150 Years of Return Predictability Around the World: A Holistic View Across Assets[†]

Yang Bai

University of Missouri

(Preliminary Draft)

First Draft: Aug. 19, 2022

This Draft: Aug. 19, 2022

Abstract

Campbell and Shiller (1988b, a) show that $d_t - p_t \approx const. + E[\Sigma_{j=1}^{\infty} \rho^{j-1}(r_{t+j} - \Delta d_{t+j})]$. Therefore, if payout growth is not predictable, the payout-price ratio decides returns and the returns must be predictable. Using 150-year data from 16 developed countries across bond, equity, and housing markets, I study this implication using the payout-price ratios, i.e., coupon price, dividend price, and rent price. None of the 48 country-asset combinations shows consistent in-sample and out-of-sample performance with positive utility gain for the mean-variance investor. However, 14 (5) countries have predictable payout growth in the equity (housing) markets. Cochrane (2008, 2011, 2020) argues that the dividend predictability and the return predictability form a joint hypothesis, and the denial of time series predictability does not hold if we reject the hypothesis that the dividend growth is predictable. Contrary to Cochrane's finding, the VAR simulation using data from all the countries in the past 150 years does *not* reject the null that the dividend growth is predictable and thus the joint hypothesis test provides weak support to return predictability.

Keywords: Bond Return Predictability**,** Certainty Equivalent Return, Coupon Price, Dividend Price, Dividend Predictability, Equity Return Predictability, Housing Return Predictability, Out-of-sample R^2, Rent Price

JEL Classification: G10, G11, G12, G14

[†] Yang Bai (yangbai@mail.missouri.edu) is from the University of Missouri-Columbia.

1. Introduction

Campbell and Shiller (1988b, a) derive a definition of returns in the following form:

$$d_t - p_t \approx const. + E[\Sigma_{j=1}^{\infty} \rho^{j-1}(r_{t+j} - \Delta d_{t+j})],$$

where $d_t - p_t$ is the dividend-price ratio, r_{t+j} is the return, and Δd_{t+j} is the dividend growth. Because dividend is persistent, the definition highlights the time-varying return driven by payout-price ratios, leading to the conclusion that the return must be predictable.

Although Goyal and Welch (2008, 2021) document comprehensive evidence that the return predictability does not exist empirically with a range of predictors, especially for out-of-sample performance, the theory implication on return predictability with respect to the return-dividend relation remains unclear. This paper studies the return predictability specifically from the angle of the theory implication. Using 150-year data from Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019), I provide new comprehensive evidence against return predictability across sixteen developed countries' bond, equity, and housing markets.

The empirical tests in the prior literature focus on the US data post WWI (Goyal and Welch, 2003; Cochrane, 2008). However, the US equity market in the past one hundred years reveals only one of the infinitely many trajectories that the return series can take, and the above relation applies not only to the equity markets but also to all the other markets with time-varying payout-price ratios, including bond and housing markets. The recent literature also emphasizes that the conclusions from the US equity market since 1927 or the 1950s may not generalize to other countries and time. For example, contrary to the earlier findings in the literature on dividend predictability, Rangvid, Schmeling, and Schrimpf (2014) and Chen (2009) show that the conclusions of the dividend predictability based on the US equity market do not directly generalize to the equity markets of other countries nor subperiods. Golez and Koudijs (2018) also show that dividend growth is predictable by extending data backward in time[1].

Meanwhile, the theoretical assumption of Campbell-Shiller decomposition does not impose asset assumption that rules out the bond market and the housing market. However, the studies of return predictability of bonds and housing markets often do not take on the perspective of payout-price ratios, leading to questions on whether the return predictability based payout ratios hold in these markets (Yang, Long, Peng, and Cai 2020; Gargano, Pettenuzzo, and Timmermann, 2017; Cochrane and Piazzesi, 2005; Campbell and Shiller, 1991, 1988b, a). To sum up, there exists a gap in the literature on whether the theory implication and Cochrane's findings hold universally and across the assets. This paper tries to fill this gap.

Despite recent debate over return predictability, I confirm that the hope of return predictability based on payout-price ratios is slim across assets globally in the past 150 years (Goyal and Welch 2021; Golez and Koudijs 2018). Table 1 reports the summary of the findings. Consistency in return predictability evaluated in three aspects, i.e., in-sample (IS) significance, out-of-sample (OOS), and OOS utility gains, is a universal problem for all the asset classes. The out-of-sample performance is terrible.

Specifically, of the forty-eight country-asset combinations, no country-asset combination shows consistent predictability. The bond excess returns are the most difficult to predict with no meaningful OOS predictability, while the housing excess returns are marginally easier to predict out of the sample. The housing market shows positive CER gains four out of sixteen cases. However, two out of these CER gains are very close to zero. Given the transaction costs, ex., commission alone can be as high as 6% in

[1] They also show that the spliced historical data supports the return predictability.

the US, whether timing the housing market with rent growth can be economically meaningful — even for the most promising market, i.e., the Finnish housing market with 0.61% CER gain — remains a question[2].

[INSERT TABLE 1 ABOUT HERE]

With risky asset portfolios based on the value-weighted average of equity and housing returns and the wealth portfolio based on the value-weighted average of equity, housing, bond, and treasury bill returns, I also examine the prediction of the countries' representative agents' portfolios, from which we can learn about the likelihood that an investor can benefit from timing the overall asset returns of a country[3]. The results are still disappointing. Both the risky asset portfolios and the wealth portfolios are not predictable if we account for the OOS performance. It is hard to realize anything through timing a country's overall asset returns.

The theory shows a relation between the return and the payout growth. If payout growth is persistent and not predictable, then the theory mechanically suggests that the payout ratio decides the return variation, especially when the payout ratio varies significantly from time to time (Campbell and Shiller 1988b, a). Therefore, I test the predictability of payout growth across the assets and the countries. With the new data covering the longest time window globally in the literature, the ordinary least square regressions show that dividend growth is predictable in fourteen countries and that rent growth is predictable in five countries. Consistent with the findings from the US equity market post WWII (Golez and Koudijs, 2018; Chen, 2009), from 1873 to 2020, dividend growth is also predictable even in the US equity market, although the returns of the US equity market are not predictable during the same period.

Cochrane (2008, 2020) argues that the relation between return and dividend as implied by the theory suggests a joint hypothesis. In other words, the return predictability is not a standalone hypothesis, and it

[2] The questions on transaction cost and its influence on portfolio constructed based on real estate holdings are interesting and meaningful. However, transaction cost is beyond the scope of this paper and remains a good question for future studies.
[3] For example, Roll's critique (1978) questions the empirical tests and argue that we do not observe the entire opportunity set of the investors. Therefore, it is towards the central interest of finance that we consider the concept of "market" in a more inclusive manner.

is more convincing to test the return predictability and the dividend predictability together. Cochrane (2008) provides a VAR testing framework. During his sample period of the US data, Cochrane rejects the dividend predictability. Because of the theory implication, the rejection of dividend predictability is equivalent to the confirmation of return predictability. Pulling the long-run global data together into Cochrane's VAR simulation framework, I show that the joint hypothesis test does *not* reject the hypothesis that the dividend growth is predictable (Cochrane 2008, 2011). In other words, the joint hypothesis test does not support the logic that the dividend growth is not predictable and thus the return must be predictable.

This study contributes to the literature in three aspects. First, it expands the understanding of return predictability across the asset markets and provides a holistic view under the theoretical payout-price perspective of return predictability in the bond, the equity, and the housing markets. In the previous literature, bond return predictability and the housing return predictability are absent in the return predictability studies using payout-price ratios. However, these assets assume important percentage in the representative agent's portfolios. Housing markets, particularly, are of crucial importance to the investors globally. As Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) point out, "housing has been a good long-run investment as equities and possibly better". More importantly, Campbell-Shiller decomposition does not require an assumption of asset classes (Campbell and Shiller, 1988b, a).

Second, the studies on the representative agents' portfolios were not possible before this new data. However, the representative agents' asset holdings are important to the literature. With this new data, we have a good definition of the aggregated risky asset market and a good definition of the aggregated wealth market including everything. Through the empirical findings using the representative agents' portfolios, this paper contributes to the understanding of the relation between the payout price and the returns in the theory that often does not specify to which market the relation between payout price and return should apply. It points out that the return predictability is difficult to realize for the aggregated asset portfolios at the country level.

Third and most importantly, this paper show consistent findings across assets and countries that challenge the theory implication and provides inconsistent evidence within Cochrane's VAR simulation framework (Cochrane, 2008; Campbell and Shiller, 1988b,a). For example, the findings with the 150-year US data rule out the possibility that the dividend growth in the US equity market is not predictable. Across assets and countries, the findings from this paper provide novel evidence that questions the return predictability implied by Campbell-Shiller decomposition based on payout-price ratios (Campbell and Shiller, 1988b, a).

This paper now proceeds as the following. Section 2 provides a brief description of the database that I adopt and the empirical methods for in-sample and out-of-sample tests. Section 3 provides the main results, including the discussions on in-sample tests with linear regressions, out-of-sample R^2, and economic performance measured in the mean-variance investors' utility gains. Section 4 concludes the paper.

2. Data and Empirical Methods

I first provide a brief description of the database I adopt and the markets I analyze. I adopt the new Jordà-Schularick-Taylor macrohistory database developed by Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019)[5].

I focus on the nominal returns and the payout-price ratios, including coupon-price, dividend-price, and rent-price ratios. The tests are conducted against long-term government bonds, stocks, and housing assets at the country level. Because the database only provides coupon yield for the bond markets, i.e., $\frac{c_t}{p_{t-1}}$, I back out the coupon price defined as $\frac{c_t}{p_t}$ with the provided bond returns. The database provides the other payout-price ratios, i.e., dividend-price and rent-price ratios.

