Wealth, Stock Returns, Government Bond Yields and Systemic Risk

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Abstract

In this paper, I assess the role of collateralizable wealth and systemic risk in explaining future asset returns. I show that the residuals of the trend relationship among housing wealth and labour income predict both stock returns and government bond yields. Using data for a set of industrialized countries, I find that when the housing wealth-to-income ratio falls, investors demand a higher risk premium for stocks. As for government bonds returns: (i) when they are seen as a component of asset wealth, investors react in the same manner; and (ii) if, however, investors perceive the increase in government bond returns as signalling a future rise in taxes or a deterioration of public finances, then investors interpret the fall in the housing wealth-to-income ratio as a fall in future bond premia. Finally, I show that the occurrence of crises episodes amplifies the transmission of housing market shocks to financial markets.

Keywords: housing wealth, labor income, stock returns, government bond returns, crises.
JEL classification: E21, E44, D12.

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1. Introduction

The theoretical and empirical literature has shown that credit markets are not perfect, and are characterized by the lack of arbitrage and rationing (Stiglitz and Weiss, 1981). Besanko and Thakor (1987) argue that these problems could be avoided if borrowers had enough collateralizable wealth. In fact, banks would be able to offer two different contracts to prospective customers: (i) one requiring a high collateral (and a low interest rate), therefore, attracting low-risk individuals; and (ii) another one requiring less collateral (and a high interest rate), thus favoring high-risk entrepreneurs.

In addition, the efficiency of the housing finance system is of key interest to financial institutions, homeowners, and policy makers. Liquidity and collateralizable wealth play, therefore, a major role for asset pricing. First, liquidity shocks are positively correlated with shocks to returns (Jones 2002). Second, assets have higher expected returns when they are positively correlated with aggregate market liquidity (Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005). Third, assets with high transaction costs or illiquid assets normally trade at a discount (Brennan and Subrahmanyam, 1996).

While differences in expected returns are typically explained by differences in risk, the covariance of portfolio returns and contemporaneous consumption growth does not fully explain the cross-sectional variation (Mankiw and Shapiro, 1986; Breeden et al., 1989). As a result, the identification of the economic sources of risk remains an important issue. Moreover, given the strong linkages between housing market developments and sotck market dynamics, many authors started to consider features of those markets in asset pricing models (Lustig and Van Nieuwerburgh, 2005; Yogo, 2006; Fernandez-Corugedo et al., 2007; Piazzesi et al., 2007; Sousa, 2007).

The current paper addresses the role of collateralizable wealth in analysing predictability of both stock and government bond returns for a set of industrialized countries. Specifically, I assess the forecasting power of the nonlinear deviations of housing wealth from its cointegrating relationship with labor income, *hwy*, for expected future returns.

The rationale behind this linkage lies on the fact that a decrease in housing prices reduces the value of housing in providing collateral services and, therefore, increases household’s exposure to idiosyncratic risk. Consequently, a decrease in the ratio of asset wealth to human wealth predicts higher stock returns. As for government bond returns, one needs to understand the way government debt is perceived by the agents. If government bonds are seen as a component of asset wealth, then investors demand a higher bond risk premium when they face a fall in the ratio of collateralizable wealth. If, however, the issuance of government debt is understood as leadig to an increase in future taxation or as a symptom of public finance deterioration, then investors will interpret the fall in the housing wealth-to-income ratio as predicting a decrease in future government bond returns.

I show that the ratio of housing wealth-to-income, *hwy*, predicts both stock and government bond returns, which highlights the characteristic of housing as providing collateral to the banking system. It also emphasizes the important channel by which shocks originated in the housing sector are transmitted to risk premium in asset markets.

The empirical findings suggest that the predictive power of *hwy* for real stock returns is substantial, ranging between 6% (US), 8% (Finland and UK), and 10% (Australia) over the next 4 quarters.

With regards to government bond returns, the analysis shows that one can cluster the set of countries into two groups. In the first group (which includes Australia, Denmark, Finland, Netherlands and Spain), *hwy* has an associated coefficient with negative sign in the forecasting regressions. The predictive power is, particularly, large for Netherlands (11%), Finland (13%) and Spain (49%). This, therefore, corroborates the idea that government debt is seen as part of the investor's asset wealth, which implies that agents exhibit a *non-Ricardian* behaviour. In the second group (which includes Belgium, Canada, France, Germany, Ireland, Italy, Japan, Sweden, the UK and the US), the forecasting regressions show that *hwy* has a positive coefficient. Specifically, the predictive ability of *hwy* is large for Germany (11%), Ireland (12%), Belgium (28%) and the US (29%). Consequently, agents in these countries perceive the rise in government bond returns rather as a deterioration of public finances and as signalling an increase in future taxation, that is, they behave in a *Ricardian* way.

Finally, I ask about the importance of episodes of crisis in amplifying the transmission of shocks in the housing market to the financial system. In particular, I assess whether the occurrence of systemic *versus* non-systemic crises can help improving our understanding about the linkages between housing and financial markets. I show that the predictive power of future asset returns is indeed improved when one takes into account the presence of such phenomena, especially, the systemic ones.

The robustness of the results is analysed in several directions. In fact, I show that: (i) the inclusion of additional control variables does not change the predictive power of *hwy*; and (ii) models that include *hwy* perform better than the autoregressive and the constant expected returns benchmark models.

The research presented in this paper is indebted to the work of Lettau and Ludvigson (2001). However, the authors use the consumer's intertemporal budget constraint to explore the predictive ability of the deviations of consumption from its long-run relationship with aggregate wealth and labour income, *cay*, for stock returns. In contrast, I use the structure of the preferences of the representative agent to assess the forecasting power of the deviations of housing wealth from its equilibrium relationship with labour income, *hwy*, for both stock returns and government bond yields.

This work is organized as follows. Section 2 reviews the literature on the predictability of asset returns. Section 3 describes the theoretical approach. Section 4 discusses the empirical results from the forecasting regressions for stock returns and government bond yields. Section 5 provides the robustness analysis. Section 6 analyses the role of systemic. Finally, in Section 7, I conclude and discuss the implications of the findings.

2. Literature review

In this section, I review the literature on the predictability of stock returns and government bond returns, in particular, by highlighting the works that focus on the transmission of housing market developments to the financial system.

2.1. Predictability of stock returns

Risk premium is generally considered as reflecting the ability of an asset to insure against consumption fluctuations. The empirical evidence has, however, shown that the covariance of returns across portfolios and contemporaneous consumption growth is not sufficient to justify the differences in expected returns. In fact, the literature on asset pricing has emphasized the role of market inefficiencies (Fama, 1998; Fama and French, 1996), the rational response of agents to time-varying investment opportunities that is driven by variation in risk aversion (Constantinides, 1990) and by changes in the joint distribution of consumption and asset returns (Duffee, 2005), and different models of economic behaviour. These explanations also justify why expected excess returns on assets appear to vary with the business cycle.

Therefore, different economically motivated variables have been developed to capture time-variation in expected returns and document long-term predictability. Lettau and Ludvigson (2001) show that the transitory deviation from the common trend in consumption, aggregate wealth and labour income is a strong predictor of stock returns, as long as the expected returns to human capital and consumption growth are not too volatile. Bansal and Yaron (2004) find that the long-run risk, that is, the exposure of assets' cash flows to consumption is an important determinant of risk premium. Julliard (2004) emphasize the role of labor income risk, while Parker and Julliard (2005) measure the risk of a portfolio by its ultimate risk to consumption, that is, the covariance of its return and consumption growth over the quarter of the return and many following quarters. Lustig and Van Nieuwerburgh (2005) show that the housing collateral ratio can shift the conditional distribution of asset prices and consumption growth. Yogo (2006) and Piazzesi et al. (2007) emphasize the role of non-separability of preferences in explaining the countercyclical variation in equity premium, while Fernandez-Corugedo et al. (2007) focus on the relative price of durable goods. Sousa (2007) shows that housing can be used as a hedge against wealth shocks. Chien and Lustig (2010) find that accounting for the importance of collateralizable wealth, namely, by allowing agents to file for bankruptcy, allows one to improve asset pricing predictions.

