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Fundamental Drivers of House Prices in Advanced Economies

by Nan Geng

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Fundamental Drivers of House Prices in Advanced Economies

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Abstract

House prices in many advanced economies have risen substantially in recent decades. But experience indicates that housing prices can diverge from their long-run equilibrium or sustainable levels, potentially followed by adjustments that impact macroeconomic and financial stability. Therefore there is a need to monitor house prices and assess whether they are sustainable. This paper focuses on fundamentals expected to drive long-run trends in house prices, including institutional and structural factors. The scale of potential valuation gaps is gauged on the basis of a cross-country panel analysis of house prices in 20 OECD countries.

JEL Classification Numbers: C33, C51, E21, R21, R31

Keywords: Housing markets, House prices, Valuation gaps, OECD countries

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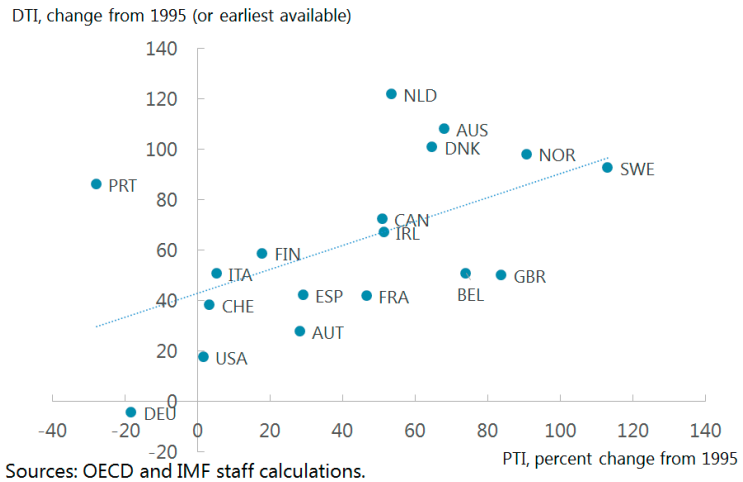
I. Introduction

Over the past two decades, house prices have risen faster than income in many advanced economies (AEs), leading to a strong uptrend in price-to-disposable income (PTI) ratios (Figure 1). These large price increases have been associated with significant increases in household debt, resulting in a similar rise in household debt-to-disposable income (DTI) ratios.

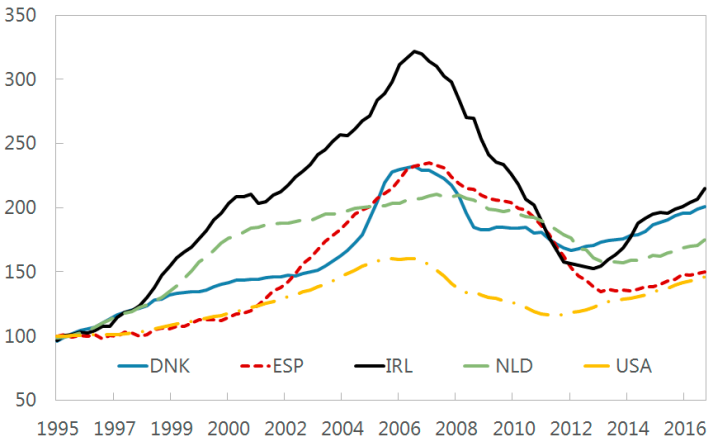
Figure 1. Uptrend in PTI and DTI Ratios in Selected AEs



Sources: OECD and IMF staff calculations.

Within this broad uptrend, sizable reversals of housing prices have also arisen around the global financial crisis (GFC), e.g., in Denmark, Ireland, and Spain, where prices have recovered to some extent but have remained below their pre-crisis peaks (Figure 2). Such reversals have had major macro-financial consequences, causing household deleveraging and reduced consumption, and, in some cases, weakened financial intermediation.

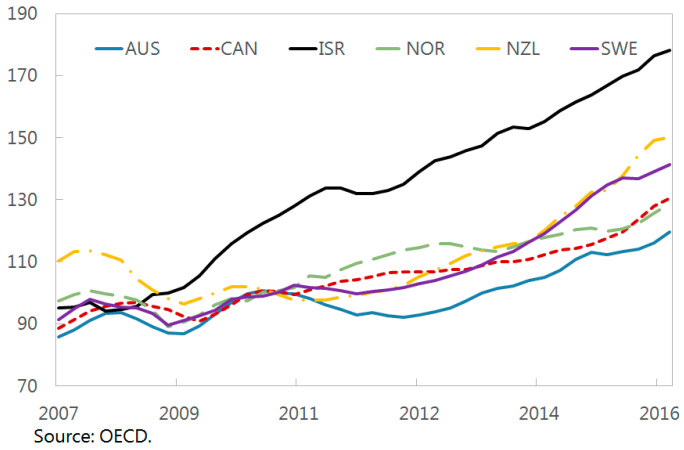
Figure 2. Real House Price Index (1995 = 100)



Source: OECD.

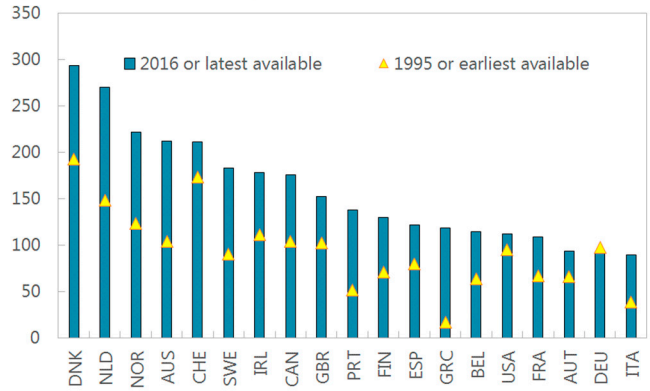
In contrast, some other AEs have experienced almost uninterrupted house price booms, with large price rises even after the GFC, seen in house price inflation reaching double digits and price levels and household debt ratios hitting record highs, e.g., in Sweden and Norway (Figure 3 & 4).

Figure 3. Real House Price Index
(2010 = 100)



Source: OECD.

Figure 4. Household Debt
(In percent of household net disposable income)

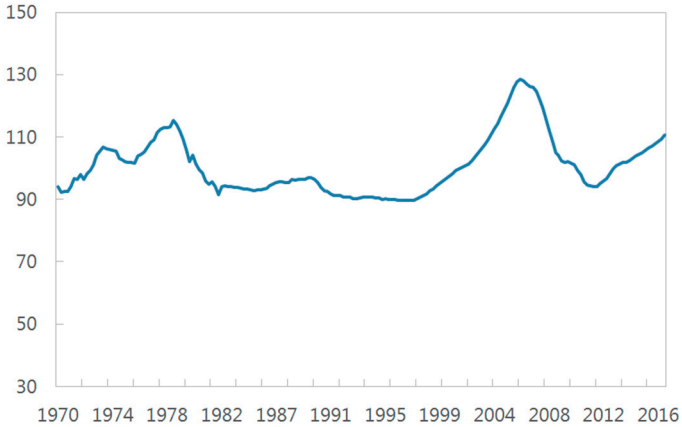


Sources: OECD and IMF staff calculations.

