Wealth-to-Income Ratio, Housing Returns, and Systemic Risk

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Abstract

We show that the residuals of the trend relationship among asset wealth and labour income predict housing returns. In particular: (i) when housing asset are complements of financial assets, investors demand a higher housing risk premium if they are hit by a shock that generates a fall in the wealth-to-income ratio; (ii) when housing assets are substitutes of financial assets, investors demand a lower housing return if they face a fall in the wealth-to-income ratio. Finally, we show that the transmission of wealth shocks to housing markets is amplified at periods of systemic crises.

Keywords: Asset wealth; labour income; housing returns; systemic risk.
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1. Introduction

It is well known that, despite reflecting the ability of an asset to insure against consumption fluctuations (Sharpe, 1964), risk premium is not well captured by the covariance between asset returns and contemporaneous consumption growth (Breeden et al., 1989). As a result, the asset pricing literature has highlighted that inefficiencies of financial markets (Fama and French, 1996) and time-variation in investment opportunities (Constantinides, 1990; Duffee, 2005) also help explaining the counter-cyclical behaviour of expected excess returns.

Another strand of research has explored the macro-financial linkages, namely, by developing empirical proxies that capture time-variation in expectations about future stock returns. The seminal work in this area is notably the one of Lettau and Ludvigson (2001), who show that the transitory deviation from the common trend in consumption, aggregate wealth and labour income, *cay*, is a strong predictor of stock returns, as long as expected returns to human capital and consumption growth are not too volatile. Bansal and Yaron (2004) and Parker and Julliard (2005) analyse the importance of long-run or ultimate consumption risk by looking at the exposure of an asset's cash flow to consumption. Lustig and van Nieuwerburgh (2005), Yogo (2006) and Piazzesi et al. (2007) evaluate the role of non-separability of preferences. Whelan (2008) and Sousa (2010a) emphasize the predictive ability of the ratio of excess consumption (i.e. consumption in excess of labour income) to observable assets and the wealth composition risk, respectively.

For bonds, Silva et al. (2003) show that the inverse relative wealth and the dummy variable for the month of January are useful predictors of excess returns. Silva et al. (2004) also find that excess returns can be predicted by the Treasury yield spreads. Cochrane and Piazzesi (2005) mention the forecasting power of a linear combination of forward rates. Ludvigson and Ng (2009) suggest a marked counter-cyclical behaviour of bond risk premia. Afonso and Sousa (2011) link the behaviour of government bond yields with the consumption-wealth ratio and the wealth composition risk. Sousa (2010b) and Sousa (2012a, 2012b, 2012c) show that the ratio of housing wealth to human wealth and the ratio of asset wealth to human wealth predict not only stock returns, but also government bond yields. The author also argues that these variables allow us to better understand whether the representative investor exhibits a Ricardian or a non-Ricardian behavior.

In contrast with the literature on the predictability of stock and (government) bond returns, only a few studies tried to explain the factors behind alternative finance, such as durable (housing) risk premium. This is somewhat surprising, in particular, in light of the fact that housing represents the most important asset in an agent's portfolio. Moreover, housing assets provide not only direct utility, but also collateral services. In this context, Sousa (2010a) shows that while financial wealth shocks are mainly transitory, fluctuations in housing wealth are very persistent. Consequently, wealth composition risk matters for the predictability of asset returns. In addition, Sousa (2012d) finds that housing can be used as a hedge against unfavourable wealth shocks.

In this paper, we assess the forecasting power of the ratio of asset wealth to human wealth, *wy*, for future housing risk premium. The rationale behind this linkage is that a fall in asset wealth reduces the value of collateral and increases household's exposure to idiosyncratic risk. If housing assets are seen as complements of financial assets, investors will demand a higher housing risk premium. However, if housing assets are substitutes of financial assets, investors will require a lower housing risk premium when the ratio of wealth-to-income falls.

Using data for 15 industrialized countries, we find that the predictive power is especially important for horizons spanning from 4 to 8 quarters. More specifically, the forecasting ability of *wy* for housing risk premium ranges between 1% (Australia, France and UK), 3% (Ireland), 7% (Germany and Netherlands), 15% (US), 16% (Sweden), 19% (Italy), 28% (Denmark), 38% (Belgium) and 41% (Spain) over the next 4 quarters.