2.2. Predictability of bond returns

In contrast with the literature on the predictability of stock returns, there are just a few studies that try to explain the factors undermining bond risk premia. Fama and Bliss (1987) show that the spread between the *n*-year forward rate and the one-year yield can forecast the *n*-year excess bond returns. Campbell and Shiller (1991) find that excess bond returns can be predicted by the Treasury yield spreads. More recently, Cochrane and Piazzesi (2005) highlight that a linear combination of forward rates explains up to 44% of the variation in next year’s excess returns on bonds with maturities ranging from one to five years.

While these findings imply that bond risk premium is time-varying, they are, in general, silent regarding its relationship with macroeconomic magnitudes. Campbell and Cochrane (1999) suggest that risk premia on equity reflects a slow-moving habit that is driven by shocks to aggregate consumption.

Despite the linkages between equity risk premia and the macroeconomic fundamentals addressed in the above-mentioned works, their importance for bond risk premia has been typically neglected. Moreover, the existing empirical evidence tends to show that excess bond returns can be forecasted not by macroeconomic variables such as aggregate consumption or inflation, but rather by pure financial indicators, such as forward spreads and yield spreads. For instance, Ludvigson and Ng (2009) find marked countercyclical variation in bond risk premia.

3. Theoretical framework and empirical approach

3.1. Theoretical consideration: housing wealth and risk premium

I assume that there is a continuum of agents who consume nondurable consumption, c_t, and housing services (from which they derive utility or collateral services), hw_t, and are endowed with stochastic labor income, $y_t(i_t, a_t)$, where i_t represents the idiosyncratic event and a_t denotes the aggregate event.

The household maximizes utility, that is

$$U(c, hw) = \sum_{s_t|s_0} \sum_{t=0}^{\infty} \beta^t p(s_t \mid s_0) u[c_t(s_t), hw_t(s_t)], \tag{1}$$

where β is the time discount factor, s_t represents the state of the economy, $p(s_t \mid s_0)$ denotes the probability of state s_t given the initial state s_0, and preferences are specified by

$$u(c_t, hw_t) = \left[c_t^{(\varepsilon-1)/\varepsilon} + \psi hw_t^{(\varepsilon-1)/\varepsilon}\right]^{(1-\gamma)\varepsilon/(\varepsilon-1)} /(1-\gamma), \tag{2}$$

where ψ >0 captures the importance of housing wealth in the utility function, ε is the intratemporal elasticity of substitution between consumption and services from housing wealth, and γ is the coefficient of risk aversion.

The solvency constraints are restrictions on the value of the household's consumption claim net of its labour income claim, that is:

$$\Lambda_{s_t}\left[c_t(s_t) + \rho_t(a_t) hw_t(s_t)\right] \geq \Lambda_{s_t}\left[y_t(s_t)\right], \tag{3}$$

where $\Lambda_{s_t}[d_t(s_t)]$ represents the price of a claim to $d_t(s_t)$, and ρ_t is the rental price of housing services.

The strength of these constraints is determined by the ratio of asset wealth to human wealth (i.e., the housing wealth-to-income ratio), *hwy*,

$$hwy_t(a_t) = \Lambda_{z_t}\left[\rho hw^a\right] / \Lambda_{z_t}\left[c^a\right], \tag{4}$$

where hw^a and c^a correspond, respectively, to aggregate housing wealth and aggregate consumption.

Equilibrium allocations and prices will depend on the consumption weight θ as follows: 1) if the household *does not switch* to a state with a binding constraint, it is $\theta_t'(\theta, s_t)$; and 2) if it *switches*, then the new weight is the cutoff level $\underline{\theta}_t(y_t, a_t)$.

In order to obtain aggregate consumption, one integrates over the new household weights, that is, $\zeta_t^a(a_t) = \int \theta'_t(\theta, s_t) d\Phi_t(\theta; a_t)$, where $\Phi_t(\bullet; a_t)$ represents the distribution over weights at the start of period *t*. The consumption share of an agent can then be represented as the ratio of his consumption weight to the aggregate consumption weight, $c_t(\theta, s_t) = \theta'_t(\theta, s_t) \cdot c_t^a(a_t) / \zeta_t^a(a_t)$, and, similarly, for the housing wealth share of an agent, $hw_t(\theta, s_t) = \theta'_t(\theta, s_t) \cdot hw_t^a(a_t) / \zeta_t^a(a_t)$, where $\zeta_t^a(a_t)$ defines a nondecreasing stochastic process.

As the ratio of housing wealth-to-income, *hwy*, decreases, the cutoff levels for the consumption weights increase, $\underline{\theta}(y_t, a_t) / \zeta_t^a(a_t)$, and, if the consumer moves to a state where the constraint is binding, then the cutoff level for the consumption share equals the household's labour income share. As a result, when the ratio of housing wealth-to-income, *hwy*, decreases, the household's exposure to labor income shocks increases and a higher risk premium is demanded. Consequently, it should predict a rise in future stock returns. In contrast with stocks, an increase in government bond yields may not be seen as a rise in wealth, but merely perceived as signalling a future increase in taxes. Therefore, when agents see government debt as a wealth component, one should observe a behavior similar to the one found for stocks; otherwise, deviations in the long-term trend among housing wealth and income should be positively related with future government bond returns.

3.2. Empirical counterpart: housing wealth-to-income ratio

Real per capita housing wealth, *hw*, and labor income, *y*, are nonstationary. As a result, I estimate the following vector error-correction model (VECM):

$$\begin{bmatrix} \Delta \log(hw_t) \\ \Delta \log(y_t) \end{bmatrix} = \alpha \left[\log(hw_t) + \varpi \log(y_t) + \vartheta t + \chi \right] + \sum_{k=1}^{K} D_k \begin{bmatrix} \Delta \log(hw_{t-k}) \\ \Delta \log(y_{t-k}) \end{bmatrix} + \varepsilon_t, \qquad (5)$$

where *t* denotes the time trend and χ is a constant. The *K* error correction terms allow one to eliminate the effect of regressor's endogeneity on the distribution of the least-squares estimators of $[1, \varpi, \vartheta, \chi]$.

The components *log (hw)* and *log (y)* are stochastically cointegrated with the cointegrating vector $[1, \varpi, \chi]$. I also impose the restriction that the cointegrating vector eliminates the deterministic trends, so that $\log(hw_t) + \varpi \log(y_t) + \vartheta t + \chi$ is stationary. Then, the ratio of housing wealth-to-income, *hwy*, is measured as the deviation from the cointegration relationship, i.e.:

$$hwy_t = \log(hw_t) + \hat{\varpi} \log(y_t) + \hat{\vartheta} t + \hat{\chi}. \qquad (6)$$

Given that the OLS estimators of the cointegration parameters are superconsistent, one can use the ratio of housing wealth-to-income, *hwy*, as a regressor without needing an errors-in-variables standard error-correction.

