Department of Social Systems and Management

Discussion Paper Series

No. 1154

Stocks, Consumption, and Wealth: Some Evidence from the Tokyo Stock Exchange

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First version, March 2004
Second version, May 2005
This version, July 2006

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Stocks, Consumption, and Wealth: Some Evidence from the Tokyo Stock Exchange

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July 2006

Abstract

This paper empirically analyzes the determinants of returns on the Tokyo Stock Price Index (Topix). The term spread and consumption-wealth ratio (CWR) are considered as explanatory variables. Using US data, the CWR is found to be relevant for predicting stock returns (Lettau and Ludvigson 2001a), and thus is introduced as a risk factor in the standard asset pricing model which results in the better performance of the asset pricing model (Lattau and Ludvigson 2001b). This paper constructs the Japanese CWR and analyzes its information content. We report that Japanese (not US) CWR contains useful information for the prediction of Japanese stock returns. However, in contrast to the US case, it does not seem to be an appropriate macroeconomic indicator representing a risk factor in Japan.

JEL classification: G100
Keywords: Topix, the consumption-wealth ratio, the capital asset pricing model

Handling editor: Professor Hamao

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1 Introduction

Japanese stock prices have generally followed a declining trend since the financial bubble burst in the early 1990s. The Topix (Tokyo Stock Price Index), which is one of the most frequently cited Japanese aggregated stock price indices, recorded its highest ever level of 2,859.57 points in December 1989, but thereafter started to decline as far as 965.77 points in August 2003. The adverse effects of the bubble bursting have hit the financial sector directly, have spread nationwide, and have led the country into a lingering economic recession.

Stock movements have had significant political and economic implications in the past. In particular, falling stock prices signal a decline in the credibility of the economic policies of the government and Bank of Japan (BOJ). Furthermore, falling stock prices have direct relevance to making financial portfolio decisions. Due to the forward-looking nature of stock prices, potential investors view companies with stagnating stock prices as facing imminent financial constraints and thus as having poor business prospects. In light of their political and economic significance, the government has frequently attempted to prevent further declines by taking direct measures, so-called price keeping operations (PKOs).[1] One might expect that the government purchase of stocks under PKOs might prevent further slips in stock prices. However, this practice seems to have had only marginal and temporary effects, if any, on stock prices (Nagayasu 2003). Therefore, a question often posed to policy-makers is what has caused this prolonged weak performance in the stock market. In this connection, weak economic fundamentals such as consumption and income (wealth) have frequently been pointed out however without empirical investigation.

Against this background, this paper revisits issues related to the determinants of Topix returns using both aggregated and disaggregated data. Our contribution to the existing literature is threefold. First, we construct the consumption-wealth ratio (CWR) for Japan. Recently, Lettau and Ludvigson (2001a) reported that the US CWR contains useful information for predicting US aggregated stock data. Secondly, to the extent that consumption is one component of this ratio, we can analyze whether weak macroeconomic conditions

[1] Due to confidentiality concerns, the size and frequency of PKOs are not disclosed.

are indeed factors contributing to the stagnated stock market. Finally, using the CWR, we extend the standard capital asset pricing model (CAPM) by relaxing its assumption of the constant risk premia. Lettau and Ludvison (2001b) show improvements in the performance of the CAPM using the US data. In short, we shall examine the relevance of the CWR in the Japanese stock market, which has not been examined before.

This paper consists of four sections. Section 2 reviews previous empirical research focusing on the determinants of stock returns. Section 3 initially explains how the Japanese CWR is constructed, and analyzes its information content for the prediction of stock returns. Since the standard capital asset pricing model (CAPM) does not perform well in Japan (e.g., Nakano and Saito 1998) indicating the existence of significant risk premia, this study is extended to investigate whether the CWR represents risk factors in Japan using the asset pricing models *à la* Lettau and Ludvigson (2001b). Finally, the paper ends with Section 4, where based on the findings from our cross-sectional analysis, we conclude that the Japanese CWR has relevant information about investors expectations of stock returns in Japan. Yet, the US CWR does not have significant information for the prediction of the Japanese stock returns although stock returns in both countries are often positively correlated (Nagayasu 2006). Furthermore, unlike the US data, the Japanese CWR seems unable to be able to summarize risk factors in Japan.