The analysis also suggests that one can cluster the set of countries into two groups. In the first group (which includes Denmark, Italy, UK and US), *wy* has an associated coefficient with negative sign in the forecasting regressions. As a result, housing and financial assets can be labelled as complements. In the second group (which includes Australia, Belgium, France, Germany, Ireland, Netherlands, Spain and Sweden), the forecasting regressions show that *wy* has an associated coefficient that is positive, thereby, implying that housing assets are seen as substitutes of financial assets.

Finally, we ask whether the occurrence of systemic and non-systemic crises can amplify the transmission of wealth shocks to the housing market. We show that the predictive power of future housing returns is indeed improved when one takes into account the presence of crises' episodes, especially, the systemic ones.

The paper is organized as follows. Section 2 describes the theoretical framework and the empirical approach. Section 3 presents the results of the forecasting regressions for housing returns and the robustness analysis. Section 4 analyses the role of systemic risk in strengthening the linkages among the wealth-to-income ratio and housing returns. Finally, in Section 5, we conclude and discuss the implications of the findings.

2. Theoretical framework and empirical approach

2.1. Wealth-to-income ratio and housing risk premium

Consider the intertemporal budget constraint of the representative consumer

$$W_{t+1} = (1 + R_{w,t+1})(W_t - C_t), \tag{1}$$

where W_t is the aggregate wealth, C_t is the private consumption, and $R_{w,t+1}$ is the return on aggregate wealth between period t and $t+1$.

Under the assumption of stationarity of the consumption-aggregate wealth ratio and imposing the non-transversality condition, $\lim_{i\to\infty} \rho_w{}^i (c_{t+i} - w_{t+i}) = 0$, Campbell and Mankiw (1989) show that equation (1) can be approximated by a first-order Taylor expansion. Taking conditional expectations, we obtain

$$c_t - w_t = E_t \sum_{i=1}^{\infty} \rho_w^i r_{w,t+i} - E_t \sum_{i=1}^{\infty} \rho_w^i \Delta c_{t+i} + k_w, \tag{2}$$

where $c \equiv logC$, $w \equiv logW$, and k_w is a constant.

Following Campbell (1996) and Sousa (2010a), the log total wealth can be approximated as

$$w_t = \alpha a_t + (1-\alpha) h_t + k_a \approx \alpha_f f_t + \alpha_u u_t + (1 - \alpha_f - \alpha_u) h_t + k_a, \tag{3}$$

where a_t is the log asset wealth, f_t is the log financial wealth, u_t is the log housing wealth, h_t is the log human wealth, and k_a is a constant.

Replacing equation (3) into (2), and assuming, as in Lettau and Ludvigson (2001), that human wealth can be proxied well by labor income (i.e., $h_t = y_t + z_t + k_h$), Sousa (2010a) shows that the wealth composition risk is an important determinant of time-variation in expected returns. As a result, by disaggregating returns on asset wealth, $r_{a,t}$, into returns on financial assets, $r_{f,t}$, and returns on housing assets, $r_{u,t}$, one can link the consumption-(dis)aggregate wealth ratio, $cday_t$, to the market expectations about future financial and housing asset returns:

$$cday_t = E_t \sum_{i=1}^{\infty} \rho_w^i r_{a,t+i} - E_t \sum_{i=1}^{\infty} \rho_w^i \Delta c_{t+i} + \eta_t + k =$$

$$= E_t \sum_{i=1}^{\infty} \rho_w^i r_{f,t+i} + E_t \sum_{i=1}^{\infty} \rho_w^i r_{u,t+i} - E_t \sum_{i=1}^{\infty} \rho_w^i \Delta c_{t+i} + \eta_t + k, \tag{4}$$

where $cday_t :\equiv c_t - \alpha_f f_t - \alpha_u u_t - (1-\alpha_f - \alpha_u) y_t$, $\eta_t \equiv (1-\alpha_f - \alpha_u) z_t$ is a stationary component, and k is a constant.