4. Results

4.1. Data

The data are quarterly, post-1960, and include sixteen countries (Australia, since 1970:1; Austria, since 1978:2; Belgium, since 1980:2; Canada, since 1965:1; Denmark, since 1977:1; Finland, since 1979:1; France, since 1970:2; Germany, since 1965:1; Ireland, since 1975:4; Italy, since 1971:4; Japan, since 1965:1; the Netherlands, since 1975:1; Spain, since 1978:1; Sweden, since 1977:1; the UK, since 1961:2; and the US, since 1965:1). It, therefore, cover the last 30 to 50 years of data. All series – with the obvious exceptions of stock returns and government bond yields - are deflated with consumption deflators, expressed in logs of per capita terms and seasonally adjusted.

Labour income is approximated by the compensation series of the NIESR Institute. In the case of the US, I follow Lettau and Ludvigson (2001). As for the UK, I follow Sousa (2010). Wealth includes financial and housing wealth and data come from National Central Banks, the Eurostat, the Bank for International Settlements (BIS), the United Nation’s Bulletin of Housing Statistics for Europe and North America.

Stock returns are computed using the share price index provided by the International Financial Statistics (IFS) of the International Monetary Fund (IMF) and the dividend yield ratio provided by Datastream. The 10-year government bond yield data are also provided by the IFS of the IMF.

The government finance data normally refers to the Central Government, that is, it excludes the Local and/or the Regional Authorities. It is typically disseminated through the monthly publications of the General Accounting Offices, Ministries of Finance, National Central Banks and National Statistical Institutes of the respective countries. The latest figures are also published in the Special Data Dissemination Standard (SDDS) section of the International Monetary Fund (IMF) website.

Data for population are taken from OECD's Main Economic Indicators and interpolated from annual series.

4.2. The long-run relation

I first use the Augmented Dickey and Fuller (1979), the Phillips and Perron (1988) and the Kwiatkowski et al. (1992) tests to determine the existence of unit roots in the series of housing wealth and labor income and conclude that they are first-order integrated, *I(1)*. Next, I analyze the existence of cointegration among the two series using the methodology of Engle and Granger (1987), Johansen and Juselius (1990), Phillips and Ouliaris (1990) and MacKinnon (1996), and find evidence that supports that hypothesis. Finally, I estimate the vector error-correction model (VECM) as expressed in (5).

Table 1 shows the estimates (ignoring the coefficient estimates on the constant and the time trend) for the shared relationship among housing wealth and income. It can be seen that, with the exceptions of Canada, France and Spain, the long-run elasticity of housing wealth with respect to labour income is positive, implying that the two aggregates tend to share a positive long-run path. The table also presents the unit root tests to the residuals of the cointegration relationship, and supports the idea that they are stationary.

[PLACE TABLE 1 HERE]

4.3. Forecasting stock returns

Section 3 shows that transitory deviations from the long-run relationship among housing wealth and income, hwy_t, mainly reflect agents' expectations of future changes in asset returns. Therefore, I look at real stock returns (denoted by SR_t) for which quarterly data are available. They should provide a good proxy for the non-human component of asset wealth.

Table 2 summarizes the forecasting power of hwy_t for different horizons. It reports estimates from OLS regressions of the *H*-period real stock return, $SR_{t+1} + \ldots + SR_{t+H}$, on the lag of hwy_t. I estimate the following model:

$$\sum_{h=1}^{H} SR_{t+h} = \alpha + \beta hwy_{t-1} + \varepsilon_t \,. \qquad (7)$$

Note that long-horizon returns are calculated by summing the (continuously compounded) quarterly returns. This implies that the observations on long-horizon returns overlap which possibly biases the different test statistics towards rejecting the null hypothesis of no predictability more often than is correct (Nelson and Kim, 1993; Stambaugh, 1999; Valkanov, 2003; Ang and Bekaert, 2006). Nevertheless, one should emphasize that these works focus on the predictive ability of the dividend yield and the price-earnings ratio which are very persistent regressors. In contrast, I assess the forecasting power of the deviations from the equilibrium relationship between housing wealth and labor income, *hwy*, which exhibit much less persistence. Thus, the abovementioned problems become less severe. Additionally, Lettau and Ludvigson (2001), Whelan (2008) and Sousa (2010) find that the bias does not impact on the predictive ability of a wide range of variables in the forecasting regressions for stock returns. Finally, the adopted methodology is standard in the empirical finance literature (Lettau and Ludvigson, 2001; Julliard, 2004; Lustig and Van Nieuwerburgh, 2005; Santos and Veronesi, 2006; Yogo, 2006; Fernandez-Corugedo et al., 2007; Piazzesi et al., 2007; Sousa, 2010).

Keeping these questions in mind, Table 2 shows that hwy_t is statistically significant for a large number of countries and the point estimates of the coefficient are large in magnitude. Moreover, its sign is negative and statistically significant for Australia, Germany, Finland, Italy, the UK, and the US. These results are in line with the framework presented in Section 3, suggesting that investors expect a fall in future stock returns when they observe a rise in the housing wealth-to-income ratio.

It can also be seen that the trend deviations explain an important fraction of the variation in future real returns (as described by the adjusted R^2), in particular, at horizons spanning from 4 to 8 quarters. In fact, at the 4-quarter horizon, hwy_t explains 5% (Japan), 6% (US), 8% (Finland and UK) and 17% (Belgium) of the real stock return. In contrast, its forecasting power is poor for countries such as Austria, Canada, France, Ireland, Japan, Netherlands and Spain.

[PLACE TABLE 2 HERE]

4.4. Forecasting government bond returns

I now look at the power of hwy_t in predicting government bond yields (denoted by BR_t) for which quarterly data are available.

Table 3 reports the forecasting ability of hwy_t for different horizons. It provides estimates from OLS regressions of the H-period real government bond return, BR_{t+1} + ... + BR_{t+H}, on the lag of hwy_t, as described by the model:

$$\sum_{h=1}^{H} BR_{t+h} = \alpha + \beta hwy_{t-1} + \varepsilon_t . \tag{8}$$

One can see that hwy_t is statistically significant for almost all countries (with the exception of Austria) and the associated coefficient are, in general, large in magnitude. At the 4-quarter horizon, hwy_t explains 11% (Germany and Netherlands), 12% (Ireland), 13% (Finland), 28% (Belgium), 29% (US) and 49% (Spain) of the real bond returns.

Interestingly the results suggest that the sign of the coefficient associated to hwy_t is negative for Australia, Finland, Netherlands and Spain, and positive for Belgium, Canada, France, Germany, Ireland, Italy, Japan, Sweden, the UK and the US. This piece of evidence corroborates the idea that government debt is seen as part of investor's wealth for the first set of countries: in the outcome of a fall in the ratio of housing wealth-to-income, agents allow consumption to rise as they expect future yields to increase. As for the second set of countries, agents perceive the rise in government bond returns as a deterioration of public finances and an increase in future taxation. As a result, they reduce consumption when they observe a fall in the ratio of housing wealth-to-income.

In practice, these results largely reflect higher sustainability of public finances in the first set of countries. Additionally, they characterize the frequent swings in public deficits and government debt and the concerns about the long-term sustainability of public finances in the second group of countries.

[PLACE TABLE 3 HERE]

5. Robustness analysis

5.1. Additional control variables

In this Section, I assess the robustness of the previous results, namely, by considering additional control variables.

Shiller (1984) and Campbell and Shiller (1988) show that the price-to-dividend ratio and the price-to-earnings ratio have predictive power for stock returns. Lamont (1998) suggests that the ratio of dividends to earnings is also a good predictor of stock returns at quarterly frequency. The relative T-bill rate, the term spread and the default spread are also shown to have forecasting power (Fama and French, 1989; Hodrick, 1992).

Table 4.1 reports the estimates from one-quarter-ahead forecasting regressions that include the dividend yield ratio ($DivYld_t$) as an additional variable. It only displays information about countries for which data on the dividend yield ratio is available.