If increases in house prices become significantly disconnected from the fundamentals driving the supply and demand for housing, the market is likely to become more vulnerable to a price correction. This could pose significant risks to macroeconomic and financial stability through the housing market's impact on aggregate demand (i.e., residential construction and household consumption) and on the banking sector (OECD, 2011; Mian et al., 2013; ECB, 2009). Moreover, the high indebtedness that typically accompanies high housing prices tends to make the economy more vulnerable to asset price movements, which can amplify shocks and macroeconomic instability through the collateral channel (Hviid and Kuchler, 2017). Alongside monitoring household debt, it is also important to monitor house prices and assess whether housing valuations are sustainable.

The most commonly used valuation benchmarks for house prices are long-run averages for the PTI ratio and the price-to-rent (PTR) ratio. Despite being a useful metric for affordability, the PTI ratio is not ideal for assessing the sustainability of housing valuations, because deviations from historical averages may reflect fundamental drivers of house prices besides income, e.g., interest rates. The PTR ratio compares house prices to the user cost of housing (Poterba, 1992), which has the advantage of summarizing the impact of a range of fundamentals while avoiding speculative factors. The PTR ratio appears quite informative for markets like the U.S. (Figure 5), but doesn't work well in countries where rental data don't reflect market costs due to rent controls e.g. Sweden, or a thin rental market e.g. Norway.

Figure 5. Price-to-Rent Ratio: United States
(Index, 2010 = 100)



Source: OECD.

Another approach in the literature is to model housing prices using multivariate econometric analysis—including factors such as disposable income, interest rates, demographics, and supply factors influencing the available housing stock—and to use these models to estimate the extent of any disequilibrium in housing prices. Girouard *et al.* (2006) and Turk (2015) provide summaries of this work for AEs. While this approach reduces the risk of omitting factors that determine sustainable house prices, the effects of policy changes related to housing are not often captured.

This paper aims to assess housing valuation risks by modelling the sustainable levels of house prices for 20 AEs in the OECD.[2] A novel contribution of the paper is its focus on the role of policy, institutional, and structural factors—i.e. tax incentives for home ownership, rent controls, and the long-run supply responsiveness of housing construction—in shaping long-run house price trends. Given the slow-moving nature of these factors, modelling their impact requires a cross-country panel methodology. Hence the paper provides estimates of the differential impact of policy and structural factors on house prices across countries in addition to consistent estimates of valuation gaps for 20 AEs.

[2] The 20 countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Israel, Italy, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

The paper is structured as follows. Section II discusses the driving forces behind the long run uptrend in house prices, including demand, supply, institutional, and structural factors. Section III lays out the cross-country model of long-run equilibrium housing prices, which seeks to take into account policy, institutional, and structural factors. Section IV presents estimation results using data from 20 OECD countries and discusses empirical findings. Section V concludes.

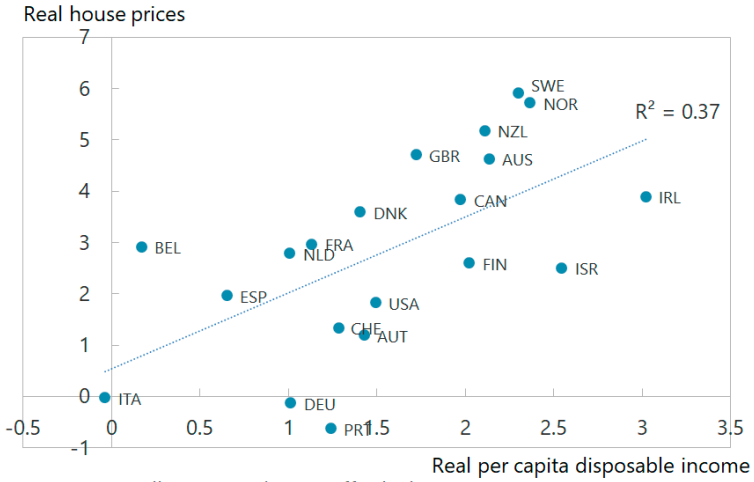
II. Fundamental Determinants of House Prices

Theoretical models, *e.g.,* Skaarup and Bodker (2010), and the empirical literature on the housing market, suggest that over the long-run house prices depend positively on disposable income, wealth, and demographic needs, and negatively on user costs and the housing stock. This section illustrates developments in these factors for the AEs. It also presents the data developed for policy, institutional, and structural factors that can affect house price dynamics through their influence on housing demand and supply, e.g., tax policies, rental market regulations, and factors affecting housing supply such as land and building regulations.

Demand Factors

Household disposable income plays a key role in shaping house price trends. The higher the real per-capita disposable income (RPDI) of households, the more they can spend to purchase a house or service a mortgage, pushing up house prices. Average annual growth in RPDI is positively correlated with that for house prices in our sample countries (Figure 6). Interestingly, this bivariate relationship has a slope exceeding unity.

Figure 6. House Prices and Per Capita Disposable Income
(Average annual percent change from 1995: Q1 to 2016: Q4)

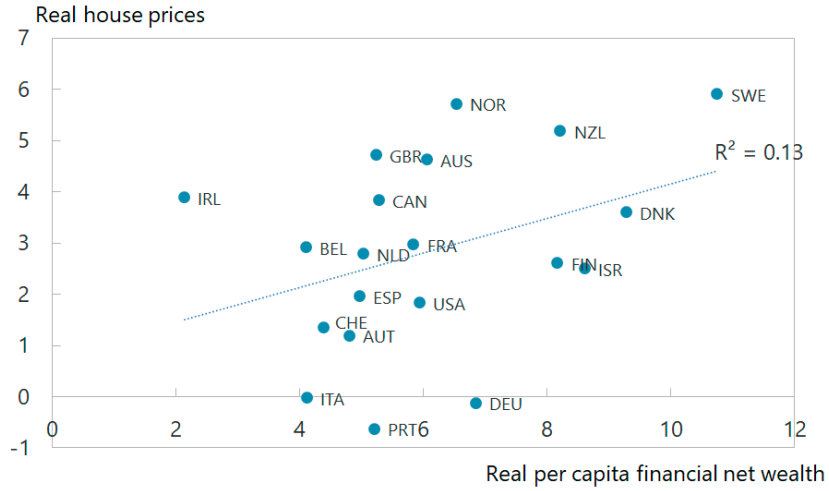


Sources: OECD, Dallas FED, and IMF staff calculations.

Household net financial wealth also appears to be a determining factor of house prices. The accumulation of financial net wealth by households has exerted upward pressure on housing demand and contributed to the rise in house prices (Figure 7). For example, Claussen

(2013) finds that of the rise in house prices in Sweden since the mid-1990s, about 60 percent can be explained by the increase in real disposable income, while the rise in household real financial wealth accounts for slightly under 10 percent of the increase.

