued at "fair market value" rather than actual value, which would tend to damp the short-term response to house prices, but there is likely to be a fairly direct longer-run correspondence between asset price increases and transfer tax receipts. Given their widespread application, it is to be expected that this asset price effect would be identifiable fairly generally across OECD economies, but the weight of such taxes in total taxation is relatively small and their eventual significance for the overall fiscal stance quite minor.

Table 5. **Inheritance, estate and gifts taxes**

	Estate/ Inheritance	Gift	Weight in total tax revenues %[1]
	RS4300 Tax imposed (Y) or not (N)		
Australia	N (since 1979)	N	0.0
Austria	N (from Aug 08)		0.1
Belgium	Y	N after 2 yrs	0.9
Canada	N[2]	Y	0.0
Czech Republic	Y	Y	0.1
Denmark	Y	Y	0.5
Finland	Y	Y	0.6
France	Y	Y	1.0
Germany	Y	Y	0.4
Greece	Y	Y	0.6
Hungary	Y	Y	0.1
Iceland	Y	N	0.2
Ireland	Y		0.5
Italy	Y (since 1/1/07)		0.1
Japan	Y	Y	1.5
Korea	Y	Y	0.9
Luxembourg	Y	Y	0.3
Mexico	N	N among families	0.0
Netherlands	Y	Y	0.7
New Zealand	N (since 1992)	Y	0.1
Norway	Y	Y	0.2
Poland	Y	Y	0.1
Portugal	N since 1/1/04		0.2
Slovak Republic	N since 1/1/04		0.0
Spain	Y	Y	0.6
Sweden	N	N	0.0
Switzerland	Y[2]	Y[3]	0.9
Turkey	Y	Y	0.1
United Kingdom	Y	Y	0.6
United States	Y[4]	Y[4]	1.0

1. Period average.
2. In the case of non-registered accounts, capital gains are recognised and become taxable on the final return of the deceased, prior to inheritance.
3. No at federal level, but most cantons levy such taxes.
4. Estate tax and generation-skipping transfer tax were gradually phased out from 2002 to 2010 but have been partially reinstated in 2011 to 2012.

Source: European Tax Handbook; national sources.

Indirect taxes

Residential housing booms can be a powerful source of cyclicality in indirect tax receipts where VAT is charged on new housing supply, but the normal cyclical adjustment process does not correct for this. Doing so would involve correcting both for the housing cycle and the house-price cycle, the latter being of particular interest here. There is little consistency among OECD economies as to VAT treatment of new (and renovated) housing. A half of OECD members (apart from the United States which does not impose a VAT) exempt new house sales from VAT, while in the United Kingdom they are zero-rated (Table 6).[9] The other half subjects such sales to VAT, which would tend to accentuate cyclical revenue buoyancy, except that VAT can often be imposed at a rate lower than the standard rate.[10] In general, though, where VAT is charged on sales of new residential buildings, which includes the cost of land, as is the EU norm,[11] indirect taxes may be directly affected by house-price as well as construction cycles.[12]

IV. Estimates of asset-related tax elasticities

As noted above, direct taxes on households comprise personal income taxes (including capital gains), property and wealth taxes. The asset price elasticities are derived as a tax-weighted average of the separate asset price elasticities relating to the personal income tax, taxes on immovable property and wealth taxes, as reported in the Annex Tables A.1-A.3. On average, the personal income tax has a weight of just under 90% in household direct taxes, taxes on immovable property 8½ per cent and wealth taxes 2½ per cent, so the bulk of the responsiveness to asset prices is generated by the income tax.

Personal income taxes

As regards the elasticities of the personal income tax with respect to asset prices (Table 7 and regression results reported in Table A1), these may be taken as reflecting the combined effects of capital gains taxation and interest deductibility (as listed in Table 1 above).

- In a half of the countries covered, a significant positive short-term house price elasticity emerges, there being a close correspondence between the finding of such an effect and the imposition of capital gains tax on immovable property. Long-term effects can be identified in about two-thirds of countries and in three cases they are negative, probably reflecting the existence of interest-deductibility in the absence of CGT (Belgium, the Netherlands), but due to unidentified factors in the case of Australia, where a relatively strong positive short-term effect is reversed over time. Indeed, the dynamics of the various equations vary considerably depending not just on the

9. Exemption implies that new house sales are input-taxed, while zero-rating implies VAT paid on inputs can be deducted. No EU Member State can introduce any *new* zero rates of VAT, though they have been able to continue charging any lower rates, including zero rates that were in place on 1 January 1991.

10. EU member states have the discretion to charge a reduced rate of VAT – between 5% and 15% – on the "provision, construction, renovation and alteration of housing, as part of a social policy". As a consequence, member states may charge a reduced rate of VAT on repair work for social housing, though there is no definition of social housing at Community level and it has therefore been defined variously in the legislation of different member states. Because of problems in differentiating renovations from new builds, harmonisation between VAT rates on the two often occurs at a reduced rate.

11. EU VAT directive 2006/112/CE specifically excludes the transfer of residential building land from the list of exempt transactions, where the transaction is made by an enterprise registered for VAT. No VAT is payable where the transaction is between individuals.

12. There may also be indirect channels, principally via wealth effects, but those channels are ignored in the existing cyclical adjustment process and are not the focus of attention here.

interaction of CGT and interest deductibility, but probably also political economy responses, which may not be adequately picked up in the discretionary policy control variables.

- Significant long-term positive equity price effects on income tax receipts are identified in around two-thirds of the OECD economies, with the coefficients clustering within a relatively narrow range and the dynamics being more uniform than for house prices. Again, the results are mostly consistent with the principles of national tax legislation, as set out in Table 1, with zero or very low responsiveness generally being identified in countries exempting capital gains from income tax.

Table 6. **VAT or GST on new home sales**

	Standard rate	Vat on new homes
		Y(yes) N(no)
Australia	10.0	Y
Austria	20.0	N (exempted)
Belgium	21.0	Y
Canada	5.0	Y
Czech Republic	19.0	Y (5%)
Denmark	25.0	N (exempted)
Finland	23.0	N (exempted)
France	19.6	Y[1]
Germany	19.0	N (exempted)
Greece	19.0	Y
Hungary	20.0	Y
Iceland	24.5	N
Ireland	21.5	Y (13.5%)
Italy	20.0	Y (10%)
Japan	5.0	Y
Korea	10.0	Y
Luxembourg	15.0	Y (3%)
Mexico	15.0	N
Netherlands	19.0	N [2]
New Zealand	12.5	Y
Norway	25.0	N
Poland	22.0	Y (7%)
Portugal	21.0	N (exempted)
Slovak Republic	19.0	Y[1]
Spain	16.0	Y (7%)
Sweden	25.0	N (exempted)
Switzerland	7.5	N (exempted)
Turkey	17.0	Y (1% & 17%)
United Kingdom	17.5	N (zero-rated)
United States	--[3]	--[3]

1. If first sale takes place less than 5 years after construction.
2. Y if sold within 2 years of first use.
3. No VAT; sales tax on materials varies by state from 0 to 7%.

Source: *European Tax Handbook 2009*; *The International Comparative Legal Guide to Real Estate 2010;* national tax sources.

The reduced form nature of the equations means that the coefficients relating to asset prices may be picking up a variety of influences besides direct asset-related effects on taxes. There may, for example, be a link in some countries from equity prices to payment via stock options, reflecting in large part their

favourable tax treatment. There could also be a more diffuse link to compositional effects on the tax base, associated with a distribution of income during asset booms towards earners with higher marginal rates (though empirical evidence on this is scant). Furthermore, as noted, the time series regressions control for discretionary tax changes through a constructed variable specified for each country as a (simple) average of statutory rates, which may be an imperfect proxy for actual discretionary changes. This means that in some cases the elasticity relating to the income tax base is a composite of automatic (income-induced) and discretionary tax changes, the effect usually being to bias it down. A downward impact on long-term asset price elasticities could occur where income tax rates are cut as CGT revenues rise (a not unusual occurrence). And conversely, it could mean that anticipatory behaviour ahead of a CGT rate change (where it is an increase) could reduce short-term asset price elasticities.

The property and wealth tax elasticities used to derive the aggregate direct household tax elasticities in Table 7 are reported in Tables A2 and A3. The elasticities of property tax with respect to house prices are generally significant, but show substantial variation, probably reflecting (accurately) the differing revaluation processes (Table 3). Long-term elasticities generally emerge as more significant than short-term ones, suggesting a gradual adjustment to equilibrium. Since much revaluation activity is quasi-discretionary, the substantial differences in elasticities may be as much a function of political economy factors as built-in statutory obligations, but there is a strong case for incorporating them into the asset price cyclical adjustment process. Wealth taxes are also found to respond to asset prices in the minority of OECD countries where these have been subject to tax, though (as noted in Table 3) any forward-looking cyclical adjustment would need to take account of more recent wealth tax abolition in several of them.

Corporation tax

Table 8 gives the elasticity results derived from a corporation tax equation which includes equity and house prices as determinants in an error-correction model (Table A4). As noted above, the tax base is realised gains, on which there is no information either directly or in terms of the tax receipts accruing from such gains. The calculation of the corporate tax yield/asset price elasticities is thus very much data-driven, with limited *a priori* pointers as to how large the elasticities should be. Moreover, the complex provisions usually applying to investment allowances, interest deductibility (which can be subject to "thin-capitalisation" restrictions) and loss carry-overs make the identification and specification of control variables particularly difficult for corporation taxes.

Here, the procedure has been to estimate the elasticity of corporation tax/asset price elasticities within an *ad hoc* framework, with controls for gross profits (national accounts definition), the corporation tax rate as a proxy for discretionary tax policy and, where the results were improved, nominal business investment as a proxy for investment allowances/expensing and/or interest deductibility. Though investment and leverage may be correlated, no explicit control is included for corporate leverage, so that asset price elasticities will be a reduced-form of capital gains effects *per se*, decisions on the timing of realisations and decisions about equity/debt issuance and withdrawal to the extent these are related to equity prices.

Table 7. **Asset price elasticities for direct taxes on households**

	Error correction term	House price elasticity		Share price elasticity	
		Long run	Short run	Long run	Short run
Australia	-0.32	-0.70	0.41	..	0.15
Austria	-0.46	..	..	0.01[x]	..[x]
Belgium	-0.89	-0.49	..	..[x]	..[x]
Canada	-0.64	0.29	0.31	0.21	0.07
Czech Republic	-0.95	..[n]	..[n]	..[x]	0.11[x]
Denmark	-0.83	0.05	0.01	0.06	0.06
Finland	-1.00	0.03	0.24	0.08	0.08
France	-0.26	0.14	0.28	0.01	0.11
Germany	-0.47	0.12	0.01	0.22[x]	0.08[x]
Greece	--	..[n]	..[n]	..[x]	..[x]
Hungary	--	..[n]	..[n]	..	..
Iceland	--	..[n]	..[n]	..	..
Ireland	-1.00[a]	0.06	-0.58	0.18	0.34
Italy	-0.87	0.15	..	..	..
Japan	-0.72	0.19	..	0.16	..
Korea	-0.82	0.63	0.09	0.09	..
Luxembourg	-0.06	..[n]	..[n]	0.13	0.08
Mexico	-0.54	..[n]	..[n]	0.40	..[x]
Netherlands	-0.76	-1.06	0.02	..[x]	..[x]
New Zealand	-0.02	0.07	0.05	..[x]	..[x]
Norway	-0.42	0.04	0.42	0.17	0.01
Poland	-0.63	..[n]	..[n]	0.56	0.20
Portugal	-1.00[a]	..[n]	..[n]	0.08	..
Slovak Republic	--	..[n]	..[n]	..[x]	..[x]
Spain	-1.02	0.68	0.54	0.10	..
Sweden	-0.85	0.03	0.46	0.01	0.13
Switzerland	-1.00[a]	0.11	0.96	0.04[x]	0.15[x]
Turkey	-0.54	..[n]	..[n]	0.39[x]	0.21[x]
United Kingdom	-0.74	0.33	..	0.19	..
United States	-0.65	0.60	0.04	0.40	0.24
Average	-0.71	0.07	0.22	0.17	0.13

Key:
.. Nil tax elasticity estimates, not statistically different from zero at 10% level of confidence.
..[n] Nil tax elasticity: national house price data unavailable.
..[x] Gains on disposals of shares exempted or no capital gains tax.
-- Not applicable or estimate unreliable; -1.00[a] Estimated coefficient not statistically different from 1 (Wald Test).
Note: Tax elasticities are weighted averages of the component tax items (personal income tax,RS1100, property taxes, RS4100 and wealth taxes, RS4200), the weights being the share of receipts in total direct taxes on households. For component elasticity estimates and weights see Annex Tables reporting the regression results.
Source: OECD estimates.

Table 8. **Asset price elasticities for corporate tax**

	Error correction term	House price elasticity		Share price elasticity	
		Long run	Short run	Long run	Short run
Australia	-1.10	0.32	..	0.33	..
Austria	-0.87	..	1.53	..[x]	..[x]
Belgium	--	..	..	..[x]	..[x]
Canada	-0.53	..	..	..	0.55
Czech Republic	--	..[n]	..[n]	..	..
Denmark	-1[a]	0.91	1.73	..	..
Finland	-0.37	1.99	3.04	0.65	0.20
France	-0.92	..	..	0.34	0.20
Germany	--	..	..	..[x]	..[x]
Greece	--	..[n]	..[n]	..[x]	..[x]
Hungary	--	..[n]	..[n]	..	..
Iceland	--	..[n]	..[n]	..	..
Ireland	-0.47	..	..	..[x]	..[x]
Italy	-0.53	0.89	..	0.67	0.31
Japan	-0.47	..	..	0.47	0.39
Korea	-1.08	..	1.14	..	0.22
Luxembourg	--	..[n]	..[n]	..[x]	..[x]
Mexico	--	..[n]	..[n]	..	..
Netherlands	--	..	..	..[x]	..[x]
New Zealand	--	..	..	..[x]	..[x]
Norway	-0.78	..	..	..	0.21
Poland	--	..[n]	..[n]	..	..
Portugal	-0.57	..[n]	..[n]	0.83	0.41
Slovak Republic	-2.11	..[n]	..[n]	..	..
Spain	-0.49	1.09	0.71	0.81	0.37
Sweden	-1[a]	..	..	0.39	0.52
Switzerland	-1[a]	0.40	..	0.28	..
Turkey	--	..[n]	..[n]	..	..
United Kingdom	-0.53	..	0.98	..	..
United States	-0.67	..	0.95	..	0.44
Average	-0.78	0.93	1.44	0.53	0.35

Key:

.. Nil tax elasticity estimates, not statistically different from zero at 10% level of confidence.

..[n] Nil tax elasticity: national house price data unavailable.

..[x] Gains on disposals of shares exempted or no capital gains tax.

-- Not applicable; -1[a] Estimated coefficient not statistically different from 1 (Wald Test).

Note: For detailed estimates see Annex Table A4.

Source: OECD estimates.

The equity price index emerges as a significant positive explanatory factor for the corporation tax yield in around half of the OECD economies, the exceptions being those countries where gains on share disposals are partly or fully exempt from tax. The long-term elasticities vary within a relatively narrow range of 0.3 to 0.8. As for the impact of property prices, the results are much more mixed with relatively high values in some cases. The interpretation of the results is difficult and the substantial cross-country variation is a problem, suggesting that corporate tax elasticities require careful attention when correcting for immovable property price cycles.

The oil price is included in the regressions as a control for energy costs, but does not emerge as a significant positive driver of corporate taxes. In the United Kingdom, however, a significant positive oil price effect is captured, acting through petroleum revenue tax.[13]

Indirect taxes

Table 9 sets out the asset price and investment related elasticities applying to indirect taxes. These are a composite of elasticities derived separately for VAT (or GST) and asset transactions taxes, given in Tables A5 and A6.

Value added taxes and GST

The basic specification for VAT receipts includes personal consumption and the value of housing investment, as a proxy for the new-house sale component of the VAT base, where it is part of the base. House prices are included on the basis that the value of housing transactions would be more related to those than to the house construction deflator (though a positive effect from house prices could also be postulated through wealth effects or the indirect effects of housing investment on the demand for higher-rated consumer goods). Controls for discretionary tax changes are introduced in the form of a country-specific time series of the standard rate of VAT. The results generally show a significant effect of house prices on VAT receipts for those countries where such a result would be expected from Table 6.

Capital transactions taxes

Table A.6 sets out the elasticities derived from equations regressing receipts from transfer and transactions taxes against equity and house prices. The results are again consistent with what would be expected from national tax codes described in Table 4, with the tax yield/equity price elasticities being generally positive, the exceptions being those countries where share transfers are not taxed (Canada, the Netherlands and Sweden). House prices also emerge as significant indirect tax drivers in a number of countries, the short-term elasticities being above unity in several countries, particularly those operating a progressive rate structure (the United Kingdom, Sweden, Ireland). The United States exhibits a particularly high transactions tax elasticity with respect to house prices.

13. For the United Kingdom, the share of oil-related revenues rose sharply to 45% in the mid-1980s before falling to around 5% at the beginning of the 1990s. Since then the share of oil revenues has been declining despite the rise in oil prices. Scerri and Reul (2009) find that taxes on oil production increase by around 0.1% of GDP for every $10 increase in the oil price. However, the increase in tax revenue on profits from oil production is partly mitigated by a fall in profits of the oil-consuming industries.

Table 9. **Asset price elasticities for indirect taxes**

	Error correction term	House price elasticity		Equity price elasticity	
		Long run	Short run	Long run	Short run
Australia	-0.92	0.19	0.29	0.36	0.11
Austria	-0.95	0.01	..	0.01	0.01
Belgium	-0.66	0.34	0.54	0.04	0.04
Canada	-0.97	..	0.89	0.01	0.02
Czech Republic	--	..[n]	..[n]	..	..
Denmark	-0.41	..	0.07	..	..
Finland	-0.39	0.06	..	..	..
France	-0.86	0.23	0.36	..	0.01
Germany	-0.19	0.02	0.03	0.03	0.03
Greece	--	..[n]	..[n]	0.10	0.04
Hungary	-0.58	..[n]	..[n]	0.07	..
Iceland	-0.90	..[n]	..[n]	0.03	0.04
Ireland	-0.74	0.39	0.67	..	0.06
Italy	-0.80	0.11	0.33	0.06	0.03
Japan	-0.60	..	..	..	0.08
Korea	-0.58	0.21	0.23	0.38	0.06
Luxembourg	--	..[n]	..[n]	..	..
Mexico	-0.51	..[n]	..[n]	0.02	0.01
Netherlands	-0.44	0.09	0.13	..	..
New Zealand	-0.59	..	..	..	..
Norway	-0.39	0.03	0.02	..	..
Poland	--	..[n]	..[n]	..	..
Portugal	-0.64	..[n]	..[n]	0.07	0.02
Slovak Republic	-1.07	..[n]	..[n]	..	..
Spain	-0.90	0.18	0.35	0.06	0.03
Sweden	-0.32	..	0.13	..	..
Switzerland	-0.91	..	0.20	0.05	0.09
Turkey	-0.52	..[n]	..[n]	0.10	0.03
United Kingdom	-1.02	..	0.16	0.09	0.11
United States	--	..[x]	..[x]	..[x]	..[x]
Average		**0.16**	**0.29**	**0.09**	**0.05**

Key: .. Nil tax elasticity estimates, not statistically different from zero at 10% confidence level.
..[n] National house price data unavailable.
..[x] No VAT or transactions taxes.
-- Not applicable or unreliable estimates.

Note: Tax elasticities are weighted by the shares of respective tax components (Value Added Tax, RS5110 and Transactions taxes, RS4400) in total indirect taxes. For detailed estimates and weights see Annex Tables A5, A6 and A8.
Source: OECD estimates.

Inheritance and gift taxes

As noted, the one category of capital taxes, as defined in *Revenue Statistics*, which is classified as a "capital tax" in the SNA is capital transfer taxes, which is comprised of estate, inheritance and gift taxes. These do not constitute a major source of revenue. Nevertheless, as noted above, they may be quite sensitive to asset prices and the asset price elasticities are reported in Tables 10 and A7.