Finally, we follow Sousa (2012a, 2012b, 2012c), rearrange terms, account for the stationarity of $\xi_t \equiv \frac{1}{\alpha}\left[(c_t - y_t) - \eta_t - k\right]$ - given that the marginal propensity to consume out of income, $c_t - y_t$, can be assumed to be constant -, and express equation (4) as

$$wy_t = -\frac{1}{\alpha} E_t \sum_{i=1}^{\infty} \rho_w^i r_{f,t+i} - \frac{1}{\alpha} E_t \sum_{i=1}^{\infty} \rho_w^i r_{u,t+i} + \frac{1}{\alpha} E_t \sum_{i=1}^{\infty} \rho_w^i \Delta c_{t+i} + \xi_t, \tag{5}$$

where $wy_t :\equiv a_t - y_t$ is the wealth-to-income ratio.

Equation (5) shows that, when the wealth-to-income ratio, *wy*, falls, consumers have expectations of higher stock returns in the future, $r_{f,t+i}$. Putting it differently, because household's exposure to labour income shocks rises, investors demand a higher risk premium for stocks and, similarly, for housing assets when they are perceived as complements of financial assets. In contrast, deviations in the long-term trend among wealth and labor income should be positively related with future housing risk premium, when agents see financial assets and housing assets as substitutes. This behavior reflects the degree of separability between financial and housing assets: when they are separable, financial and housing assets will be substitutes, so agents can easily "smooth out" any transitory movement in their asset wealth arising from time variation in expected return; if, however, they are non-separable, financial and housing assets will be complements, and agents will not be able to "smooth out" exogenous shocks.

Therefore, valuable information can be extracted by looking at the sign of the coefficients associated to *wy* in the forecasting regressions for housing risk premium.

2.2. Asset wealth, labour income, and housing risk premium

Log real per capita asset wealth, *log* (w_t), and labour income, *log* (y_t), are nonstationary. As a result and as in Sousa (2012a, 2012b, 2012c), we estimate the following Vector Error-Correction Model (VECM):

$$\begin{bmatrix} \Delta \log(w_t) \\ \Delta \log(y_t) \end{bmatrix} = \alpha\left[\log(w_t) + \varpi \log(y_t) + \vartheta t + \chi\right] + \sum_{k=1}^{K} D_k \begin{bmatrix} \Delta \log(w_{t-k}) \\ \Delta \log(y_{t-k}) \end{bmatrix} + \varepsilon_t, \qquad (6)$$

where t denotes the time trend and χ is a constant, $[1, \varpi, \vartheta, \chi]$ is the cointegrating vector and the K error-correction terms control for the effect of the regressor's endogeneity on the distribution of the least-squares estimators.

The components *log (w)* and *log (y)* are stochastically cointegrated and we impose the restriction that the cointegrating vector eliminates the deterministic trends, so that $\log(w_t) + \varpi \log(y_t) + \vartheta t + \chi$ is stationary. Then, the ratio of wealth to income, *wy*, is measured as the deviation from the cointegration relationship:

$$wy_t = \log(w_t) + \hat{\varpi} \log(y_t) + \hat{\vartheta} t + \hat{\chi}. \qquad (7)$$

3. Results

3.1. Data

The data used in this study is quarterly, post-1960, and covers 15 countries (Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Spain, Sweden, UK and US).

The wealth data is sourced from the Bank for International Settlements (BIS), the Eurostat, the national central banks, and the United Nation's Bulletin of Housing Statistics for Europe and North America.

Labour income is proxied by the compensation series of the National Institute of Economic and Social Research (NIESR), or constructed as in Lettau and Ludvigson (2001) and Sousa (2010a), for the US and the UK.

Housing risk premium is captured by housing real returns, which are computed using the housing price index and the price-rent ratio provided by the BIS.

The population series is provided by the OECD's Main Economic Indicators and interpolated (from annual data).

Finally, all series are deflated, and expressed in logarithms of per capita terms and seasonally adjusted, with the obvious exception of housing risk premium.