Figure 7. House Prices and Per Capita Financial Net Wealth
(Average annual percent change from 1995: Q1 to 2016: Q4)



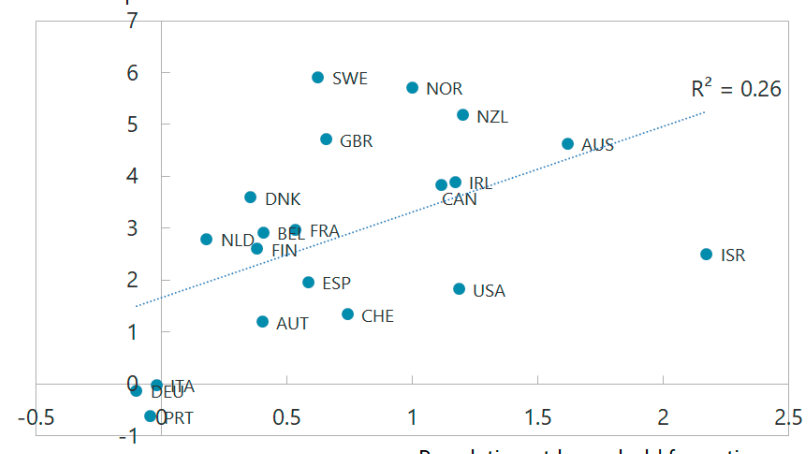
Sources: OECD, Dallas FED, and IMF staff calculations.

Housing demand has also been fueled by declining interest rates. Interest rates have gone down substantially since 2000 and stayed low in recent years, with real rates falling close to or below zero in many countries. These falls reduce the user cost of housing through savings on financing costs. In addition, housing investment returns have held up as long-term bond yields declined along with the slide of policy rates, which stimulated housing purchases for investment purposes. From studies on advanced countries, the semi-elasticity of real housing prices with respect to interest rates ranges between close to zero and 6 percent.[3]

Demographic trends reinforced the high demand for owner-occupied housing. Population growth, including from high rates of net migration, together with increases in the share of the population in the age group for household formation, will boost housing demand. In many AEs—including Australia, Ireland, Israel, New Zealand, Norway—the fast growth of population at household formation ages since the mid-1990s has been associated with large increases in real house prices (Figure 8).

[3] See Turk (2015) for a summary of findings from the literature.

Figure 8. House Prices and Population
(Average annual percent change from 1995: Q1 to 2016: Q4)

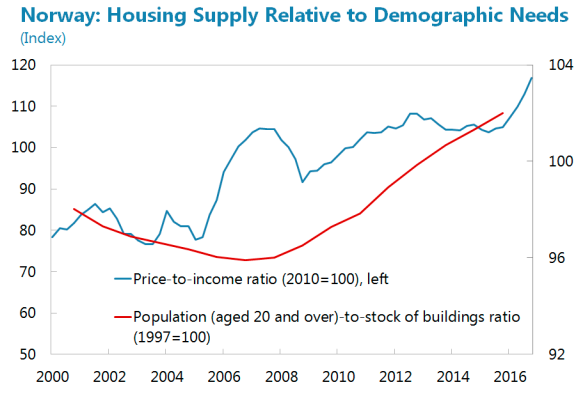


Sources: OECD, Dallas FED, and IMF staff calculations.

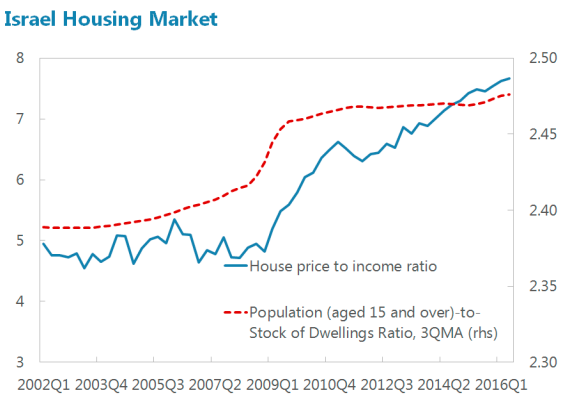
Supply Factors

Undersupply conditions can also contribute to housing price gains outpacing incomes. Over recent decades, residential investment has grown significantly in many countries, but it remained below demographic needs and significant housing supply shortages accumulated in some. For example, in Norway and Israel, lags in supply responses to demographic needs have resulted in continued increases in the ratio of population to the stock of dwellings over the past decade or more, associated with prices rising faster than incomes (Figure 9). In the case of Sweden, a prolonged period of underinvestment in housing has been identified as a key driver of Sweden's house price inflation (IMF, 2016; European Commission, 2017).

Figure 9. PTI Ratios and Housing Supply Relative to Demographic Needs



Sources: OECD, Statistics Norway, and Fund staff calculations.



Sources: CBS, Haver, and Fund staff calcuations.

Structural and Institutional Factors

Differences in price elasticities of housing supply can affect house price dynamics. Subject to a given increase in long-run demand, markets with an inelastic (steeper) long-run supply curve will not build as much new dwellings as markets with elastic supply, resulting in greater increase in prices (Figure 10; Anundsen et al., 2016). Divergences in housing supply elasticities may reflect both natural (i.e. topographical) and man-made constraints (e.g. stringent local regulations on land use, cumbersome building permit procedures, and capacity constraints in the construction sector). To take these structural differences in the supply side into account, long-run supply elasticities for each of the 20 OECD countries in the sample are estimated separately using quarterly data for 1989-2016 based on the methodology of Caldera Sanchez *et. al*. (2011) using a system of long-run price and investment equations. The derived long-run price elasticities of new housing supply vary greatly from about 0.2 in Switzerland to 1.6 in the US (Figure 11), indicating that it is important to allow for differences in the slope of the long-run housing supply curve.

Figure 10. Low Supply Response to Rising Demand Can Amplify Price Increases

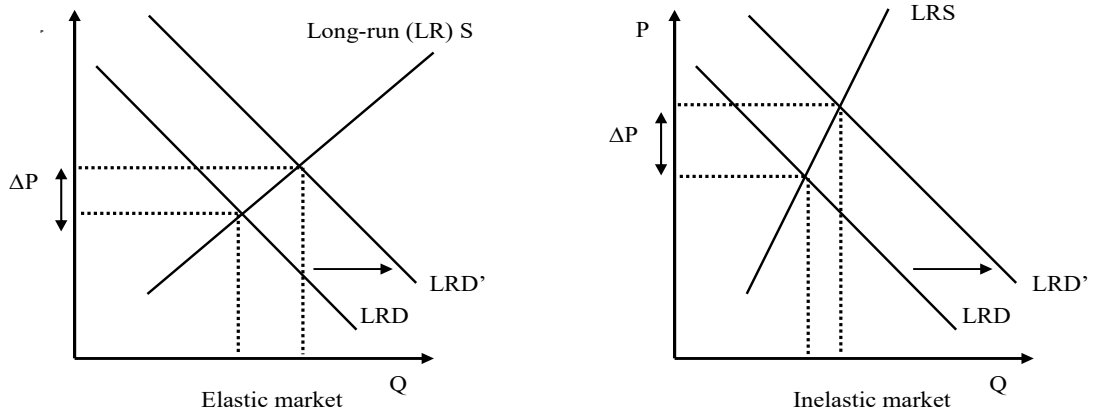
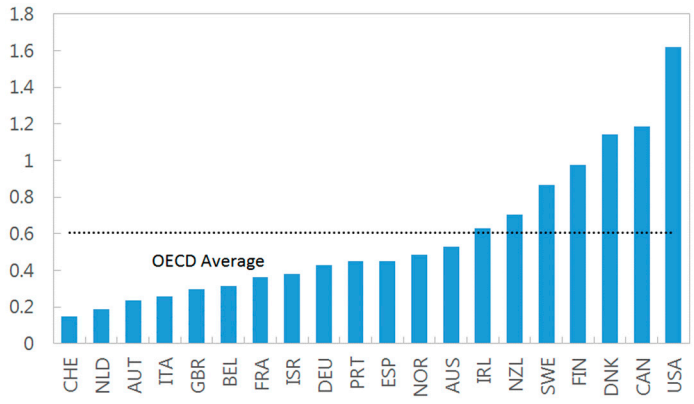