Table 10. **Capital tax elasticities (inheritance and gift taxes)**

	Error correction term	House price		Equity price	
		Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity
Australia	--	..[x]	..[x]	..[x]	..[x]
Austria	-0.35	..[x]	..[x]	1.70	..
Belgium	-0.83	1.24	0.98	0.14	..
Canada	--	..[x]	..[x]	..[x]	..[x]
Czech Republic[2]	--	..[n]	..[n]	..	..
Denmark	-0.49	0.47	..	..	..
Finland	-0.26	1.10	..	0.30	..
France	-0.35	..	0.93	0.53	..
Germany	-0.27	..	..	0.90	..
Greece	-0.36	..[n]	..[n]	0.32	..
Hungary	-0.28	..[n]	..[n]	0.58	0.22
Iceland	-0.56	..[n]	..[n]	..	0.20
Ireland[3]	-1.07	..	..	0.70	0.83
Italy	-0.62	0.69	..	..	0.36
Japan	-0.59	1.12	..	0.54	0.28
Korea	-0.21	..	..	..	0.46
Luxembourg	--	..[n]	..[n]	..	..
Mexico	--	..[x]	..[x]	..[x]	..[x]
Netherlands	-0.99	0.89	2.19	..	..
New Zealand	--	..[x]	..[x]	..[x]	..[x]
Norway	-0.39	0.74	..	..	..
Poland	-0.33	..[n]	..[n]	1.93	0.36
Portugal	-0.63	..[x]	..[x]	0.61	0.21
Slovak Republic	--	..[x]	..[x]	..[x]	..[x]
Spain	-0.19	0.82	..	..	0.30
Sweden	--	..[x]	..[x]	..[x]	..[x]
Switzerland	-1.11	0.67	..	0.33	0.69
Turkey	-0.28	..[n]	..[n]	0.81	..
United Kingdom	-0.62	0.67	0.54	0.28	0.35
United States	-0.52	..	..	1.00	0.47
Average	**-0.51**	**0.84**	**1.16**	**0.71**	**0.39**

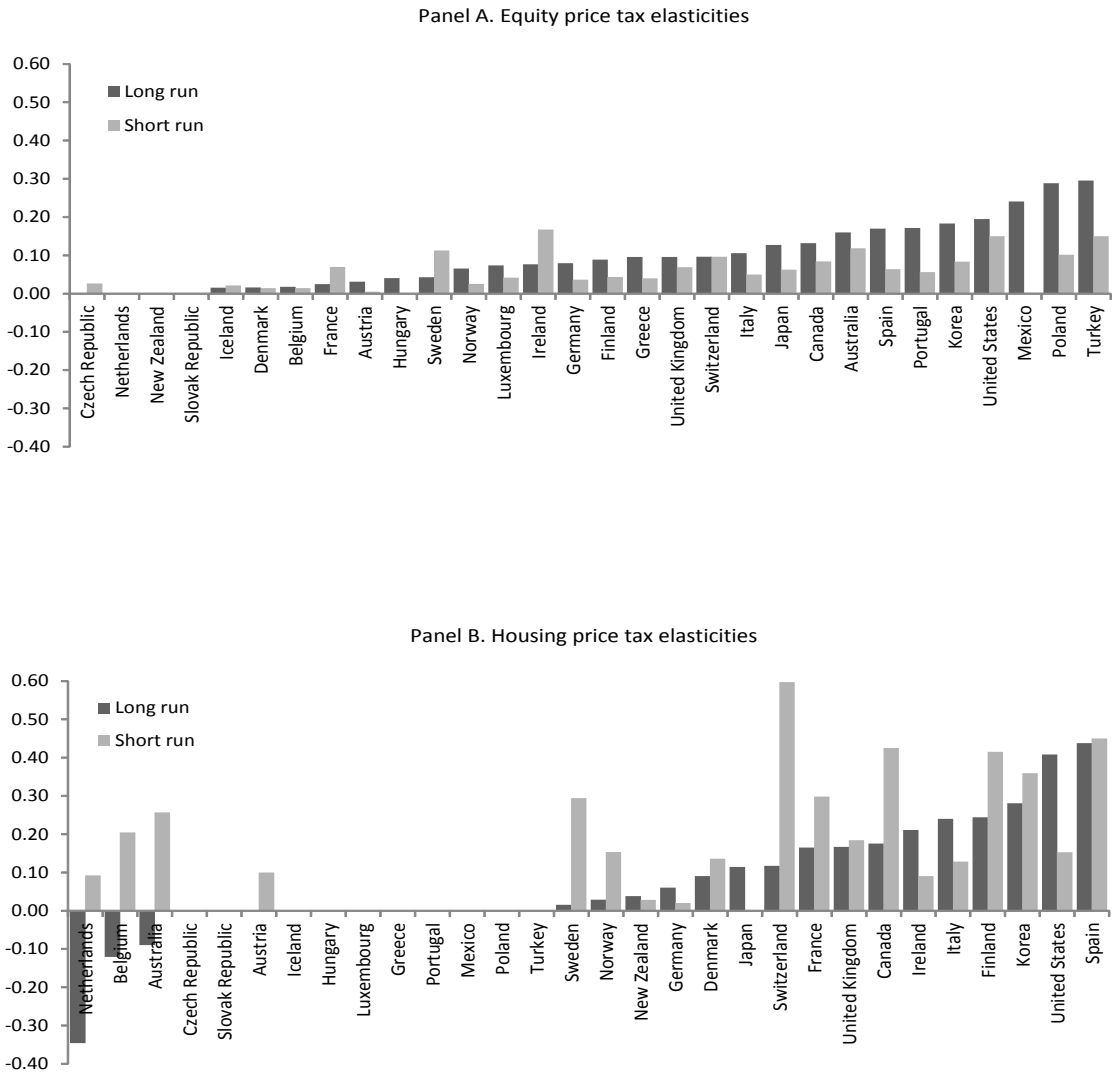
Key:
.. Nil tax elasticity estimates, not statistically different from zero at 10% confidence level.
..[n] National house price data unavailable.
..[x] No inheritance or gift taxes imposed.
-- Not applicable or unreliable estimates.
Note: For detailed estimates see Annex Table A7.
Source: OECD estimates.

The capital tax results appear to be relatively consistent with the national tax codes, significant elasticities with respect to equity prices being found in the majority of OECD countries, clustering in the 0.3 to 0.7 range. House prices also emerge as significant drivers in about a third of OECD economies, within a range of 0.5 to 1.2.

Aggregate responses to asset prices

Figure 1 brings together the results described in Tables 7-10, in terms of tax-weighted aggregate elasticities for the four categories of taxation (see Annex Table A.8). The ranking is according to the magnitude of the aggregate long-term elasticities. These vary, along a rather smooth progression, from zero to 0.3 with respect to equity prices, with a relatively consistent positive adjustment from short- to long-term impact, except in the case of France, Ireland and Sweden, where the data indicate a gradual erosion in the short-term response. The aggregate response to house prices is more heterogeneous, within a range of -0.35 and 0.45, because of a mix of causes, including interest-deductibility, which makes for negative elasticities in a few cases; discretionary policy responses, including irregular and lagged revaluation of some bases, and more marked differences in institutional treatment of immovable property gains than applies to equities. These factors tend to make the long-term elasticity lower than the short-term one in the majority of cases. The United States, Spain, Korea and Canada are in the top third for both categories of elasticity. The Netherlands, Belgium and Austria show the lowest general responses.

Figure 1. **Aggregated long-run and short-run asset price tax elasticities in OECD countries**



Note: Housing price data are not available for the following countries: Czech Republic, Greece, Hungary, Iceland, Luxembourg, Mexico, Portugal, Slovak Republic and Turkey.
Source: OECD calculations.

V. Defining the fundamental component of share and house prices

Difficulties in separating structural from temporary components of asset price movements at the time they occur have deterred governments from trying to cyclically adjust asset-related revenues (Box 2). Nevertheless, there may be strong strategic budgetary arguments for attempting to do so. In political economy terms, an approach which quarantines revenue "windfalls" until they are proven to be permanent fits well into a rules-based budget approach, whereby effective budget planning is based on the premise that it is likely to be less misleading and potentially less disruptive to take a cautious approach to available revenues.[14] For this approach to be implemented, it suffices to set a structural budget benchmark for asset prices (in the same way as for output growth). The benchmark calculations can then be used for assessing the dependability of revenues linked to asset price movements. Furthermore, an understanding of the sensitivity of the budget to "asset price gaps" does not depend on the definition of a single benchmark to be useful for budget planning purposes.

The approach used here is thus, first, to establish a "fundamental" benchmark for assessing the cyclical component of asset prices, based on their longer-run determinants and, second, to compare the results with those derived from asset price cycles which are defined relative to a more trend-based, benchmark, such as the smoothing of asset price movements using an HP filter. Fundamental house and equity prices and the asset price gaps that emerge from them, have been defined as follows.

"Fundamental" house prices

The housing valuation model used is developed in André (2010), which itself is based on a model by Poterba (1984), where long-term equilibrium house prices are determined by the influence of the user cost of housing on the price-to-rent ratio. At equilibrium, the model states that rents should be equal to the user cost of housing:

$$\frac{P}{R}* = \frac{1}{i^a + \tau + f - \pi} \tag{7}$$

where P/R* represents the "fundamental" price-to-rent ratio, i^a the after-tax nominal mortgage interest rate, τ the property tax rate on owner-occupied houses, f the recurring holding costs consisting of depreciation, maintenance and the risk premium on residential property and π the expected capital gains on houses (see Annex B for definitions of these variables).

The "fundamental" house price measure is intended to set a conservative bound to structural house price movements and may be compared with less conservative assumptions. However, this housing gap measure does not reflect structural changes in credit market conditions and has the characteristic that many housing markets appear to be currently overvalued.

"Fundamental" equity prices

The stock price valuation model used to calculate fundamental equity prices is based on a modified version of the Gordon equity price formula. The basic model states that over the long run, the dividend (or

14. The argument here is related to the benefits of fiscal prudence, whereby excess-of-forecast revenues are used to pay down debt and common-pool distortions are avoided by smoothing longer-run tax and expenditures. See for example van der Ploeg (2008).

earnings) yield plus the future growth in earnings should correspond to the risk-free real interest rate plus a risk premium so that:

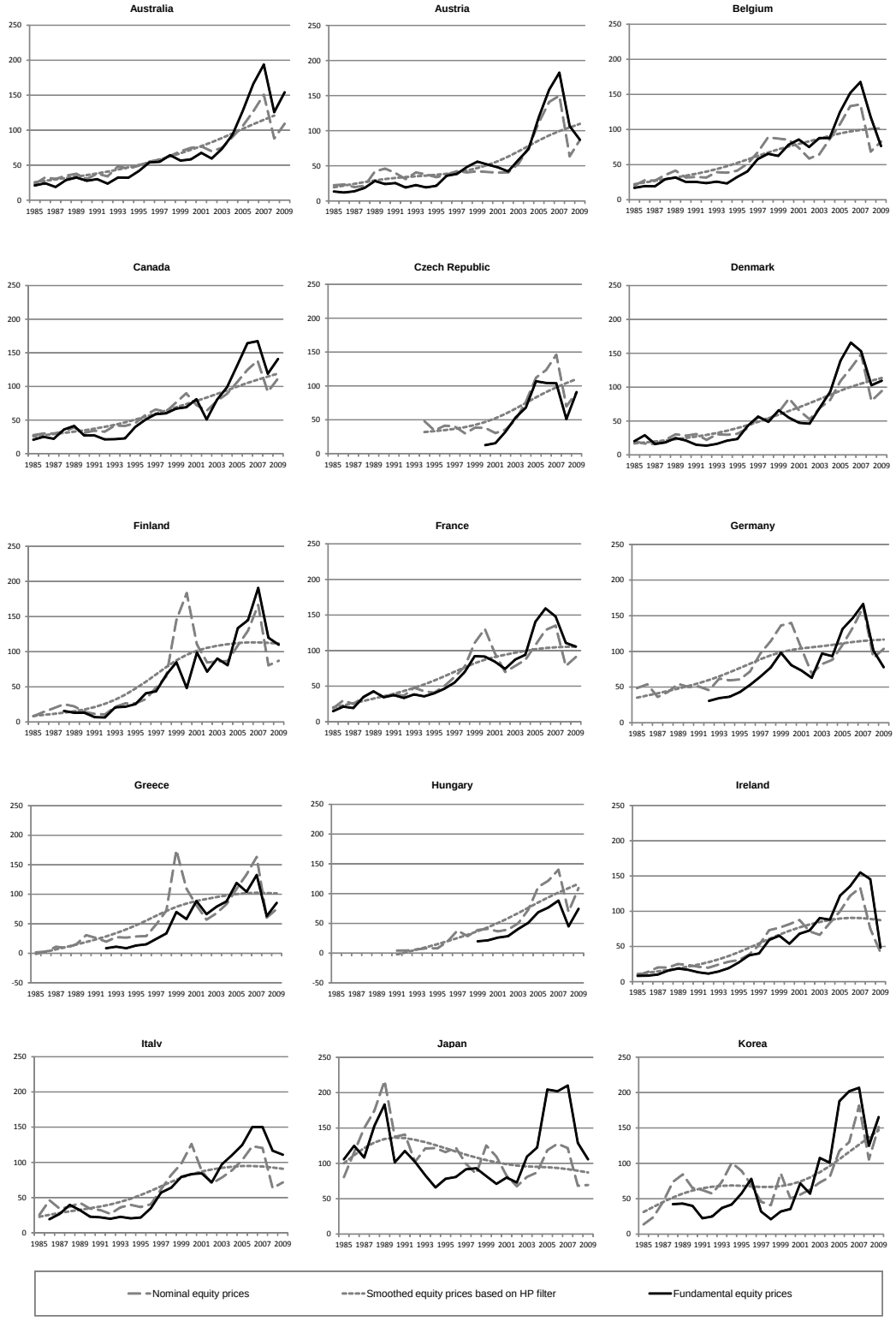
$$\frac{P}{E}* = (1+g)/(r+\sigma-g) \quad (8)$$

where r is the risk free interest rate, σ is the risk premium, g is the long-run growth of earnings and P/E* may be taken as an equilibrium, or "fundamental", measure of the price/earnings ratio. The actual P/E index can diverge from the fundamental one in the short run, both for speculative reasons and because earnings growth can exceed trend when markets are recovering from cyclical troughs (Fuller and Hsia, 1984: see Annex B). The objective of the asset-cycle adjustment process is to net out the tax revenue effects of such short-term asset price movements.

However, defining the relevant risk-free rate and the risk premium are problematic. Secularly declining interest rates have been an important driver of fundamental equity prices and need to be incorporated as drivers of fundamental prices, but interest rates also respond to the cycle, as may risk premia. In the recent recessionary environment, for example, quantitative easing has driven the risk free rate to historically low levels, pushing up fundamental equity valuations, but spreads between corporate and government bonds have increased, with the opposite effect. On account of this, national government bond yields have been adjusted by including another variable in the denominator, namely the spread between US corporate AAA bonds and 10-year US Treasuries.

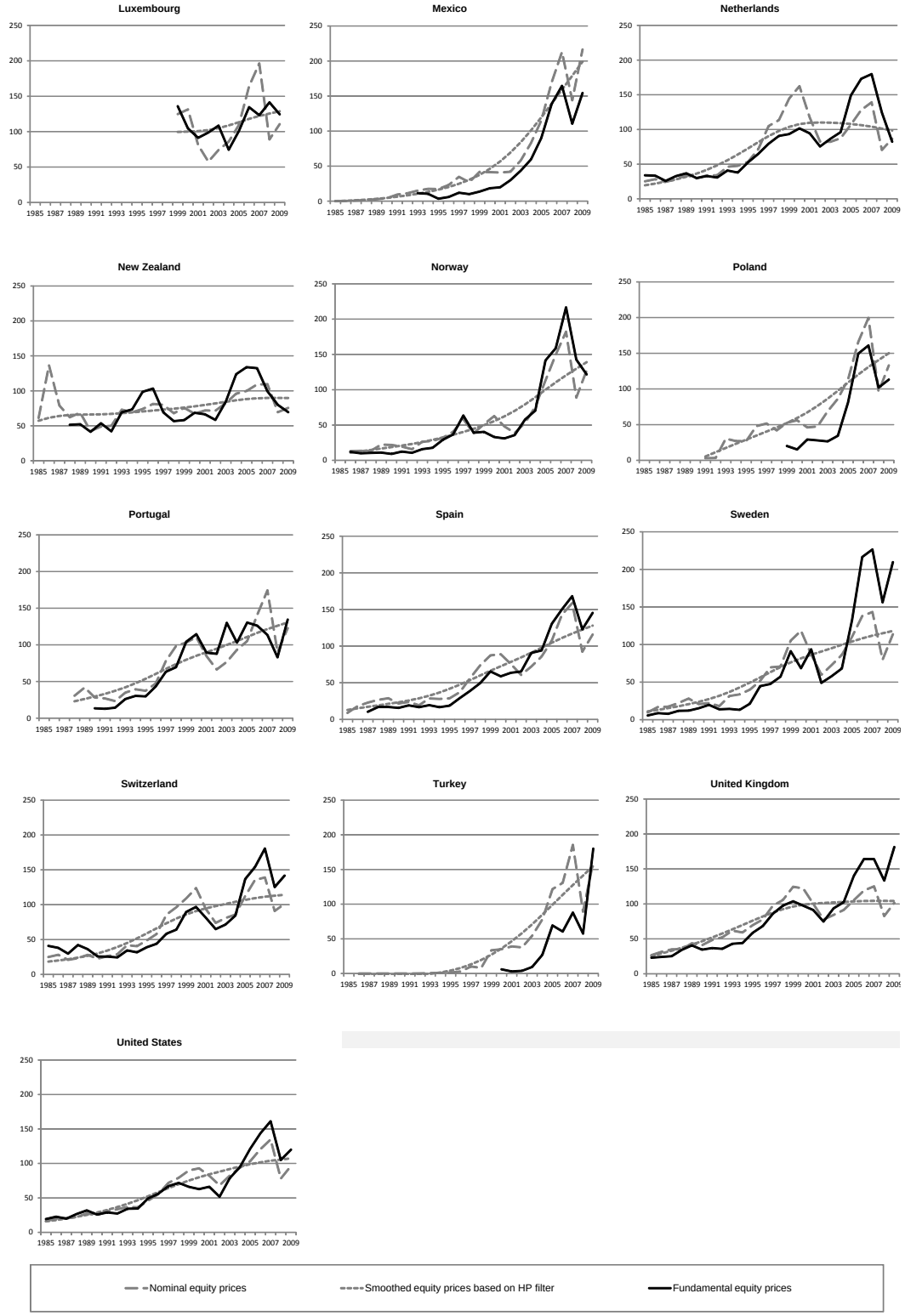
Asset price cycle estimates are presented in Figures 2 and 3. The diagrams plot the price indexes for fundamental, HP and actual asset prices, referring to the base year used for current price indexes. Price overvaluation occurs when fundamental or HP values are below the current price index and undervaluation when they are above. The model is calibrated so that the long-run average P/E ratios for the fundamental and smoothed equity price series are the same as for the actual series. It will be seen that the fundamental and smoothed house price series tell similar stories, for the most part, though the gaps based on fundamental prices show greater cyclical amplitude. This degree of correlation is absent from the two measures of equity price gaps, which often display divergent movements.