3.2. The long-run relation

First, we use the Augmented Dickey and Fuller (1979) and the Phillips and Perron (1988) tests to determine the existence of unit roots in the series of aggregate wealth and labor income and conclude that they are first-order integrated, *I(1)*. Next, we analyze the existence of cointegration among the two series using the methodologies of Engle and Granger (1987) and Johansen and Juselius (1990), and find evidence that supports that hypothesis. Finally, we estimate the vector error-correction model (VECM) as expressed in (6).

Table 1 reports the estimates (ignoring coefficients for the constant and the trend) of the equilibrium relationship between aggregate wealth and labour income. First, it shows that the coefficient associated to income in the cointegrating vection is statistically significant for all countries, therefore, giving rise to the existence of an economically meaningful linkage between the two aggregates. Second, the point estimates for income are positive (with the exception of Denmark). This suggests that wealth and income tend to share a positive long-run path. Finally, the cointegration tests show that the residuals of the cointegrating relationship among aggregate wealth and income are stationary.

[PLACE TABLE 1 HERE.]

3.3. Forecasting housing risk premium

We look at the predictability of housing risk premium, that is, real housing returns (denoted by $r_{u,t}$) over different horizons. Table 2 reports estimates from OLS regressions of the H-period real housing return, $r_{u,t+1} + \ldots + r_{u,t+H}$, on the lag of wy_t. Therefore, we consider the following model:

$$\sum_{h=1}^{H} r_{u,t+h} = \alpha + \beta wy_{t-1} + \varepsilon_t \,. \tag{8}$$

It shows that wy_t is statistically significant for a large number of countries, with the exceptions of Canada, Finland and Japan. Moreover, the trend deviations capture an important fraction of the variation in future housing risk premium (as described by the adjusted R^2), in particular, at horizons spanning from 4 to 8 quarters. In fact, at the 4-quarter horizon, wy_t explains 1% (Australia, France and UK), 3% (Ireland), 7% (Germany and Netherlands), 15% (US), 16% (Sweden), 19% (Italy), 28% (Denmark), 38% (Belgium) and 41% (Spain) of the housing risk premium.

The results also suggest that the sign of the coefficient of wy_t is positive for Australia, Belgium, France, Germany, Ireland, Netherlands, Spain and Sweden, which therefore, indicates that agents demand a lower housing risk premium when they observe a fall in the wealth-to-income ratio. In this case, housing assets are seen as substitutes for financial assets. As for Denmark, Italy, UK and US, the sign of the coefficient of wy_t is negative and supports the idea that housing assets are complements of financial assets: when the ratio of asset wealth to human wealth falls, investors demand a higher risk premium for housing.

[PLACE TABLE 2 HERE.]

3.4. Nested forecast comparisons

We make nested forecast comparisons, in which we compare the mean-squared forecasting error from a series of one-quarter-ahead out-of-sample forecasts obtained from a prediction equation that includes *wy* as the sole forecasting variable, to a variety of forecasting equations that do not include it.

We consider two benchmark models: the *autoregressive benchmark* and the *constant expected returns benchmark*. In the *autoregressive benchmark*, we compare the mean-squared forecasting error from a regression that includes just the lagged housing return as a predictive variable to the mean-squared error from regressions that include, in addition, *wy*. In the *constant expected returns benchmark*, we compare the mean-squared forecasting error from a regression that includes a constant (as the only explanatory variable) to the mean-squared error from regressions that include, in addition, *wy*. As a result, the unrestricted model *nests* the benchmark model.

Table 3 summarizes the nested forecast comparisons for the equations of the housing risk premium using *wy*. It shows that, in general, models that include *wy* generally have a lower mean-squared forecasting error. This is particularly important when the benchmark model is the *constant expected returns benchmark*, and, therefore, supports the existence of time-variation in housing risk premium.

[PLACE TABLE 3 HERE.]

4. Accounting for systemic risk

Financial crises can be contagious and damaging, and prompt quick policy responses, as they typically lead economies into recessions and sharp current account imbalances.

In this Section, we condition the predictive power of *wy* on the occurrence of systemic crisis episodes, which include banking, currency and debt crises (Laeven and Valencia, 2008).