Figure 11. Estimated Long-Run Housing Supply Elasticity 1/



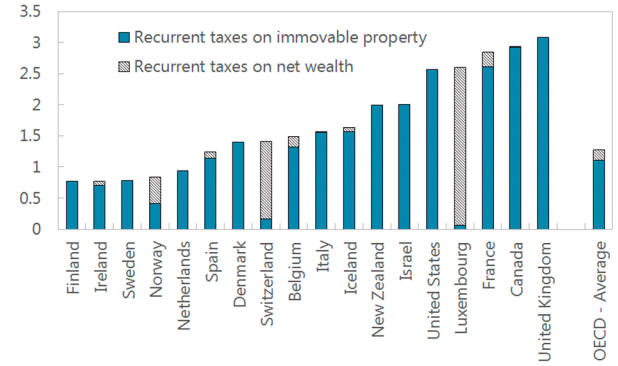
Sources: OECD and IMF staff estimates.

1/ The long-run elasticity of real dwelling investment with respect to real housing prices is estimated using 1989Q1-2016Q4 data based on the methodology used in Caldera Sanchez et. al. (2011).

Tax incentives for mortgage financing and home ownership, which reduce the user cost of housing, can contribute to high and rising house prices.[4] In many AEs, housing investment receives favorable tax treatment relative to other investment. This favorable tax treatment on housing investment may crowd out capital from more productive use than housing and encourage excessive leverage (OECD, 2009; Geng et al., 2016).

- Typically, capital gains taxes are exempted, deferred, or reduced for principle residences after a certain holding period, while such an exemption is usually not granted to other types of investment (ESRB, 2015). In some cases, the economic importance of recurrent property taxes is reduced by low tax rates and outdated or below-market cadastral values (Figure 12; OECD, 2011).

Figure 12. Recurrent Taxes on Residential Property
(Percent of GDP; in 2015)



Sources: OECD and staff calculations.

- Many countries grant tax relief on mortgage interest payments, thereby incentivizing households to borrow more and purchase more expensive houses (Andrews, 2010). Mortgage interest deductibility (MID) is usually capped at a nominal amount, but is unbounded in some cases, e.g., the Netherlands, Sweden, and Norway (Table 1). This tax relief tends to be capitalized into house prices, without necessarily expanding housing opportunities for households (Capozza et al., 1996; Harris, 2010). Several countries have implemented reforms to gradually phase out or reduce MID in recent years. For example, Portugal and Spain have removed MID since 2012 and 2013,[5] respectively, and in Ireland from 2018. More gradual and/or moderate reductions of MID have been adopted in Denmark, Finland, and the Netherlands. We have therefore updated the 2009 tax relief index from the OECD to take these reforms into account.[6]

[4] Key elements of user cost of owner-occupied housing include adjusted mortgage interest costs for tax deductibility, maintenance costs, property taxes, and expected net capital gains (Poterba, 1984).

[5] Loans taken out before end-2011 in Portugal, and before end-2012 in Spain, still enjoy MID in the form of a tax credit at 15 percent of the interest payment up to a ceiling.

[6] This OECD index takes into account if interest payments on mortgage debt are deductible from taxable income, if there are any limits on the allowed period of deduction of the deductible amount, if tax credits for loans are available, and if imputed rent from home ownership is taxed.

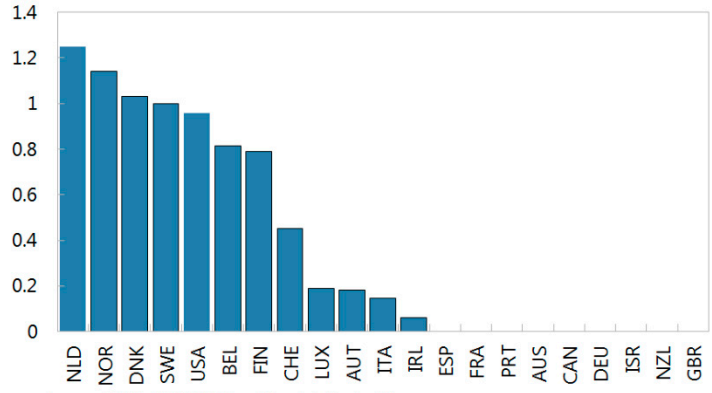
According to this indicator, as of 2016 tax relief is most generous in the Netherlands and effectively zero in countries where mortgage loans are not tax favored (Figure 13).

Table 1. Current MID from Personal Income Taxes and Recent Reforms in Selected AEs

	Denmark	Finland	Ireland	Netherlands	Norway	Spain	Sweden	UK
Rate of deductibility (in percent)	32.7	35 for capital income deduction	Removed from 2018 (Until 2017: Up to 30 percent for first-time homebuyers, and up to 15 percent for others.)	100 percent for pre-2013 loans; 100 percent for post-2013 fully amortizing loans (within 30 years)	100 (full deduction)	0 for properties purchased after Jan 1, 2013	30 deduction against tax liabilities	0
Caps/notes/recent reforms	Reduced from 32.7 percent in 2012 to 25 percent in 2019 (27 percent in 2017) for annual mortgage interest expense over DKK 50,000	Reduced from 65 percent in 2016 to 25 percent in 2019; 30 percent for the excess interest expense over capital income against income tax, up to EUR 1,400 per year (32 percent for first-time homebuyers)	Deductibility varies by origination date (only 2004-12), and borrower's marital status	The maximum tax rate at which mortgage interest can be deducted has been reduced by 0.5 points per year from 52 percent in 2013, to 38 percent in 2041 (49.5 percent in 2018) 1/		15 percent deduction up to EUR 9,040 per year, for properties purchased before Dec 31, 2012	Reduced to 21 percent for annual mortgage interest expense over SEK 100,000	Mortgage interest relief at source abolished in 2000

Sources: National tax and other authorities; Bourassa et al. (2013); Smidova (2016).
1/ The recently released coalition agreement proposes a much more rapid phase-out in steps of 3 percentage points annually until the basic rate of 37 percent is reached in 2023, but this is still subject to approval by the parliament.