Figure 2. **Equity price cycles based on fundamental and smoothed prices**
Indexes, nominal equity price = 100 in 2005



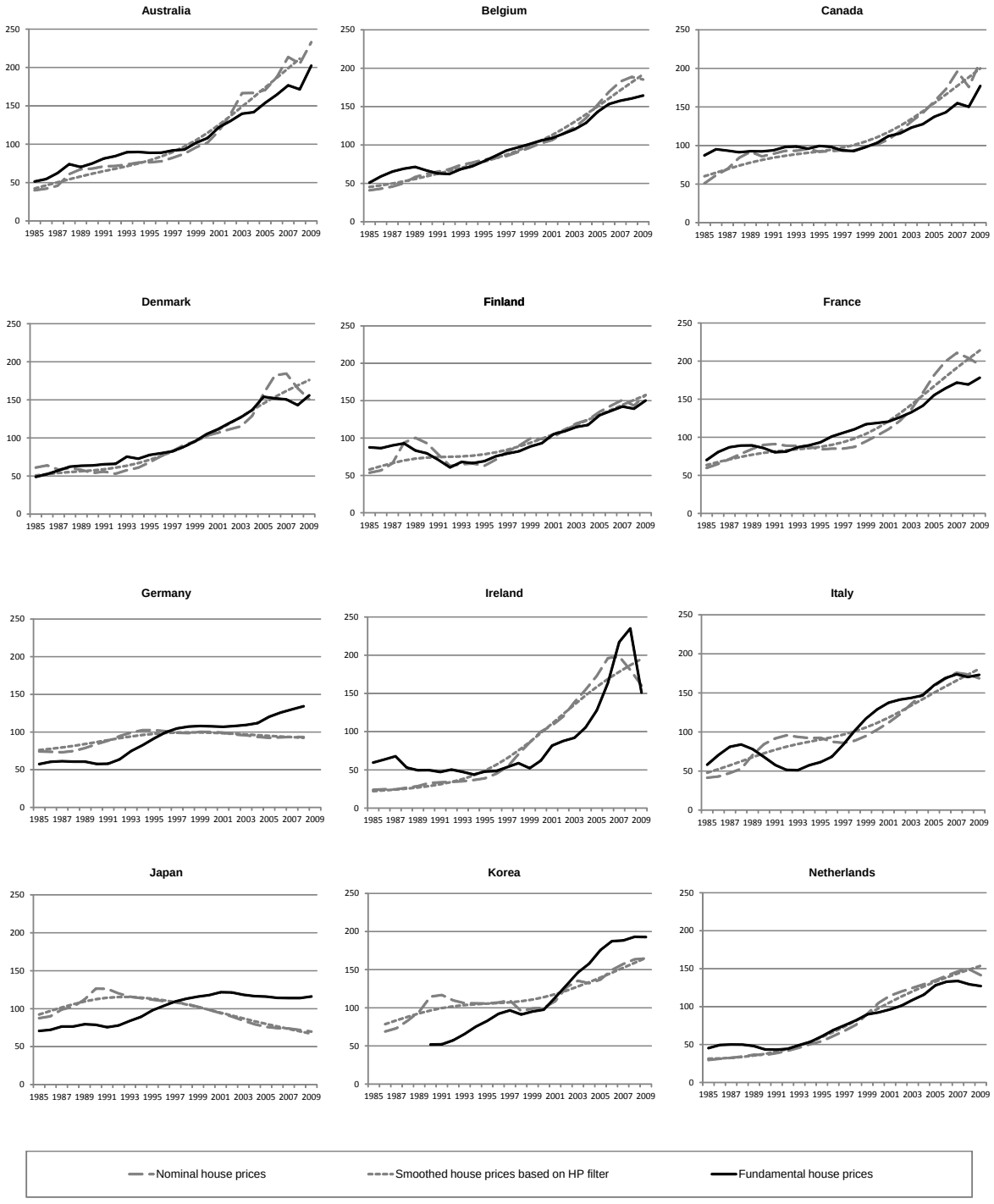
Source: OECD calculations.

Figure 2. **Equity price cycles based on fundamental and smoothed prices** (continued)
Indexes, nominal equity price = 100 in 2005



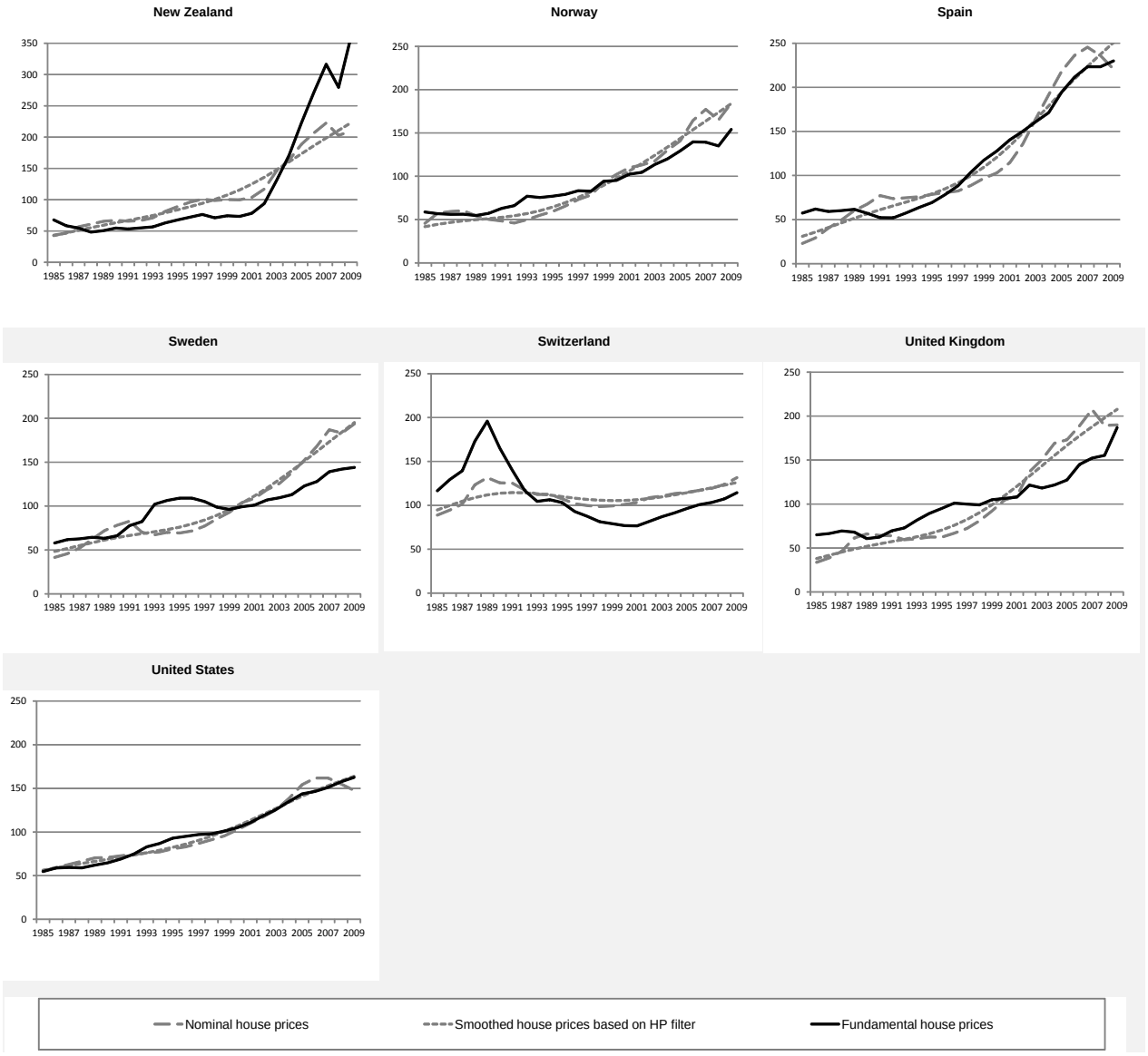
Source: OECD calculations.

Figure 3. **House price cycles based on fundamental and smoothed prices**
Indexes, nominal price index = 100 in 2000



Source: OECD calculations.

Figure 3. **House price cycles based on fundamental and smoothed prices** (continued)
Indexes, nominal price index = 100 in 2000



Source: OECD calculations.

Comparing Figures 2 and 3, the most striking element is the lack of correlation between fundamental equity and house prices. Indeed, based on fundamental prices, significant negative correlations can be observed between house price gaps and equity price gaps in the overwhelming majority of cases (of varying degrees of significance). This means that the aggregate asset price based cyclical adjustment process is frequently one made up of divergent movements between the two asset classes. This will be seen below to be a particular feature of the more recent period. The main driver of fundamental stock prices over the period under review, as noted, has been the decline in the discount rate (together with the risk premium up to the financial crisis). Such a model tends to show that stock markets were overvalued during the dot-com bubble and undervalued in the run-up to the recent recession, in contrast to house prices.

Correlations between asset price and output gaps are given in Table 11. House price gaps are significantly but partially correlated with output gaps in the majority of cases and there is a fair amount of consistency between both measures of the house-price gap. Equity-price gaps are less correlated with output gaps and the two measures tell somewhat different stories. This serves to underline the fact that asset price effects on revenues could not be simply subsumed under the rubric of "built-in stabilisers", since they sometimes operate in directions complementary or contrary to orthodox stabilisers. Furthermore, the complex relations between cycles means that the possibility that there could be a degree of 'double counting' between the existing cyclical adjustment model and the one specified here (a possibility already rendered moot by the way the elasticities are specified, as noted in Box 1) is quite remote.

Table 11. **Correlations between output and asset price gaps**

Correlation between output gap and:	Fundamental asset price gap in:	
	House prices	Equity prices
Australia	*0.19*	*-0.12*
Belgium	*0.24*	*-0.27*
Canada	*-0.10*	**-0.35**
Denmark	**0.70**	**-0.45**
Finland	**0.55**	*0.17*
France	*0.32*	*-0.21*
Germany	*-0.44*	*-0.12*
Ireland	**0.49**	*-0.20*
Italy	-0.21	**0.69**
Japan	*0.29*	*-0.10*
Korea	*0.15*	*-0.20*
Netherlands	*0.25*	*0.02*
New Zealand	*0.11*	*-0.05*
Norway	**0.49**	**-0.57**
Spain	*-0.10*	*0.07*
Sweden	**0.35**	*0.12*
Switzerland	**-0.56**	**-0.52**
United Kingdom	*0.20*	*0.19*
United States	**0.48**	*0.05*
Average	**0.17**	**-0.11**

Note: Figures in bold are significant at the 10% confidence level, figures in italics are not significant.
Source: OECD estimates.

VI. Estimates of asset price adjusted structural balances

Structural budget estimates

Asset price adjusted structural balances are presented in Figure 4, based on the elasticities in section IV and the asset price gaps estimated in section V.[15] Estimates have been generated on the basis of asset price gaps measured according to both fundamental and HP filter methods. However, the preferred yardstick is the "fundamental" gap measure, which is more easily interpretable in terms of its drivers than the HP filter measure, which simply smoothes asset prices in a rather arbitrary way. As noted earlier, the estimates add the asset price cycle adjustment to the existing structural balances, the output gap elasticities embedded in the original cyclical adjustment model being left unchanged. Hence, the differences between old and new estimates are purely attributable to the asset price adjustment.

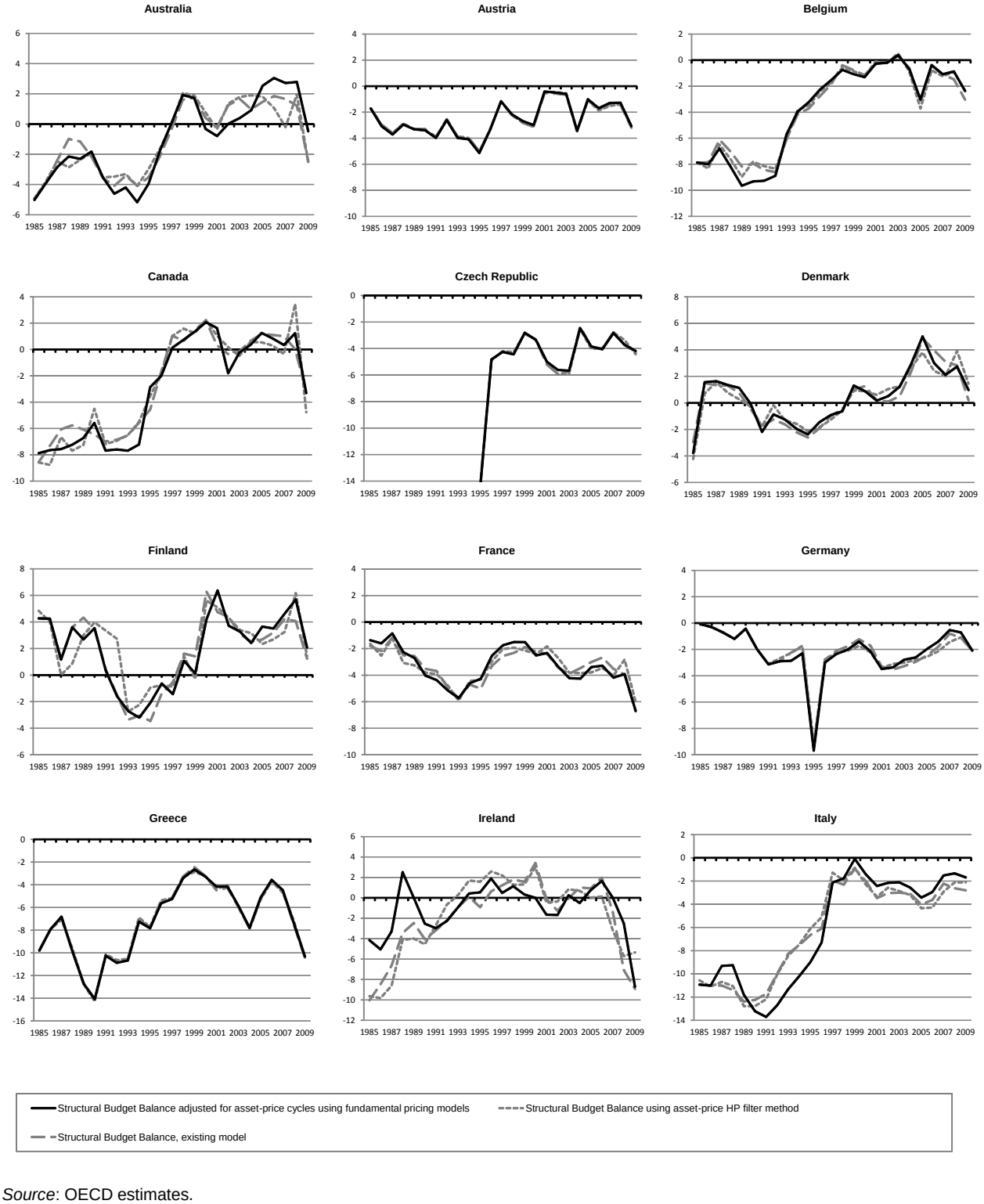
The extent of the asset-cycle adjustment – and hence the difference between the new and existing indicator – varies substantially among OECD countries, as a result of differences in asset price cycles and tax sensitivities (Table 12). A consistent picture emerges in the run-up to the bursting of the dot-com bubble (1998–2000), insofar as adjusted structural budget balances are virtually all significantly more negative than the unadjusted structural balance, by an average of almost ½ percentage point of potential GDP a year for the aggregate of OECD economies in the case of the "fundamental price" simulations. In the subsequent slower-growth period, asset-adjusted structural balances also deteriorated relative to the CAB because of the revenue effects of a widening house-price gap, notably in the case of the United States, the United Kingdom, France, Canada, Sweden, Australia and (most markedly) Ireland.[16]

15. The basic data behind the graphs are given in Annex C.

16. For a discussion of the impact of asset-related taxes on the Irish structural budget prior to and following the financial crisis see OECD (2009) and Kanda (2010).

Figure 4. **Asset-cycle adjusted structural budget balances**

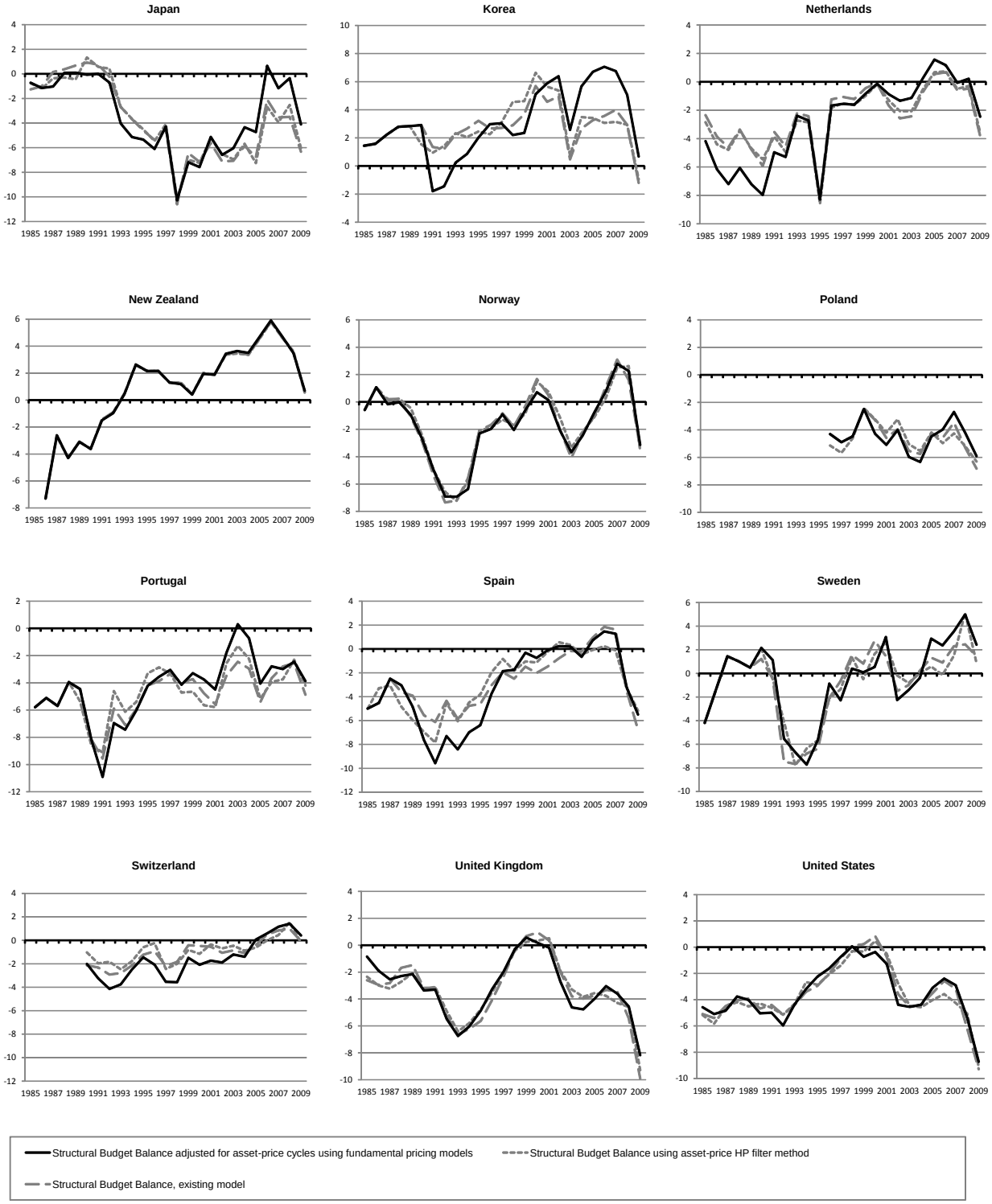
As percentage of potential GDP



Source: OECD estimates.

Figure 4. **Asset-cycle adjusted structural budget balances (continued)**

As percentage of potential GDP



Source: OECD estimates.