2 Literature Review

The majority of research has been conducted on US aggregated stock market data, and has focused on stock returns. The data transformation from stock prices to returns is partly in order to make use of the stationarity of stock returns because in this case the analysis can be based on the standard statistical distribution.

Previous research has identified a number of indicators that may help select a comprehensive set of determinants for stock returns.[2] Typical examples of explanatory variables include the dividend-price ratio (DPR), the price-book value ratio (PBR), the price-earnings ratio (PER), the term spread ($Term$) between long- and short-term assets, and short-term interest rates. As shown by Campbell and Shiller (1988), the DPR is pos-

[2] A comprehensive review is provided by Campbell, Lo, and MacKinlay (1997) and Cochrane (2005).

itively correlated with stock returns if expected dividend growth is unchanged. A low PBR implies that a stock price is undervalued and is thus expected to increase in the future. Similarly, a low PER is often viewed as indicating undervalued stock prices and thus purchasing such stocks is regarded as a good investment.

Empirical results seem to support the first two views. A positive relationship between Japanese stock returns and the DPR is reported by Rao, Aggarwal, and Hiraki (1992); a negative relationship between the PBR and stock returns by Chan, Hamao, and Lakonishok (1991) and Aggarwal, Hiraki, and Rao (1992). Somewhat mixed results for the PER have been documented by Aggarwal, Rao, and Hiraki (1990) and Chan, Hamao, and Lakonishok (1991). Therefore, these studies seem to suggest that Japanese stock returns can be predicted by some of these explanatory variables.[3]

These results from Japanese data share many of those of the US data. Among indicators, Campbell, Lo, and MacKinlay (1997) report that the interest rate and the DPR seem to contain much information on US stock returns. In particular, the DPR is the most successful explanatory variable for long-horizon forecasts according to their review.

More recently, based on the well-known linearized formula for the DPR (Campbell and Shiller 1988), Lettau and Ludvigson (2001) have proposed use of the consumption-wealth ratio (CWR) for the prediction of stock returns, as it is expected to capture business cycle movements. Assuming that wealth (W) consists of human capital and asset holdings, W can be defined as:

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

where C_t is consumption and R is the net return on the wealth. Approximating equation (1) based on the first order Taylor expansion and solving forwardly, the non-explosive solution will result in the consumption-wealth ratio ($c_t - w_t$). In other words, like the dividend-price ratio, DPR, (e.g., Campbell and Shiller 1988), they derive the relationship between $c_t - w_t$ and the returns ($r_t = ln(1 + R)$) in logarithmic form as follows.

$$c_t - w_t = E_t \sum_{i=1}^{\infty} \rho^i (r_{t+i} - \Delta c_{t+i}) \tag{2}$$

[3]Fama (1991) discusses that the presence of explanatory variables could represent market inefficiency since the fundamental determinants may indicate the existence of risk factors.

where c_t and w_t are log consumption and wealth at time t respectively, and $\Delta c_{t+i} = c_{t+i} - c_{t+i-1}$. The E_t is an expectations operation, and ρ is the ratio of investment to wealth. Notably, like the dividend-price ratio, this equation indicates a positive relationship between the consumption-wealth ratio and stock returns. This positive correlation can be interpreted as investors reducing their current consumption relative to their wealth when they perceive a decline in future returns. In their analysis of prediction of US stock data, Lettau and Ludvigson (2001a) show a positive relationship between stock returns and the CWR and furthermore the latter is found to contain very useful information for the short-term prediction of stock returns indicating that it reflects changes in the investors' expectations about future returns.