Figure 13. Tax Relief for Housing Finance, 2016
(Index; increasing in degree of tax relief)

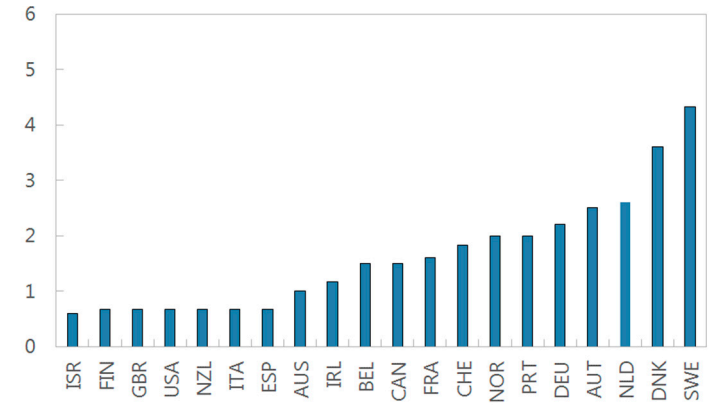


Sources: OECD, ESRB (2015), and Fund staff calculations.
Note: This indicator takes into account if interest payments on mortgage debt are deductible from taxable income, if there are any limits on the allowed period of deduction or the deductible amount, if tax credits for loans are available, and if imputed rent from home ownership is taxed.

Rent controls, by reducing incentives to use housing efficiently, tend to raise house prices. The option to rent housing provides a potential check on house price pressures. Rent controls, however, can create "lock-in" effects where renters remain in space that may exceed their needs, reducing the effective housing supply and creating queues that make renting a less viable alternative. We have therefore updated the 2009 rent control index from the OECD taking into account recent reforms, e.g., the 2013 reform in Spain (Figure 14).

According to this indicator, Sweden currently has the most stringent rent controls among OECD countries, which has resulted in a declining supply of rental apartments as they are converted into tenant-owned condominiums. Waiting times for rental apartments average at 10 years, leaving many households with no option but to purchase housing, which is also incentivized by the generous tax deductibility of mortgage interest payments (IMF, 2017).

Figure 14. Rent Control 1/
(Scale 0–6, increasing in degree of control)



Sources: OECD, Cuerpo et. al. (2014), and Fund staff estimates.
1/ The indicator is a composite indicator of the extent of controls of rents, how increases in rents are determined and the permitted cost pass-through onto rents in each country.

III. A Cross-Country Model of Trends in House Prices

The long-run relationship between real house prices and their potential determinants discussed above is modelled in a cross-country setting. Following the literature on modelling the housing market,[7] housing demand (D) can be expressed as a function of the real price level of housing (P) and other factors shifting demand (summarized in X). In the long run, the equilibrium price of housing (P^*) is that at which the demand for housing matches the stock of housing (S):

$$D(X, P^*) = S \qquad (1)$$

With households maximizing an inter-temporal utility function with non-separability between housing and non-housing consumption (Skaarup and Bodker (2010)), the long-run housing price (p^*) can be derived as a reduced form of its fundamental determinants, which include real per capita household disposable income y_{it}, user cost of housing $user\ cost_{it}$, real per capita household net financial wealth w_{it}, and the housing stock per capita s_{it}.[8]

[7] See Meen (2001), Aoki et al. (2002), and Poterba (1984), etc.

[8] The aim of this paper is not to achieve the best fitting model of house prices, but to account for their long-run trends with factors that are not highly dependent on housing prices, as a basis for estimating the sustainable level of house prices. Credit is not included in the model because it can be driven by house prices; higher house prices increase the debt needed to purchase housing while also expanding the value of collateral for borrowing.

$$p_{it}^{*} = f(y_{it}, user\ cost_{it}, w_{it}, s_{it}) \quad (2)$$

In practice, actual house prices will not always be at the long-run equilibrium, such that for each country *i*, and time *t*, there is an error term ε_{it}^{p} between the observed price p_{it} and the long-run equilibrium real house prices p_{it}^{*} which gives the following formula for p_{it}:

$$p_{it} = p_{it}^{*} + \varepsilon_{it}^{p} = f(y_{it}, user\ cost_{it}, w_{it}, s_{it}) + \varepsilon_{it}^{p} \quad (3)$$

In the estimated equation, the user cost would ideally be captured by the real after-tax interest rate for mortgage borrowing. In practice, for most countries it is difficult to calculate the effective after-tax interest rate, so we use the updated version of tax relief index from the OECD tr_{it} (discussed in Section II) to proxy for the generosity of tax incentives for home ownership and mortgage financing. The value of tax incentives for housing will tend to rise with household income, which is captured by including an interaction term between tax relief and income, although the level of debt may also shape the value of this relief. A square term of the real mortgage rate is also added to capture any non-linear relationship between house prices and interest rates following the present value formula.

In addition, the updated OECD rent control index rc_{it} (discussed in Section II; rescaled to 0-1) is added to test the impact of rent control, by interacting it with housing supply s_{it} as it is expected to hinder the efficient use of existing housing stock. To test whether the long-run impact of demand factors depends on the elasticity of housing supply, we include additional interaction terms of the demeaned long-run supply elasticities sr_i with demand variables in the full augmented model. Therefore, the total long-run impact of demand factors can vary across countries. In summary, the long-run relationship between real house prices and their potential determinants is estimated in a cross-country panel model as follows:

$$p_{it} = (\beta_1 + \beta_2\, sr_i) * y_{it} + (\beta_3 + \beta_4\, sr_i) * morr_{it} + (\beta_5 + \beta_6\, sr_i) * w_{it} + (\beta_7 + \beta_8\, rc_{it}) * s_{it} + \beta_9\, y_{it} * tr_{it} + \beta_{10}\, morr_{it}^{2} + \alpha_i + \varepsilon_{it}^{p} \quad (4)$$

The error term, which is used to gauge the extent of possible housing valuation gaps, is expected to be stationary, i.e., equation (4) is a cointegrating relationship. Country fixed effects are included to reflect unobserved cross-country differences affecting price levels.

Annex I summarizes the definition of variables and data sources. All variables are in log terms except for mortgage rates, the housing stock to population ratio, the tax relief and rent control indices, and long-run supply elasticities. In addition, robust standard errors are clustered at the country level to allow for an arbitrary variance-covariance matrix within each country. The estimation sample includes 2042 observations for 20 advanced countries in the OECD over the period of 1990: Q3–2016: Q4.

IV. Empirical Findings

The estimation results on long-run determinants of real house prices under different model specifications are presented in Table 2. Column (2) is the baseline and columns (3–5) show results under augmented model specifications that take into account policy, institutional, and structural factors. The explanatory variables all have the expected sign and most are statistically significant. The residuals are confirmed to be stationary, i.e., equation (4) is a cointegrating relationship.