Table 12. **Aggregate asset-cycle adjustment to the standard CAB model**

As percentage of potential GDP, levels

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	0.3	0.0	-0.7	-0.6	-1.2	-1.3	-0.1	1.1	1.2	1.1	1.6	2.0
Austria	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.2	0.1
Belgium	-0.4	-0.3	-0.2	0.0	-0.1	0.1	-0.1	0.1	0.0	0.0	0.6	0.7
Canada	0.1	-0.1	-0.1	1.3	-1.4	-0.1	-0.3	0.1	-0.3	-0.7	1.2	-0.1
Czech Republic	0.0	0.0	0.0	0.2	0.3	0.1	-0.1	0.0	0.0	-0.1	0.0	0.1
Denmark	-0.2	0.3	-0.4	0.0	0.4	0.7	0.6	0.1	-1.0	-1.0	-0.1	0.8
Finland	-0.5	-1.3	-2.1	1.6	-0.7	0.2	-0.1	1.0	0.3	0.4	1.6	0.8
France	0.8	0.4	-0.3	0.1	0.1	-0.3	-0.8	-0.4	-0.6	-0.7	0.0	0.0
Germany	-0.2	-0.2	-0.4	-0.2	0.2	0.5	0.3	0.5	0.4	0.3	0.4	0.0
Greece	-0.1	-0.2	-0.1	0.3	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.1
Hungary	0.0	0.0	-0.2	-0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0
Ireland	-0.7	-1.2	-3.4	-1.6	-0.4	0.3	-1.5	-0.2	-0.3	1.4	4.6	0.2
Italy	0.5	0.9	0.6	1.0	0.9	0.9	0.5	0.6	0.7	0.7	1.3	1.1
Japan	0.3	-0.8	-0.4	0.5	0.5	1.0	1.5	2.0	2.7	2.4	3.1	2.2
Korea	-0.7	-1.3	-0.6	1.3	1.4	2.1	3.0	3.4	3.5	2.7	2.1	1.9
Netherlands	-0.4	-0.4	0.0	0.8	1.2	1.3	1.0	1.0	0.5	0.5	0.7	1.4
New Zealand	-0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1
Norway	-0.3	-0.3	-1.0	-0.4	-0.1	0.4	-0.1	0.3	-0.3	-0.3	0.7	0.2
Poland	0.0	0.0	-1.0	-0.5	-0.1	-0.4	-0.6	-0.2	0.6	0.8	1.1	0.9
Portugal	-0.2	0.4	1.0	1.1	1.7	2.8	2.2	1.4	0.9	-0.2	0.1	1.0
Spain	0.7	1.2	1.3	1.4	1.0	0.4	-0.5	-0.2	-0.4	-0.3	0.3	1.3
Sweden	-1.2	-0.7	-2.2	1.6	-0.8	-0.4	-0.6	1.6	1.4	1.3	2.5	1.0
Switzerland	-1.7	-1.1	-1.6	-1.2	-0.8	-0.3	-0.3	0.5	0.1	0.3	0.4	0.5
United Kingdom	0.0	-0.1	-0.8	-0.5	-0.7	-0.8	-0.8	-0.2	0.3	-0.1	0.9	1.7
United States	-0.1	-1.0	-1.2	-0.5	-0.8	0.0	0.0	0.4	0.2	0.3	0.8	0.6

Source: OECD estimates.

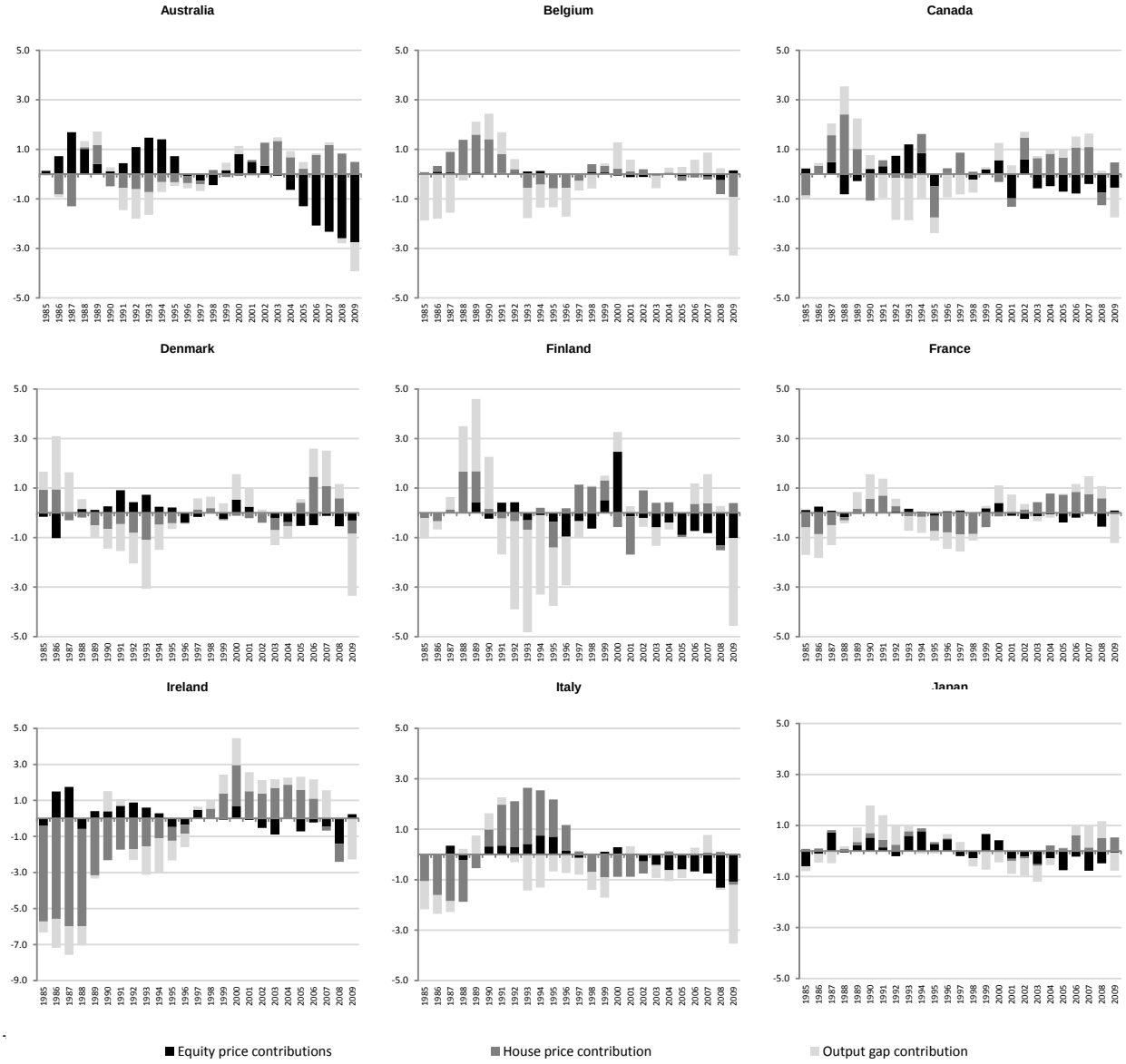
Respective contributions of asset price cycles

The effects of house- and equity-price cycles can be complementary or offsetting, consistent with the lack of systematic mutual correlation noted above. Figure 5 describes the relative contributions of the two asset price cycles and the output cycle to the budget balance (see also Annex Table C6).

Some countries are found to be very sensitive to house price cycles, which can account up to 3% of GDP in either direction, notably Ireland, the Netherlands, Spain, Italy and to a lesser extent the United Kingdom and Switzerland. Equity price cycles tend to have a smaller impact in almost all countries (apart from Korea and Australia). Overall, asset price gaps are found to have larger effects on budgetary cycles than output gaps and, with a few exceptions, such as Korea, Germany and Switzerland, house and equity prices are found to have a counter-cyclical impact. However, in certain countries (Sweden and Finland), the model indicates a degree of volatility emanating from equity price movements, which can be explained by the fact that tax sensitivity to equity prices are more short-term than long-term driven.

Figure 5. **Cyclical component broken down by house and stock price cycles**

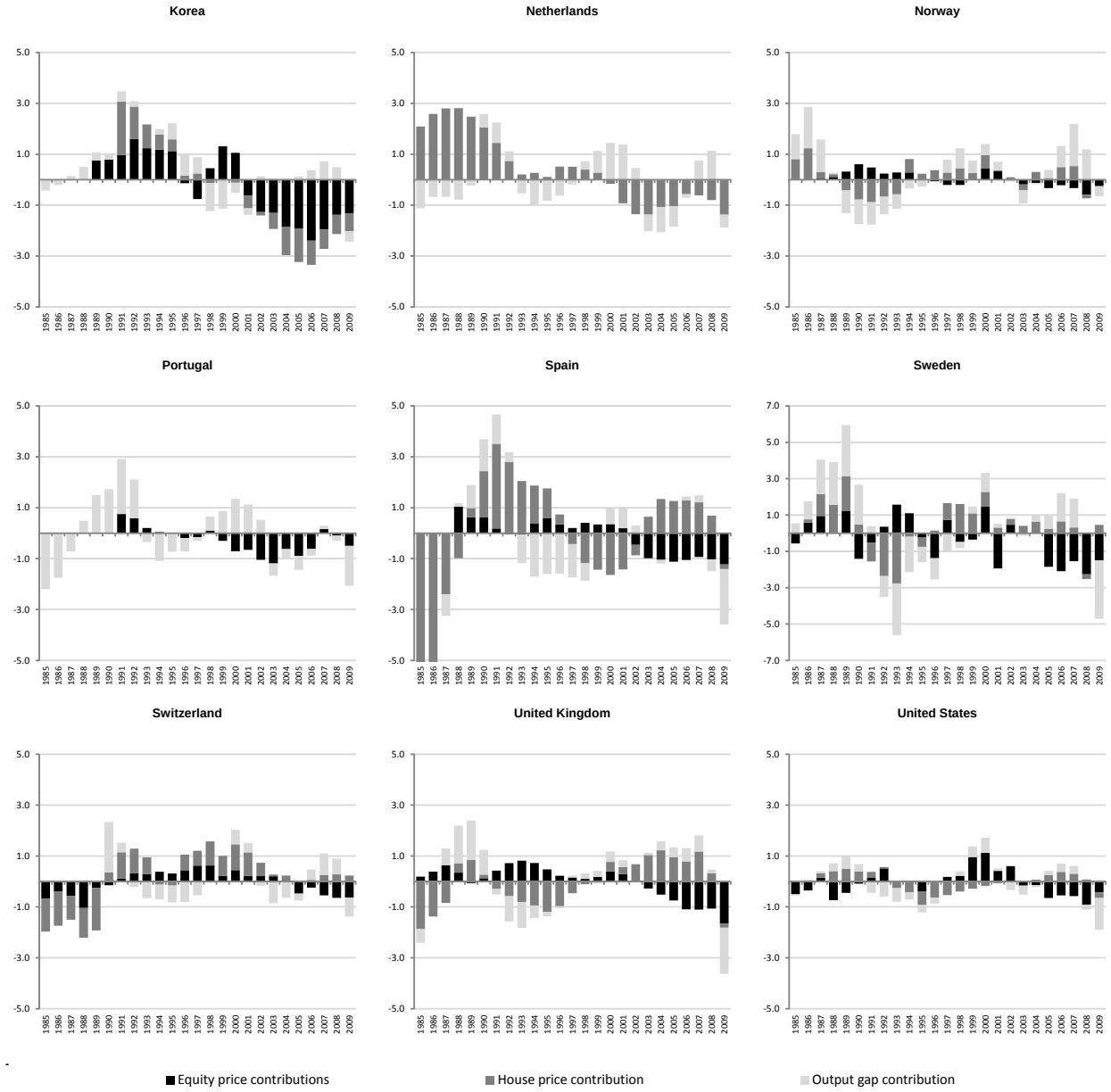
Per cent of potential GDP



Source: OECD calculations.

Figure 5. **Cyclical component broken down by house and stock price cycles** (continued)

Per cent of potential GDP



Source: OECD calculations.

Viewing the respective asset price effects in the context of the business cycle, the dominance of equity price effects is evident in the run up to the dot-com collapse, while in the pre-financial crisis period (2005-07), the situation is characterised by offsetting negative house-price effects and positive equity price effects, as positive house price gaps and negative equity price gaps opened further. The implication is that equity markets were not overvalued relative to their long-term trend prior to the financial crisis. During and subsequent to the crisis, in 2008-09, the model identifies a strong negative asset cycle effect on actual budget balances, which translates into a positive asset cycle adjustment for the majority of countries, indicating that actual budget balances were more negative, by an average of around 1% of GDP per annum, than they would be if asset prices were at normal levels.

Asset-cycle adjusted indicators of discretionary change

Identifying the effects of asset price cycles on the budget permits a more accurate measurement of discretionary – *i.e.* deliberate – policy changes on the budget. It was noted at the beginning of the paper that *changes* in the standard measures of structural budget balance may have become misleading indicators of the magnitude, and even direction, of policy change, because they incorporate shifts due to asset prices as well as deliberate policy measures. Table 13 presents estimates of discretionary fiscal policy change which are stripped of the effects of asset price cycles on revenues, these being derived from the annual changes in the asset price adjusted CAB calculations described above. Annex C, Tables C4 and C5 apply the asset-cycle adjustment to the OECD's measures of "underlying" budget stance and discretionary change, which eliminate the effects of "one-off" factors as well as the output cycle (Joumard *et. al*. 2008).

On an individual country basis the profile of change can sometimes be altered quite significantly, particularly in showing less fiscal restraint or more relaxation in the run up to the recession of the early 2000s and subsequently in showing less deliberate loosening when the recession hit. In the case of the more recent upturn and recession, this pattern is not so apparent in the upturn but quite marked in 2008, when the degree of deliberate fiscal loosening is significantly smaller, on average, than shown by the standard indicator. Again, there are significant differences across countries and in some cases the sign of the discretionary change can change.

Table 13. **Discretionary budget changes based on standard CAB and asset-cycle adjusted indicators**

As percentage of total GDP, year on year point differences

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	*Asset price adjusted CAB*	-0.19	-2.05	-0.47	0.81	0.38	0.52	1.62	0.51	-0.33	0.07	-3.26
	Standard CAB	0.13	-1.33	-0.60	1.44	0.40	-0.69	0.50	0.38	-0.18	-0.45	-3.72
Austria	*Asset price adjusted CAB*	-0.51	-0.31	2.58	-0.08	-0.11	-2.82	2.42	-0.69	0.40	0.02	-1.80
	Standard CAB	-0.59	-0.31	2.60	-0.04	-0.09	-2.81	2.42	-0.72	0.37	-0.02	-1.76
Belgium	*Asset price adjusted CAB*	-0.32	-0.23	1.04	0.06	0.59	-1.07	-2.34	2.64	-0.70	0.22	-1.51
	Standard CAB	-0.37	-0.39	0.86	0.15	0.46	-0.94	-2.55	2.77	-0.72	-0.35	-1.57
Canada	*Asset price adjusted CAB*	0.62	0.72	-0.44	-3.43	1.56	0.58	0.91	-0.43	-0.49	0.89	-4.54
	Standard CAB	0.83	0.72	-1.89	-0.66	0.19	0.82	0.53	-0.08	-0.10	-0.99	-3.21
Czech Republi	*Asset price adjusted CAB*	1.63	-0.54	-1.64	-0.62	-0.05	3.21	-1.39	-0.21	1.22	-0.88	-0.47
	Standard CAB	1.63	-0.54	-1.86	-0.72	0.18	3.39	-1.53	-0.12	1.24	-0.97	-0.59
Denmark	*Asset price adjusted CAB*	1.95	-0.44	-0.70	0.34	0.71	1.72	2.07	-2.01	-0.89	0.62	-1.76
	Standard CAB	1.50	0.25	-1.09	-0.08	0.42	1.85	2.51	-0.91	-0.87	-0.26	-2.62
Finland	*Asset price adjusted CAB*	-0.95	4.06	2.19	-2.66	-0.43	-0.87	1.23	-0.14	1.10	1.08	-3.61
	Standard CAB	-0.20	4.87	-1.55	-0.36	-1.27	-0.60	0.18	0.52	1.02	-0.15	-2.83
France	*Asset price adjusted CAB*	0.00	-1.01	0.19	-1.03	-0.86	-0.04	0.87	0.10	-0.90	0.27	-2.77
	Standard CAB	0.43	-0.34	-0.17	-1.05	-0.45	0.41	0.47	0.34	-0.85	-0.43	-2.77
Germany	*Asset price adjusted CAB*	0.60	-0.73	-1.36	0.12	0.59	0.17	0.64	0.56	0.88	-0.18	-1.38
	Standard CAB	0.54	-0.47	-1.61	-0.22	0.27	0.32	0.48	0.67	0.99	-0.31	-0.98
Greece	*Asset price adjusted CAB*	0.76	-0.64	-0.87	-0.01	-1.71	-1.92	2.67	1.54	-0.89	-2.90	-2.95
	Standard CAB	0.83	-0.78	-1.25	0.21	-1.72	-1.88	2.64	1.66	-0.96	-3.00	-2.91
Hungary	*Asset price adjusted CAB*	2.21	1.83	-1.11	-4.80	1.45	0.30	-1.90	-2.14	4.79	1.76	2.73
	Standard CAB	2.21	1.99	-1.17	-4.98	1.42	0.23	-1.80	-2.07	4.78	1.76	2.73
Iceland	*Asset price adjusted CAB*	1.52	0.84	-2.39	-1.15	0.12	1.86	3.83	1.80	-0.76	-18.54	0.94
	Standard CAB	1.52	0.84	-2.39	-1.15	0.12	1.86	3.83	1.80	-0.76	-18.54	0.94
Ireland	*Asset price adjusted CAB*	-0.81	-0.33	-1.66	-0.03	1.95	-0.76	1.26	0.90	-1.65	-2.51	-6.20
	Standard CAB	-0.23	1.86	-3.52	-1.16	1.20	1.08	-0.10	1.05	-3.35	-5.70	-1.84
Italy	*Asset price adjusted CAB*	1.68	-1.35	-0.99	0.27	0.05	-0.45	-0.87	0.48	1.42	0.18	-0.34
	Standard CAB	1.37	-1.08	-1.45	0.44	0.02	-0.08	-0.92	0.38	1.41	-0.40	-0.19
Japan	*Asset price adjusted CAB*	3.09	-0.39	2.44	-1.45	0.54	1.70	-0.39	5.38	-1.82	0.82	-3.76
	Standard CAB	4.17	-0.72	1.53	-1.49	0.05	1.21	-0.92	4.69	-1.46	0.05	-2.84
Korea	*Asset price adjusted CAB*	0.14	2.76	0.77	0.50	-3.82	3.10	1.04	0.35	-0.31	-1.68	-4.39
	Standard CAB	0.79	2.01	-1.12	0.39	-4.49	2.19	0.60	0.30	0.44	-1.07	-4.13
Luxembourg	*Asset price adjusted CAB*	-1.16	1.22	0.33	-3.74	-0.76	-1.35	0.64	0.74	1.44	-0.48	-2.19
	Standard CAB	-1.16	1.22	0.33	-3.74	-0.76	-1.35	0.64	0.74	1.44	-0.48	-2.19
Netherlands	*Asset price adjusted CAB*	0.79	0.68	-0.73	-0.47	0.20	1.39	1.31	-0.40	-1.24	0.28	-2.67
	Standard CAB	0.78	0.33	-1.56	-0.91	0.15	1.70	1.28	0.13	-1.26	0.11	-3.34
New Zealand	*Asset price adjusted CAB*	-0.77	1.53	-0.06	1.55	0.21	-0.14	1.20	1.21	-1.18	-1.24	-2.79
	Standard CAB	-0.85	1.55	-0.09	1.50	0.16	-0.17	1.22	1.23	-1.17	-1.12	-2.93
Norway	*Asset price adjusted CAB*	1.46	1.30	-0.57	-2.20	-1.61	1.22	1.67	1.54	2.02	-0.53	-5.39
	Standard CAB	1.50	1.97	-1.17	-2.48	-2.11	1.80	1.26	2.14	2.00	-1.49	-4.99
Poland	*Asset price adjusted CAB*	1.99	-1.80	-0.81	1.07	-1.95	-0.37	1.86	0.50	1.28	-1.52	-1.70
	Standard CAB	1.99	-0.80	-1.30	0.62	-1.57	-0.22	1.49	-0.32	1.10	-1.82	-1.51
Portugal	*Asset price adjusted CAB*	0.84	-0.46	-0.74	2.71	2.08	-1.02	-3.33	1.27	-0.20	0.54	-1.42
	Standard CAB	0.26	-1.04	-0.80	2.10	1.02	-0.51	-2.46	1.76	0.86	0.24	-2.31
Spain	*Asset price adjusted CAB*	1.44	-0.43	0.65	0.34	-0.04	-0.87	1.41	0.73	-0.19	-4.52	-2.25
	Standard CAB	1.01	-0.53	0.55	0.69	0.60	-0.03	1.16	0.90	-0.23	-5.16	-3.24
Slovak Republ	*Asset price adjusted CAB*	-0.76	-3.82	5.77	-1.88	5.33	0.44	-0.76	-1.46	0.31	-0.98	-0.58
	Standard CAB	-0.76	-3.82	5.77	-1.88	5.33	0.44	-0.76	-1.46	0.31	-0.98	-0.58
Sweden	*Asset price adjusted CAB*	-0.31	0.45	2.54	-5.34	0.84	1.02	3.33	-0.58	1.18	1.44	-2.55
	Standard CAB	-0.73	1.93	-1.29	-2.95	0.49	1.23	1.10	-0.41	1.37	0.17	-1.01
Switzerland	*Asset price adjusted CAB*	2.08	-0.59	0.35	-0.16	0.69	-0.20	1.47	0.53	0.56	0.27	-1.00
	Standard CAB	1.42	-0.06	-0.06	-0.52	0.20	-0.24	0.69	0.90	0.35	0.14	-1.06
United Kingdo	*Asset price adjusted CAB*	0.85	-0.38	-0.36	-2.53	-1.91	-0.15	0.79	0.94	-0.57	-0.94	-3.62
	Standard CAB	1.00	0.27	-0.59	-2.35	-1.81	-0.17	0.24	0.43	-0.16	-1.97	-4.46
United States	*Asset price adjusted CAB*	-0.79	0.37	-0.91	-3.12	-0.16	0.17	1.30	0.69	-0.51	-2.47	-3.36
	Standard CAB	0.12	0.61	-1.56	-2.86	-0.96	0.16	0.90	0.92	-0.61	-3.02	-3.10

Source: OECD estimates.