The results show that the coefficient estimates of *hwy* and their statistical significance do not change with respect to the findings of Table 2 where only *hwy* was included in the set of explanatory variables. Moreover, the dividend yield ratio ($DivYld_t$) seems to provide some relevant information about future asset returns: it is statistically significant in a large number of regressions.

By its turn, Table 4.2 summarizes the estimates from one-quarter-ahead forecasting regressions that include the inflation rate (*Inflation*) and the deficit-to-GDP ratio (*Deficit*) as potential determinants of future government bond yields.

Brandt and Wang (2003) argue that the risk premium is driven by shocks to inflation and to aggregate consumption. Gale and Orszag (2003) highlight that budget deficits may raise nominal interest rates, because they reduce aggregate savings and increase the stock of government debt. Despite this, the literature has not provided a consensual answer yet (Engen and Hubbard, 2005).

The results show do not show substantial changes vis-a-vis the findings reported in Table 3, where only *hwy* was considered in the set of regressors. In addition, both inflation and the deficit-to-GDP ratio help forecasting bond returns. Therefore, this suggests that investors use government bonds to hedge against the risk of inflation. It also reveals that a deterioration of the fiscal stance is typically associated with a rise in future government bond yields.

[PLACE TABLE 4.1 HERE]

[PLACE TABLE 4.2 HERE]

5.2. Nested forecast comparisons

Some recent studies (Bossaerts and Hillion, 1999; Goyal and Welch, 2003, 2004) expressed concerns about the apparent predictability of stock returns because, while a number of financial variables display significant in-sample forecasting power, they seem to have negligible out-of-sample predictive properties. In addition, the forecasting results presented so far could suffer from the "look-ahead" bias that arises from a long-term relationship estimated using the full sample (Brennan and Xia, 2005). In this context, some robust statistics such as the Clark and McCracken's (2001) encompassing test (ENC-NEW), the McCracken's (2006) equal forecast accuracy test (MSE-F) and the modified Diebold and Mariano (1995) encompassing test proposed by Harvey et al. (1998) could allow one to explore the out-of-sample performance of the forecasting model. Note, however, that the in-sample and the out-of-sample tests are equally reliable under the null of no predictability (Inoue and Killian, 2004). Moreover, the results from out-of-sample forecasts where the cointegrating vector is reestimated every period using only the data available at the time of the forecast could strongly understate the predictive power of the regressor (Lettau and Ludvigson, 2001). Therefore, it would make it difficult for *hwy* to display forecasting power when the theory is true. Finally, Hjalmarsson (2006) shows that out-of-sample forecasting exercises are unlikely to generate evidence of predictability, even when the correct model is estimated and there is, in fact, predictability.

With these caveats in mind and as a final robustness check, I make nested forecast comparisons, in which I look at the mean-squared forecasting error from a series of one-quarter-ahead out-of-sample forecasts obtained from a prediction equation that includes *hwy* as the sole forecasting variable and the mean-squared forecasting error from a variety of forecasting equations that do not include *hwy*. As a result, the unrestricted model *nests* the benchmark model.

I consider two benchmark models: the *autoregressive benchmark* and the *constant expected returns benchmark*. In the *autoregressive benchmark*, I compare the mean-squared forecasting error from a regression that only includes the lagged asset return as the predictive variable with the mean-squared error from regressions that include, in addition, *hwy*. In the *constant expected returns benchmark*, I compare the mean-squared forecasting error from a regression that includes a constant (as the only explanatory variable) with the mean-squared error from regressions that include, additionally, *hwy*.

Table 5 summarizes the nested forecast comparisons for the equations of real stock returns and government bond yields. It shows that including *hwy* in the forecasting regressions, in general, improves over the benchmark models. This is particularly important when the benchmark model is the *constant expected returns benchmark*, and, therefore, supports the existence of time-variation in expected returns.

[PLACE TABLE 5 HERE]

6. Does systemic risk matter?

Financial crises can be contagious and damaging, and prompt quick policy responses, as they typically lead economies into recessions and sharp current account imbalances. Among the many causes of financial crises, one can refer: (i) credit booms; (ii) currency and maturity mismatches; (iii) large capital inflows; and (iv) unsustainable macroeconomic policies.

Honohan and Laeven (2005) and Laeven and Valencia (2008) identify episodes of financial crises, and systemic crises include currency, debt and banking crises. A systemic currency crisis corresponds to a nominal depreciation of the currency of at least 30% and, simultaneously, at least a 10% increase in the rate of depreciation compared to the year before. A systemic debt crisis describes a situation where there are sovereign defaults to private lending and debt rescheduling programs. In a systemic banking crisis, there is a large number of defaults on corporate and financial sectors, non-performing loans increase sharply, asset prices eventually depress, and real interest rates increase dramatically.

6.1. Systemic crises

In order to assess the importance of systemic crises, I estimate the following models:

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

$$\sum_{h=1}^{H} BR_{t+h} = \alpha + \beta hwy_{t-1} + \mu hwy_{t-1} * SystemicCrisis + \varepsilon_t, \tag{10}$$

where *SystemicCrisis* is a dummy variable that takes the value of 1 in the presence of a systemic crisis and 0 otherwise, and *H* refers to the number of quarters-ahead of the forecasting exercise. Given that the effects of systemic crises may not be immediate, I consider *H=4*, therefore, allowing for a time lag from the date of the occurrence of the crisis and the emergence of its effects.

Tables 6.1 and 6.2 report the estimates from 4-quarters-ahead forecasting regressions as expressed by equations (9) and (10), respectively. The results show that both the coefficient estimates of *hwy* does not change relative to the previous findings. Moreover, the coefficient associated to the interaction between *hwy* and the dummy variable for the systemic crisis is, in general, statistically significant. In addition, it has an opposite sign of the one associated with *hwy*, implying that investors demand a higher risk premium for both stocks and government bonds during systemic crises.

[PLACE TABLE 6.1 HERE]

[PLACE TABLE 6.2 HERE]

6.2. Non-systemic crises

Finally, I analyse the impact of non-systemic systemic crises, and regress the following equations:

$$\sum_{h=1}^{H} SR_{t+h} = \alpha + \beta hwy_{t-1} + \mu hwy_{t-1} * NonSystemicCrisis + \varepsilon_t , \qquad (11)$$

$$\sum_{h=1}^{H} BR_{t+h} = \alpha + \beta hwy_{t-1} + \mu hwy_{t-1} * NonSystemicCrisis + \varepsilon_t , \qquad (12)$$

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. Similarly to the case of systemic crisis, I allow for a lag in the transmission of the effects of non-systemic crises to financial markets and consider *H=4*.

Tables 7.1 and 7.2 summarize the results from 4 quarters-ahead forecasting regressions. In general, the coefficient associated with the interaction between *hwy* and the dummy variable for the non-systemic crisis is statistically significant and has, with the exception of Finaland, the opposite sign of the one associated with *hwy*. Therefore, in the outcome of a non-systemic crisis, investors demand a higher risk premium.

[PLACE TABLE 7.1 HERE]

[PLACE TABLE 7.2 HERE]

7. Conclusion

This paper explores the predictive power of the nonlinear deviations of housing wealth from its equilibrium relationship with labour income (summarized by the variable *hwy*) for expected future asset returns.

The above-mentioned common trend summarizes agent's expectations of both stock returns and government bond yields. In particular, when the housing wealth-to-income ratio falls (increases), forward-looking investors will demand a higher (lower) risk premium given that they will be exposed to larger (smaller) idiosyncratic shocks.