Table 2. A Cross-Country Panel Model: Long-Run Determinants of Real House Prices

Variables	(1)	(2)	(3)	(4)	(5)
y , log	1.652	1.638	1.538	1.544	1.533
	[0.034]***	[0.034]***	[0.036]***	[0.036]***	[0.037]***
morr , percent	-1.922	-2.759	-2.234	-2.116	-1.776
	[0.214]***	[0.431]***	[0.431]***	[0.432]***	[0.426]***
morr^2 , percent		0.079	0.066	0.051	0.058
		[0.035]**	[0.034]**	[0.033]	[0.032]*
w , log	0.031	0.033	0.023	0.020	0.056
	[0.008]***	[0.009]***	[0.009]**	[0.009]**	[0.010]**
s, percent	-1.070	-1.080	-0.943	-1.267	-1.322
	[0.062]***	[0.062]***	[0.063]***	[0.103]***	[0.102]***
*tr * y* (log)			0.362	0.351	0.487
			[0.048]***	[0.047]***	[0.046]***
*rc * s* (percent)				1.156	0.436
				[0.294]***	[0.230]*
*sr * y* (log)					-0.007
					[0.141]
*sr * morr*					1.133
					[0.154]***
*sr *w* (log)					-0.060
					[0.033]*
Obervations	2042	2042	2042	2042	2042
Adj. R-squared	0.853	0.853	0.856	0.857	0.867
Number of countries	20	20	20	20	20
Country fixed-effect	Y	Y	Y	Y	Y
Corrected for heteroskedasticity	Y	Y	Y	Y	Y
Panel Cointegration Tests for Model (5)					
Kao (Engle-Granger based)		*t-Statistics*	*-3.806*	*Prob.*	*0.0001*
Panel Unit Root Test on Residuals of Model (5)					
Levin, Lin & chu t		*Statistics*	*-2.705*	*Prob.*	*0.003*

Note: Dependent is the log of real house prices. Significance at 1, 5, and 10 percent levels indicated by ***, **, and *, respectively. Robust standard errors clustered at the country level.

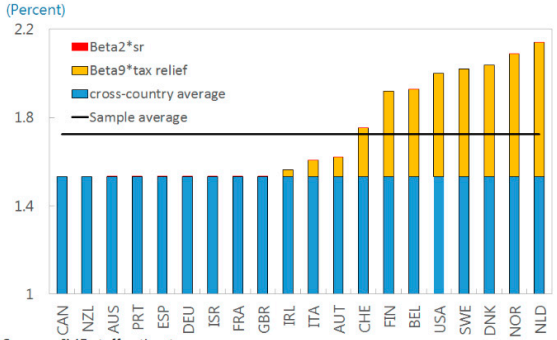
The estimated long-run impact of fundamental demand and supply factors are consistent with priors and statistically significant. On the demand side, a 1 percent rise in per capita disposable income raises long-run equilibrium house prices by a cross-country average of 1.5–1.7 percent, suggesting that housing is a luxury good, accounting for much of

the uptrend in PTI ratios.[9] Meanwhile, a 1 percentage point increase in the real mortgage rate reduces real house prices by a cross-country average of about 1.8–2.8 percent. In addition, real per capita household net financial wealth has a small positive impact on real house prices. On the supply side, a 1 percent increase in the housing stock per capita is associated with a reduction in house prices by about 1.3 percent in countries with no rent control.

The impact of demand and supply factors on long-run house prices varies across countries depending on policy and structural factors:

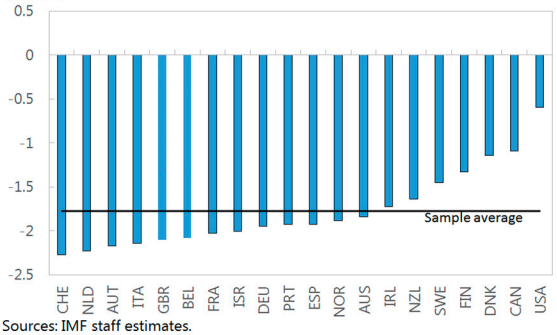
- Depending on the generosity of tax relief (and the long-run supply elasticities), a 1 percent increase in per capita disposable income results in different impacts on house prices across countries, with the largest impact of 2.1 percent seen in the Netherlands and the least impact of 1.6 percent seen in countries where housing finance is not tax favored, such as Canada (Figure 15).
- With varying long-run supply elasticities, the same increase in mortgage rates can have significantly different long-run impacts on house prices across countries, with an amplified impact seen in less elastic markets (e.g., Switzerland) and a moderated impact seen in more elastic markets, e.g. the US (Figure 16).
- As expected, rent controls are found to offset part of the dampening effects of supply increases on real house prices, confirming that controls hinder the efficient use of the housing stock. This efficiency impact is concentrated on countries with the most stringent controls (Figure 17). In the case of Sweden, which has the most stringent rent control in our sample, a 1 percent

Figure 15. Variation in Estimated Long-Run Impact of One Ppt Increase in Income on House Prices



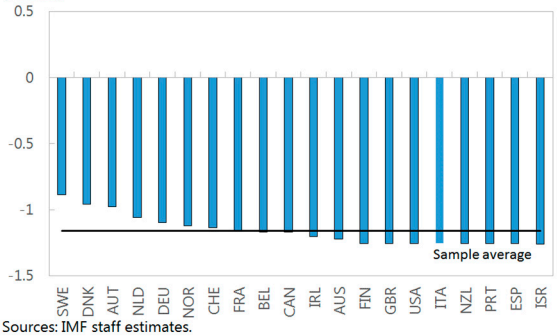
Sources: IMF staff estimates.

Figure 16. Variation in Estimated Long-Run Impact of One Ppt Increase in Real Mortgage Rate on House Prices



Sources: IMF staff estimates.

Figure 17. Variation in Estimated Long-Run Impact of One Ppt Increase in Housing Stock Per Capita on House Prices



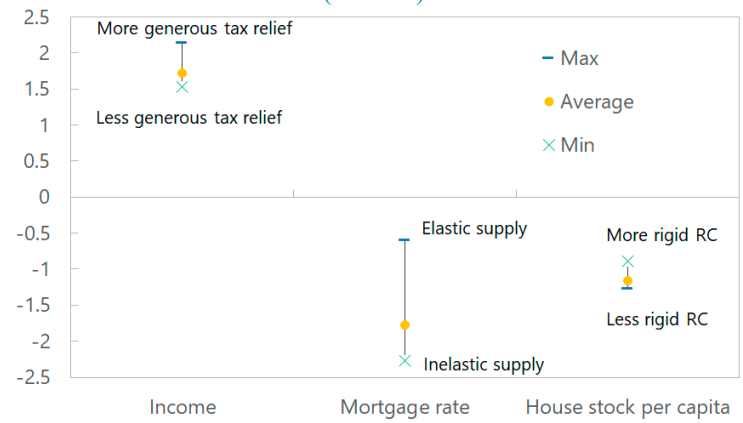
Sources: IMF staff estimates.

[9] Our estimates are consistent with findings by studies for AEs, as summarized by Girouard *et al.* (2006). In addition, more recent studies find a similar magnitude of this parameter, e.g. 1-1.3 as estimated by Andrews (2010) for 15 OECD countries and 1.3 as estimated by Turk (2015) for Sweden.

increase in the housing stock per capita reduces long-run house prices by only 0.9 percent compared with 1.3 percent in countries without rent control.