[5] The Jordà-Schularick-Taylor macrohistory database is maintained by the University of Bonn, Germany. See https://www.macrohistory.net/database/ for details. This paper adopts the 6th update of the database.

For each country, I calculate the excess returns of each market and the excess returns of the representative agent's portfolios. Then, I create the lagged payout-price ratios. Following the literature, I define both the payout-price ratios and the excess returns in log scales. The housing prices and the rents are defined as the average housing prices and the average rents for the country. The bond returns, as well as the asset allocation practice, assume annual rebalance on new long-term government bonds[6]. Table A1 reports the summary statistics.

In general, the returns are representative (Jordà, Knoll, Kuvshinov, Schularick, and Taylor, 2019). For example, the authors of the database validate the aggregation of the countries level housing market returns using different methods and from different perspectives.

2.1 Empirical Methods

This paper focuses on the three popular metrics in the literature, i.e., IS significance measured with the t statistics, OOS R^2, and CER gains. For the IS tests, I adopt the predictive ordinary least squares regression with lagged payout-price ratio.

$$r^e_{i,j,t} = a_{ij} + b_{i,j}\, dp_{i,j,t-1} + \varepsilon_{i,j,t},$$

where $dp_{i,j,t-1}$ stands for the payout-price ratio for asset I in country j in year t-1. In other words, for each asset in each country, I separately fit the country-asset combination an IS regression. With the aggregated portfolios, i.e., the representative agent' portfolios in each country, I include all three payout-price ratios, i.e., coupon price, dividend price, and rent price. I report Newey-West t statistics for the coefficients.

In the OOS tests, I start modeling with at least 20 years and adopt an expanding window that uses all the past observations (Campbell and Thompson, 2008; Goyal and Welch, 2008). I roll forward this setup to

[6] The maturities vary. See Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) for details.

make one-year-ahead predictions in each year. The prediction evaluation is based on the OOS R^2 statistics. Following the literature, I define OOS R^2 as:

$$R_{i.j}^2 = 1 - \frac{\Sigma_{t=T_1}^{T}\left(r_{i,j,t}^e - \hat{r}_{i,j,t|t-1}\right)^2}{\Sigma_{t=T_1}^{T}\left(r_{i,j,t}^e - \bar{r}_{i,j,t|t-1}\right)^2},$$

where T_1 is the starting year of prediction, $\hat{r}_{t|t-1}$ is the alternative prediction delivered by payout-price ratio, $\bar{r}_{i,j,t|t-1}$ is the prevailing historical average of excess return, and $r_{i,j,t}^e$ is the realized true excess return (See Goyal and Welch 2008; Campbell and Thompson 2008; Nealy, Rapach, Tu and Zhou 2014).

Besides statistical metrics, I also report OOS economic performance measured in CER gain calculated as the difference between the CER delivered by the portfolio based on the alternative predictions and the CER delivered by the portfolio based on the prevailing historical average of excess returns. Following Brennan and Xia (2004), Campbell and Thompson (2008) and Goyal and Welch (2008), I define CER as:

$$CER = E\left[R_p\right] - \frac{\gamma}{2} \cdot Var(R_p),$$

where R_p is the portfolio of mean-variance investor with risk aversion coefficient $\gamma = 5$. The portfolio is formed for the mean-variance investor through Markowitz rule. The mean-variance investor allocates her fund between the asset of interest, i.e., long-term government bond, equity, and housing, and the risk-free rate proxied by treasury bill of the local market. The weight on risky assets is:

$$w_{i,j,t} = \frac{1}{\gamma}\frac{\hat{r}_{i,j,t|t-1}}{\hat{\sigma}_{i,j,t|t-1}},$$

where $\hat{r}_{i,j,t|t-1}$ is the predicted excess return in percentage and $\hat{\sigma}_{i,j,t|t-1}$ is the predicted variance of excess returns (Campbell and Thompson 2008). I estimate the variance with the past 20-year realized variance. The mean-variance investor decides the weight w_t to allocate the fund to the risky assets. Following the literature, I force the weight to be in [0,1.5], i.e., the investor can take a 50% leverage in her position but cannot short sell the asset (Campbell and Thompson 2008; Goyal and Welch 2008; Nealy, Rapach, Tu, and Zhou 2014).

To understand the trading cost difference between portfolios based on the prevailing average of excess returns and the portfolios based on the predictions, I calculate the relative turnover ratio using the weight changes in the mean-variance investor's portfolio. The relative turnover ratio is calculated as the turnover rate of the portfolio based on the prevailing average of excess returns over the turnover rate of the portfolio based on the predictions. The turnover rate is defined as:

$$Turnover = \frac{1}{T}\Sigma_{t=1}^{T}\Sigma_{k=1}^{2}(|w_{i,j,k,t+1} - w_{i,j,k,t}|),$$

where T is the number of years in OOS predictions and $w_{i,j,k,t+1}$ is the weight for asset I in country j. The subscript k stands for treasury bill when k=1 and stands for risky assets, i.e., one of bond, equity, and housing, when k=2 (DeMiguel, Garlappi, and Uppal 2009; Nealy, Rapach, Tu, and Zhou 2014).

Towards the end of this paper, I conducted another set of predictive regressions for the payout growth in the equity and the housing markets using payout-price ratios, i.e., dividend price and rent price. I exclude the bond market because coupon payments are fixed, i.e., $\Delta d = 0$. Specifically, I fit the following ordinary least squares regression:

$$\Delta d_{i,j,t} = a_{i,j} + \beta_{i,j} dp_{i,j,t-1} + \varepsilon_{i,j,t},$$

where $\Delta d_{i,j,t}$ is the payout growth. This regression is implied by the theoretical relation between return predictability and dividend predictability. One way to show the return predictability is to provide evidence that the dividend growth is not predictable. If the dividend growth is not predictable, then the theory mechanically suggests that the payout price ratio, ex., $d_t - p_t$, decides return variation. On the flip side, if dividend predictability exists, it will immediately reduce the possibility that the return is predictable by the theory.

Extended from the theoretical relation, Cochrane argues that the test on the return predictability is a joint test of the return predictability and the dividend predictability. Therefore, any individual test on return predictability or dividend predictability may not be credible. He illustrates that the dividend price, the dividend growth, and the return can comove within a VAR system:

$$\begin{bmatrix} d_{t+1} - p_{t+1} \\ \Delta d_{t+1} \\ r_{t+1} \end{bmatrix} = \begin{bmatrix} \phi \\ b_d \\ b_r \end{bmatrix} (d_t - p_t) + \begin{bmatrix} \varepsilon_{t+1}^{dp} \\ \varepsilon_{t+1}^{dp} \\ \varepsilon_{t+1}^{r} \end{bmatrix}.$$

Through economic identities based on Campbell-Shiller decomposition under the assumption that the return is not predictable, this system reduces to a bivariate VAR system including the top two relations (Campbell and Shiller, 1988b, a). In other words, when we test the return predictability through the coefficient b_r, we cannot ignore the intrinsic relation between b_r and b_d. Cochrane shows that the joint hypothesis test rejects the dividend predictability during his sample period of US data (Cochrane, 2008). He argues that the absence of dividend predictability provide a more convincing support to return predictability than the evidence against return predictability from testing return predictability alone. I follow Cochrane (2009) and include his simulation tests towards the end of section 3. Because the coupons on long-term government bonds are usually fixed, i.e., $\Delta d = 0$, I focus on the equity and the housing markets for both the predictive regressions and the VAR simulation.

3. Empirical Results

I report the results from the IS predictive Regressions in this section. Using lagged payout-price ratios, I fit OLS regressions using excess returns. In summary, the IS regressions show limited predictability across countries for the bond and the equity markets. Payout prices predict excess returns in only two countries' bond markets and five countries' equity markets. However, the housing market results are compelling. The rent-price ratios predict excess returns in eight countries' housing markets, demonstrating a promising potential for consistent predictability. Table 2 reports the results.

[INSERT TABLE 2 ABOUT HERE]

Besides the predictions made for the asset markets directly, I also seek to understand whether we can make successful predictions for each country's representative agent's portfolios. Using the unique database, I calculate excess returns for the risky asset portfolios and the wealth portfolios in each country. Each risky asset portfolio comprises the equity and the housing markets, weighted by their respective capitalization. Similarly, each wealth portfolio comprises the bond market, equity market, the housing market, and the treasury bill market, weighted by their respective capitalization. Including all three payout-price ratios, the representative agents' portfolios seem promising in presenting strong return predictability according to the IS regressions. Only three countries have no IS predictability for risky asset portfolios, i.e., none of the three payout-price ratios has a significant regression coefficient. Twelve wealth portfolios show the potential of realizing return predictability based on the IS tests.

The OOS tests are much tougher. Table 3 reports the results. Based on the OOS R^2 statistics, no OOS predictability exists in any of the 16 bond markets. This finding is consistent with the findings from the US (Thornton and Valente, 2012). Dividend price predicts only one equity market out of the sample: the UK equity market. Despite strong evidence in the IS tests, the housing markets perform no better. Only two housing markets seem predictable: the French housing market and the German housing market.

[INSERT TABLE 3 ABOUT HERE]

Consistency between the IS performance and the OOS performance does not exist. No bond market out of the sixteen countries show performance that is consistent in the sample and out of the sample. Only the British market show hope for equity. Housing markets are similar, and the two markets that show some potential are the French housing market and the German housing market. For the representative agents' portfolios, only the French representative agent enjoys consistent IS and OOS predictability for the risky asset portfolio and the wealth portfolio.