VII. Asset cycles and forward-looking adjustment

Using the model in real time

The asset-cycle adjustment process developed above has been fundamentally retrospective. However, it is also designed for use in identifying the effects of asset price movements on government revenues in real time, in order to prevent some of the mistakes in interpreting the fiscal stance that have occurred over previous cycles. An important consideration here has been to create an adjustment process which can be used in a short-term forecasting context, allowing for the fact that actual share and house prices cannot be forecast accurately but fundamental prices may be more reliably extrapolated. This provides a framework for assessing revenue "surprises". In this context, a "reduced-form" tax modelling approach is an advantage (compared with a more institutionally elaborate model), with respect to quantifying the linkages between aggregate asset price indicators (which are available contemporaneously as far as equity indexes are concerned and with a somewhat greater delay for house prices) and tax yields, given the lags involved.

Even so, an important consideration to emerge is that institutional differences mean that the asset-cycle adjustment process has very different implications from one OECD economy to another. Emphasis has been placed on creating a set of asset-cycle related elasticities which reflect the institutional characteristics of national tax systems, which differ much more in relation to asset price movements than to traditional tax bases. To the extent that institutional harmonisation is absent, it has not been possible to apply a more standardised set of elasticities based on pooled regressions. Moreover, it implies that the elasticities are liable to change, going forward, as statutory tax provisions change. This means that provision has to be made for altering the elasticities when tax legislation changes.

Strategic value of the asset price adjustment model

The asset price adjustment models developed here have a potential strategic value insofar as a better understanding of the links between asset prices and revenues can guard against revenue "surprises" and their adverse consequences for budget planning. While the analysis has shown an important sensitivity to the precise definition of asset price cycles, which has been an important inhibiting factor against the official use of asset price adjusted fiscal indicators, the problems do not seem of a different order of magnitude, or significance, from those applying to the CAB – where revisions to potential GDP estimates can be the source of substantial *ex post* revisions to structural budget balances.

Moreover, while the preferred structural benchmark in the above analysis has been that based on "fundamental" prices (compared to an HP, or otherwise smoothed benchmark), the tax models which have been derived could potentially be used relative to any *normative* benchmark, depending on whether budget strategy errs on the side of caution in predicting structural balances or is willing to allow unexpected revenue buoyancy to upset budget planning.

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Annex A

Regression results

This Annex presents the regression results, including control variables, behind the tax elasticities in Tables 7-10.

Table A.1. **Personal income tax elasticities (RS1100)**

			Asset-price variables				Control variables					
			House price		Share price		Gross income		Pers. income tax rate		*Dummies*	*Sample*
	R^2 Adjusted	Error correction term	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity		
Australia	**0.80**	-0.31 **	-0.88 **	0.42 **	-0.13	0.16 *	2.36 **	1.99 **	0.17	0.05	*89, 00*	*[83-05]*
Austria	**0.81**	-0.48 **	-0.16	-0.10	0.11	0.01	0.94 *	-0.23	-0.33	0.23 *	*94,05*	*[85-08]*
Belgium[3]	**0.87**	-0.91 **	-0.50 **	0.26			1.83 **	1.72 **	-0.47 **	-0.23	*92*	*[90-06]*
Canada	**0.86**	-0.76 **	0.16 *	0.36 **	0.26 **	0.09 *	0.33	1.30 **	1.64 **	0.58 **	*87*	*[85-08]*
Czech Republic[3]	**0.84**	-0.99 **	--	--			0.85 **	1.00	-0.21	0.06		*[93-08]*
Denmark	**0.71**	-0.86 **	-0.09	-0.20	0.07 *	0.06 *	0.90 **	0.82	-0.14 **	-0.32 **	*88,98*	*[85-08]*
Finland	**0.67**	-1.02 **	0.03	0.25 **	0.08 *	0.08 **	0.73 **	0.82	0.04	-0.04	*92*	*[87-08]*
France	**0.87**	-0.25 **	-0.69	0.37 *	0.26	0.14 **	1.68 *	-0.60	-0.72	-0.03	*91,98*	*[85-08]*
Germany	**0.87**	-0.49 **	-0.86	0.09	0.21 **	0.08 *	0.80 *	2.49 **	0.00	0.14 **	*90,95*	*[85-07]*
Greece[1]	**0.40**	-0.43	--	--	0.30	0.07	1.49	1.49	0.67	0.26		*[90-08]*
Hungary[1]	**0.64**	0.79	--	--	-0.16	0.05	1.78	0.13	2.81 *	-1.13		*[91-08]*
Iceland[1]	**0.00**	-0.56	--	--	0.31	0.04	1.27	1.02	2.77	0.89		*[00-08]*
Ireland[2]	**0.72**	-1.57 **	-0.10	-0.63 **	0.19 **	0.36 **	0.96 **	0.41	0.14	-0.38	*88,07*	*[85-07]*
Italy	**0.85**	-0.93 **	0.16 **	-0.07	0.03	0.03	0.93 **	-0.05	-0.25	-0.46 **	*94,99*	*[85-08]*
Japan[4]	**0.67**	-0.90 **	0.04	0.58	0.21 *	0.03	0.67 *	3.00 **	0.00	0.00	*93,98*	*[85-08]*
Korea[4]	**0.92**	-0.94 **	-0.01	-0.24	0.10 *	0.07	1.17 **	1.48 **	0.00	0.00	*90,97*	*[00-08]*
Luxembourg[1]	**0.64**	-1.13	--	--	-0.16	0.05	1.78	0.13	2.81 *	-1.13		*[99-08]*
Mexico	**0.89**	0.13 **	--	--	0.41	0.12	0.80 **	1.52 **	0.20	0.13	*95,98*	*[91-08]*
Netherlands	**0.71**	-0.80 **	-1.24 **	-0.17	-0.09	-0.28	1.86 *	2.28 **	-1.26 **	-0.43		*[82-04]*
New Zealand[3]	**0.58**	0.44 *					0.95 *	0.19	1.24 **	0.44	*95,98*	*[91-08]*
Norway	**0.83**	-0.42 **	0.02	0.46 **	0.16 *	0.02	0.59 *	0.57 **	0.09	0.01		*[85-08]*
Poland	**0.99**	-0.78 **	--	--	0.69 **	0.25 **	0.44 **	0.86 *	5.46 **	-0.93 **	*03*	*[96-07]*
Portugal[2]	**0.83**	-1.28 **	--	--	0.08 **	0.02	0.92 **	1.80 **	0.10	0.05		*[92-08]*
Slovak Republic[1]	**0.40**	5.52	--	--	-1.09	4.05	0.86	18.42	-3.56	5.52		*[94-08]*
Spain	**0.85**	-1.09 **	0.69 **	0.60 **	0.10 **	0.04	0.41 **	-0.13	0.65 **	0.40 **		*[86-08]*
Sweden	**0.85**	-0.87 **	0.07	0.49 **	0.08	0.13 **	0.57 **	0.27	-0.08	-0.16 **	*87,99*	*[85-08]*
Switzerland[2]	**0.77**	-1.40 **	0.11	1.09 **	0.02	0.15 *	0.65 **	0.76	-0.60	0.36	*05*	*[86-07]*
Turkey[4]	**0.87**	-0.56 **	--	--	0.41 **	0.22 **	0.61 *	1.08 **	0.00	0.00	*95,98*	*[00-08]*
United Kingdom	**0.78**	-0.81 **	0.24 **	-0.01	0.25 **	0.06	0.70 **	1.11 **	0.32 **	0.04	*86,87*	*[85-08]*
United States	**0.90**	-0.79 **	0.47 *	-0.20	0.50 **	0.31 **	-0.20	1.25 **	0.43 **	0.05	*89,90,00*	*[85-08]*

Key : * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.
1. Unreliable estimates due to too few observations.
2. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).
3. Gains on share disposals exempted, or in the case of New Zealand no tax on capital gains.
4. No change in tax rate over the period.
Source : OECD estimates.

Table A.2. **Property tax elasticities (RS4100)**

			House price				Dummies	Sample
	R^2 Adjusted	Error correction term	Long run elasticity		Short run elasticity			
Australia	**0.71**	-0.39 **	0.87 **		0.29 **			*[85-08]*
Austria	**0.84**	-0.03	0.35		-0.04			*[86-08]*
Belgium[2]								*[85-08]*
Canada	**0.73**	-0.17 **	0.91 **		0.12 **		*92,98*	*[85-08]*
Czech Republic[1]	**-**		--		--			--
Denmark	**0.81**	-0.21 **	0.97 **		0.03		*87,93*	*[85-08]*
Finland	**0.75**	-0.43 **	1.00 **		-0.02			*[95-08]*
France	**0.70**	-0.27 **	0.57 **		0.14			*[92-08]*
Germany	**0.56**	-0.08 **	2.99 **		0.34 **			*[85-08]*
Greece[1]	**-**		--		--			--
Hungary[1]	**-**		--		--			--
Iceland[1]	**-**		--		--			--
Ireland	**0.77**	-0.18 **	0.85 **		-0.01		*86,87*	*[85-08]*
Italy	**0.29**	0.03	0.47		-0.83			*[90-08]*
Japan	**0.67**	-0.16 **	0.78 **		-0.26			*[85-08]*
Korea	**0.67**	-0.19 **	3.94 **		0.57 **		*06*	*[85-08]*
Luxembourg[1]	**-**		--		--			--
Mexico[1]	**-**		--		--			--
Netherlands	**0.75**	-0.42 **	0.69 **		0.10		*06*	*[85-08]*
New Zealand	**0.55**	-0.18 **	0.66 **		0.49 **			*[75-08]*
Norway	**0.64**	-0.24 **	0.92 **		-0.32		*02, 06*	*[85-08]*
Poland[1]	**-**		--		--			--
Portugal[1]	**-**		--		--			--
Slovak Republic[1]	**-**	-	--		--			--
Spain	**0.69**	-0.19 **	0.55 **		0.26 *			*[92-08]*
Sweden	**0.70**	-0.36 **	0.68 *		-0.29		*91,96*	*[85-08]*
Switzerland	**0.23**	-0.60 **	1.27 **		0.21			*[98-08]*
Turkey[1]	**-**		--		--			--
United Kingdom	**0.96**	-0.52 **	0.62 **		0.17			*[85-08]*
United States	**0.69**	-0.11 **	1.05 **		0.20 *		*90*	*[85-08]*

Key : * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.
1. Unreliable estimates due to too few observations or no results due to missing observation.
2. No residential tax on households.
Source : OECD estimates.

Table A.3. **Wealth tax elasticities (RS4200)**

			House price		Share price		*Dummies*	*Sample*
	R^2 Adjusted	**Error correction term**	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity		
Australia[1]								
Austria	**0.51**	-0.20 **	--	--	0.50 **	0.02	*86.88*	*[75-93]*
Belgium	**0.97**	-0.94 **	1.77 **	2.00	0.07	0.17		*[97-07]*
Canada[1]								
Czech Republic[1]								
Denmark[2]	**0.71**	-0.52 **	6.49 **	3.29 **				*[84-94]*
Finland	**0.67**	-0.68 **	0.07	-0.75	0.82 **	0.78 **		*[86-05]*
France	**0.94**	-0.66 **	0.69 **	0.19	0.61 **	0.35 **		*[94-08]*
Germany	**0.78**	-0.25 **	0.00	0.00	1.35 **	0.27 **	*90*	*[85-96]*
Greece[1]								
Hungary[1]								
Iceland[3]								*[93-08]*
Ireland[1]								
Italy[1]								
Japan[1]								
Korea[1]								
Luxembourg	**0.97**	-0.29 **	--	--	0.62 **	0.35 **		*[99-08]*
Mexico[1]								
Netherlands[2]	**0.42**	-0.41 **	0.30	1.13 **			*91,93*	*[82-00]*
New Zealand[1]								*[85-08]*
Norway	**0.68**	-0.45 **	0.37 **	-0.04	0.35 **	0.10 *	*98*	*[85-08]*
Poland[1]								
Portugal[1]								
Slovak Republic[1]								
Spain[4]	**0.96**	-1.14 **	0.43 **	-0.62 **	0.50 **	0.09	*89*	*[85-08]*
Sweden[4]	**0.68**	-1.18 **	-0.53 **	0.30	0.74 **	0.78 **		*[85-06]*
Switzerland	**0.64**	-0.34 **	0.82 **	0.06	0.40 **	0.12 **	*90,91*	*[85-08]*
Turkey[1]								
United Kingdom[1]								
United States[1]								

Key : * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.
1. No wealth tax imposed.
2. No capital transaction taxes on shares.
3. Unreliable estimates due to too few observations or no results due to missing observation.
4. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).

Source : OECD estimates.

Table A.4. **Corporate tax elasticities (RS1200)**

			Asset-price variables				Control variables							
			House price		Share price		Gross profit		Business investment		Corporate tax		*Dummies*	*Sample*
	R^2 Adjusted	Error correction term	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity		
Australia[2]	**0.91**	-1.10 **	0.32 *	0.01	0.33 *	-0.03	1.02 **	0.52			0.51 *	0.81 **		*[86-07]*
Austria	**0.81**	-0.87 **	0.46	1.53 *	-0.09	-0.20	1.71 **	2.57 **			0.56	0.08	*01*	*[85-08]*
Belgium[1]	**0.77**	-0.32 **	0.44	-0.27			1.91	1.23 *	-0.84	-0.46 *	-0.07	0.84 **	*92,98*	*[82-08]*
Canada	**0.78**	-0.53 **	0.66	0.23	-0.18	0.55 *	1.71 **	2.28 **			2.90 *	-0.30	*91,99*	*[85-08]*
Czech Republic[1]	**0.65**	-0.90 *	--	--			3.41 *	2.39 *			2.09	1.58 **	*96,04*	*[94-08]*
Denmark[2]	**0.90**	-1.31 **	0.91 **	1.73 **	-0.16	-0.12	1.26 **	1.87 **			0.67 **	0.59 *	*91,00*	*[85-08]*
Finland	**0.99**	-0.37 **	1.99 *	3.04 **	0.65 **	0.20 **	-2.30	1.42 **			4.09 **	4.92 **	*95,05*	*[90-06]*
France	**0.66**	-0.92 **	-0.06	0.25	0.34 **	0.20 *	1.08 *	1.00			0.66 *	0.58 *	*91,05*	*[85-08]*
Germany[1]	**0.82**	-0.61 **	-0.15	2.32			2.81 **	-0.28	-2.62 *	0.56	0.16	2.54 **	*95*	*[82-07]*
Greece[1]	**0.72**	-0.68 **	--	--			1.77 **	0.92			1.40 **	1.17 **		*[90-08]*
Hungary	**0.85**	-0.74 **	--	--	0.09	-0.03	1.14 **	1.11 **			0.53 **	0.32 **		*[94-08]*
Iceland[3]	**0.68**	-0.61 **	--	--	1.11 **	-0.11	-0.58	-1.91 **			0.00	0.00		*[00-08]*
Ireland[1]	**0.71**	-0.47 **	-0.46	0.29			2.72 **	-0.76			1.50 **	0.72 **	*89,93*	*86-06*
Italy	**0.63**	-0.53 *	0.89 **	0.21	0.67 **	0.31 **	-0.11	1.87 *			0.94 *	0.90 **	*00,05*	*[85-08]*
Japan	**0.76**	-0.47 **	-0.19	0.50	0.47 *	0.39 **	0.51	1.10 **			0.00	0.00		*[85-08]*
Korea	**0.61**	-1.08 **	0.42	1.14 *	0.12	0.22 *	1.19 **	1.74			0.00	0.00	*99*	*[00-08]*
Luxembourg[3]	**0.00**	-1.39	--	--	0.55	0.08	-1.09	-0.94			-3.48	-2.57		*[00-08]*
Mexico[3]														*[91-08]*
Netherlands[1]	**0.54**	-0.71 **	0.00	0.00			0.69 **	0.27			0.34	0.28	*84,96,03*	*[82-07]*
New Zealand[1]	**0.80**	-0.37 *					1.14	2.21 **			1.65 *	1.27 **		*[85-08]*
Norway	**0.98**	-0.78 **	-0.20	0.39	0.07	0.21 *	2.52 **	2.12 **			0.91 **	0.59 **	*89*	*[85-03]*
Poland	**0.91**	-0.99 **	--	--	0.05	-0.38	0.57 **	4.68 **			-0.84 **	0.36	*99*	*[92-08]*
Portugal	**0.96**	-0.57 **	--	--	0.83 **	0.41 **	0.15	1.68 **			-0.18	-0.59 *	*96,97,01*	*[85-08]*
Slovak Republic	**0.99**	-2.11 **	--	--	0.23 **	0.48 **	1.23 **	2.36 **			1.02 **	0.90 **		*[99-08]*
Spain	**0.89**	-0.49 **	1.09 **	0.71 **	0.81 **	0.37 **	-0.76	3.79 **			11.23 **	0.34	*88,97*	*[85-08]*
Sweden[2]	**0.87**	-1.15 **	-0.13	-0.14	0.39 **	0.52 **	1.69 **	1.54 **	-0.12	-0.02	0.91 **	0.56 **	*89,90*	*[83-08]*
Switzerland[2]	**0.84**	-1.04 **	0.40 **	0.04	0.28 **	-0.11	-0.22	0.68 *			-1.72 **	-0.83 **	*01*	*[85-08]*
Turkey	**0.83**	-0.23 *	--	--	-0.42	-0.10	1.53 *	1.11 **			0.00	0.00		*[00-08]*
United Kingdom	**0.76**	-0.53 **	0.24	0.98 **	0.19	0.36	1.93 **	0.12	-1.13 *	0.66 *	2.09 **	0.94	*01*	*[82-07]*
United States	**0.92**	-0.67 **	0.10	0.95 *	0.12	0.44 **	2.07 **	0.22	-1.20 **	1.13 **	-0.12	-0.88 **	*90,04*	*[85-08]*

Key : * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.