4.1. Systemic crises

We start by evaluating the impact of systemic crises and estimate the following model

$$\sum_{h=1}^{H} r_{u,t+h} = \alpha + \beta wy_{t-1} + \mu wy_{t-1} * SystemicCrisis + \varepsilon_t, \tag{9}$$

where *SystemicCrisis* is a dummy variable that takes the value of 1 in the presence of an episode of systemic crisis and 0 otherwise, and *H* refers to the number of ahead periods in the forecasting exercise.

Table 4 reports the estimates from 1 quarter-ahead forecasting regressions. The results show that the point coefficient estimates of *wy* and their statistical significance do not change with respect to the previous findings. Moreover, the coefficient associated with the interaction between *wy* and the dummy variable for the systemic crisis is, in general, statistically significant.

[PLACE TABLE 4 HERE.]

4.2. Non-systemic crises

We also assess the importance of non-systemic systemic crises, and regress the model specified as

$$\sum_{h=1}^{H} r_{u,t+h} = \alpha + \beta wy_{t-1} + \mu wy_{t-1} * NonSystemicCrisis + \varepsilon_t, \qquad (10)$$

where *NonSystemicCrisis* is a dummy variable that takes the value of 1 in the presence of a non-systemic crisis and 0 otherwise, and *H* refers to the number of quarters-ahead of the forecasting exercise.

Table 5 summarizes the results from 1 quarter-ahead forecasting regressions. Again, the empirical evidence suggests that the point coefficient estimates of *wy* and their statistical significance remain unchanged. In what concerns the coefficient associated with the interaction between *wy* and the dummy variable for the non-systemic crisis, the results are somewhat weaker, especially, in comparison with the ones found for systemic crises. In fact, the interaction term is not statistically significant in most of the cases. However, its sign is typically positive, implying that, the occurrence of a non-systemic crisis leads investors to demand a higher risk premium for housing.

[PLACE TABLE 5 HERE.]

5. Conclusion

The current financial crisis has highlighted the strong connections between the financial system, the housing sector and the banking sector not only in domestic terms, but also when considering inter-country dimensions. In fact, the linkages between monetary stability and financial stability emerged very strongly during the most recent financial turmoil (Rafiq and Mallick, 2008; Mallick and Mohsin, 2010; Sousa, 2010c; Castro, 2010, 2011).

In this paper, we explore the predictive power of the trend deviations among asset wealth and human wealth (summarized by the variable *wy*) for future housing risk premium. We argue that, when the wealth-to-income ratio falls (increases) and financial and housing assets are complements, forward-looking investors will demand a higher (lower) housing risk premium, as they will be exposed to larger (smaller) idiosyncratic shocks. In contrast, if housing assets are substitutes of financial assets, then investors will interpret the fall in the wealth-to-income ratio as predicting a decrease in future housing risk premium.

Using data for fifteen industrialized countries, we show that the predictive power of *wy* for housing risk premium is particularly strong at horizons from 4 to 8 quarters.

The analysis also suggests that one can consider two sets of countries: (i) those where housing assets are complements of financial assets (Denmark, Italy, UK and US); and (ii) those where agents see housing assets as substitutes for financial assets (Australia, Belgium, France, Germany, Ireland, Netherlands, Spain and Sweden).

Finally, we find that systemic crises amplify the effects of idiosyncratic shocks on housing markets. Consequently, the present work opens new avenues of investigation in the field of alternative finance and, in particular, durable (housing) finance. First, it provides insights about the joint dynamics of asset wealth and labour income and how it can deliver valuable content about future housing risk premium. Second, it signals that the functional form of the preferences of the representative agent can be explored to assess the degree of substitution or complementarity between financial and housing assets and, therefore, the patterns of financial and housing asset returns. Finally, it suggests that by incorporating features of the housing market in the consumer's utility function, one can develop empirical proxies that track well the behavior of housing risk premium and, therefore, can be useful at developing hedging strategies against unfavorable wealth shocks (Sousa, 2012d).

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Table 1 – Cointegration estimations.