I evaluate the economic performance for the predictions in the OOS periods through CER gains, the utility gains of the mean-variance investors in each country. Table 4 reports the findings of the economic performance. The economic performance in the bond and the equity markets is consistent with the weak IS and OOS performance. Two countries show positive CER gain in the bond markets, while the equity markets in Australia, Netherland and Spain show positive CER gains. Despite the strong IS performance in the housing markets, the OOS economic performance in the housing markets is consistent with the disappointing OOS statistical performance. Only four housing markets deliver positive CER gains, and two of the four markets show very limited CER gains. Note that the transaction costs in the real estate market are huge, and the mean-variance investors from all the countries will forgo even the positive CER gains when they consider the transaction costs[7].

[INSERT TABLE 4 ABOUT HERE]

Finally, table 4 also reports the trading turnover measured as the relative ratios (See section 2). Although the economic performance is weak, the turnover rates based on the payout-price ratios in the bond and the equity markets are higher than the turnover rates of the portfolios based on the prevailing excess returns by multiple folds. For example, in the Italian equity market, despite realizing nonpositive CER gains and sizably lower Sharpe ratios, the turnover rates of portfolio based on the dividend-price ratios can be four times higher than the turnover rates of the portfolios based on the prevailing excess returns. The turnover rates of the housing portfolios can also be several times higher than their corresponding null portfolios' turnover rates. In the French housing market, trading for the prediction portfolio is about 4 times as frequent as the trading for the portfolio based on the prevailing excess returns. Consistent with the CER results, it is unlikely that the strategies based on rent-price ratios will generate any profits out of the

---

[7] For example, see https://homebay.com/tips/real-estate-agent-commission-101-for-sellers/. The commission fee alone can be close to 6% in the US. A careful study from Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) further indicates that the transaction costs in 13 out of the 16 countries in the housing markets are around 7.7% of the property's value. Although the frequent trading can incur high cumulative costs in the bond and the equity markets, this paper considers annual rebalance and thus the transaction costs in the housing markets are much higher than the transaction costs in the bond markets and equity markets. In other words, even if there is significant predictability in the housing market based on the testing results, it is highly likely that the predictability will not realize in the real world. However, I do not find much evidence that the housing market is predictable with rent-price ratio. On the side, Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019) document that it is unlikely that the taxes can contribute to the differences of the returns in these markets.

sample, even if we do not consider the high transaction costs in the housing markets. The representative agents' portfolios show much worse turnover rates. Many countries show negative economic gains with relative turnover ratios above 5, emphasizing the fact that the mean-variance investors in these countries cannot get better off economically by timing the representative agents' portfolio returns.

Because of the unique relation between dividend growth and return predictability, the rejection of dividend growth is equivalent to the confirmation of return predictability. Therefore, I test the relation with ordinary least squares regressions across the countries and the markets. Table 5 reports the results.

[INSERT TABLE 5 ABOUT HERE]

In the past 150 years, 14 countries show significant loadings on dividend price in their equity markets, including the US (See also Rangvid, Schmeling, and Schrimpf, 2014). This is consistent with the findings in the 50-year *quarterly* data *from 1973 to 2009* by Rangvid, Schmeling, and Schrimpf (2014) but contradictory to the previous findings for long term dividend predictability (ex., Chen 2009). The relation between the payout-price and the excess return also exists in five housing markets, including Belgium, Germany, Portugal, Switzerland, and the US. If the theory is correct and we rely on the IS tests of the return predictability and the payout predictability, we can safely conclude that the return predictability does not exist in the equity markets of Denmark, Finland, Germany, Italy, Japan, Netherland, Norway, Spain, Sweden, Switzerland, and the US, and the return predictability does not exist in the housing markets of Belgium, Switzerland, and the US[8].

Beyond the IS tests for the payout predictability, I also replicate the simulation of Cochrane's VAR system including the dynamic relations of the payout price series, the payout growth series, and the return series (Cochrane 2008). Cochrane (2008, 2011) argues that return predictability and the dividend predictability form a joint hypothesis and thus should be tested together. Specifically, Cochrane (2008)

[8] Inoue and Killian (2005) show that the IS tests are more powerful than the OOS tests.

argues that the tests on return predictability is a joint test involving three parameters, i.e., ϕ, b_d, and b_r, in the following VAR system:

$$\begin{bmatrix} d_{t+1} - p_{t+1} \\ \Delta d_{t+1} \\ r_{t+1} \end{bmatrix} = \begin{bmatrix} \phi \\ b_d \\ b_r \end{bmatrix} (d_t - p_t) + \begin{bmatrix} \varepsilon_{t+1}^{dp} \\ \varepsilon_{t+1}^{dp} \\ \varepsilon_{t+1}^{r} \end{bmatrix}.$$

However, based on Campbell-Shiller (1988b, a) decomposition, two identity relations exist that reduce one dimension of the system, leading to the VAR system below under the null hypothesis that return predictability does not exist, where the parameters reflect the joint null hypothesis, i.e., $b_r = 0, and\ b_d = \rho\phi - 1 < 0$.

$$\begin{bmatrix} d_{t+1} - p_{t+1} \\ \Delta d_{t+1} \\ r_{t+1} \end{bmatrix} = \begin{bmatrix} \phi \\ \rho\phi - 1 \\ 0 \end{bmatrix} (d_t - p_t) + \begin{bmatrix} \varepsilon_{t+1}^{dp} \\ \varepsilon_{t+1}^{d} \\ \varepsilon_{t+1}^{d} - \rho\varepsilon_{t+1}^{dp} \end{bmatrix}.$$

Under the assumptions, Cochrane (2008) argues that if the return predictability does not exist, then dividend growth has to be predictable, and b_d has to be equal to $\rho\phi - 1 < 0$. During his sample period of the US data, Cochrane (2008) documents that the tests on the VAR system rejects the null hypothesis that the dividend growth is predictable, which presents strong evidence that the return is predictable according to the theory.

Using data from all the markets, I conduct the VAR simulation analysis with 10000 repetitions following Cochrane (2008) for the equity and the housing markets. Figure 1 reports the findings. The simulation does *not* reject the null hypothesis that the returns are *not* predictable in the equity and the housing markets. However, different from the findings in other studies, the hypothesis that dividend growth is predictable is also *not* rejected in the equity markets using all of the international data, presenting new evidence against the time series return predictability globally (Cochrane 2008; Golez and Koudijs 2018).

On the other hand, the simulation suggests that there can be hope to observe return predictability in the housing markets[9].

[INSERT FIGURE 1 ABOUT HERE]

4. Conclusion

Return predictability has been a central focus of the asset pricing literature because it is regarded as a crucial indicator of time-varying returns. The theory implies that the return is predictable if the dividend (or rent for housing market) is not predictable (Campbell and Shiller, 1988b, a). Although the literature reaches some solid conclusions for the OOS performance with the US equity market data (Goyal and Welch, 2008, 2021), the literature is inconclusive regarding the relation between the return predictability and the dividend predictability. Cochrane's VAR simulation also leaves a hope that the return predictability exists because we reject the hypothesis that the divided growth is predictable within the VAR framework (Cochrane, 2008). Collectively, a gap exists in the literature that calls for a study to reconsider the relation between the empirical findings and the theory implications from the angle of the return-dividend relation.

Meanwhile, a paucity of research into the generalizability of such conclusions exists for other asset markets and across countries, where the theoretical conclusion also applies, and the predictability in the *long run* for payout growth, ex., dividend growth, remains inconclusive globally. For example, despite the similarity, no study has documented the return predictability of payout-price ratios in the bond and the housing markets. In the recent years, a couple of papers show the possibility that the findings of the US equity market cannot generalize to the other (sub) time periods and countries (Golez and Koudijs, 2018;

[9] However, since the observed rent-price coefficient b_r is negative for the housing markets, it is still possible that the rent process has a rent price coefficient smaller than 0 and thus is predictable, especially consider that 1/3 of the countries in the OLS regressions show predictable rent growth. A simulation test with a null hypothesis of zero on b_r will be included soon.

Rangvid, Schmeling, and Schrimpf, 2014; Chen, 2009). This paper addresses these issues through a comprehensive examination across assets and countries.

I provide to the literature a holistic view on the return predictability implied by Campbell and Shiller (1988b, a). With evidence from sixteen countries since the 1870s and across bond, equity, and housing markets, the return predictability of payout-price ratios, i.e., coupon price, dividend price, and rent price, remains weak in the sample, out of the sample, and economically. None of the forty-eight country-asset combinations shows consistent IS performance, OOS performance, and positive utility gain. When we limit our consideration to the bond and the equity markets, only two bond markets and four equity markets show IS predictability. The OOS performance is even worse, and the economic performance is terrible.

Using the weighted averages of excess returns from the bond, the equity, and the housing markets, I evaluate the predictability of the excess returns from the representative agents' portfolios in all sixteen countries. The results are consistent with the findings from the individual markets, suggesting that the mean-variance investors cannot benefit from timing the representative agents' portfolios using the payout-price ratios.

The theory implies that the rejection of dividend (or rent for housing market) predictability is equivalent to the confirmation of return predictability. Consistent with the findings using data from the 1970s by Rangvid, Schmeling and Schrimpf (2014), I document that, in the past 150 years, 14 (5) countries show dividend (rent) predictability. Even the dividend growth in the US equity market is predictable from the 1870s to 2020. In other words, from the perspective of the return-dividend relation as implied by the theory, we do not have a clear support for return predictability from the angle of dividend predictability.

Cochrane (2008, 2011) argues that this relation indicates a joint hypothesis and that the absence of the dividend predictability implies the return predictability. (Cochrane, 2008). In the end, I run the simulation proposed by Cochrane with the pulled data from all the countries in the past 150 years to account for all the possible trajectories of market movements. The joint hypothesis test does not reject that null that the return is not predictable and the dividend is predictable. Taking together with Cochrane's VAR analysis, the IS and the OOS tests, the findings from this paper collectively highlight the absence of evidence to support the return predictability based on payout-price ratios across assets and countries.