1. Gains on share disposals exempted, or in the case of New Zealand no tax on capital gains.
2. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).
3. Unreliable estimates due to too few observations.

Source : OECD estimates.

Table A.5. **Indirect tax elasticities – Value added tax (RS5110)**

			Asset-related variable		Control variables							
			House price		Consumption		VAT		Residential investment		*Dummies*	*Sample*
	R^2 Adjusted	Error correction term	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity		
Australia[4]	**0.99**	-1.00 **	0.26 **	0.41 **	0.90 **	-0.95	0.00	0.00	0.00	0.00		*[00-08]*
Austria[1,4]	**0.72**	-0.97 **			0.97 **	0.13	0.00	0.00			*95*	*[85-08]*
Belgium	**0.53**	-0.66 **	0.32 *	0.51 **	0.50	1.14 **	1.04 *	0.46	0.00	0.00	*88,99*	*[85-08]*
Canada	**0.86**	-0.96 **	-0.03	0.90 *	1.20 **	0.44	-0.03	0.70 **	-0.25	-0.32 *	*06*	*[92-08]*
Czech Republic	**0.63**	-0.32 *	--	--	1.33 **	1.24 **	0.41 **	-0.31	0.00	0.00	*04*	*[94-08]*
Denmark[1]	**0.74**	-0.41 **			1.25 **	0.94 **	-0.24	-0.12			*88*	*[85-08]*
Finland[1,4]	**0.79**	-0.38 **			1.12 **	2.01 **	0.00	0.00				*[94-08]*
France	**0.52**	-0.89 **	0.20 **	0.33 **	0.50 **	0.55	1.42 **	1.13 **	0.00	0.00	*95*	*[85-08]*
Germany[1]	**0.75**	-0.18 *			1.50 *	1.74 **	-0.02	0.70 **			*91*	*[85-08]*
Greece	**0.75**	0.00	--	--		0.86 **		0.99 **	na	na		*[88-08]*
Hungary	**0.68**	-0.61 **	--	--	1.37 **	2.70 **	-0.20 *	-0.09	na	na	*02*	*[88-08]*
Iceland[1]	**0.62**	-0.96 **			1.08 **	1.34 **	0.13	0.23			*89,91,01*	*[89-08]*
Ireland	**0.76**	-0.76 **	0.26 *	0.56 **	0.83 **	0.77 *	-0.14	0.59 **	0.00	0.00	*01*	*[85-08]*
Italy	**0.87**	-0.82 **	-0.03	0.39 **	1.17 **	0.86 *	-0.19	0.64	0.00	0.00	*94,89,00*	*[85-08]*
Japan	**0.94**	-0.79 **			1.66 *	2.04 *	0.95 **	0.88 **				*[91-07]*
Korea[4]	**0.84**	-0.81 **	0.32 *	0.01	1.10 **	1.42 **	0.00	0.00	-0.07	0.13		*[85-08]*
Luxembourg	**0.05**	-0.18	--	--	1.66	0.72 **	-0.39	-0.27	na	na		*[85-08]*
Mexico[1]	**0.93**	-0.51 **			1.09 **	1.13 **	0.60 *	0.38 **				*[85-08]*
Netherlands[1]	**0.35**	-0.42 *			1.11 *	0.98 **	1.07 *	0.40 *				*[85-08]*
New Zealand[1]	**0.92**	-0.60 **			1.03 **	0.72 *	0.01	-0.18			*88*	*[85-08]*
Norway[1]	**0.72**	-0.39 **			0.69 *	1.09 **	2.78 **	0.62 *			*87,03*	*[85-07]*
Poland[3]	**0.59**	0.00	--	--		0.18		0.00	0.00	0.70 **		*[97-08]*
Portugal[1]	**0.88**	-0.67 **			1.26 **	0.57	-0.09	-0.01			*91,93*	*[88-08]*
Slovak Republic[2]	**0.42**	-1.08 *	--	--	0.78 **	0.77	-0.87	-0.88 **	na	na		*[88-08]*
Spain	**0.87**	-1.00 **	-0.08	0.20 *	1.35 **	3.19 **	-0.01	-0.17	0.00	0.00	*92*	*[88-06]*
Sweden[1]	**0.84**	-0.33 **			1.72 **	2.08 **	-2.64	-0.92			*95*	*[85-08]*
Switzerland[1]	**0.75**	-1.04 **			1.39 **	1.09	0.59	0.99 **				*[94-08]*
Turkey[4]	**0.82**	-0.54 **	--	--	1.08 **	1.50 **	0.00	0.00	na	na		*[85-08]*
United Kingdom[1,2]	**0.72**	-1.09 **			1.00 **	0.92 *	0.31 **	0.19				*[85-08]*
United States[1]												

Key: * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.

1. No VAT on new homes, or in the case of the United States, no VAT applicable.
2. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).
3. Unreliable estimates due to too few observations.
4. No change in VAT tax rate over the period.

Source: OECD estimates.

Table A.6. **Indirect taxes – Financial and capital transaction tax elasticities (RS4400)**

			House price				Share price				*Dummies*	*Sample*
	R^2 Adjusted	**Error correction term**	Long run elasticity		Short run elasticity		Long run elasticity		Short run elasticity			
Australia	**0.70**	-0.73	**	-0.23		-0.11	1.24	**	0.40	**	*93,03*	*[85-08]*
Austria	**0.90**	-0.64	**	0.25	*	-0.27	0.34	**	0.20	**	*87*	*[85-08]*
Belgium	**0.71**	-0.68	**	0.50	*	0.85	**	0.39	**	0.32	**	*[85-08]*
Canada[1,2]	**0.91**	-1.46	**				0.80	**	1.23	**		*[03-08]*
Czech Republic[1,3]	**0.00**	0.00		--		--						*[94-08]*
Denmark	**0.68**	-0.61	**	0.50		1.44	**	-0.04		0.08		*95,00*	*[85-08]*
Finland	**0.39**	-0.62	**	1.19	**	1.27		-0.24		0.17			*[97-08]*
France	**0.52**	-0.44	**	0.65	*	0.73	**	0.12		0.20	**		*[85-08]*
Germany	**0.77**	-0.74	**	0.43	*	0.90	*	0.79	**	0.75	**	*00,03*	*[85-08]*
Greece	**0.52**	-0.26	**	--		--		0.85	**	0.36	**		*[90-08]*
Hungary	**0.47**	0.13		--		--		1.61	*	-0.17			*[91-08]*
Iceland	**0.25**	-0.36		--		--		0.47	*	0.62	**		*[93-08]*
Ireland	**0.69**	-0.61	**	1.25	**	1.42	**	0.26		0.49	**		*[85-08]*
Italy	**0.52**	-0.69	**	0.73	**	-0.20		0.39	**	0.19	**	*96,01*	*[85-08]*
Japan	**0.50**	0.19		1.67		-0.26		0.30		0.32	**	*89,95*	*[85-08]*
Korea	**0.64**	-0.10	**	-0.08		0.70	*	1.17		0.20	*	*99*	*[87-07]*
Luxembourg	**0.82**	-0.94	**	--		--		0.56	*	0.66	**		*[91-08]*
Mexico	**0.70**	-0.49	**	--		--		0.71	**	0.26	**	*85,96*	*[85-08]*
Netherlands	**0.63**	-0.71	**	1.02	**	1.45	**	0.12		0.13			*[85-08]*
New Zealand[1]	**0.47**	-0.05		-2.42		0.84						*88,98*	*[75-08]*
Norway[1]	**0.74**	-0.54	**	1.36	**	0.90	**					*92,99*	*[85-08]*
Poland	**0.82**	-0.94	**	--		--		0.56	*	0.66	**		*[94-08]*
Portugal	**0.65**	-0.27	**	--		--		1.03	**	0.27	**	*95*	*[85-08]*
Slovak Republic[1]													
Spain	**0.81**	-0.37	**	1.12	**	1.13	**	0.38	**	0.20	*		*[85-08]*
Sweden[1]	**0.83**	-0.20	**	0.33		3.20	**					*86,93,95*	*[85-08]*
Switzerland	**0.65**	-0.36	*	-0.77		1.11	*	0.28	**	0.50	**		*[85-08]*
Turkey	**0.76**	-0.35	**	--		--		1.00	**	0.29	**	*97*	*[86-08]*
United Kingdom	**0.89**	-0.23	**	0.67		1.93	**	1.06	**	1.30	**	*89,92*	*[85-08]*
United States	**0.57**	-0.90	**	0.29		5.10	**	1.27	**	0.62			*[75-89]*

Key: * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.

1. No transaction taxes on immovable property or share disposals, or both (such as for Slovak Republic).
2. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).
3. Unreliable estimates due to too few observations.

Source : OECD estimates.

Table A.7. **Capital tax elasticities (RS4300)**

	R^2 Adjusted	Error correction term	House price		Share price		*Dummies*	*Sample*
			Long run elasticity	Short run elasticity	Long run elasticity	Short run elasticity		
Australia[1]								
Austria	**0.75**	-0.35 **	-1.43	-1.52	1.70 **	0.20	*01*	*[85-08]*
Belgium	**0.48**	-0.83 **	1.24 **	0.98 **	0.14 *	0.08	*04*	*[85-08]*
Canada[1]								
Czech Republic[3]	**0.43**	-0.62 **	--	--	-0.51 **	0.11		*[96-08]*
Denmark	**0.58**	-0.49 **	0.47 *	0.09	0.16	-0.07	*87,02*	*[85-08]*
Finland	**0.56**	-0.26 **	1.10 **	0.30	0.30 *	0.06	*89,96*	*[85-06]*
France	**0.57**	-0.35 **	0.05	0.93 **	0.53 *	0.09	*92,97*	*[85-08]*
Germany	**0.37**	-0.27 **	0.86	-0.41	0.90 *	0.01	*90,04*	*[85-08]*
Greece	**0.42**	-0.36 **	--	--	0.32 *	0.07		*[90-08]*
Hungary	**0.42**	-0.28 *	--	--	0.58 *	0.22 *	*02,04*	*[91-08]*
Iceland	**0.75**	-0.56 **	--	--	0.34	0.20 *	*07*	*[94-08]*
Ireland[2]	**0.77**	-1.07 **	0.25	0.27	0.70 **	0.83 **	*01,02*	*[93-08]*
Italy	**0.60**	-0.62 **	0.69 **	-0.21	0.29	0.36 **	*93*	*[75-02]*
Japan	**0.47**	-0.59 **	1.12 **	-0.79	0.54 *	0.28 *		*[85-08]*
Korea	**0.44**	-0.21 **	3.34	-0.39	0.96	0.46 **	*90,98*	*[88-08]*
Luxembourg[3]	**0.19**	0.22	--	--	0.78	-0.60 *		*[91-08]*
Mexico[1]								
Netherlands	**0.48**	-0.99 **	0.89 **	2.19 **	-0.01	0.01		*[85-08]*
New Zealand[3]	**0.58**	-0.31	-1.12 *	-1.51 **	1.26 **	-0.19	*85*	*[75-91]*
Norway	**0.66**	-0.39 **	0.74 *	0.06	0.31	0.11	*90,95,08*	*[87-08]*
Poland	**0.63**	-0.33 **	--	--	1.93 **	0.36 **		*[94-04]*
Portugal	**0.98**	-0.63 **	0.48	-1.33	0.61 **	0.21 **		*[92-03]*
Slovak Republic[3]	**0.84**	0.06	--	--	11.56	-1.70		*[99-06]*
Spain	**0.79**	-0.19 *	0.82 *	0.27	0.52	0.30 **	*87,94*	*[85-08]*
Sweden[1]								
Switzerland[2]	**0.63**	-1.11 **	0.67 **	0.02	0.33 **	0.69 **	*87*	*[85-04]*
Turkey	**0.66**	-0.28 **	--	--	0.81 **	0.12	*94,98,03*	*[87-08]*
United Kingdom	**0.47**	-0.62 **	0.67 **	0.54 **	0.28 **	0.35 **		*[87-08]*
United States[4]	**0.84**	-0.52 **	-0.58	-0.04	1.00 **	0.47 **	*90, 94*	*[85-08]*

Key: * statistically significant at 10% level ; ** statistically significant at 5% level; (--) missing data.

1. No tax on inheritance and gifts.
2. Coefficient for the speed of adjustment is statistically not different from -1.0 (Wald Test).
3. Unreliable estimates due to too few observations. In the case of New Zealand taxes on inheritance and gifts were removed since 1992.
4. For the United States, exemption tax levels for inheritance taxes was taken into account as an additional control variable. The estimates for long-term effects are negative, as expected, and significant at 10% level, but are not shown in the table.

Source: OECD estimates.

Table A.8. **Aggregation weights by tax components**

As per cent of total tax revenues

	Personal income tax				Corporate tax	Indirect tax			Capital tax
	RS1100	RS4100	RS4200	*sub-total*	RS1200	RS5110	RS4400	*sub-total*	RS4300
Australia	40.8	4.6	--	*45.4*	16.6	10.9	4.4	*27.4*	0.0
Austria	22.1	0.6	0.3	*23.0*	4.6	19.1	0.6	*23.7*	0.1
Belgium	31.3	0.8	0.1	*32.2*	6.5	14.9	1.9	*21.4*	0.9
Canada	37.1	8.4	0.8	*46.3*	9.4	14.3	0.2	*23.7*	0.0
Czech Republic	12.2	0.5	--	*12.7*	12.0	18.0	0.7	*30.0*	0.1
Denmark	52.0	2.2	0.1	*54.3*	5.8	20.0	1.0	*25.8*	0.5
Finland	31.9	0.8	0.1	*32.8*	6.9	18.7	1.0	*25.6*	0.6
France	14.9	4.4	0.4	*19.8*	5.9	17.5	1.3	*23.3*	1.0
Germany	26.0	1.1	0.5	*27.6*	4.4	17.7	0.6	*22.1*	0.4
Greece	13.0	0.4	0.1	*13.5*	7.9	21.7	2.8	*29.6*	0.6
Hungary	18.2	0.6	--	*18.8*	5.9	25.1	1.2	*31.0*	0.1
Iceland	33.6	3.7	1.2	*38.5*	3.9	27.0	1.6	*30.9*	0.2
Ireland	29.2	2.2	--	*31.5*	10.2	22.9	3.5	*33.1*	0.5
Italy	25.8	1.6	0.2	*27.6*	8.3	14.2	2.4	*22.6*	0.1
Japan	22.3	7.1	--	*29.5*	17.2	6.6	2.1	*23.8*	1.5
Korea	15.4	2.9	--	*18.3*	13.6	17.7	8.5	*31.3*	0.9
Luxembourg	20.1	0.3	5.6	*26.0*	16.6	14.9	2.1	*31.6*	0.3
Mexico	26.5	0.9	--	*27.4*	--	19.1	0.5	*19.1*	0.0
Netherlands	19.0	1.7	0.3	*21.1*	8.6	17.5	1.7	*26.1*	0.7
New Zealand	44.4	5.3	--	*49.6*	11.8	23.6	0.3	*35.4*	0.1
Norway	24.2	0.6	1.3	*26.2*	18.2	19.4	0.5	*37.6*	0.2
Poland	15.3	3.6	--	*18.9*	7.2	21.5	--	*28.8*	0.1
Portugal	15.8	1.3	--	*17.1*	8.7	22.9	1.7	*31.6*	0.2
Slovak Republic	9.5	1.3	--	*10.9*	8.9	22.8	0.2	*31.7*	0.0
Spain	20.3	1.8	0.5	*22.6*	8.7	16.6	3.3	*25.4*	0.6
Sweden	33.6	1.9	0.4	*35.8*	5.7	17.4	0.7	*23.1*	0.2
Switzerland	36.3	0.6	4.5	*41.4*	8.3	12.2	2.8	*20.5*	0.9
Turkey	16.9	0.7	--	*17.6*	7.0	22.6	2.6	*29.6*	0.1
United Kingdom	28.7	8.9	--	*37.7*	9.4	18.4	1.7	*27.8*	0.6
United States	37.5	10.2	--	*47.6*	9.3	7.9	0.0	*17.2*	1.0

Key : (--) Missing data.

Source : OECD calculations.

Annex B

Methodology and data sources

This annex describes the methodology used to adjust the fiscal balance for asset price cycles, together with information on data sources and availability. The presentation is broken down into three steps, describing: 1) the method used to estimate individual and aggregated asset-related tax elasticities; 2) the procedure by which revenues and the fiscal balance are adjusted for asset price cycles; and 3) the definition and calculation of asset price cycles. The final section provides detailed information on the data and their availability.

I. Estimations of asset based tax elasticities and the error correction model

The error correction model and the asset price tax elasticities

Long-run tax elasticities can be estimated by using an ordinary least square (OLS) regression of the log of tax revenue on the log of income or the tax base:

$$\ln(T_t) = c + \beta \ln(Y_t) + u_t \quad (1)$$

where T_t represents the level of tax during period t and Y_t is the level of aggregate income during the period and β measures the long-run tax elasticity. However, this approach is usually biased because tax revenues are non-stationarity. Both taxes and income/tax bases are positively correlated with a time trend and will not return to their mean values over time. Using first differences of the log of tax revenues and income/tax base variables will resolve the non-stationarity problem but leads to estimates of short-run tax elasticities. Using first differences, the tax equation takes the following form:

$$\Delta\ln(T_t) = c + \alpha \Delta\ln(Y_t) + u_t \quad (2)$$

where α is measuring the short-run tax elasticity.

Holcombe and Sobel (1997) were the first to argue for a better specification based on an error correction (EC) model. This specification adds a term to the short-run elasticity estimating equation representing the departure of the long-run elasticity estimate from its predicted value in the prior time period. The EC model can be written as follows:

$$\Delta\ln(T_t) = c + \alpha \Delta\ln(Y_t) + \gamma(lnT_{t-1} - \beta lnY_{t-1}) + u_t \quad (3)$$

where α and β are respectively short- and long-run tax elasticities and γ the error correction term.

The error correction term (ECT) captures the link between the short- and long-run tax elasticities, measuring the deviation from long-run equilibrium, which is corrected gradually through a series of partial short-run adjustments. In other words, the ECT gives an estimate of the proportion of the pre-existing disequilibrium which is eliminated every year. The value ranges from 0 and 1, where a value of 1 indicates

that 100% of the disequilibrium is eliminated in the current period and a value of 0.5 indicates that only 50% is eliminated in the first year.

The error correction model can be adapted to derive asset price tax elasticities where the tax base *per se* is unobservable (and/or data unavailable) and where it is the lagged response to asset price variables (house and share nominal prices), which may be thought of as the original drivers of the base. The equation is estimated for each tax revenue component where tax sensitivities to asset prices are expected to be found (*e.g.* sub-tax items of personal income taxes, corporate taxes, indirect taxes and capital taxes). Thus, the reduced form equation based on the error correction model to be estimated is:

$$\Delta lnT_j = c + \sum_n \alpha_{j,n} \Delta lnX_n + \sum_k \alpha_{j,k} \Delta lnA_k + \gamma_j \left(lnT_{t-1,j} - \sum_n \beta_{j,n} lnX_{t-1,n} - \sum_k \beta_{j,k} lnA_{t-1,k} \right) + u_t \quad (4)$$

where T_j is the tax revenue of the j^{th} tax component, X_n the n^{th} control variable, A_k the k^{th} asset price variable, α_j the short-run tax elasticity, β_j the long-run tax elasticity, and γ_i the error correction term.

Country specifications and institutional settings

For each tax revenue component, a common framework is applied across OECD countries in order to identify tax-specific asset and control variables. In doing so, the implicit objective is to achieve the best specification and maximise the goodness of fit, in order to get reasonable, stable and consistent estimates of asset related tax elasticities. Tax specific control variables and their definitions are shown in Table B.1.