As for bond yields, if government bonds are understood as another wealth component, then investors behave in the same way as for stocks. However, if the increase in government bond yields is perceived as a symptom of the deterioration of the fiscal stance, investors will interpret the fall in the wealth-to-income ratio as a fall in future bond risk premium.

Using data for sixteen industrialized countries, I show that the predictive power of *hwy* for real stock returns is particularly strong at horizons from 4 to 8 quarters. In what concerns bond returns, the analysis suggests that one can consider two sets of countries: (i) those where investors seem to behave in a *non-Ricardian* way (Australia, Denmark, Finland, Netherlands and Spain); and (ii) those where investors seem to be forward-looking and to have a *Ricardian* behavior (Belgium, Canada, France, Germany, Ireland, Italy, Japan, Sweden, the UK and the US).

Finally, I show that systemic crises amplify the linkages between shocks in collateralizable wealth and financial markets. Therefore, the current work opens new and challenging avenues for understanding the dynamics of the relationship between the housing sector, stock market and government bond developments, and the banking system.

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References

Acharya, V. V., and Pedersen, L. H., 2005, “Asset pricing with liquidity risk”, Journal of Financial Economics, Vol. 77, pp. 375-410.

Ang, A., and Bekaert, G., 2006, “Stock return predictability: Is it there?”, Review of Financial Studies, Vol. 20 No. 3, pp. 651-707.

Bansal, R., and Yaron, A., 2004, "Risks for the long run: a potential resolution of asset pricing puzzles", Journal of Finance, Vol. 59, pp. 1481-1509.

Baxter, M., and Jermann, U. J., 1997, "The international diversification puzzle is worse than you think", American Economic Review, Vol. 87, pp. 170-180.

Besanko, D. A., and Thakor, A. V., 1987, “Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets”, International Economic Review, Vol. 28, pp. 671-689.

Bester, H., 1985, “Screening versus rationing in credit markets with imperfect information”, American Economic Review, Vol. 75, pp. 850-855.

Bossaerts, P., and Hillion, P., 1999. “Implementing statistical criteria to select return forecasting models: What do we learn?”, Review of Financial Studies, Vol. 12 No. 2, pp. 405-428.

Brandt, M. W., and Wang, K. Q., 2003, “Time-varying risk aversion and unexpected inflation, Journal of Monetary Economics, Vol. 50, pp. 1457-1498.

Breeden, D. T., Gibbons, M. R., and Litzenberger, R. H., 1989, "Empirical tests of the consumption-oriented CAPM", Journal of Finance, Vol. 44, pp. 231-262.

Brennan, M. J., and Subrahmanyam, A., 1996, “Market microstructure and asset pricing: on the compensation for illiquidity in stock returns”, Journal of Financial Economics, Vol. 41, pp. 441-464.

Brennan, M., and Xia, Y., 2005, “tay's as good as cay”, Finance Research Letters, Vol. 2, pp. 1-14.

Campbell, J., and J. Cochrane, 1999, "By force of habit: a consumption-based explanation of aggregate stock market behaviour", Journal of Political Economy, Vol. 107, pp. 205-251.

Campbell, J., and Mankiw, N., 1989, "Consumption, income, and interest rates: reinterpreting the times series evidence", in Blanchard, O., and Fischer, S. (Eds.), NBER Macroeconomics Annual, MIT Press, Cambridge, Massachussets, pp. 185-216.

Campbell, J. Y., and Shiller, R. J., 1991, “Yield spreads and interest rates: a bird’s eye view”, Review of Economic Studies, Vol. 58, pp. 495-514.

Campbell, J. Y., and Shiller, R. J., 1988, "The dividend-price ratio and expectations of future dividends and discount factors", Review of Financial Studies, Vol. 1, pp. 195-228.

Chien, Y., and Lustig, H., 2010, “The market price of aggregate risk and the wealth distribution”, Review of Financial Studies, Vol. 23, pp. 1596-1650.

Clark, T., and McCracken, M., 2001, “Tests of equal forecast accuracy and encompassing for nested models”, Journal of Econometrics, Vol. 105, pp. 85-110.

Cochrane, J. H., and Piazzesi, M., 2005, “Bond risk premia”, American Economic Review, Vol. 95 No. 1, pp. 138-160.

Constantinides, G., 1990, "Habit-formation: a resolution of the equity premium puzzle", Journal of Political Economy, Vol. 98, pp. 519-543.

Dickey, D. A., and Fuller, W. A., 1979, “Distributions of the estimators for autoregressive time series with a unit root”, Journal of American Statistical Association, Vol. 74, pp. 427-431.

Diebold, F., and Mariano, R., 1995, “Comparing predictive accuracy”, Journal of Economics and Business Statistics, Vol. 13, pp. 253-263.

Duffee, G., 2005, "Time variation in the covariance between stock returns and consumption growth", Journal of Finance, Vol. 60 No. 4, pp. 1673-1712.

Engen, E. M., and Hubbard, R. G., 2005, “Federal government debt and interest rates”, NBER Macroeconomics Annual, Vol. 19.

Engle, R., and Granger, C., 1987, “Co-integration and error-correction: representation, estimation and testing”, Econometrica, Vol. 55 No. 2, pp. 251-276.

Fama, E., 1998, "Market efficiency, long term returns and behavioral finance", Journal of Financial Economics, Vol. 49 No. 3, pp. 283-306.

Fama, E. F., and Bliss, R. H., 1987, “The information in long-maturity forward rates”, American Economic Review, Vol. 77 No. 4, pp. 680-692.

Fama, E., and French, K., 1996, "Multifactor explanations of asset pricing anomalies", Journal of Financial Economics, Vol. 51 No. 1, pp. 55-84.

Fama, E. F., and French, K. R., 1989, “Business conditions and expected returns on stocks and bonds”, Journal of Financial Economics, Vol. 25, pp. 23-49.

Fernandez-Corugedo, E., Price, S., and Blake, A., 2007, “The dynamics of consumers’ expenditure: the UK consumption ECM redux”, Economic Modelling, Vol. 24, pp. 453-469.

Gale, W. G., and Orszag, P. R., 2003, “Economic effects of sustained budget deficits”, National Tax Journal, Vol. 56, pp. 463-485.

Goyal, A., and Welch, I., 2003, “Predicting the equity premium with dividend ratios”, Management Science, Vol. 49, pp. 639-654.

Goyal, A., and Welch, I., 2004, “A comprehensive look at the empirical performance of equity premium prediction”, NBER Working Paper No. 10483.

Harvey, D., Leybourne, S., and Newbold, P., 1998, “Tests for forecast encompassing”, Journal of Business and Economic Statistics, Vol. 16, pp. 254-259.

Hjalmarsson, E., 2006, “Should we expect significant out-of-sample results when predicting stock returns?”, Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 855.

Hodrick, R. J., 1992, "Dividend yields and expected stock returns: alternative procedures for inference and measurement", Review of Financial Studies, Vol. 5, pp. 357-386.

Honohan, P., and Laeven, L., 2005, Systemic financial distress: containment and resolution, Cambridge: Cambridge University Press.

Inoue, A., and Kilian, L., 2004, “In-sample or out-of-sample tests of predictability: which one should we use?”, Econometric Reviews, Vol. 23, pp. 371-402.

Jagannathan, R., and Wang, Z., 1996, "The conditional CAPM and the cross-section of expected returns", Journal of Finance, Vol. 51, pp. 3-54.

Johansen, S., and Juselius, K., 1990, “Maximum likelihood estimation and inference on cointegration with applications to the demand for money”, Oxford Bulletin of Economics and Statistics, Vol. 52, pp. 169-210.

Julliard, C., 2004, "Labor income risk and asset returns", Princeton University, Primary Job Market Paper.