Recently, the explanatory power of the CWR has been examined for stock returns in countries other than the US. For example, Hamburg, Hoffmann, and Keller (2005) have constructed a German CWR and report, unlike the US, the poor performance of the German CWR in predicting its own stock returns. In a more global context, Nitschka (2004) examines the predictability of stock returns in industrialized countries using the US CWR (CWR^*), and confirms the significance of the CWR^* except for Japan. Inclusion of the CWR^* in explaining stock returns in other countries can be justified in highly integrated financial markets where a positive correlation likely exists between stock returns across countries.

Due to the availability of data, this study will focus mainly on the information content of the Japanese and US CWR and $Term$ in predicting Japanese stock returns. As summarized by Cochrane (2005), $Term$ is found to contain more relevant information than the DPR and PER particularly for short-term prediction. Therefore, we consider only the short-term (up to two years) prediction of stock returns.[4]

[4]Our focus on the short-term prediction of stock returns is also due to the size of available data required to construct a Japanese CWR.

3 Empirical Analysis

3.1 Data Description and Preliminary Analysis

Our data set includes the stock return (r), the term spread ($Term$), and the consumption-wealth ratio (CWR). All data are quarterly and are obtained from the Nikkei Needs database,[5] except "wealth" which is from the Flow of Funds Accounts data compiled by the BOJ. The type of data used to derive the CWR is largely consistent with Lettau and Ludvigson (2001a). (See Appendix I for detailed information.) However, while our data for Japan measure the wealth level of households only, the US wealth (Lettau and Ludvigson 2001a) represents that of households and nonprofit organizations.[6] The US CWR (CWR^{*}) is obtained from Ludvigson's homepage (http://www.econ.nyu.edu/user/ludvigsons).

Our sample period covers 1970Q3 to 1999Q1, and is determined by the availability of data.[7] Notably, interest rate data are available in this database from 1970Q3, and wealth data based on the 1963 System of National Accounts (SNA) methodology are available until 1999Q1. While more recent wealth data are available for Japan, they are compiled using the 1993 SNA. Since reconciliation of these data based on different methodologies is extremely complicated because of the different classification, measurement, and valuation methods employed in the data compilation, we shall not attempt to create a recent data set consistent with the 1963 SNA methodology.

Our endogenous variable, the stock return, is based on the Topix, the most comprehensive aggregated stock data in Japan (Figure 1). The Tokyo Stock Exchange (TSE) consists of a first and second section, and the shares listed (about 1,500 companies) on the first section are included in the compilation of the Topix. The basic time-series properties of the log stock returns ($r_t = log(P_t/P_{t-1})$, where P_t is a stock price index at time t) are summarized in Table 1 where the stock returns are found to be normally distributed and

[5] The Nikkei Needs database contains Japanese financial and economic indicators, and is one of the most comprehensive databases in Japan.

[6] In Japan, households are a significant sector in Japan holding about 60 percent of the total assets in 2005. Nonprofit organizations account for only a fraction of the total assets, and its asset size is a mere 8 percent approximately of households.

[7] The PER and PBR are available from 1977 from Nikkei Media Marketing, which will be used in subsection 3.3.

contain no ARCH component. In addition to r_t, like Lettau and Ludvigson (2001), excess returns ($\widetilde{r}_t$) are also analyzed and are obtained here by subtracting the moving average components (lags from one to four) from the original data.

The $Term$ is also considered here as an explanatory variable. The standard market expectation is that stock returns will decline along with a rise in the term spread because an increase in the term spread indicates increased inflationary pressure based on the expectations theory of the term structure. Therefore, it is expected that a negative correlation exists between the term spread and stock returns.[8] In this study, the $Term$ is calculated by subtracting the short-term interest rate from the long-term one, and, in this study, is based on the one-month call market rate and the yield on the 10 year government bond.