Table B.1. **Asset and control variable definitions by tax revenue components**

Tax category	Control variables (X_j)	Asset price variables (A_k)
Personal income taxes (RS1100)	Taxable personal income (GROSSINC) = gross net take home pay (WSSS-SSRG), public transfers (TRRH) and self employed revenues (YOTH) Personal income tax rate	House price, equity prices
Property taxes (RS4100)	*None*	House price
Wealth taxes (RS4200)	*None*	House price, equity prices
Corporate taxes (RS1200)	Gross operating surplus (GROSSOP) = Value added (GDP-TIND+TSUB) – Labour costs (WSSS) Corporate tax rates	House price, equity prices
Indirect Tax (RS5110)	Private consumption (CP) Residential investment (IH) VAT rates	House price
Financial and capital transactions (RS4400)	*None*	House price, equity prices
Capital taxes (RS4300)	*None*	House price, equity prices

Within this common framework, a number of country specific factors had to be taken into account in order to reflect the institutional settings as described in Tables 1 to 5. As a result, individual tax equations had to be tailored on a country-by-country basis. These specifications are as follows:

- Asset price variables have been excluded from the country tax equation where the tax codes determined that there was no relevant tax. Similarly, the time period sample for the regressions has had to be adapted where legislation has changed or a tax introduced or abolished.

- Structural economic changes or policy measures may affect tax revenues which are not necessarily captured by the tax base control variables. Country specific time dummy variables have then had to be included in the regressions to stabilise the estimates.

- Control variables may need to be differentiated across countries as tax data collection and definition are not necessarily standardised in Revenue Statistics. For example, corporate tax revenues for the United Kingdom include oil taxes which need to be controlled for, with the introduction of an oil price variable in addition to the other standard control variables.

- A further reason for tailoring the tax equation is that any misspecification (due to over- or under-specification) introduces a degree of bias into the estimates, affecting their quality and their robustness.

The need for these specific country adjustments indicates that estimations based on data pooling rather than country time series regressions may provide a misleading picture of the asset-related tax sensitivities, unless pooling applies to institutionally similar groups of countries.

Aggregation of asset based tax elasticities

Asset tax elasticities need to be aggregated to be consistent with the tax definitions existing in the SNA framework. Up to this point, tax elasticities are estimated for each tax sub-components as defined in Revenue Statistics (as can be seen in Annex Tables A1 to A7), which need to be aggregated according to the 93 SNA definitions (see Box 2). Aggregation weights are computed on an average basis over the observed sample period. These are shown in Table A8, while aggregated tax elasticities are reported in Tables 7 to 10 and used in correcting the fiscal balance for the asset related cycles. Only significant tax elasticity estimates are taken into consideration in the aggregation. The error correction term is also aggregated along the same lines, reflecting the weighted sum of the tax disequilibrium to be eliminated.

II. Asset price cycles: definition and normalisation procedures

Defining "fundamental" house prices

The housing valuation model used to define the house price cycle is developed in André (2010), based on a model by Poterba (1984), where long-term equilibrium house prices are determined by the influence of the user cost of housing on the price-to-rent ratio. At equilibrium, the model states that rents should equal the user cost of housing:

$$P/R^{*} = \frac{1}{i^{a} + \tau + f - \pi} \tag{5}$$

where P/R* represents the "fundamental" price-to-rent ratio, i^{a} the after-tax nominal mortgage interest rate, τ the property tax rate on owner-occupied houses, f the recurring holding costs consisting of depreciation, maintenance and the risk premium on residential property and π is expected capital gains on houses.

The "fundamental" value of the price-to-rent ratio will be sensitive to the assumptions made about the after-tax mortgage rate and the expected capital gains on houses, given that property tax rates and recurring holding costs usually display some inertia. The underlying computational assumptions are as follows:

- The mortgage rate i^{a} used to discount future rents over an infinite horizon is proxied by using 10-year government bond yields. The latter are assumed to move in line with mortgage rates and

are comparable across countries. However, they fail to account for specific mortgage and credit market developments.

- The expected capital gain π is approximated by a five-year moving-average of the consumer price inflation rate. The rationale behind this assumption is that households are supposed to expect capital gains on a nominal basis but not in real terms. As such, expected capital gains move in line with expected inflation, which in turn is usually backward-looking.

- Depreciation, maintenance costs and the risk premium are conventionally assumed to be set at 4%, while property tax rates are drawn from calculations shown in Girouard *et al*. (2006).

The fundamental P/R ratio is normalised so that the long-run average is equal to the average of the actual P/R ratio from 1985 to 2008.

Defining "fundamental" equity prices

The Gordon equity price formula states that, over the long run, the dividend yield plus the future growth in earnings should correspond to the risk-free interest rate plus a risk premium. Though the model is based on the expected growth rate in dividends, the growth rate in earnings can be substituted in steady state so that:

$$\frac{P}{E}* = (1+g)/(r+\sigma-g) \qquad (6)$$

where P/E* is the equilibrium price/earnings ratio for the economy, r is the risk free interest rate, σ is the risk premium and g is the long-run growth of earnings. Over the cycle, the actual P/E ratio can diverge from "fundamentals", particularly when markets are recovering from a trough and short-run earnings growth is above normal, before converging to the historical norm (Fuller and Hsia, 1984).[1] Hence, fundamental valuations may differ from actual share values.

The "fundamental" measure of stock prices will be particularly sensitive to the proxy used for the risk free interest rate and its differential with earnings growth. A number of considerations have to be addressed here in order to produce stable ratios both in terms of magnitude (bounding "theoretical" P/E values within 0 to 1) and volatility (*e.g.* avoiding situations where interest rates and earnings converge, driving up P/E ratio towards infinite values), implying some particular choices for the proxies to be used:

- The model could be specified in real or nominal terms. However, it becomes volatile and unstable when real interest rates are negative, so that the risk free interest rate is based on the nominal 10-year government bond yield. This rate has declined to historically very low levels since the early 2000s, initially reflecting the easiness of monetary policy conditions in the context of price stability (Ahrend *et al*., 2006) but also "safe haven" effects which may not apply to corporate risk-free rates. The risk free rate may thus be understated, causing an overvaluation of the P/E ratio at the equilibrium. To allow for this, government bond yields for all countries are adjusted by adding the spread between the US AAA corporate yield and the US Treasury 10-year bond yield. The risk premium is conventionally set at 4%.

1. The actual value of the stock market can diverge cyclically from the "fundamental" value, according to the formula $P/E = [(1+g) + H(g'-g))]/(r + \sigma - g)$, where g' is short-term earnings and H is the half-life of non normal earnings growth in years: *i.e.* earnings growth returns linearly to its mean over a period of two half lives.

- Long-run corporate earnings growth is constrained to equal the year-on-year growth rate of the economy. In practice, this is defined as real potential output growth, which is comparable across countries and estimated within the OECD's forecasting framework. The "fundamental" valuation measure thus excludes the effects of inflation expectations, which can have important non-neutral cyclical effects on actual share values.

The average "fundamental" P/E ratio, so calculated, is calibrated with the average of the actual P/E ratio over the 1985 to 2008 period, which ensures that cyclical deviations from "fundamentals" are symmetrical over the period analysed. A "fundamental" share price index can then be created, based on the same base year as actual share prices (2000) (Figure 2).

The asset-cycle adjustment can then be defined analogously to the CAB, where each individual tax revenue component is cyclically adjusted as follows:

$$T_i^* = T_i \left({}^{Y^*}\!/_{Y} \right)^{\varepsilon_{ti,y}} \tag{7}$$

The asset price cyclical adjustment can be defined in similar terms:

$$T_j^{**} = T_j \left({}^{A_k^*}\!/_{A_k} \right)^{\varepsilon_{j,k}} \tag{8}$$

where, for a given asset k and tax revenue category j, (A_k^*/A_k) indicates the asset price gaps of nominal relative to fundamental prices and $\varepsilon_{j,k}$ is the estimated asset price tax elasticity for the k^{th} asset price variable.

III. Cyclical adjustment in the error-correction model

As the estimated tax elasticity is derived from a tax equation based on the ECT model, the asset price cycle adjustment has to take into account short- and long-term elasticities. Thus, the asset related cyclical adjustment as shown in equation (8), combined with the ECT model equation (4) can be rewritten as follows:

$$T_j^{**} = T_j \left(\frac{A_k^*/A_{t-1,k}^*}{A_k/A_{t-1,k}} \right)^{\propto_{j,k}} \left({}^{A_{t-1,k}^*}\!/_{A_{t-1,k}} \right)^{-\gamma_j \beta_{j,k}} \tag{9}$$

where α_j the short-run tax elasticity, β_j the long-run tax elasticity, and γ_j the error correction term are estimated from the log-linear regression (4) at tax sub-levels (j).

Aggregating sub tax components (j) into SNA tax categories (i) and taking into account of both equity and house price cycles, in addition to the original output cyclical adjustment, asset price adjusted revenues are defined as follows:

$$T_i^{***} = T_i \left(\frac{Y^*}{Y}\right)^{\varepsilon ti,y} \prod_k \left(\frac{A_k^* / A_{t-1,k}^*}{A_k / A_{t-1,k}} \right)^{\alpha_{i,k}} \left(\frac{A_{t-1,k}^*}{A_{t-1,k}}\right)^{-\gamma_i \beta_{i,k}} \quad (10)$$

where $\alpha_{i,k}$, $\beta_{i,k}$ and $\gamma_{i,k}$ are respectively weighted averages across sub-tax component *j* of estimated $\alpha_{j,k}$, $\beta_{j,k}$ and $\gamma_{j,k}$ (short-, long-term tax elasticity and error correction term of tax *j* related to a given asset price cycle *k*).

Decomposing the adjustment into asset price and output gap components

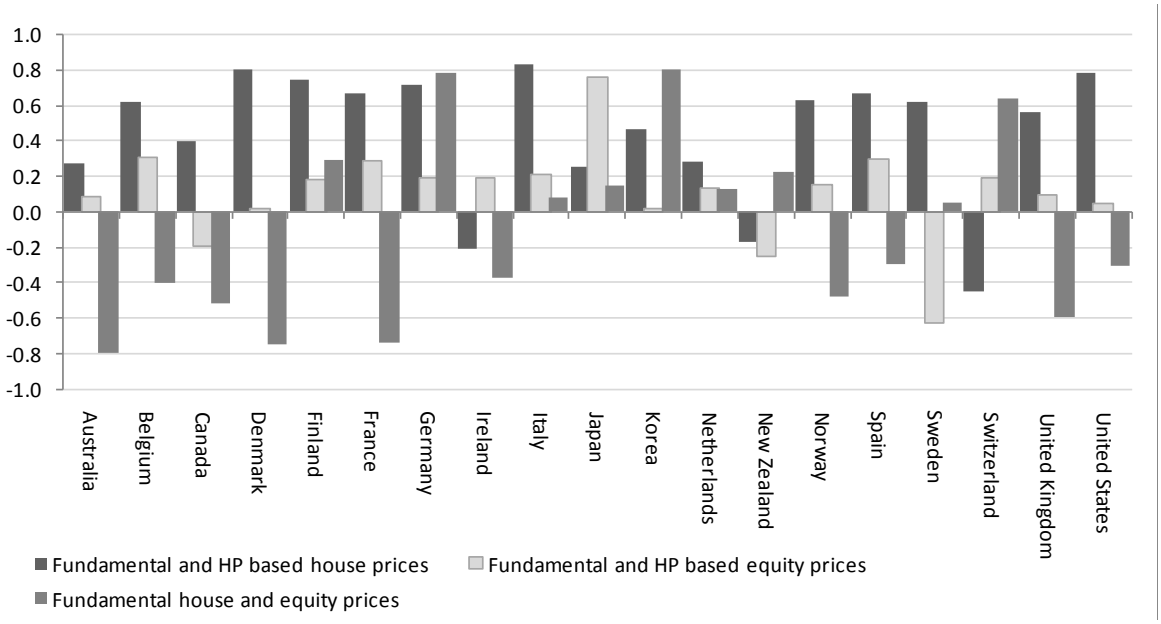
The asset-cycle adjustment can be decomposed into its asset price components. Figure 6 does this for the three adjustment components which comprise the asset price adjusted CAB as a % of potential GDP, *i.e.* those related to equity and house price gaps and output gaps. The extent to which the aggregate adjustment is driven by the individual components is derived by holding all other factors unchanged (the gap set to 1) except for the one considered. Summing up across the various factors give the total cyclical component for which tax revenues are adjusted for. This decomposition can be of strategic importance due to the fact that the correlations among asset price and output gaps is at most partial and may be negative.

Sensitivity of asset price gaps to definition

The sensitivity of asset price gaps to their definition can be gauged from the correlations between the various measures (Figure B.1). House prices measured by the "fundamental" and HP methods are fairly closely correlated, but equity prices are not. The diagram also shows that fundamental measures of house and equity prices are often uncorrelated or negatively correlated, indicating that the two asset prices are being driven by different fundamentals.

Figure B.1. **Gap correlations**

Correlation coefficients



IV. Data sources and availability

The data used are mainly drawn from OECD sources. Macroeconomic and fiscal variables are from ABD and EO86 databases. Tax revenue data are extracted from the *Revenue Statistics* database. Discretionary tax rates (personal income, corporate and VAT rates) are drawn from OECD Centre for Tax Policy documentation. Housing prices (nominal values and price-to-rent ratios) are collected within the Economics Department from national sources. Stock price data (nominal values and price-to-earnings ratios) are drawn from DataStream.

The annual data set covers the period from 1975 to 2008. Estimates are based on shorter time period (from 1985 to 2008) mainly constrained by the data availability of discretionary tax rates (see Table B.2).

Table B.2. **Data availability for asset variables and discretionary tax rates**

	Nominal house price	Price-to-rent-ratio	Nominal stock price	Price-to-earnings ratio	Personal income tax rate	Corporate tax rate	VAT rate
Australia	x	x	x	x	85-08	85-08	00-08
Austria	86-09	--	x	x	85-08	85-08	85-08
Belgium	88-09	x	x	x	85-08	85-08	85-08
Canada	x	x	x	x	85-08	85-08	91-08
Czech Republic	99-09	--	94-09	94-09	93-08	93-08	94-08
Denmark	x	x	x	x	85-08	85-08	85-08
Finland	x	x	x	89-09	85-08	85-08	94-08
France	x	x	x	x	85-08	85-08	85-08
Germany	x	x	x	x	85-08	85-08	85-08
Greece	99-09	--	x	90-09	85-08	85-08	88-08
Hungary	94-09	--	91-09	92-09	89-08	89-08	88-08
Iceland	--	--	--	--	00-08	00-08	89-08
Ireland	x	x	x	x	85-08	85-08	85-08
Italy	x	x	x	x	85-08	85-08	85-08
Japan	x	x	x	x	85-08	90-08	90-08
Korea	86-09	--	x	89-09	00-08	00-08	85-08
Luxembourg	--	--	99-09	99-09	na	00-08	85-08
Mexico	--	--	x	91-09	85-08	85-08	80-08
Netherlands	x	x	x	x	85-08	85-08	85-08
New Zealand	x	x	x	88-09	85-08	85-08	86-08
Norway	x	x	86-09	x	85-08	85-08	85-08
Poland	98-09	--	91-09	94-09	92-08	92-09	94-08
Portugal	88-09	--	88-09	90-09	85-08	85-08	88-08
Slovak Republic	95-09	--	--	--	93-08	93-09	88-08
Spain	x	x	x	87-09	85-08	85-08	94-08
Sweden	x	x	x	x	85-08	85-08	85-08
Switzerland	x	x	x	x	85-08	85-08	94-08
Turkey	--	x	86-09	91-09	00-08	00-09	85-08
United Kingdom	x	x	x	x	85-08	85-08	85-08
United States	x	x	x	x	85-08	85-08	na

Note: (x) Data are available over the full sample period (1975-2009).
(--) Data are not available.

Annex C

Structural budget balance data

Tables C1 to C3 give the asset price adjusted structural balances data behind the graphs shown in Figure 4, the aggregate asset price adjustment shown in Table 12 (Table C1 minus Table C3) and the discretionary changes shown in Table 13 (equal to the year-to-year differences in Table C1 and C3). Tables C4 and C5 apply the same asset price cycle adjustments to underlying budget balances – *i.e.* cyclically adjusted balances net of "one-off" effects (Joumard *et al*., 2008). Table C6 gives the period-averaged data behind the cyclical adjustment decomposition shown in Figure 5.

Table C.1. **Structural budget balances (CAB) adjusted for "fundamental" asset price cycles**

As percentage of potential GDP, levels

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	1.92	1.73	-0.32	-0.79	0.02	0.40	0.91	2.53	3.04	2.72	2.79	-0.47
Austria	-2.17	-2.68	-2.99	-0.41	-0.49	-0.60	-3.42	-1.01	-1.70	-1.30	-1.28	-3.07
Belgium	-0.75	-1.07	-1.30	-0.27	-0.20	0.39	-0.68	-3.02	-0.38	-1.08	-0.87	-2.37
Canada	0.74	1.35	2.07	1.63	-1.80	-0.24	0.34	1.26	0.83	0.34	1.23	-3.31
Czech Republic	-4.44	-2.81	-3.35	-4.99	-5.62	-5.66	-2.46	-3.85	-4.06	-2.84	-3.71	-4.18
Denmark	-0.64	1.31	0.87	0.17	0.52	1.23	2.94	5.02	3.01	2.12	2.73	0.98
Finland	1.08	0.12	4.18	6.37	3.71	3.28	2.42	3.65	3.51	4.62	5.69	2.08
France	-1.50	-1.51	-2.51	-2.33	-3.36	-4.22	-4.26	-3.39	-3.29	-4.19	-3.92	-6.69
Germany	-2.00	-1.40	-2.13	-3.49	-3.36	-2.78	-2.61	-1.97	-1.41	-0.53	-0.71	-2.09
Greece	-3.41	-2.65	-3.28	-4.16	-4.16	-5.87	-7.79	-5.12	-3.58	-4.47	-7.37	-10.31
Hungary	-6.43	-4.22	-2.39	-3.50	-8.30	-6.85	-6.55	-8.46	-10.59	-5.80	-4.04	-1.31
Iceland	-1.12	0.40	1.24	-1.14	-2.30	-2.18	-0.32	3.51	5.31	4.55	-13.99	-13.05
Ireland	1.14	0.33	0.00	-1.66	-1.69	0.26	-0.50	0.76	1.66	0.01	-2.50	-8.70
Italy	-1.76	-0.08	-1.43	-2.42	-2.15	-2.10	-2.56	-3.43	-2.94	-1.52	-1.34	-1.68
Japan	-10.27	-7.19	-7.58	-5.13	-6.58	-6.04	-4.34	-4.73	0.65	-1.17	-0.35	-4.11
Korea	2.21	2.35	5.11	5.88	6.39	2.57	5.67	6.71	7.06	6.75	5.06	0.68
Luxembourg	4.77	3.61	4.83	5.15	1.41	0.65	-0.70	-0.06	0.68	2.12	1.65	-0.54
Netherlands	-1.61	-0.82	-0.14	-0.87	-1.34	-1.14	0.26	1.57	1.17	-0.07	0.22	-2.45
New Zealand	1.18	0.42	1.95	1.88	3.43	3.64	3.50	4.70	5.91	4.72	3.49	0.70
Norway	-2.05	-0.59	0.71	0.14	-2.06	-3.67	-2.45	-0.78	0.76	2.79	2.26	-3.14
Poland	-4.47	-2.48	-4.28	-5.09	-4.01	-5.97	-6.34	-4.48	-3.97	-2.70	-4.22	-5.91
Portugal	-4.13	-3.29	-3.75	-4.49	-1.78	0.30	-0.72	-4.05	-2.78	-2.99	-2.45	-3.87
Spain	-1.76	-0.32	-0.75	-0.10	0.24	0.20	-0.67	0.74	1.47	1.28	-3.24	-5.49
Slovak Republic	-6.81	-7.57	-11.39	-5.63	-7.51	-2.18	-1.74	-2.50	-3.96	-3.64	-4.62	-5.20
Sweden	0.41	0.09	0.54	3.08	-2.26	-1.41	-0.39	2.95	2.37	3.55	4.99	2.43
Switzerland	-3.57	-1.49	-2.08	-1.73	-1.89	-1.20	-1.40	0.07	0.59	1.15	1.42	0.42
United Kingdom	-0.29	0.56	0.18	-0.19	-2.71	-4.62	-4.77	-3.98	-3.04	-3.61	-4.55	-8.17
United States	0.06	-0.73	-0.36	-1.27	-4.39	-4.55	-4.38	-3.08	-2.39	-2.90	-5.37	-8.73

Source: OECD estimates.