In summary, the estimation results confirm that policies and structural factors play an important role in shaping long-run house price developments (Figure 18). Tax relief on housing investment contributes to spurring housing demand and driving up house prices, with a positive income shock translating into a greater price impact in countries with more generous tax relief. For example, phasing out tax relief on mortgage financing and rent controls in Sweden is estimated to help reduce house prices by about 4 percent in the long run. Meanwhile, the long-run responsiveness of supply seems to primarily affect house price elasticities with respect to mortgage rate, with larger long-run impact on real house prices in markets with less elastic supply. In addition, rent control reduces the impact of supply increases on house prices, but the impact is more moderate.

Figure 18. Cross-Country Variation in House Price Elasticities with Respect to Demand and Supply Shifters
(Percent)



Source: IMF staff estimates.

Country-by-country results are presented for augmented model estimates in column (5). The long-run relationship broadly captures trends in housing prices since the early 1990s in most countries (Figure 19).[10] The model suggests that overvaluation was widespread in the years leading up to the GFC. In some countries, the fall in house prices after the GFC is estimated to have put the market into undervaluation territory. Among those countries, house prices have recovered thereafter, and as of end-2016 can be grouped as: (i) those estimated to remain undervalued (Denmark, Finland, Germany, and the US); (ii) those estimated as broadly fairly-valued (Ireland, Israel, Portugal, and Spain); and (iii) those back into overvaluation territory (Australia, Austria, the Netherlands, and New Zealand).[11] Meanwhile, some other countries experienced limited housing price corrections after the GFC and are

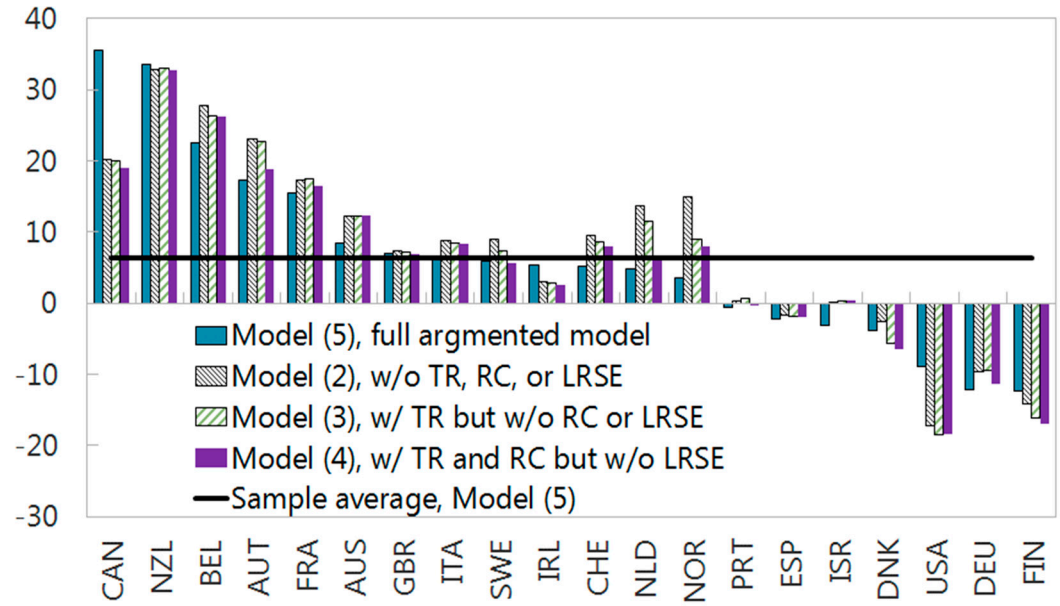
[10] For Belgium, France, and Germany, the gaps between the estimated long-run equilibrium and actual housing prices are sizable for prolonged periods, as further discussed below.

[11] The grouping of countries here is based on similarities in empirical results, and is not definitive.

either: (i) estimated to be overvalued as of end-2016 (Canada, Norway, Sweden, and the United Kingdom); or (ii) experiencing persistent overvaluation (Belgium, France, Italy, Switzerland).[12]

The model estimation suggests on average a modest overvaluation of 6 percent on current fundamentals including policy and structural factors. As illustrated in Figure 20, in most cases the valuation gaps are similar across model specifications. For model (5), estimated housing valuation gaps as of 2016: Q4 range from 12 percent undervaluation in Finland to 35 percent overvaluation in Canada. However, real mortgage rates are well below their average since 2000 so they may unwind to some extent over time. This would lower equilibrium housing prices, implying that house prices could be more overvalued than estimated if allowing for a normalization of interest rates. For example, based on our model estimates, a 2 percentage point increase in the real mortgage rate would reduce house prices by about 4–6 percent in equilibrium, implying that house prices could be up to 12 percent overvalued on average in our sample countries.

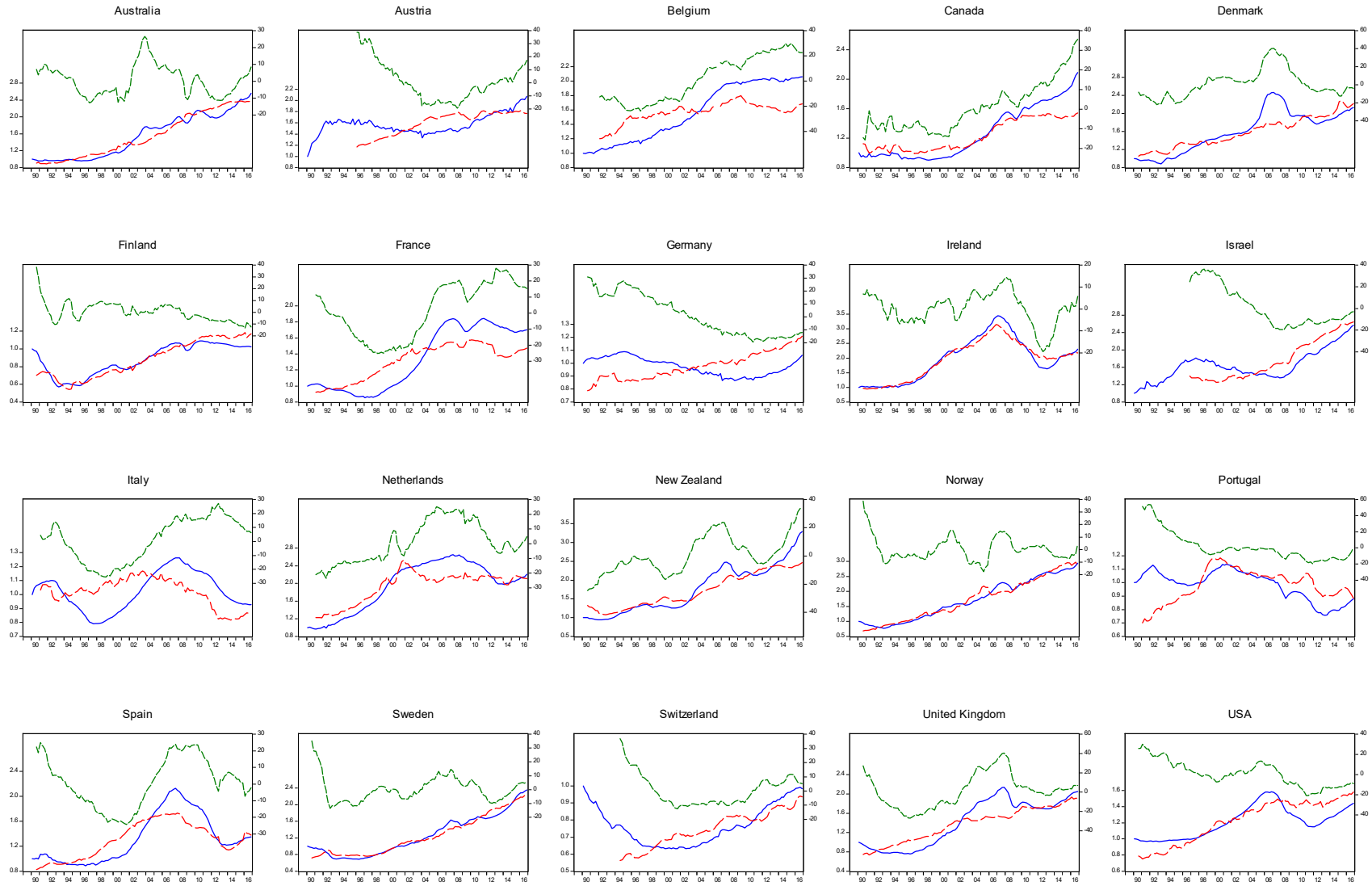
Figure 20. Housing Valuation Gap Under Different Model Specifications
(Percent, as of 2016: Q4)