References

Bansal, Ravi, and Amir Yaron. “Risks for the Long Run: A Potential Resolution of Asset Pricing Puzzles.” *The Journal of Finance*, vol. 59, no. 4, Aug. 2004, pp. 1481–1509.

Boudoukh, Jacob, et al. “The Myth of Long-Horizon Predictability.” *Review of Financial Studies*, vol. 21, no. 4, 25 Oct. 2006, pp. 1577–1605.

Campbell, John Y. “Stock Returns and the Term Structure.” *Journal of Financial Economics*, vol. 18, no. 2, June 1987, pp. 373–399.

Campbell, John Y., and Robert J. Shiller. “Stock Prices, Earnings, and Expected Dividends.” *The Journal of Finance*, vol. 43, no. 3, July 1988, pp. 661–676.

Campbell, John Y., and Robert J. Shiller. “The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors.” *The Review of Financial Studies*, vol. 1, no. 3, 1988, pp. 195–228.

Campbell, John Y., and Samuel B. Thompson. “Predicting Excess Stock Returns out of Sample: Can Anything Beat the Historical Average?” *Review of Financial Studies*, vol. 21, no. 4, 20 Nov. 2007, pp. 1509–1531.

Campbell, John Y., and Robert J. Shiller. “Yield Spreads and Interest Rate Movements: A Bird’s Eye View.” *The Review of Economic Studies*, vol. 58, no. 3, May 1991, p. 495.

Chen, Long. “On the Reversal of Return and Dividend Growth Predictability: A Tale of Two Periods.” *Journal of Financial Economics*, vol. 92, no. 1, Apr. 2009, pp. 128–151.

Clark, Todd E, and Michael W McCracken. “Tests of Equal Forecast Accuracy and Encompassing for Nested Models.” *Journal of Econometrics*, vol. 105, no. 1, Nov. 2001, pp. 85–110.

Clark, Todd E., and Kenneth D. West. “Approximately Normal Tests for Equal Predictive Accuracy in Nested Models.” *Journal of Econometrics*, vol. 138, no. 1, May 2007, pp. 291–311.

Cochrane, John H. “The Dog That Did Not Bark: A Defense of Return Predictability.” *Review of Financial Studies*, vol. 21, no. 4, 22 Sept. 2007, pp. 1533–1575.

Cochrane, John H. “Presidential Address: Discount Rates.” *The Journal of Finance*, vol. 66, no. 4, 19 July 2011, pp. 1047–1108.

Cochrane, John H. “The Dog and the Straw Man: Response to “Dividend Growth Does Not Help Predict Returns Compared to Likelihood-Based Tests: An Anatomy of the Dog.”” *Critical Finance Review*, vol. 10, no. 3, 2021, pp. 465–470.

Cochrane, John H, and Monika Piazzesi. “Bond Risk Premia.” *American Economic Review*, vol. 95, no. 1, Feb. 2005, pp. 138–160.

DeMiguel, Victor, et al. “Optimal versus I Diversification: How Inefficient Is the 1/N Portfolio Strategy?” *Review of Financial Studies*, vol. 22, no. 5, 2007, pp. 1915–1953.

Fama, Eugene F., and Kenneth R. French. “Business Conditions and Expected Returns on Stocks and Bonds.” *Journal of Financial Economics*, vol. 25, no. 1, Nov. 1989, pp. 23–49.

---. “Dividend Yields and Expected Stock Returns.” *Journal of Financial Economics*, vol. 22, no. 1, Oct. 1988, pp. 3–25.

Foster, F. Douglas, et al. “Assessing Goodness-Of-Fit of Asset Pricing Models: The Distribution of the Maximal R 2.” *The Journal of Finance*, vol. 52, no. 2, June 1997, p. 591

Golez, Benjamin, and Peter Koudijs. “Four Centuries of Return Predictability.” *Journal of Financial Economics*, vol. 127, no. 2, Feb. 2018, pp. 248–263.

Goyal, Amit, et al. “A Comprehensive Look at the Empirical Performance Of Equity Premium Prediction II.” *SSRN Electronic Journal*, 2021.

Goyal, Amit, and Ivo Welch. “Predicting the Equity Premium with Dividend Ratios.” *Management Science*, vol. 49, no. 5, May 2003, pp. 639–654.

Gargano, Antonio, et al. “Bond Return Predictability: Economic Value and Links to the Macroeconomy.” *Management Science*, vol. 65, no. 2, Feb. 2019, pp. 508–540.

Inoue, Atsushi, and Lutz Kilian. “In-Sample or Out-of-Sample Tests of Predictability: Which One Should We Use?” *Econometric Reviews*, vol. 23, no. 4, 2 Jan. 2005, pp. 371–402.

Jordà, Òscar, et al. “The Rate of Return on Everything, 1870–2015.” *The Quarterly Journal of Economics*, 9 Apr. 2019.

Kandel, Shmuel, and Robert F. Stambaugh. “On the Predictability of Stock Returns: An Asset-Allocation Perspective.” *The Journal of Finance*, vol. 51, no. 2, June 1996, pp. 385–424.

Keim, Donald B., and Robert F. Stambaugh. “Predicting Returns in the Stock and Bond Markets.” *Journal of Financial Economics*, vol. 17, no. 2, Dec. 1986, pp. 357–390.

Kothari, S.P., and Jay Shanken. “Book-To-Market, Dividend Yield, and Expected Market Returns: A Time-Series Analysis.” *Journal of Financial Economics*, vol. 44, no. 2, May 1997, pp. 169–203.

Lettau, Martin, and Sydney Ludvigson. “Consumption, Aggregate Wealth, and Expected Stock Returns.” *The Journal of Finance*, vol. 56, no. 3, June 2001, pp. 815–849.

McCracken, Michael W. “Asymptotics for out of Sample Tests of Granger Causality.” *Journal of Econometrics*, vol. 140, no. 2, Oct. 2007, pp. 719–752.

Neely, Christopher J., et al. “Forecasting the Equity Risk Premium: The Role of Technical Indicators.” *Management Science*, vol. 60, no. 7, July 2014, pp. 1772–1791.

Newey, Whitney K., and Kenneth D. West. “A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix.” *Econometrica*, vol. 55, no. 3, May 1987, p. 703.

Pastor, Lubos, and Robert F. Stambaugh. “Predictive Systems: Living with Imperfect Predictors.” *The Journal of Finance*, vol. 64, no. 4, 16 July 2009, pp. 1583–1628.

Rangvid, Jesper, et al. “Dividend Predictability around the World.” *Journal of Financial and Quantitative Analysis*, vol. 49, no. 5-6, 22 Aug. 2014, pp. 1255–1277.

Rapach, David E., et al. “International Stock Return Predictability: What Is the Role of the United States?” *The Journal of Finance*, vol. 68, no. 4, 16 July 2013, pp. 1633–1662.

Rapach, David, and Guofu Zhou. “Asset Pricing: Time-Series Predictability.” *SSRN Electronic Journal*, 2021.

Stambaugh, Robert F. “Predictive Regressions.” *Journal of Financial Economics*, vol. 54, no. 3, Dec. 1999, pp. 375–421.

Valkanov, Rossen. “Long-Horizon Regressions: Theoretical Results and Applications.” *Journal of Financial Economics*, vol. 68, no. 2, May 2003, pp. 201–232.

Welch, Ivo, and Amit Goyal. “A Comprehensive Look at the Empirical Performance of Equity Premium Prediction.” *Review of Financial Studies*, vol. 21, no. 4, 17 Mar. 2007, pp. 1455–1508.

West, Kenneth D. “Asymptotic Inference about Predictive Ability.” *Econometrica*, vol. 64, no. 5, Sept. 1996, p. 1067.

Yang, Bingduo, et al. “Testing the Predictability of U.S. Housing Price Index Returns Based on an IVX-AR Model.” *Journal of the American Statistical Association*, vol. 115, no. 532, 7 Jan. 2020, pp. 1598–1619.