Table C.2. **Structural budget balances (CAB) adjusted for HP filtered asset price cycles**

As percentage of potential GDP, levels

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	2.06	1.90	0.77	-0.34	1.36	1.79	1.91	1.81	1.07	-0.20	1.95	-2.50
Austria	-2.23	-2.79	-3.08	-0.44	-0.45	-0.55	-3.43	-1.09	-1.87	-1.53	-1.40	-3.09
Belgium	-0.56	-0.84	-1.21	-0.11	-0.18	0.51	-0.88	-3.71	-0.78	-1.23	-0.90	-2.34
Canada	1.58	1.25	2.23	1.05	0.17	-0.49	0.58	0.55	0.29	-0.35	3.46	-4.77
Czech Republic	-4.25	-2.90	-3.30	-5.04	-5.94	-5.87	-2.52	-4.02	-4.00	-2.80	-3.35	-4.43
Denmark	-0.55	0.94	0.88	0.61	1.06	1.26	2.67	3.81	2.42	2.03	3.91	1.46
Finland	1.42	-0.29	5.61	5.09	4.30	3.39	3.16	2.34	2.69	3.25	6.17	1.43
France	-1.92	-2.14	-2.40	-1.83	-2.70	-3.81	-3.84	-3.79	-3.46	-4.04	-2.82	-6.02
Germany	-2.09	-1.73	-2.21	-3.41	-3.10	-3.00	-2.79	-2.55	-2.15	-1.43	-1.08	-2.09
Greece	-3.33	-2.87	-3.22	-4.35	-4.05	-5.94	-7.86	-5.30	-3.67	-4.70	-7.16	-10.42
Hungary	-6.69	-4.18	-2.26	-3.33	-8.15	-6.68	-6.52	-8.51	-10.78	-6.00	-4.16	-1.03
Iceland	-0.96	0.44	1.46	-0.80	-2.07	-2.13	-0.50	3.23	5.06	4.19	-12.88	-12.27
Ireland	1.27	1.32	3.01	-0.47	-0.36	0.83	0.70	0.03	0.13	-3.18	-5.71	-5.34
Italy	-1.94	-0.85	-2.32	-3.35	-2.57	-2.86	-3.20	-4.35	-4.28	-2.92	-2.11	-2.11
Japan	-10.20	-6.99	-7.23	-5.22	-6.52	-6.95	-5.69	-7.26	-2.68	-3.94	-2.53	-6.04
Korea	4.55	4.61	6.64	5.65	5.37	0.76	3.48	3.41	3.07	3.14	2.94	-0.95
Luxembourg	4.77	3.61	4.83	5.15	1.41	0.65	-0.70	-0.06	0.68	2.12	1.65	-0.54
Netherlands	-1.63	-0.97	-0.18	-1.29	-2.07	-2.07	-0.53	0.67	0.74	-0.49	-0.29	-3.56
New Zealand	1.29	0.44	2.02	1.90	3.36	3.45	3.37	4.55	5.80	4.64	3.62	0.55
Norway	-1.69	-0.83	1.48	0.75	-1.11	-3.33	-2.16	-1.12	0.28	2.51	2.62	-3.55
Poland	-4.62	-2.41	-3.23	-4.20	-3.23	-5.04	-5.54	-4.20	-4.96	-4.26	-5.19	-6.30
Portugal	-4.72	-4.64	-5.64	-5.79	-2.56	-1.28	-2.23	-5.17	-3.94	-3.74	-2.30	-4.20
Spain	-1.82	-1.04	-1.13	-0.23	0.56	0.33	-0.46	-0.08	0.22	-0.12	-3.27	-5.17
Slovak Republic	-6.81	-7.57	-11.39	-5.63	-7.51	-2.18	-1.74	-2.50	-3.96	-3.64	-4.62	-5.20
Sweden	1.35	-0.49	1.65	2.60	-0.18	-0.81	0.02	0.58	-0.13	1.50	5.10	0.87
Switzerland	-2.00	-0.81	-1.14	-0.35	-0.69	-0.46	-0.88	-0.61	0.00	0.45	1.54	-0.21
United Kingdom	-0.40	0.25	0.34	0.51	-1.92	-3.29	-3.83	-3.56	-3.76	-4.29	-4.59	-9.28
United States	-0.30	-0.33	0.47	-0.49	-2.78	-4.47	-4.57	-4.01	-3.57	-4.25	-5.05	-9.10

Source: OECD estimates.

Table C.3. **Cyclically adjusted balance (CAB) without asset cycle adjustment**

As percentage of potential GDP, levels

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	1.61	1.74	0.42	-0.19	1.26	1.66	0.97	1.47	1.85	1.66	1.22	-2.50
Austria	-2.23	-2.82	-3.13	-0.54	-0.57	-0.66	-3.47	-1.05	-1.77	-1.41	-1.43	-3.19
Belgium	-0.38	-0.76	-1.15	-0.29	-0.14	0.32	-0.62	-3.17	-0.39	-1.12	-1.47	-3.04
Canada	0.65	1.48	2.20	0.31	-0.35	-0.17	0.65	1.19	1.10	1.01	0.02	-3.19
Czech Republic	-4.44	-2.81	-3.35	-5.21	-5.92	-5.75	-2.36	-3.88	-4.01	-2.76	-3.73	-4.33
Denmark	-0.48	1.02	1.27	0.18	0.10	0.52	2.36	4.88	3.97	3.10	2.83	0.21
Finland	1.61	1.41	6.29	4.73	4.37	3.11	2.50	2.68	3.20	4.22	4.07	1.24
France	-2.32	-1.88	-2.22	-2.40	-3.44	-3.89	-3.48	-3.01	-2.67	-3.52	-3.95	-6.72
Germany	-1.76	-1.22	-1.70	-3.31	-3.52	-3.26	-2.94	-2.46	-1.79	-0.80	-1.11	-2.09
Greece	-3.27	-2.44	-3.22	-4.48	-4.27	-5.99	-7.86	-5.22	-3.56	-4.52	-7.52	-10.43
Hungary	-6.43	-4.22	-2.22	-3.39	-8.37	-6.95	-6.72	-8.51	-10.59	-5.80	-4.05	-1.32
Iceland	-1.12	0.40	1.24	-1.14	-2.30	-2.18	-0.32	3.51	5.31	4.55	-13.99	-13.05
Ireland	1.80	1.57	3.42	-0.09	-1.25	-0.05	1.03	0.93	1.98	-1.37	-7.08	-8.92
Italy	-2.31	-0.94	-2.02	-3.47	-3.03	-3.01	-3.09	-4.01	-3.63	-2.22	-2.62	-2.80
Japan	-10.60	-6.44	-7.16	-5.63	-7.11	-7.06	-5.85	-6.77	-2.08	-3.54	-3.49	-6.33
Korea	2.89	3.68	5.69	4.57	4.96	0.47	2.66	3.26	3.56	4.00	2.93	-1.20
Luxembourg	4.77	3.61	4.83	5.15	1.41	0.65	-0.70	-0.06	0.68	2.12	1.65	-0.54
Netherlands	-1.22	-0.43	-0.10	-1.67	-2.58	-2.42	-0.73	0.55	0.68	-0.58	-0.48	-3.81
New Zealand	1.26	0.41	1.96	1.87	3.37	3.54	3.36	4.58	5.81	4.64	3.52	0.59
Norway	-1.79	-0.29	1.68	0.50	-1.98	-4.09	-2.30	-1.03	1.10	3.10	1.61	-3.38
Poland	-4.47	-2.48	-3.28	-4.58	-3.96	-5.53	-5.75	-4.26	-4.57	-3.48	-5.30	-6.81
Portugal	-3.98	-3.72	-4.77	-5.57	-3.47	-2.45	-2.96	-5.42	-3.66	-2.79	-2.56	-4.87
Spain	-2.49	-1.48	-2.01	-1.46	-0.78	-0.17	-0.20	0.96	1.86	1.63	-3.53	-6.77
Slovak Republic	-6.81	-7.57	-11.39	-5.63	-7.51	-2.18	-1.74	-2.50	-3.96	-3.64	-4.62	-5.20
Sweden	1.56	0.82	2.76	1.46	-1.49	-1.00	0.23	1.33	0.92	2.29	2.46	1.46
Switzerland	-1.84	-0.42	-0.48	-0.54	-1.06	-0.86	-1.09	-0.40	0.50	0.85	0.99	-0.08
United Kingdom	-0.33	0.67	0.94	0.35	-1.99	-3.80	-3.97	-3.74	-3.31	-3.47	-5.44	-9.90
United States	0.12	0.23	0.84	-0.72	-3.58	-4.55	-4.38	-3.48	-2.56	-3.17	-6.19	-9.29

Source: OECD estimates.

Table C.4. **Underlying budget balance adjusted for "fundamental" asset price cycles**

As percentage of potential GDP, levels

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	0.92	-0.53	-0.42	0.00	0.06	1.03	2.22	2.45	2.13	1.09	-2.00
Austria	-3.15	-3.36	-0.66	-1.19	-1.36	-0.49	-1.38	-1.93	-1.53	-2.18	-3.31
Belgium	-0.96	-1.16	-0.30	-0.24	-0.84	-0.85	-0.48	-0.43	-0.94	-1.04	-2.89
Canada	0.99	1.97	1.50	-1.85	-0.23	0.52	1.50	1.19	0.54	1.39	-3.67
Czech Republic	-5.11	-5.98	-4.68	-4.54	-5.25	-2.54	-3.05	-3.45	-2.08	-3.43	-4.79
Denmark	1.31	0.87	0.29	0.39	1.21	2.66	4.97	3.00	2.42	2.89	0.90
Finland	0.11	3.77	6.31	3.64	3.17	2.42	3.86	3.84	4.49	5.02	1.65
France	-1.39	-2.71	-2.32	-3.44	-4.44	-4.31	-3.76	-3.04	-3.68	-3.16	-5.52
Germany	-1.67	-2.11	-3.17	-3.04	-2.33	-2.17	-1.41	-0.98	-0.13	0.00	-1.26
Greece	-1.63	-3.91	-3.28	-3.47	-5.30	-6.38	-4.45	-7.16	-8.00	-10.33	-13.74
Hungary	-6.39	-3.98	-4.75	-8.08	-8.13	-8.11	-9.47	-10.70	-5.00	-2.85	-0.81
Iceland	-0.06	0.53	-1.69	-2.98	-2.61	-0.91	2.43	3.49	2.05	-3.34	-10.05
Ireland	1.66	-0.41	-1.81	-1.82	-0.12	-0.85	0.38	1.21	-0.64	-2.23	-9.29
Italy	-0.09	-1.49	-2.22	-1.82	-3.08	-3.13	-3.42	-1.83	-1.31	-1.36	-1.95
Japan	-7.44	-7.18	-5.63	-6.61	-5.66	-5.26	-3.26	-1.01	-1.24	-0.37	-4.95
Korea	1.77	4.40	5.37	5.98	5.90	5.40	6.14	6.66	6.29	4.44	1.22
Luxembourg	3.40	4.77	3.53	1.43	0.66	-0.45	0.05	1.26	2.27	1.77	0.84
Netherlands	-1.31	-0.29	-0.63	-1.23	-0.99	0.15	1.43	0.88	-0.19	0.10	-2.88
New Zealand	0.27	1.95	1.78	3.44	3.34	3.32	3.71	5.07	3.92	0.90	-0.51
Norway	-0.86	1.21	0.20	-1.82	-3.29	-2.20	-0.65	0.94	3.05	3.06	-0.19
Poland	-3.08	-4.79	-5.58	-4.21	-5.33	-5.62	-3.66	-2.72	-1.40	-2.66	-5.72
Portugal	-2.78	-3.02	-4.06	-3.04	-2.03	-2.20	-3.28	-2.18	-3.04	-3.20	-6.61
Slovak Republic	-4.83	-4.63	-5.53	-6.26	-3.76	-3.91	-2.61	-4.48	-4.13	-3.51	-4.96
Spain	-1.63	-1.70	-1.48	-0.86	-0.51	-0.07	0.68	1.67	1.73	-2.56	-7.28
Sweden	-0.31	0.23	2.83	-2.38	-1.69	-0.84	2.93	2.14	2.96	4.42	3.55
Switzerland	-2.02	-0.83	-1.44	-1.31	-1.28	-1.38	0.11	0.66	1.37	2.56	2.29
United Kingdom	0.36	-0.10	-0.21	-2.87	-4.65	-4.98	-4.37	-3.21	-4.20	-4.34	-6.62
United States	-0.94	-0.61	-1.56	-4.61	-4.67	-4.60	-3.25	-2.83	-3.25	-5.15	-8.22
OECD average	-1.24	-1.04	-1.06	-1.88	-1.90	-1.63	-0.65	-0.41	-0.27	-0.86	-3.46

Source: OECD estimates.

Table C.5. **Underlying discretionary changes net of "fundamental" asset price adjustments**

As percentage of potential GDP

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Australia	-0.09	-1.45	0.11	0.42	0.06	0.97	1.19	0.23	-0.32	-1.04	-3.08
Austria	-1.04	-0.21	2.70	-0.53	-0.16	0.87	-0.89	-0.54	0.40	-0.66	-1.12
Belgium	-0.46	-0.20	0.86	0.05	-0.60	-0.01	0.37	0.05	-0.51	-0.10	-1.85
Canada	0.47	0.97	-0.46	-3.35	1.62	0.74	0.98	-0.30	-0.65	0.85	-5.06
Czech Republic	1.02	-0.87	1.30	0.14	-0.72	2.72	-0.51	-0.40	1.36	-1.34	-1.37
Denmark	1.79	-0.44	-0.58	0.10	0.82	1.45	2.31	-1.97	-0.58	0.47	-1.99
Finland	-0.39	3.66	2.54	-2.67	-0.47	-0.75	1.45	-0.02	0.65	0.53	-3.38
France	0.08	-1.33	0.39	-1.12	-1.00	0.13	0.55	0.72	-0.64	0.52	-2.35
Germany	0.66	-0.44	-1.06	0.14	0.71	0.16	0.75	0.43	0.86	0.13	-1.26
Greece	1.72	-2.28	0.63	-0.19	-1.83	-1.08	1.93	-2.71	-0.84	-2.33	-3.42
Hungary	0.11	2.41	-0.77	-3.33	-0.05	0.02	-1.36	-1.23	5.70	2.15	2.04
Iceland	1.30	0.59	-2.23	-1.28	0.37	1.69	3.35	1.05	-1.43	-5.39	-6.71
Ireland	0.73	-2.07	-1.40	-0.01	1.69	-0.72	1.23	0.83	-1.85	-1.59	-7.06
Italy	1.96	-1.40	-0.73	0.41	-1.26	-0.05	-0.29	1.59	0.52	-0.05	-0.59
Japan	-2.40	0.26	1.55	-0.98	0.96	0.39	2.00	2.25	-0.22	0.86	-4.58
Korea	-0.47	2.63	0.96	0.62	-0.09	-0.49	0.74	0.51	-0.36	-1.85	-3.22
Luxembourg	-1.11	1.37	-1.24	-2.10	-0.77	-1.10	0.49	1.22	1.01	-0.50	-0.93
Netherlands	0.96	1.02	-0.34	-0.59	0.24	1.14	1.28	-0.55	-1.07	0.29	-2.97
New Zealand	-0.57	1.68	-0.17	1.66	-0.10	-0.02	0.39	1.35	-1.15	-3.02	-1.41
Norway	1.84	2.07	-1.01	-2.02	-1.47	1.09	1.55	1.59	2.11	0.01	-3.24
Poland	1.19	-1.71	-0.79	1.37	-1.12	-0.29	1.96	0.95	1.32	-1.26	-3.06
Portugal	0.80	-0.25	-1.04	1.02	1.02	-0.17	-1.08	1.10	-0.86	-0.16	-3.40
Slovak Republic	3.12	0.20	-0.90	-0.73	2.49	-0.14	1.30	-1.87	0.35	0.62	-1.45
Spain	0.80	-0.07	0.22	0.62	0.35	0.44	0.75	0.99	0.06	-4.28	-4.72
Sweden	0.59	0.54	2.60	-5.21	0.69	0.85	3.77	-0.79	0.82	1.46	-0.86
Switzerland	1.46	1.19	-0.61	0.13	0.03	-0.10	1.49	0.55	0.71	1.19	-0.27
United Kingdom	0.70	-0.46	-0.11	-2.66	-1.78	-0.34	0.62	1.16	-0.99	-0.14	-2.28
United States	-0.75	0.33	-0.95	-3.05	-0.07	0.07	1.35	0.42	-0.42	-1.90	-3.07

Source: OECD estimates.

Table C.6. **Relative contribution of house and equity price gaps to the asset price adjusted budget balance**

As per cent of potential GDP

	Australia		Austria		Belgium	
Period	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	-0.17	0.01	0.03	0.00	-0.03	-0.26
2001-2004	-0.03	-0.76	0.01	0.00	0.06	-0.07
2005-2007	1.90	-0.72	0.03	0.00	0.09	0.12
2008-2009	2.68	-0.66	0.04	0.00	0.05	0.74

	Canada		Czech Republic		Denmark	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	-0.18	0.07		0.00	-0.08	-0.01
2001-2004	0.36	-0.50	0.13	0.00	0.09	0.31
2005-2007	0.63	-0.94	-0.03	0.00	0.38	-0.98
2008-2009	0.64	0.02	0.08	0.00	0.43	-0.03

	Finland		France		Germany	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	-0.78	-0.43	-0.20	0.53	-0.21	0.07
2001-2004	0.33	-0.05	0.14	-0.35	0.18	0.09
2005-2007	0.82	-0.22	0.21	-0.78	0.30	0.19
2008-2009	1.17	-0.10	0.23	-0.26	0.11	0.24

	Greece		Ireland		Italy	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	0.12	0.00	-0.21	-1.39	-0.14	0.83
2001-2004	0.05	0.00	0.37	-1.60	0.34	0.31
2005-2007	-0.11	0.00	0.47	-0.82	0.67	-0.02
2008-2009	0.03	0.00	0.59	0.52	1.21	0.01

	Japan		Korea		Netherlands	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	-0.27	0.02	-0.94	0.09	0.00	-0.17
2001-2004	0.33	0.00	1.26	0.59	0.00	1.18
2005-2007	0.58	-0.29	2.09	1.01	0.00	0.74
2008-2009	0.27	-0.52	1.35	0.73	0.00	1.09

	New Zealand		Norway		Poland	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	0.00	-0.01	-0.08	-0.41	-1.04	0.00
2001-2004	0.00	0.06	-0.01	-0.05	-0.44	0.00
2005-2007	0.00	0.09	0.29	-0.36	0.26	0.00
2008-2009	0.00	0.07	0.41	0.10	0.66	0.00

	Portugal		Spain		Sweden	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	0.30	0.00	-0.37	1.42	-0.20	-1.17
2001-2004	0.88	0.00	0.57	-0.04	0.37	-0.41
2005-2007	0.45	0.00	1.03	-1.25	1.83	-0.40
2008-2009	0.30	0.00	1.13	-0.25	1.88	-0.10

	Switzerland		United Kingdom		United States	
	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE	EQUITY PRICE	HOUSE PRICE
1998-2000	-0.43	-0.92	-0.22	-0.07	-0.77	0.29
2001-2004	-0.15	-0.44	0.13	-0.81	-0.18	0.01
2005-2007	0.42	-0.10	0.98	-0.97	0.59	-0.31
2008-2009	0.64	-0.25	1.36	-0.08	0.67	0.07

Source: OECD estimates.

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