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., Shin, Y., 1992, “Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root?”, Journal of Econometrics, Vol. 54 No. 1-3, pp. 159-178.

Laeven, L., and Valencia, F., 2008, “Systemic banking crises: a new database”, IMF Working Paper No. 224.

Lamont, O., 1998, “Earnings and expected returns”, Journal of Finance, Vol. 53, pp. 1563-1587.

Lettau, M., Ludvigson, S., 2004, "Understanding trend and cycle in asset values: reevaluating the wealth effect on consumption", American Economic Review, Vol. 94, pp. 276-299.

Lettau, M., and S. Ludvigson, 2001, “Consumption, Aggregate Wealth, and Expected Stock Returns”, Journal of Finance, Vol. 41 No. 3, pp. 815-849.

Ludvigson, S., and Ng, S., 2009, “Macro factors in bond risk premia”, Review of Financial Studies, Vol. 22 No. 12, pp. 5027-5067.

Lustig, H., and van Nieuwerburgh, S., 2005, "Housing collateral, consumption insurance, and risk premia: an empirical perspective", Journal of Finance, Vol. 60, pp. 1167-1219.

Mackinnon, J., 1996, “Numerical distribution functions for unit-root and cointegration tests”, Journal of Applied Econometrics, Vol. 11, pp. 601-618.

Mankiw, N. G., and Shapiro, M. D., 1986, "Risk and return: consumption beta versus market beta", Review of Economics and Statistics, Vol. 68, pp. 452-459.

McCracken, M., 2006, “Asymptotics for out-of-sample tests of causality”, Journal of Econometrics, Vol. 140, pp. 719-752.

Nelson, C. R., and Kim, M. J., 1993, “Predictable stock returns: The role of small sample bias”, Journal of Finance, Vol. 48 No. 2, pp. 641-661.

Newey, W., and West, K., 1987, “A simple positive semi-definite, heterokedasticity, and autocorrelation consistent covariance matrix”, Econometrica, Vol. 55 No. 3, pp. 703-708.

Pastor, L., and Stambaugh, R. F., 2003, “Liquidity risk and expected stock returns”, Journal of Political Economy, Vol. 3, pp. 642-685.

Parker, J. A., and Julliard, C., 2005, "Consumption risk and the cross section of expected returns", Journal of Political Economy, Vol. 113, pp. 185-222.

Phillips, P. C. B., and Ouliaris, S., 1990, “Asymptotic properties of residual based tests for cointegration”, Econometrica, Vol. 58, pp. 165-193.

Piazzesi, M., Schneider, M., and Tuzel, S., 2007, "Housing, consumption and asset pricing", Journal of Financial Economics, Vol. 83, pp. 531-569.

Richards, A., 1995, "Comovements in national stock market returns: evidence of predictability, but not cointegration", Journal of Monetary Economics, Vol. 36, pp. 631-654.

Santos, T., and Veronesi, P., 2006, “Labor income and predictable stock returns”, Review of Financial Studies, Vol. 19, pp. 1-44.

Shiller, R. J., 1984, "Stock prices and social dynamics", Brookings Papers on Economic Activity, Vol. 84, pp. 457-510.

Sousa, R. M., 2010, “Consumption, (dis)aggregate wealth, and asset returns”, Journal of Empirical Finance, Vol. 17 No. 4, pp. 606-622.

Sousa, R. M., 2007, “Wealth shocks and risk aversion”, University of Minho, NIPE Working Paper Nº. 28.

Stambaugh, R. F., 1999, “Predictive regressions”, Journal of Financial Economics, Vol. 54 No. 3, pp. 375-421.

Stiglitz, J., and Weiss, A., 1981, “Credit rationing in markets with imperfect information”, American Economic Review, Vol. 71 No. 3, pp. 393-410.

Valkanov, R., 2003, “Long-horizon regressions: theoretical results and applications”, Journal of Financial Economics, Vol. 68, pp. 201-232.

Whelan, K., 2008, “Consumption and expected asset returns without assumptions about unobservables”, Journal of Monetary Economics, Vol. 55, No. 7, pp. 1209-1221.

Yogo, M., 2006, "A consumption-based explanation of expected stock returns", Journal of Finance, Vol. 61 No. 2, pp. 539-580.

Zeldes, S., 1989, “Optimal consumption with stochastic income: deviations from certainty equivalence”, Quarterly Journal of Economics, Vol. 104 No. 2, pp. 275-298.

List of Tables

Table 1 – Cointegration estimations. $hwy_t = \log(hw_t) + \hat{\varpi}\log(y_t) + \hat{\vartheta}t + \hat{\chi}$.

	$\hat{\varpi}$	Augmented Dickey and Fuller (1979) t-statistic	MacKinnon (1996) Critical values		Kwiatkowski et al. (1992) LM-statistic	Kwiatkowski et al. (1992) Critical values	
		Lags: Automatic based on SIC	5%	10%	Bandwidth: Newey-West using Bartlett kernel	5%	10%
Australia	1.89*** (2.57)	-1.98	-2.88	-2.58	0.15	0.46	0.35
Austria	27.75*** (4.62)	-3.90	-2.88	-2.58	0.64	0.46	0.35
Belgium	4.73*** (8.37)	-5.22	-2.88	-2.58	0.47	0.46	0.35
Canada	-10.20*** (-2.93)	-3.11	-2.88	-2.58	0.49	0.46	0.35
Denmark	12.38*** (3.42)	-2.13	-2.89	-2.58	0.74	0.46	0.35
Finland	1.80*** (3.81)	-3.22	-2.88	-2.58	0.59	0.46	0.35
France	-4.01*** (-2.95)	-3.55	-2.89	-2.58	0.59	0.46	0.35
Germany	0.54*** (2.87)	-6.27	-2.88	-2.58	0.34	0.46	0.35
Ireland	4.09*** (5.58)	-2.79	-2.88	-2.58	0.73	0.46	0.35
Italy	1.25*** (3.00)	-3.31	-2.89	-2.58	0.34	0.46	0.35
Japan	2.18*** (5.79)	-2.80	-2.88	-2.58	0.68	0.46	0.35
Netherlands	4.17*** (8.31)	-4.88	-2.88	-2.58	0.22	0.46	0.35
Spain	-20.49* (-1.40)	-1.79	-2.91	-2.59	0.70	0.46	0.35
Sweden	4.63*** (3.47)	-3.05	-2.88	-2.58	0.52	0.46	0.35
UK	2.59*** (3.73)	-3.09	-2.88	-2.58	0.10	0.46	0.35
US	4.48*** (9.31)	-2.97	-2.89	-2.58	0.27	0.46	0.35

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

Table 2 – Forecasting real stock returns: estimated effect of *hwy*.