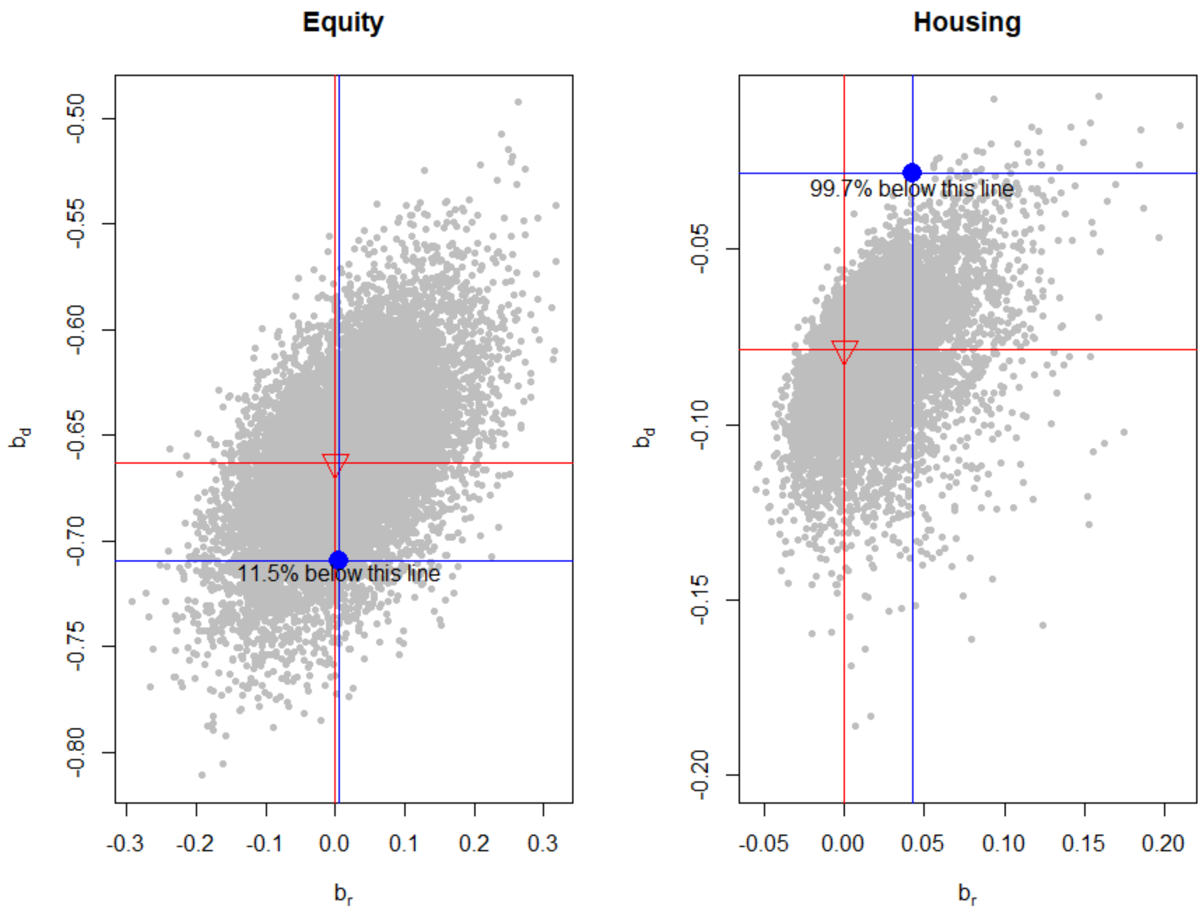

Figure 1 VAR Simulation of Cochrane (2008)

	Estimates				Null		
	$\hat{\rho}$	$\hat{\phi}$	$\hat{b}_d$	$\hat{b}_r$	ϕ_0	$b_{d,0}$	$b_{r,0}$
Equity	0.966	0.349	-0.711	0.006	0.349	-0.663	0.000
Housing	0.954	0.966	-0.033	0.043	0.966	-0.079	0.000

This figure presents the simulation results of excess return system following the VAR analysis by Cochrane (2008). Red lines and triangles mark the null hypothesis. Blue lines and solid dots mark the empirical estimates. The parameters are based on all the observations across the countries. The input of the covariance is based on the empirical estimates. The empirical estimates and the null hypotheses are stated in the above table.

In the equity market, the simulation does not reject the joint hypothesis that the return is not predictable, and the dividend is predictable. In the housing market, the simulation rejects the hypothesis that the rent is predictable. However, it is still possible that the coefficient of rent price is negative, i.e., $b_d < 0$, which means rent can be predictable[10].

[10] Results with a null $b_{d,0} < 0$ instead of $b_{d,0} = -0.079$ will be included in the updated draft soon.

Table 1 Summary of Results

This table reports the summary of in-sample and out-of-sample results across the countries and assets. The tests are all conducted for excess returns calculated as the difference between the asset returns and the treasury bills. The predictors are payout-price ratios, i.e., coupon-price ratios, dividend-price ratios, and the rent-price ratios. The tests cover long-term government bonds, stocks, housing assets, and representative portfolios formed with these assets. The risky portfolios include housing assets and stocks. The wealth portfolios include long-term government bonds, stocks, housing assets, and treasury bills. The representative agents' portfolios are value-weighted based on market capitalization. The predictors for representative agents' portfolios include all payout-price ratios. The "IS" columns report the in-sample significance of the predictors based on the Newey-West t stats. The "OOS" columns report the out-of-sample R-squared statistics. The "CER" columns report the Certainty Equivalent Return (CER) gains calculated using the null portfolios and the alternative portfolios, where the null portfolios are the prevailing average of excess returns, and the alternative portfolios are based on the predictions from the payout-price ratios. "Y" indicates the predictor successfully passed the test and marks either a significant in-sample coefficient, a significant positive out-of-sample R-squared value, or a positive CER gain. Predictions that pass both the in-sample test and the out-of-sample test are highlighted with gold background.

	Bond			Equity			Housing			Risky			Wealth		
Country	IS	OOS	CER	IS	OOS	CER	IS	OOS	CER	IS	OOS	CER	IS	OOS	CER
Australia				Y		Y									
Belgium				Y											
Denmark							Y			Y			Y		
Finland							Y		Y	Y			Y		
France				Y			Y	Y		Y	Y		Y	Y	
Germany							Y	Y		Y			Y		
Italy									Y	Y		Y	Y		Y
Japan	Y		Y				Y		Y						
Netherlands						Y	Y			Y			Y		
Norway										Y			Y		
Portugal	Y			Y			Y			Y			Y		
Spain			Y			Y				Y			Y		
Sweden										Y					
Switzerland									Y	Y			Y		
UK				Y	Y		Y			Y			Y		
USA										Y			Y		

Table 2 In-Sample Predictive Regression

This table reports the in-sample predictive OLS regressions of the excess returns from different asset classes using payout-price ratios in annual frequency. The excess returns are calculated as the difference between the asset returns and the treasury bill rates. The tests cover long-term government bonds, stocks, housing assets, and the two representative portfolio returns formed with these assets. The risky portfolios are the countries' representative agents' portfolios formed with housing assets and stocks. The wealth portfolios are the countries' representative agents' portfolios formed with bonds, stocks, housing assets, and treasury bills. These aggregated portfolios are value weighted. The coefficients are the regression loadings on the predictor ratios. The t stats are the Newey-West t stats. Panel A through E report the results for bond excess returns, equity excess returns, housing excess returns, risky portfolio excess returns, and wealth portfolio excess returns, respectively.

Panel A: Bond Excess Return on Coupon Price					
Country	Start	End	Coeff	NW t	R^2
Australia	1901	2020	0.024	1.626	0.022
Belgium	1871	2020	0.003	0.183	0.000
Denmark	1871	2020	0.007	0.474	0.003
Finland	1871	2020	0.016	1.369	0.016
France	1871	2020	-0.006	-0.687	0.002
Germany	1871	2020	-0.001	-0.207	0.000
Italy	1871	2020	-0.005	-0.255	0.001
Japan	1882	2020	**-0.017**	-4.645	0.079
Netherlands	1871	2020	-0.002	-0.211	0.000
Norway	1871	2020	0.003	0.197	0.000
Portugal	1872	2020	**0.026**	1.652	0.019
Spain	1901	2020	-0.015	-1.009	0.013
Sweden	1872	2020	0.008	0.625	0.004
Switzerland	1901	2020	-0.004	-0.728	0.003
UK	1871	2020	0.016	1.183	0.009
USA	1872	2020	0.009	0.488	0.003

Table 2 (Continued)

Panel B: Equity Excess Return on Dividend Price					
Country	Start	End	Coeff	NW t	R^2
Australia	1871	2020	**0.124**	1.673	0.031
Belgium	1871	2020	**0.049**	2.021	0.013
Denmark	1874	2020	-0.004	-0.138	0.000
Finland	1913	2020	0.029	0.717	0.003
France	1871	2020	**0.095**	3.179	0.051
Germany	1871	2020	-0.003	-0.051	0.000
Italy	1871	2020	0.019	0.377	0.001
Japan	1887	2020	0.018	0.743	0.005
Netherlands	1901	2020	0.066	1.108	0.018
Norway	1882	2020	0.041	0.738	0.007
Portugal	1872	2020	**0.029**	7.066	0.147
Spain	1901	2020	0.001	0.659	0.000
Sweden	1872	2020	0.019	0.370	0.001
Switzerland	1901	2020	-0.018	-0.399	0.002
UK	1872	2020	**0.216**	3.878	0.129
USA	1873	2020	0.025	0.804	0.004

Table 2 (Continued)

Panel C: Housing Excess Return on Rent Price					
Country	Start	End	Coeff	NW t	R^2
Australia	1902	2020	0.034	1.373	0.010
Belgium	1891	2020	-0.033	-1.270	0.013
Denmark	1877	2020	**0.039**	2.008	0.048
Finland	1921	2020	**0.097**	2.119	0.120
France	1872	2020	**0.089**	2.132	0.059
Germany	1872	2020	**0.054**	1.965	0.047
Italy	1929	2020	0.033	0.880	0.038
Japan	1932	2020	**0.100**	2.421	0.132
Netherlands	1872	2020	**0.097**	3.481	0.115
Norway	1872	2020	0.053	1.390	0.021
Portugal	1949	2020	**0.086**	2.533	0.103
Spain	1902	2020	0.048	1.601	0.028
Sweden	1884	2020	0.030	1.008	0.014
Switzerland	1903	2020	0.022	0.695	0.005
UK	1897	2020	**0.071**	2.501	0.037
USA	1892	2020	0.078	1.460	0.021

Table 2 (Continued)