Sources: IMF staff estimates.
Note: TR=tax relief; RC=rent control; and LRSE=long-run supply elasticities.

[12] While our model points to a positive valuation gap—which has been shrinking since 2012 as household disposable income recovers—for Italy, the Italian central bank's housing model—which takes into account also lending conditions—finds that house prices in Italy have remained in line with fundamentals during both the GFC and sovereign debt crisis.

Figure 19. Actual and Estimated Long-Run Equilibrium House Prices, and Estimated Valuation Gaps in Selected OECD AEs



Note: Blue and red lines represent actual and estimated long-run equilibrium house prices, respectively; and green lines (RHS) refer to valuation gaps in percent.

The estimated valuations from this exercise should be interpreted with caution. As for any econometric analysis, the estimated equilibrium price levels are subject to uncertainty. Moreover, for several countries, i.e., Belgium, France, and Germany, the estimated gaps seem prolonged with actual prices only crossing equilibrium levels once. Although the case of the Netherlands indicates that it is possible for prolonged gaps to eventually be corrected, it may be that housing markets in these countries have some characteristics that are not fully captured by the model, suggesting additional caution be taken when interpreting the results.[13] In addition, any valuation at the country level risks concealing highly heterogeneous valuation developments at the regional level.[14]

V. CONCLUSIONS

Assessing the sustainability of house price developments has become an integral part of macro-financial surveillance. Many AEs have experienced a remarkable run-up in their national housing markets in the past two decades and in some cases house prices have remained strong in recent years. Understanding housing price developments and monitoring the extent to which house prices deviate from levels supported by long-run fundamental factors are important for assessing risks to financial and macroeconomic stability.

This paper models house prices on a cross-country basis seeking insights on deviations from sustainable valuations. Based on standard theory, it selects a small set of supply and demand fundamental drivers of house prices to model long-run equilibrium house prices in 20 AEs in the OECD. The novel feature of the model is the incorporation of policy, institutional, and structural factors—i.e. tax incentives for home ownership, rent controls, and the long-run supply responsiveness of housing construction. The estimated long-run relationship broadly captures trends in housing prices since the early 1990s. Hence, the uptrend in real housing prices largely reflects fundamentals, especially rising real disposable incomes. On average, the overvaluation of housing prices on current fundamentals is modest, but there are significant variations in the estimated valuation gaps across our sample.

Policy, institutional, and structural factors are found to be important determinants of long-run equilibrium house prices. The impact of shocks to the traditional demand and

[13] For example, the Belgian central bank's housing model and the Selected Issues paper of the 2015 Article IV Consultation with Belgium—which take into account a number of structural and financial factors such as the reduction in household size and tax policy changes—find that house prices in Belgium were close to equilibrium in the years following the GFC and have become overvalued only in the most recent years (by 11 percent at peak in 2015 and by 6.5 percent on average in 2017).

[14] For example, while the overall long-run supply elasticity is high in Canada, Toronto and Vancouver have much lower supply elasticities than the rest of Canada. With aggregate overvaluation being driven by Toronto and Vancouver, model (5) may have overestimated the valuation gap. In this case, it may be that model (4)—which does not include long-run elasticity of supply—provides a more accurate estimate, as it is also in line with findings of the Bank of Canada.

supply factors on long-run house prices varies significantly across countries depending on policies and structural factors. In particular, more generous tax relief, stricter rent control, and below-average long-run supply responsiveness are found to drive up house prices.

In this regard, structural reforms in the housing market should be considered alongside macroprudential instruments. Structural reforms can over time improve housing affordability, thereby reducing debt accumulation and enhancing financial stability**.** These structural reforms include, but are not limited to, reforms to raise the long-run elasticity of housing supply, phasing out rent control, and reducing tax incentives for home ownership and debt financing. Such instruments may complement and support the more commonly used macroprudential tools such as limits on loan-to-value ratios, as the impact of reforms on supply and demand fundamentals may shape longer-term expectations in the housing market.

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Annex I: Variable Definitions and Data Sources

Variable	Definition / Note	Source
p	Real house price index, in log terms, seasonally adjusted	OECD.
y	Real per capita household personal disposable income, in log terms, seasonally adjusted.	Haver Analytics, national statistics websites.
$morr$	Real mortgage rate, in percent. Calculated as weighted nominal mortgage rate (all maturities) minus the HICP inflation rate.	Haver Analytics, national statistics websites.
w	Real per capita household net financial wealth, in log terms.	OECD, Haver Analytics, and national statistics websites. Quarterly data is generated by interpolating annual data using a cubic spline.
s	Housing stock per capita, ratio.	OECD, Haver Analytics, national statistics websites, and country authorities.
tr	Index of tax relief on housing finance. The indicator takes into account whether interest payments on mortgage debt are deductible from taxable income, if there are any limits on the allowed period of deduction or the deductible amount, if tax credits for loans are available, and if imputed rent from home ownership is taxed.	OECD, ESRB (2015), IMF country staff reports, country authorities, and Fund staff calculations.
rc	Index of the strictness of rent controls. A composite indicator of the extent of controls on rents, how increases in rents are determined, and the permitted pass-through of cost into rents in each country.	OECD, Cuerpo *et. al.* (2014), IMF country staff reports, and Fund staff calculations.
sr	Long-run elasticity of real dwelling investment with respect to real housing prices.	Estimated using 1989: Q1–2016: Q4 data based on the methodology used in Caldera Sanchez *et. al.* (2011).