	Forecast Horizon *H*						Forecast Horizon *H*				
	1	2	3	4	8		1	2	3	4	8
Australia	-0.20***	-0.40***	-0.53***	-0.64***	-0.99***	Ireland	0.04	0.10	0.15	0.18	0.02
	(-2.61)	(-3.23)	(-3.58)	(-3.70)	(-3.83)		(0.87)	(1.31)	(1.53)	(1.50)	(0.10)
	[0.05]	[0.13]	[0.16]	[0.10]	[0.12]		[0.00]	[0.01]	[0.01]	[0.01]	[0.00]
Austria	0.00	0.00	0.00	0.00	-0.02*	Italy	-0.25**	-0.41**	-0.47*	-0.43	0.23
	(0.59)	(0.43)	(0.46)	(0.20)	(-1.92)		(2.14)	(-2.07)	(1.92)	(-1.63)	(0.87)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]		[0.06]	[0.05]	[0.04]	[0.02]	[0.00]
Belgium	0.17***	0.34***	0.49***	0.62***	0.93***	Japan	0.08	0.13	0.17	0.19	0.07
	(2.92)	(3.80)	(4.28)	(4.41)	(4.71)		(1.20)	(1.18)	(1.22)	(1.11)	(0.31)
	[0.08]	[0.12]	[0.15]	[0.17]	[0.16]		[0.02]	[0.02]	[0.02]	[0.02]	[0.00]
Canada	-0.00	-0.00	0.00	0.01	0.04	Netherlands	0.02	0.00	-0.03	-0.06	-0.28
	(-0.34)	(-0.13)	(0.13)	(0.36)	(1.37)		(0.23)	(0.04)	(-0.18)	(-0.30)	(-0.95)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.02]		[0.00]	[0.00]	[0.00]	[0.00]	[0.01]
Denmark	0.03***	0.05***	0.08***	0.11***	0.23***	Spain	-0.01	-0.01	-0.01	-0.02	-0.01
	(2.33)	(2.76)	(2.85)	(3.18)	(3.96)		(-1.38)	(-1.24)	(-1.08)	(-0.98)	(-0.39)
	[0.03]	[0.04]	[0.04]	[0.05]	[0.11]		[0.02]	[0.02]	[0.01]	[0.01]	[0.00]
Finland	-0.11**	-0.25***	-0.39***	-0.52***	-1.06***	Sweden	0.16***	0.29***	0.38***	0.47***	0.86***
	(-2.07)	(-2.88)	(-3.12)	(-3.24)	(-3.53)		(2.80)	(3.27)	(3.44)	(3.65)	(5.25)
	[0.02]	[0.05]	[0.06]	[0.08]	[0.13]		[0.07]	[0.09]	[0.09]	[0.10]	[0.18]
France	-0.01	-0.03	-0.03	-0.01	0.10	UK	-0.20*	-0.34*	-0.46*	-0.54*	-0.59**
	(-0.43)	(-0.61)	(-0.51)	(-0.22)	(1.06)		(-1.75)	(-1.71)	(-1.78)	(-1.82)	(-2.13)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]		[0.06]	[0.06]	[0.08]	[0.08]	[0.05]
Germany	-0.27**	-0.56***	-0.87***	-1.18***	-2.10***	US	-0.16*	-0.33**	-0.45**	-0.62***	-1.42***
	(-2.38)	(-3.27)	(-4.03)	(-4.75)	(-7.39)		(-1.81)	(-2.16)	(-2.32)	(-2.71)	(-4.89)
	[0.04]	[0.06]	[0.08]	[0.11]	[0.16]		[0.03]	[0.04]	[0.05]	[0.06]	[0.16]

Notes: Newey-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 – Forecasting real government bond returns: estimated effect of *hwy*.

	Forecast Horizon *H*						Forecast Horizon *H*				
	1	2	3	4	8		1	2	3	4	8
Australia	-0.05**	-0.11**	-0.16*	-0.21**	-0.38***	Ireland	0.08***	0.17***	0.25***	0.34***	0.79***
	(-1.96)	(-1.95)	(-1.94)	(-1.96)	(-1.87)		(4.63)	(4.59)	(4.57)	(4.61)	(5.30)
	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]		[0.11]	[0.11]	[0.12]	[0.12]	[0.17]
Austria	-0.00	-0.00	-0.00	-0.00	0.00	Italy	0.05**	0.08*	0.10	0.11	0.04
	(-0.30)	(-1.62)	(-1.24)	(-1.26)	(0.07)		(2.01)	(1.79)	(1.50)	(1.18)	(0.22)
	[0.00]	[0.01]	[0.01]	[0.01]	[0.00]		[0.02]	[0.02]	[0.01]	[0.01]	[0.00]
Belgium	0.11***	0.22***	0.32***	0.43***	0.80***	Japan	0.05	0.10	0.14**	0.17***	0.32***
	(6.62)	(6.92)	(6.92)	(6.92)	(6.65)		(0.96)	(1.38)	(2.15)	(3.41)	(3.25)
	[0.25]	[0.28]	[0.28]	[0.28]	[0.27]		[0.02]	[0.03]	[0.06]	[0.09]	[0.09]
Canada	0.01***	0.02***	0.02***	0.04***	0.09***	Netherlands	-0.06***	-0.13***	-0.20***	-0.25***	-0.46***
	(3.12)	(3.46)	(3.81)	(4.22)	(6.02)		(-3.04)	(-3.94)	(-4.07)	(-3.90)	(-3.59)
	[0.05]	[0.06]	[0.07]	[0.08]	[0.14]		[0.08]	[0.11]	[0.11]	[0.11]	[0.10]
Denmark	-0.01	-0.03	-0.05	-0.07*	-0.18**	Spain	-0.02***	-0.03***	-0.05***	-0.06***	-0.12***
	(-1.12)	(-1.29)	(-1.50)	(-1.72)	(-2.32)		(-7.69)	(7.61)	(-7.98)	(-8.58)	(-10.57)
	[0.01]	[0.01]	[0.02]	[0.02]	[0.03]		[0.44]	[0.46]	[0.47]	[0.49]	[0.49]
Finland	-0.10***	-0.21***	-0.32***	-0.43***	-0.91***	Sweden	0.04*	0.05	0.08*	0.10**	0.13
	(-4.37)	(-5.25)	(-5.73)	(-5.95)	(-6.68)		(1.82)	(1.62)	(1.84)	(2.20)	(1.35)
	[0.09]	[0.11]	[0.12]	[0.13]	[0.15]		[0.03]	[0.03]	[0.03]	[0.04]	[0.02]
France	0.01**	0.03**	0.04**	0.05**	0.10**	UK	0.01	0.03	0.06	0.10	0.31***
	(2.35)	(2.36)	(2.36)	(2.31)	(2.26)		(0.54)	(0.77)	(1.14)	(1.46)	(2.59)
	[0.03]	[0.03]	[0.03]	[0.03]	[0.03]		[0.00]	[0.00]	[0.01]	[0.01]	[0.03]
Germany	0.05***	0.12***	0.20***	0.30***	0.81***	US	0.21***	0.42***	0.63***	0.81***	1.41***
	(2.70)	(4.07)	(4.90)	(5.78)	(9.42)		(7.44)	(7.56)	(7.60)	(7.38)	(6.28)
	[0.03]	[0.06]	[0.08]	[0.11]	[0.26]		[0.30]	[0.31]	[0.30]	[0.29]	[0.25]

Notes: Newey-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 4.1 – Forecasting real stock returns: additional control variables.

	hwy_{t-1}	$DivYld_{t-1}$	Adj. R-square		hwy_{t-1}	$DivYld_{t-1}$	Adj. R-square
Australia	-0.19**	5.55**	[0.08]	Ireland	0.04		[0.00]
	(2.34)	(2.22)			(0.87)		
Austria	0.00		[0.00]	Italy	-0.23**	20.48***	[0.14]
	(0.59)				(-2.02)	(3.20)	
Belgium	0.12*	-0.43	[0.04]	Japan	0.01	9.94**	[0.04]
	(1.85)	(-0.17)			(0.12)	(2.00)	
Canada	-0.00	3.13	[0.01]	Netherlands	0.73**	6.24	[0.15]
	(-0.24)	(1.20)			(2.44)	(0.66)	
Denmark	0.03***		[0.03]	Spain	-0.01		[0.02]
	(2.33)				(-1.38)		
Finland	-0.22***	-1.65	[0.05]	Sweden	0.13**	12.48***	[0.12]
	(-2.61)	(-0.66)			(2.46)	(2.73)	
France	-0.01	1.28	[0.01]	UK	-0.00	3.60***	[0.03]
	(-0.33)	(0.70)			(-0.01)	(-0.01)	
Germany	-0.68***	11.33***	[0.11]	US	0.16*	-0.07	[0.03]
	(-2.98)	(2.75)			(1.68)	(-0.04)	