Panel D: Representative Agents' Risky Asset Portfolios on All Payout-Price Ratios									
			Coupon Price		Dividend Price		Rent Price		
Country	Start	End	Coeff	NW t	Coeff	NW t	Coeff	NW t	R^2
Australia	1902	2020	-0.061	-1.435	0.044	1.299	-0.042	-1.595	0.061
Belgium	1891	2020	0.004	0.178	-0.002	-0.044	-0.015	-0.955	0.005
Denmark	1880	2020	-0.006	-0.288	0.024	1.010	**-0.026**	-2.510	0.064
Finland	1921	2019	0.018	0.483	**0.118**	2.613	-0.011	-0.551	0.110
France	1872	2020	**-0.074**	-5.578	**0.093**	2.389	-0.006	-0.465	0.238
Germany	1872	2020	-0.023	-1.106	**0.061**	2.897	**-0.028**	-3.254	0.091
Italy	1929	2020	**-0.108**	-2.875	**0.032**	1.726	-0.033	-1.484	0.267
Japan	1932	2020	0.012	0.466	0.084	1.181	0.010	0.997	0.152
Netherlands	1901	2020	-0.031	-1.190	**0.119**	3.067	-0.025	-1.385	0.174
Norway	1882	2019	-0.016	-0.638	**0.061**	1.933	-0.034	-1.466	0.050
Portugal	1949	2019	0.001	0.605	**0.134**	4.065	-0.020	-0.810	0.181
Spain	1902	2017	-0.020	-0.884	0.032	1.214	**-0.042**	-1.879	0.061
Sweden	1884	2019	-0.026	-0.974	**0.060**	1.729	**-0.029**	-1.685	0.038
Switzerland	1903	2015	-0.004	-0.369	0.048	1.074	**-0.035**	-3.584	0.079
UK	1897	2019	**0.075**	2.386	**0.060**	1.807	-0.007	-0.407	0.079
USA	1892	2020	-0.004	-0.206	0.074	1.406	**-0.045**	-2.912	0.061

Table 2 (Continued)

Panel E: Representative Agents' Wealth Portfolios on All Payout-Price Ratios									
			Coupon Price		Dividend Price		Rent Price		
Country	Start	End	Coeff	NW t	Coeff	NW t	Coeff	NW t	R^2
Australia	1902	2020	-0.051	-1.497	0.028	1.069	-0.024	-1.183	0.042
Belgium	1891	2020	0.003	0.163	0.004	0.128	-0.012	-0.811	0.005
Denmark	1880	2020	-0.007	-0.468	0.014	0.753	**-0.020**	-2.399	0.047
Finland	1921	2019	0.017	0.516	**0.108**	2.688	-0.006	-0.319	0.116
France	1872	2020	**-0.053**	-4.814	**0.075**	2.313	-0.004	-0.409	0.216
Germany	1872	2020	-0.017	-1.014	**0.050**	2.830	**-0.021**	-3.084	0.087
Italy	1929	2020	**-0.083**	-2.712	0.014	1.122	-0.028	-1.644	0.244
Japan	1932	2020	0.014	0.663	0.051	0.785	0.008	1.202	0.144
Netherlands	1901	2020	-0.027	-1.229	**0.069**	2.325	-0.017	-1.138	0.120
Norway	1882	2019	-0.014	-0.713	**0.045**	1.763	**-0.031**	-1.779	0.054
Portugal	1949	2019	0.002	1.502	**0.113**	7.887	-0.002	-0.260	0.168
Spain	1902	2017	-0.014	-0.773	0.020	0.830	**-0.035**	-1.895	0.059
Sweden	1884	2019	-0.015	-0.692	0.036	1.216	-0.021	-1.523	0.024
Switzerland	1903	2015	-0.001	-0.127	0.055	1.475	**-0.033**	-3.935	0.090
UK	1897	2019	**0.048**	1.771	0.018	0.645	0.006	0.456	0.056
USA	1892	2020	-0.008	-0.547	**0.085**	1.944	**-0.028**	-2.467	0.052

Table 3 Out-of-Sample Tests

This table reports the out-of-sample R-squared statistics in annual frequency with p values from Clark-West tests. The out-of-sample tests cover long-term government bonds, stocks, housing assets, and the two representative portfolio returns formed with these assets. For each asset class and each country, predictions start after 20 years after the data become available. The moving window is an expanding window, which uses all the historical data that are available. The risky portfolios are the countries' representative agents' portfolios formed with housing assets and stocks. The wealth portfolios are the countries' representative agents' portfolios formed with long-term government bonds, stocks, housing assets and treasury bills. These aggregated portfolios are value weighted.

	Bond		Equity		Housing		Risky		Wealth	
Country	R^2_{OOS}	P_{CW}	R^2_{OOS}	P_{CW}	R^2_{OOS}	P_{CW}	R^2_{OOS}	P_{CW}	R^2_{OOS}	P_{CW}
Australia	-0.011	0.513	0.014	0.180	-0.026	0.459	-0.019	0.311	-0.043	0.719
Belgium	-0.030	0.547	-0.010	0.317	-0.100	0.628	-0.318	0.655	-0.249	0.548
Denmark	-0.060	0.545	-0.042	0.514	-0.002	0.220	-0.125	0.807	-0.167	0.594
Finland	-0.088	0.764	-0.052	0.149	-0.169	0.436	-0.118	0.083	-0.111	0.074
France	-0.022	0.508	0.003	0.280	**0.042**	0.030	**0.102**	0.033	**0.108**	0.021
Germany	-0.148	0.592	-20.631	0.408	**0.014**	0.049	-0.287	0.025	-0.322	0.034
Italy	-0.090	0.535	-0.238	0.258	0.045	0.172	-0.292	0.153	-0.296	0.241
Japan	0.009	0.159	-0.099	0.989	-0.040	0.576	-0.429	0.438	-0.684	0.432
Netherlands	-0.036	0.323	-0.021	0.904	0.034	0.110	-0.010	0.146	-0.079	0.434
Norway	-0.038	0.737	-0.023	0.553	-0.089	0.205	-0.225	0.995	-0.258	0.912
Portugal	-0.049	0.828	0.030	0.313	0.052	0.144	-4.703	0.601	-4.891	0.670
Spain	-0.065	0.371	-0.547	0.990	-0.017	0.454	-0.115	0.150	-0.093	0.129
Sweden	-0.087	0.849	-0.019	0.097	-0.017	0.326	-0.078	0.112	-0.102	0.167
Switzerland	-0.144	0.233	-0.120	0.228	-0.051	0.339	-0.074	0.133	-0.066	0.145
UK	-0.050	0.204	**0.099**	0.020	-0.065	0.019	-0.151	0.543	-0.186	0.672
USA	-0.029	0.869	-0.022	0.711	-0.224	0.928	-0.195	0.907	-0.267	0.605

Table 4 Out-of-Sample Economic Performance

This table reports the Sharpe ratio, Certainty Equivalent Return (CER) gains, and relative turnover based on the null portfolios formed with the prevailing historical mean of excess returns and the alternative portfolios formed with the predictions made by payout-price ratios. Both the null portfolios and the alternative portfolios are constructed from the mean-variance investor's perspective. The risk aversion coefficient is assumed to be 5. Sharpe Ratios and relative turnover are in decimal, while CER gains are in percentage. Bold font indicates positive CER gain. The significance of the CERs is decided following DeMiguel, Garlappi, and Uppal (2009) and reported through z stats.

Panel A: Bond Markets					
	Null SR	Alt SR	CER Gain	CER Z	Turnover
Australia	-0.01	0.05	-0.47	-1.47	2.03
Belgium	-0.01	0.00	-0.69	-2.74	2.78
Denmark	-0.02	-0.06	-0.69	-4.13	5.91
Finland	0.12	0.20	-0.90	-1.01	6.71
France	0.00	-0.02	-0.25	-9.64	2.16
Germany	0.27	0.22	-0.40	-9.28	1.83
Italy	-0.09	-0.03	-0.50	-1.06	5.28
Japan	0.00	0.19	**0.66**	7.32	Inf
Netherlands	-0.05	-0.14	-0.58	-12.35	2.75
Norway	-0.05	-0.13	-0.44	-5.95	2.68
Portugal	0.06	0.03	-0.94	-2.29	1.70
Spain	-0.04	0.00	**0.14**	2.60	2.17
Sweden	0.01	0.08	-0.30	-1.30	4.82
Switzerland	0.41	0.32	-0.46	-6.99	2.69
UK	0.02	-0.02	-0.22	-10.51	3.53
USA	0.01	0.02	0.01	0.29	54.04

Table 4 (Continued)

Panel B: Equity Markets					
	Null SR	Alt SR	CER Gain	CER Z	Turnover
Australia	0.40	0.42	**0.27**	6.27	1.53
Belgium	0.15	0.17	-0.10	-0.67	4.53
Denmark	0.21	0.16	-0.78	-4.14	1.95
Finland	0.30	0.26	-0.71	-3.94	3.23
France	0.15	0.18	0.02	0.08	4.77
Germany	0.09	0.09	-6.05E+18	0.00	1.34
Italy	0.06	0.01	-1.64	-3.11	4.20
Japan	0.13	0.05	-0.47	-3.99	3.30
Netherlands	0.33	0.38	**1.52**	1.90	3.69
Norway	0.01	0.01	-0.48	-3.14	4.57
Portugal	0.20	0.14	-1.11	-3.81	2.32
Spain	0.16	0.22	**0.34**	2.99	2.30
Sweden	0.18	0.15	-0.19	-28.27	1.57
Switzerland	0.23	0.13	-1.36	-2.42	3.31
UK	0.26	0.31	-0.29	-0.44	3.31
USA	0.25	0.18	-0.31	-1.59	2.39

Table 4 (Continued)

Panel C: Housing Markets					
	Null SR	Alt SR	CER Gain	CER Z	Turnover
Australia	0.38	0.32	-2.74	-4.74	2.85
Belgium	0.81	0.79	-0.48	-1.64	4.09
Denmark	0.73	0.70	-0.47	-1.54	1.67
Finland	0.73	0.77	**0.61**	1.82	1.34
France	0.89	0.85	-0.51	-5.92	3.90
Germany	0.43	0.48	0.39	0.90	2.40
Italy	0.29	0.33	**0.53**	14.74	0.86
Japan	0.46	0.47	**0.13**	11.60	Inf
Netherlands	0.77	0.82	0.21	0.38	2.40
Norway	0.72	0.64	-1.03	-1.67	3.24
Portugal	0.78	0.77	-0.22	-4.57	4.26
Spain	0.40	0.36	-0.20	-0.65	2.28
Sweden	0.82	0.73	-0.87	-2.83	1.97
Switzerland	1.15	1.14	**0.01**	3.54	0.00
UK	0.55	0.55	-0.12	-0.21	3.31
USA	0.76	0.62	-0.82	-6.92	1.97