	$\hat{\varpi}$	Augmented Dickey and Fuller (1979) t-statistic	MacKinnon (1996) Critical values	
		Lags: Automatic based on Schwartz Information Criteria (SIC)	5%	10%
Australia	1.73*** (3.72)	-2.04	-2.88	-2.58
Belgium	1.06** (2.05)	-3.16	-2.88	-2.58
Canada	2.89*** (4.11)	-3.12	-2.88	-2.58
Denmark	-6.35* (1.87)	-2.88	-2.88	-2.58
Finland	2.17*** (12.53)	-2.73	-2.88	-2.58
France	1.04*** (3.05)	-2.68	-2.88	-2.58
Germany	0.63*** (2.76)	-3.78	-2.88	-2.58
Ireland	1.99*** (4.72)	-2.51	-2.88	-2.58
Italy	1.10*** (3.73)	-3.55	-2.88	-2.58
Japan	1.94*** (4.56)	-2.38	-2.88	-2.58
Netherlands	1.08** (1.92)	-3.43	-2.88	-2.58
Spain	4.60*** (4.71)	-2.64	-2.88	-2.58
Sweden	1.19* (1.56)	-2.17	-2.88	-2.58
UK	0.79* (1.36)	-2.31	-2.88	-2.58
US	0.53* (1.45)	-2.70	-2.88	-2.58

Notes: Newey and West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10, 5, and 1% level, respectively.

Table 2 – Forecasting housing risk premium.

	Forecast Horizon *H*						Forecast Horizon *H*				
	1	2	3	4	8		1	2	3	4	8
Australia	0.04**	0.06**	0.07*	0.06	0.02	Ireland	0.05	0.09	0.15	0.23*	0.20***
	(2.15)	(2.17)	(1.84)	(1.37)	(0.30)		(0.92)	(1.00)	(1.36)	(1.73)	(12.12)
	[0.03]	[0.03]	[0.02]	[0.01]	[0.00]		[0.01]	[0.01]	[0.02]	[0.03]	[0.03]
Belgium	0.06***	0.12***	0.18***	0.24***	0.51***	Italy	-0.28***	-0.51***	-0.68***	-0.81***	-1.44
	(5.43)	(7.33)	(9.21)	(9.68)	(11.57)		(-4.49)	(-4.66)	(-4.74)	(-4.93)	(-7.31)
	[0.20]	[0.31]	[0.35]	[0.38]	[0.47]		[0.24]	[0.23]	[0.21]	[0.19]	[0.30]
Canada	-0.00	-0.01	-0.00	0.00	0.05	Japan	0.02	0.00	0.02	0.04	-0.02
	(-0.38)	(-0.32)	(-0.20)	(0.06)	(0.94)		(0.30)	(0.03)	(0.32)	(0.70)	(-0.21)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]		[0.00]	[0.00]	[0.00]	[0.01]	[0.00]
Denmark	-0.02***	-0.05***	-0.09***	-0.12***	-0.28***	Netherlands	0.05***	0.09***	0.12***	0.15***	0.27***
	(-2.49)	(-3.43)	(-3.89)	(-4.66)	(-6.73)		(4.41)	(4.48)	(4.41)	(4.23)	(4.53)
	[0.07]	[0.15]	[0.21]	[0.28]	[0.54]		[0.08]	[0.08]	[0.07]	[0.07]	[0.07]
Finland	0.06	0.10	0.13	0.16	0.31	Spain	0.08***	0.16***	0.23***	0.30***	0.42***
	(1.17)	(1.22)	(1.06)	(1.08)	(1.60)		(6.82)	(8.41)	(9.14)	(9.45)	(6.71)
	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]		[0.28]	[0.38]	[0.41]	[0.41]	[0.26]
France	0.03**	0.05**	0.06*	0.05	-0.02	Sweden	0.06***	0.12***	0.17***	0.23***	0.40***
	(2.48)	(2.14)	(1.75)	(1.29)	(-0.29)		(2.94)	(4.70)	(5.40)	(6.69)	(5.97)
	[0.04]	[0.03]	[0.02]	[0.01]	[0.00]		[0.05]	[0.10]	[0.13]	[0.16]	[0.16]
Germany	0.04***	0.08***	0.12***	0.14***	0.16***	UK	0.02	0.01	-0.03	-0.09	-0.44***
	(3.06)	(4.15)	(4.78)	(5.32)	(3.82)		(0.60)	(0.17)	(-0.34)	(-0.82	(-3.15)
	[0.04]	[0.06]	[0.07]	[0.07]	[0.05]		[0.01]	[0.00]	[0.00]	[0.01]	[0.09]
						US	-0.03***	-0.07***	-0.11***	-0.14***	-0.27***
							(-4.68)	(-5.35)	(-5.96)	(-6.24)	(-6.31)
							[0.09]	[0.12]	[0.14]	[0.15]	[0.16]