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

Table 4.2 – Forecasting real government bond returns: additional control variables.

	hwy_{t-1}	$Inflation_{t-1}$	$Deficit_{t-1}$	Adj. R-square		hwy_{t-1}	$Inflation_{t-1}$	$Deficit_{t-1}$	Adj. R-square
Australia	-0.05	0.00	0.01	[0.03]	Ireland	0.05**			[0.02]
	(-1.59)	(1.10)	(0.26)			(2.01)			
Austria	-0.00	0.00		[0.01]	Italy	0.06***	0.01***	0.33***	[0.77]
	(-0.35)	(0.85)				(3.88)	(9.55)	(10.02)	
Belgium	0.04**	-0.00	-0.11***	[0.49]	Japan	0.04	0.01***	3.53**	[0.31]
	(2.49)	(-0.28)	(-4.93)			(0.47)	(4.67)	(2.06)	
Canada	-0.00	0.00**	0.04	[0.07]	Netherlands	-0.05***	0.00	0.22***	[0.28]
	(-0.51)	(2.08)	(0.05)			(-2.59)	(1.33)	(5.83)	
Denmark	-0.01	0.01***		[0.16]	Spain	-0.01***	0.01**	0.29***	[0.58]
	(-1.15)	(5.41)				(-6.42)	(2.19)	(3.11)	
Finland	-0.05*	-0.00***	0.35***	[0.20]	Sweden	0.04	0.00	0.04	[0.03]
	(-1.84)	(-3.87)	(4.22)			(1.51)	(0.62)	(0.30)	
France	0.02***	0.01***	0.02	[0.30	UK	-0.01	0.00***	0.03	[0.13]
	(4.01)	(4.89)	(0.43)			(-0.51)	(3.48)	(0.46)	
Germany	0.05**	0.00**	0.19**	[0.08]	US	0.17***	0.02***	0.28	[0.52]
	(2.47)	(1.98)	(2.02)			(5.97)	(7.49)	(1.35)	

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

Table 5 – One-quarter ahead forecasts of returns: *hwy* model vs. constant/AR models.

	Real stock returns		Real government bond returns	
	$MSE_{hwy}/MSE_{constant}$	MSE_{hwy}/MSE_{AR}	$MSE_{hwy}/MSE_{constant}$	MSE_{hwy}/MSE_{AR}
Australia	0.978	0.980	0.988	1.004
Austria	1.003	1.004	1.003	1.004
Belgium	0.964	0.990	0.870	1.005
Canada	1.003	1.004	0.979	1.000
Denmark	0.990	0.995	1.000	1.005
Finland	0.992	0.994	0.957	0.997
France	1.003	1.003	0.988	1.004
Germany	0.986	0.988	0.990	0.994
Ireland	1.002	1.002	0.945	1.004
Italy	0.976	0.992	0.994	1.003
Japan	0.996	0.996	0.995	1.000
Netherlands	1.005	1.004	0.962	1.005
Spain	0.996	0.997	0.753	1.005
Sweden	0.969	1.002	0.992	1.005
UK	0.975	0.969	1.003	1.003
US	0.991	0.997	0.842	0.997

Notes: MSE – mean-squared forecasting error. *, **, *** - statistically significant at the 10, 5, and 1% level, respectively.

Table 6.1 – Forecasting real stock returns: impact of systemic crises.

	hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square		hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	-0.84***	0.972**	[0.13]	Ireland	No episodes of systemic crisis		
	(-4.15)	(2.05)					
Austria	No episodes of systemic crisis			Italy	-0.46	0.10	[0.02]
					(-1.42)	(0.20)	
Belgium	No episodes of systemic crisis			Japan	No episodes of systemic crisis		
Canada	0.01	-0.07	[0.00]	Netherlands	No episodes of systemic crisis		
	(0.43)	(-0.76)					
Denmark	0.17***	-0.13	[0.07]	Spain	No episodes of systemic crisis		
	(2.60)	(-1.56)					
Finland	No episodes of systemic crisis			Sweden	No episodes of systemic crisis		
France	-0.01	-4.45***	[0.01]	UK	-1.10***	1.13**	[0.16]
	(-0.19)	(-7.47)			(-2.66)	(2.18)	
Germany	-1.22***	0.38	[0.11]	US	-0.70***	-0.96**	[0.07]
	(-4.45)	(0.92)			(2.81)	(-2.09)	

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

Table 6.2 – Forecasting real government bond returns: impact of systemic crises.

	hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square		hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	-0.40***	0.97***	[0.11]	Ireland	No episodes of systemic crisis		
	(-3.71)	(4.40)					
Austria	No episodes of systemic crisis			Italy	0.01	0.31	[0.02]
					(0.05)	(1.02)	
Belgium	No episodes of systemic crisis			Japan	No episodes of systemic crisis		
Canada	0.04***	-0.38***	[0.26]	Netherlands	No episodes of systemic crisis		
	(5.55)	(-12.99)					
Denmark	-0.24***	0.34***	[0.09]	Spain	No episodes of systemic crisis		
	(-2.97)	(3.34)					
Finland	No episodes of systemic crisis			Sweden	No episodes of systemic crisis		
France	0.05**	0.88*	[0.03]	UK	0.36***	-0.53***	[0.10]
	(2.28)	(1.88)			(3.86)	(-3.93)	
Germany	0.28***	0.21*	[0.12]	US	0.89***	-1.05***	[0.32]
	(4.99)	(1.84)			(7.81)	(-4.83)	

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

Table 7.1 – Forecasting real stock returns: impact of non-systemic crises.

	hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square		hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	No episodes of non-systemic crisis			Ireland	No episodes of non-systemic crisis		
Austria	No episodes of non-systemic crisis			Italy	No episodes of non-systemic crisis		
Belgium	No episodes of non-systemic crisis			Japan	0.00	0.69**	[0.04]
					(0.02)	(2.13)	
Canada	No episodes of non-systemic crisis			Netherlands	No episodes of non-systemic crisis		
Denmark	No episodes of non-systemic crisis			Spain	No episodes of non-systemic crisis		
Finland	-0.42***	-1.74***	[0.12]	Sweden	0.57***	-0.47	[0.12]
	(-2.68)	(-3.04)			(3.69)	(-1.40)	
France	No episodes of non-systemic crisis			UK	No episodes of non-systemic crisis		
Germany	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.

Table 7.2 – Forecasting real government bond returns: impact of non-systemic crises.

	hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square		hwy_{t-1}	hwy_{t-1} * *SystemicCrisis*	Adj. R-square
Australia	No episodes of non-systemic crisis			Ireland	No episodes of non-systemic crisis		
Austria	No episodes of non-systemic crisis			Italy	No episodes of non-systemic crisis		
Belgium	No episodes of non-systemic crisis			Japan	-0.13***	1.13***	[0.58]
					(-2.58)	(12.20)	
Canada	No episodes of non-systemic crisis			Netherlands	No episodes of non-systemic crisis		
Denmark	No episodes of non-systemic crisis			Spain	No episodes of non-systemic crisis		
Finland	-0.32***	-1.84***	[0.24]	Sweden	0.12**	-0.09	[0.04]
	(-4.58)	(-6.36)			(2.06)	(-1.03)	
France	No episodes of non-systemic crisis			UK	No episodes of non-systemic crisis		
Germany	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.