Table 4 (Continued)

Panel D: Representative Agents' Risky Asset Portfolios					
	Null SR	Alt SR	CER Gain	CER Z	Turnover
Australia	0.43	0.37	-2.45	-4.67	6.29
Belgium	0.64	0.59	-0.83	-1.43	5.07
Denmark	0.70	0.66	-0.45	-3.02	2.39
Finland	0.50	0.64	1.26	0.88	1.32
France	0.92	0.75	-1.87	-3.47	11.39
Germany	0.44	0.56	0.93	1.02	7.61
Italy	0.30	0.34	**0.56**	2.20	3.97
Japan	0.42	0.40	-0.15	-1.08	4.64
Netherlands	0.81	0.77	-0.72	-2.14	7.11
Norway	0.76	0.62	-1.42	-4.48	5.27
Portugal	0.65	0.56	-1.60	-5.98	2.89
Spain	0.46	0.46	0.08	0.13	5.11
Sweden	0.73	0.70	-0.39	-1.13	3.50
Switzerland	0.90	0.88	-0.06	-0.36	6.25
UK	0.57	0.48	-0.95	-1.00	3.88
USA	0.62	0.52	-1.07	-4.63	7.24

Table 4 (Continued)

Panel E: Representative Agents' Wealth Portfolios					
	Null SR	Alt SR	CER Gain	CER Z	Turnover
Australia	0.45	0.43	-0.28	-3.45	6.90
Belgium	0.64	0.54	-1.02	-2.16	4.77
Denmark	0.71	0.67	-0.47	-1.76	5.05
Finland	0.50	0.63	1.27	1.06	1.32
France	0.86	0.70	-1.53	-5.86	20.24
Germany	0.45	0.60	0.69	1.04	8.50
Italy	0.36	0.38	**0.26**	1.80	4.12
Japan	0.47	0.45	-0.21	-5.51	6.22
Netherlands	0.84	0.76	-0.83	-9.20	9.16
Norway	0.76	0.66	-1.01	-4.36	6.65
Portugal	0.63	0.51	-1.85	-7.76	2.73
Spain	0.50	0.45	-0.49	-1.04	5.50
Sweden	0.77	0.75	-0.37	-1.36	4.30
Switzerland	0.92	0.87	-0.38	-2.40	5.28
UK	0.53	0.43	-0.89	-1.50	3.09
USA	0.61	0.53	-0.66	-8.14	5.73

Table 5 Payout Predictability: Dividend Growth and Rent Growth

This table reports the OLS regressions of payout growth on payout-price ratios. Panel A reports for the equity markets using dividend growth and dividend price. Panel B reports for the housing markets using rent growth and rent price.

Panel A: Dividend Growth on Dividend Price					
Country	Start	End	Coeff	NW t	R^2
Australia	1871	2020	-0.088	-1.317	0.017
Belgium	1871	2020	**-0.125**	-2.097	0.045
Denmark	1874	2020	**-0.119**	-2.847	0.060
Finland	1914	2020	**-0.256**	-4.040	0.130
France	1871	2020	-0.033	-0.582	0.008
Germany	1871	2020	**-0.871**	-40.747	0.904
Italy	1871	2020	**-0.175**	-3.410	0.091
Japan	1887	2020	**-0.028**	-1.779	0.024
Netherlands	1901	2020	**-0.366**	-3.740	0.192
Norway	1882	2020	**-0.275**	-2.044	0.117
Portugal	1872	2020	**-0.695**	-4.702	0.635
Spain	1901	2020	**-0.864**	-28.774	0.865
Sweden	1872	2020	**-0.296**	-5.682	0.201
Switzerland	1901	2020	**-0.194**	-4.621	0.128
UK	1872	2020	**-0.164**	-1.705	0.067
USA	1873	2020	**-0.097**	-3.133	0.127

Table 5 (Continued)

Panel B: Rent Growth on Rent Price					
Country	Start	End	Coeff	NW t	R^2
Australia	1902	2020	0.028	1.107	0.007
Belgium	1891	2020	**-0.097**	-1.827	0.191
Denmark	1877	2020	-0.028	-1.613	0.089
Finland	1921	2020	-0.010	-0.174	0.001
France	1872	2020	0.050	1.272	0.020
Germany	1872	2020	**-0.064**	-1.831	0.083
Italy	1929	2020	-0.033	-0.795	0.044
Japan	1932	2020	-0.020	-0.489	0.007
Netherlands	1872	2020	0.004	0.273	0.002
Norway	1872	2020	-0.011	-0.463	0.002
Portugal	1949	2020	**0.080**	2.630	0.112
Spain	1902	2020	-0.008	-0.388	0.002
Sweden	1884	2020	0.001	0.051	0.000
Switzerland	1903	2020	**-0.070**	-3.047	0.165
UK	1897	2020	-0.020	-0.673	0.007
USA	1892	2020	**-0.129**	-4.208	0.233

Appendix

Table A1 Summary Statistics

This table reports the summary statistics of the variables in this paper. Panel A (B/C/D) reports the summary statistics of the bond markets (equity markets/housing markets/representative agents' portfolios) with coupon-price ratio (dividend-price ratio/rent-price ratio/weighted average of excess returns). The excess returns and payout-price ratios are all in log scales.

Panel A: Bond Markets								
Country	Variable	Mean	SD	Min	Q1	Median	Q3	Max
Australia	Bond Excess Return	0.01	0.07	-0.18	-0.03	0.00	0.04	0.23
Australia	CP	-2.97	0.41	-3.77	-3.26	-3.00	-2.80	-1.97
Belgium	Bond Excess Return	0.01	0.07	-0.20	-0.03	0.01	0.05	0.25
Belgium	CP	-3.13	0.45	-4.95	-3.39	-3.15	-2.85	-2.05
Denmark	Bond Excess Return	0.00	0.07	-0.22	-0.04	0.00	0.04	0.37
Denmark	CP	-3.07	0.59	-5.79	-3.30	-3.14	-2.88	-1.71
Finland	Bond Excess Return	0.01	0.09	-0.28	-0.02	0.01	0.05	0.35
Finland	CP	-2.92	0.71	-7.29	-3.15	-2.99	-2.54	-1.57
France	Bond Excess Return	0.01	0.09	-0.25	-0.04	0.01	0.07	0.28
France	CP	-3.14	0.60	-6.72	-3.46	-3.13	-2.80	-1.85
Germany	Bond Excess Return	0.02	0.05	-0.19	-0.01	0.01	0.04	0.32
Germany	CP	-3.13	0.61	-7.04	-3.31	-3.10	-2.79	-2.34
Italy	Bond Excess Return	0.01	0.09	-0.34	-0.02	0.01	0.04	0.32
Italy	CP	-2.84	0.43	-4.22	-3.06	-2.91	-2.69	-1.67
Japan	Bond Excess Return	0.00	0.05	-0.15	-0.03	-0.01	0.03	0.19
Japan	CP	-3.22	0.86	-7.57	-3.20	-2.87	-2.81	-2.27
Netherlands	Bond Excess Return	0.01	0.06	-0.21	-0.03	0.01	0.05	0.20
Netherlands	CP	-3.25	0.50	-5.93	-3.46	-3.30	-3.01	-2.21
Norway	Bond Excess Return	0.00	0.05	-0.18	-0.02	0.00	0.02	0.18
Norway	CP	-3.14	0.45	-4.66	-3.38	-3.13	-2.94	-2.03
Portugal	Bond Excess Return	0.02	0.11	-0.38	-0.02	0.02	0.07	0.58
Portugal	CP	-2.87	0.55	-4.94	-3.24	-2.99	-2.39	-1.80
Spain	Bond Excess Return	0.01	0.07	-0.25	-0.01	0.01	0.03	0.25
Spain	CP	-3.05	0.50	-5.13	-3.22	-3.13	-3.02	-1.87
Sweden	Bond Excess Return	0.01	0.08	-0.42	-0.03	0.00	0.03	0.21
Sweden	CP	-3.18	0.64	-7.73	-3.37	-3.20	-2.97	-2.12
Switzerland	Bond Excess Return	0.02	0.05	-0.13	-0.01	0.01	0.04	0.16
Switzerland	CP	-3.40	0.61	-8.02	-3.49	-3.31	-3.11	-2.61
UK	Bond Excess Return	0.01	0.09	-0.26	-0.04	0.00	0.04	0.31
UK	CP	-3.20	0.52	-4.73	-3.56	-3.30	-2.92	-1.71
USA	Bond Excess Return	0.00	0.07	-0.18	-0.03	0.00	0.03	0.22
USA	CP	-3.24	0.42	-4.05	-3.46	-3.30	-3.03	-1.97

Table A1 (Continued)