Notes: Newey and West (1987) corrected t-statistics appear in parenthesis. Adjusted R-square is reported in square brackets. *, **, *** denote statistical significance at the 10, 5, and 1% level, respectively.

Table 3 – One-quarter ahead forecasts of housing risk premium:
wy model vs. constant/AR models.

	Housing risk premium	
	$MSE_{wy}/MSE_{constant}$	MSE_{wy}/MSE_{AR}
Australia	0.990	1.002
Belgium	0.898	0.970
Canada	1.003	1.003
Denmark	0.967	0.971
Finland	0.996	1.005
France	0.986	1.002
Germany	0.982	0.987
Ireland	1.001	1.005
Italy	0.876	0.931
Japan	1.003	0.999
Netherlands	0.965	1.004
Spain	0.856	0.984
Sweden	0.977	0.991
UK	1.001	0.991
US	0.959	0.986

Note: MSE – mean-squared forecasting error.

Table 4 – Forecasting housing risk premium: impact of systemic crises.

	wy_{t-1}	wy_{t-1} * *SystemicCrisis*	Adj. R-square		wy_{t-1}	wy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	0.06***	-0.17***	[0.08]	Ireland	No episodes of systemic crisis		
	(-3.48)	(-3.74)					
Belgium	No episodes of systemic crisis			Italy	-0.32***	0.14*	[0.24]
					(-3.66)	(1.67)	
Canada	-0.00	-0.05	[0.00]	Japan	No episodes of systemic crisis		
	(-0.34)	(-1.12)					
Denmark	-0.02**	-0.00	[0.07]	Netherlands	No episodes of systemic crisis		
	(-2.37)	(-0.10)					
Finland	No episodes of systemic crisis			Spain	No episodes of systemic crisis		
France	0.03***	0.24***	[0.08]	Sweden	No episodes of systemic crisis		
	(2.53)	(3.52)					
Germany	0.03***	0.18***	[0.10]	UK	0.09**	-0.08	[0.06
	(2.80)	(3.13)			(2.07)	(-1.29)	
				US	-0.03***	0.07*	[0.08]
					(-4.58)	(1.62)	

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10, 5, and 1% level, respectively.

Table 5 – Forecasting housing risk premium: impact of non-systemic crises.

	wy_{t-1}	wy_{t-1} * *SystemicCrisis*	Adj. R-square		wy_{t-1}	wy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	No episodes of non-systemic crisis			Ireland	No episodes of non-systemic crisis		
Belgium	No episodes of non-systemic crisis			Italy	No episodes of non-systemic crisis		
Canada	No episodes of non-systemic crisis			Japan	-0.00	0.07	[0.01]
					(-0.03)	(0.64)	
Denmark	No episodes of non-systemic crisis			Netherlands	No episodes of non-systemic crisis		
Finland	-0.10	0.31***	[0.14]	Spain	No episodes of non-systemic crisis		
	(-1.40)	(3.04)					
France	No episodes of non-systemic crisis			Sweden	0.06***	0.08	[0.06]
					(2.51)	(0.60)	
Germany	No episodes of non-systemic crisis			UK	No episodes of non-systemic crisis		
				US	No episodes of non-systemic crisis		

Notes: Newey-West (1987) corrected t-statistics appear in parenthesis. *, **, *** - statistically significant at the 10, 5, and 1% level, respectively.