Panel B: Equity Markets								
Country	Variable	Mean	SD	Min	Q1	Median	Q3	Max
Australia	Equity Excess Return	0.05	0.14	-0.58	0.00	0.07	0.13	0.36
Australia	DP	-3.03	0.20	-3.56	-3.19	-3.03	-2.88	-2.59
Belgium	Equity Excess Return	0.03	0.20	-0.86	-0.08	0.01	0.13	0.79
Belgium	DP	-3.37	0.47	-5.81	-3.52	-3.26	-3.11	-2.44
Denmark	Equity Excess Return	0.04	0.16	-0.70	-0.05	0.02	0.10	0.46
Denmark	DP	-3.18	0.55	-4.59	-3.35	-2.98	-2.82	-2.17
Finland	Equity Excess Return	0.07	0.26	-0.76	-0.08	0.07	0.23	0.95
Finland	DP	-3.14	0.48	-4.78	-3.31	-3.03	-2.85	-2.34
France	Equity Excess Return	0.02	0.19	-0.56	-0.08	0.02	0.14	0.73
France	DP	-3.40	0.44	-5.35	-3.54	-3.29	-3.17	-2.57
Germany	Equity Excess Return	0.20	1.80	-2.19	-0.06	0.05	0.15	21.64
Germany	DP	-3.87	3.21	-25.72	-3.69	-3.34	-3.00	-2.06
Italy	Equity Excess Return	0.03	0.25	-0.68	-0.09	0.02	0.16	0.91
Italy	DP	-3.35	0.48	-5.57	-3.55	-3.19	-3.05	-2.60
Japan	Equity Excess Return	0.02	0.20	-0.52	-0.12	0.03	0.15	0.61
Japan	DP	-3.51	0.82	-5.41	-4.21	-3.21	-2.85	-2.33
Netherlands	Equity Excess Return	0.06	0.18	-0.72	-0.04	0.07	0.17	0.54
Netherlands	DP	-3.14	0.37	-4.01	-3.44	-3.16	-2.86	-2.30
Norway	Equity Excess Return	0.02	0.18	-0.82	-0.06	0.02	0.13	0.52
Norway	DP	-3.27	0.39	-4.57	-3.46	-3.24	-3.04	-2.12
Portugal	Equity Excess Return	0.02	0.22	-0.73	-0.06	0.03	0.10	0.67
Portugal	DP	-3.94	2.91	-25.72	-3.81	-3.34	-2.96	-2.63
Spain	Equity Excess Return	0.04	0.18	-0.50	-0.08	0.04	0.15	0.65
Spain	DP	-3.80	3.55	-25.72	-3.52	-3.24	-2.99	-2.19
Sweden	Equity Excess Return	0.04	0.18	-0.53	-0.05	0.06	0.14	0.49
Sweden	DP	-3.26	0.32	-4.23	-3.41	-3.23	-3.05	-2.61
Switzerland	Equity Excess Return	0.04	0.18	-0.44	-0.06	0.05	0.15	0.45
Switzerland	DP	-3.57	0.50	-4.88	-3.93	-3.52	-3.20	-2.23
UK	Equity Excess Return	0.04	0.16	-0.79	-0.02	0.04	0.13	0.81
UK	DP	-3.21	0.27	-3.91	-3.40	-3.20	-3.04	-2.15
USA	Equity Excess Return	0.05	0.17	-0.54	-0.06	0.07	0.16	0.40
USA	DP	-3.23	0.45	-4.45	-3.45	-3.15	-2.93	-2.29

Table A1 (Continued)

Panel C: Housing Markets								
Country	Variable	Mean	SD	Min	Q1	Median	Q3	Max
Australia	Housing Excess Return	0.05	0.10	-0.20	0.00	0.04	0.08	0.84
Australia	RP	-3.33	0.28	-4.11	-3.42	-3.26	-3.13	-2.85
Belgium	Housing Excess Return	0.07	0.09	-0.15	0.03	0.06	0.09	0.38
Belgium	RP	-2.89	0.30	-3.49	-3.13	-2.82	-2.68	-2.36
Denmark	Housing Excess Return	0.05	0.07	-0.16	0.02	0.06	0.09	0.24
Denmark	RP	-2.77	0.41	-3.71	-3.12	-2.60	-2.43	-2.14
Finland	Housing Excess Return	0.07	0.13	-0.27	0.04	0.08	0.13	0.53
Finland	RP	-2.81	0.45	-3.87	-2.94	-2.76	-2.44	-2.18
France	Housing Excess Return	0.07	0.08	-0.10	0.02	0.06	0.11	0.42
France	RP	-3.08	0.23	-3.67	-3.18	-3.06	-2.92	-2.65
Germany	Housing Excess Return	0.04	0.10	-0.34	0.00	0.04	0.09	0.44
Germany	RP	-2.93	0.38	-3.50	-3.26	-2.98	-2.71	-2.03
Italy	Housing Excess Return	0.03	0.11	-0.16	-0.02	0.02	0.07	0.60
Italy	RP	-3.57	0.66	-5.31	-3.58	-3.39	-3.18	-2.82
Japan	Housing Excess Return	0.05	0.07	-0.13	0.00	0.04	0.08	0.28
Japan	RP	-3.15	0.26	-3.67	-3.38	-3.15	-2.95	-2.60
Netherlands	Housing Excess Return	0.06	0.09	-0.25	0.01	0.06	0.11	0.29
Netherlands	RP	-2.89	0.32	-3.61	-3.10	-2.91	-2.67	-2.04
Norway	Housing Excess Return	0.05	0.08	-0.23	0.01	0.06	0.11	0.42
Norway	RP	-2.76	0.23	-3.42	-2.84	-2.70	-2.61	-2.43
Portugal	Housing Excess Return	0.07	0.08	-0.19	0.02	0.08	0.12	0.28
Portugal	RP	-3.28	0.32	-3.77	-3.50	-3.33	-3.07	-2.38
Spain	Housing Excess Return	0.05	0.12	-0.36	-0.03	0.04	0.12	0.38
Spain	RP	-3.34	0.40	-4.21	-3.61	-3.30	-3.07	-2.40
Sweden	Housing Excess Return	0.06	0.07	-0.30	0.01	0.07	0.10	0.27
Sweden	RP	-2.73	0.29	-3.59	-2.87	-2.68	-2.53	-2.16
Switzerland	Housing Excess Return	0.05	0.06	-0.09	0.01	0.06	0.09	0.20
Switzerland	RP	-3.12	0.19	-3.51	-3.26	-3.13	-2.98	-2.73
UK	Housing Excess Return	0.04	0.09	-0.18	-0.01	0.04	0.09	0.29
UK	RP	-3.32	0.24	-3.81	-3.46	-3.30	-3.14	-2.78
USA	Housing Excess Return	0.05	0.08	-0.31	0.02	0.04	0.08	0.32
USA	RP	-2.98	0.15	-3.30	-3.06	-2.99	-2.92	-2.57

Table A1 (Continued)

Panel D: Representative Agents' Portfolios								
Country	Variable	Mean	SD	Min	Q1	Median	Q3	Max
Australia	Risky Excess Return	0.05	0.09	-0.23	0.02	0.05	0.08	0.76
	Wealth Excess Return	0.04	0.07	-0.15	0.02	0.04	0.07	0.60
Belgium	Risky Excess Return	0.07	0.11	-0.19	0.01	0.05	0.11	0.51
	Wealth Excess Return	0.05	0.08	-0.10	0.01	0.04	0.08	0.41
Denmark	Risky Excess Return	0.05	0.08	-0.15	0.02	0.05	0.09	0.25
	Wealth Excess Return	0.04	0.06	-0.12	0.01	0.04	0.08	0.23
Finland	Risky Excess Return	0.08	0.16	-0.25	0.02	0.08	0.14	0.80
	Wealth Excess Return	0.07	0.14	-0.22	0.02	0.07	0.12	0.73
France	Risky Excess Return	0.07	0.08	-0.07	0.01	0.05	0.11	0.35
	Wealth Excess Return	0.05	0.06	-0.08	0.01	0.04	0.09	0.24
Germany	Risky Excess Return	0.04	0.09	-0.35	0.00	0.04	0.08	0.39
	Wealth Excess Return	0.03	0.07	-0.26	0.00	0.03	0.07	0.35
Italy	Risky Excess Return	0.04	0.11	-0.18	-0.02	0.03	0.07	0.57
	Wealth Excess Return	0.04	0.09	-0.09	0.00	0.02	0.06	0.47
Japan	Risky Excess Return	0.05	0.08	-0.12	0.01	0.04	0.08	0.27
	Wealth Excess Return	0.04	0.06	-0.11	0.01	0.04	0.07	0.22
Netherlands	Risky Excess Return	0.07	0.09	-0.15	0.02	0.06	0.12	0.33
	Wealth Excess Return	0.05	0.07	-0.12	0.01	0.05	0.09	0.21
Norway	Risky Excess Return	0.05	0.07	-0.19	0.02	0.06	0.10	0.28
	Wealth Excess Return	0.04	0.06	-0.16	0.01	0.05	0.08	0.23
Portugal	Risky Excess Return	0.07	0.09	-0.24	0.03	0.08	0.13	0.31
	Wealth Excess Return	0.06	0.09	-0.23	0.03	0.07	0.12	0.30
Spain	Risky Excess Return	0.05	0.10	-0.33	-0.02	0.05	0.10	0.34
	Wealth Excess Return	0.04	0.08	-0.21	-0.01	0.04	0.09	0.25
Sweden	Risky Excess Return	0.06	0.08	-0.14	0.00	0.06	0.11	0.37
	Wealth Excess Return	0.05	0.07	-0.13	0.00	0.05	0.09	0.30
Switzerland	Risky Excess Return	0.05	0.07	-0.11	0.00	0.06	0.11	0.24
	Wealth Excess Return	0.05	0.06	-0.09	0.00	0.05	0.09	0.21
UK	Risky Excess Return	0.05	0.09	-0.19	-0.01	0.06	0.11	0.27
	Wealth Excess Return	0.03	0.07	-0.13	-0.01	0.04	0.08	0.23
USA	Risky Excess Return	0.05	0.09	-0.34	0.01	0.06	0.10	0.31
	Wealth Excess Return	0.04	0.08	-0.33	0.01	0.05	0.08	0.30