3.2 Estimating the Consumption-Wealth Ratio

While all the above-mentioned variables are readily available, the CWR needs to be estimated in some way. For this purpose, Lettau and Ludvigson (2001) make the following operational suggestion. Assume that the total assets (W_t) consist of nonhuman (A_t) and human (H_t) assets ($W_t \equiv A_t + H_t$), and this identity can be approximated in log form as $w_t \approx \beta_1 a_t + (1 - \beta_1) h_t$, where indicators with small letters are log variables. By approximating h_t by log labor income (y_t), the CWR can be expressed as:

$$CWR_t = c_t - \beta_a a_t - \beta_y y_t \tag{3}$$

where c_t is log consumption and a_t is log nonhuman assets. Equation (3) can be regarded as one type of consumption function where the consumption is determined by wealth and labor income, and the CWR_t is a residual term. According to this equation, a positive relationship exists between consumption, and both asset wealth and labor income. Furthermore, when these three data are non-stationary and co-integrated, the term, CWR, must be stationary.

Prior to the co-integration study, the time-series properties of the data are analyzed using two unit root tests, the Augmented Dicky-Fuller and Dicky-Fuller GLS tests. In

[8] However, despite the theory, there is often evidence of a positive relationship between them in the US data (e.g., Fama and French 1989).

addition to components of the CWR (log consumption (c), income (y), and wealth (w)), log stock data are examined. The results are summarized in Table 2 and show that consumption, income, wealth, and stock prices are all non-stationary as we fail to reject the null of the unit root for the data in level. Non-stationary consumption, income, and wealth are consistent with previous studies (Ho 2004, Sekine 1998), and allow us to proceed to the co-integration study. Furthermore, this table shows that the stock returns (r), excess returns ($\tilde{r}$), and $Term$ are stationary.

Table 3 summarizes the main results from the co-integration method, and confirms that there is one stationary linear combination among our variables. This result is based on the VAR with $p = 5$ which is determined on the basis of the Akaike Information Criterion (AIC). Furthermore, this table presents estimates for the co-integrating vector, β, and the adjustment matrix, α. The β is a vector comprising parameters for our variables in the long-run context ($c_t + \beta_a a_t + \beta_y y_t + \beta_{Const} + \beta_{Trend} t \sim I(0)$), and α measures adjustment speeds to the long-run paths.[9] The parameter included in β for consumption is normalized and thus our estimates in Table 3 should be interpreted as follows:

$$c_t = 0.370a_t + 0.280y_t + 6.499 + 0.001Trend \quad (4)$$

Consistent with standard economic theory and the results from the US data, an increase in financial assets and/or income will result in a rise in consumption. The CWR is thus obtained on the basis of equation (3): $CWR_t = c_t - 0.370a_t - 0.280y_t - 6.499 - 0.001Trend$, and is plotted in Figure 2.

The stability of this co-integration relationship is analyzed using the method developed by Hansen and Johansen (1999). Figure 3 presents recursive estimates of eigenvalues with a 5 percent confidence band (an upper figure), and also shows recursive estimates of τ statistics (a lower figure) with which the existence of co-integration can be confirmed over time. This can be interpreted as evidence in favor of our co-integrating parameters.

Finally, this table also shows loading parameters, suggesting that the CWR_{t-1} enters negatively and significantly in the consumption equation, which is part of the VECM. The sign and significance of this variable are consistent with the time-series properties of the

[9] The terminology, "long-run," used here is consistent with that frequently used in co-integration study (Johansen 1995).

Error Correction Term which in our study is CWR_{t-1} (Engle and Granger 1987), and confirm convergence of the VECM.

3.3 Predictability of Stock Returns

3.3.1 Evidence from Time-series data

Now, we shall examine the predictability of stock returns using the explanatory variables identified in previous sub-sections. Thus, in addition to $Term$ and CWR, we consider the US CWR (CWR^*), which is estimated by Lettau and Ludvigson (2001a), as one explanatory variable. Inclusion of the last term is motivated by Nitschka (2004) who documented that the US CWR contains useful information for predicting stock returns in other industrialized countries, and is justified due to the increased integration of the financial markets between Japan and the US where stock prices tend to move in the same direction. The co-movement of stock returns can be explained by common shocks which have become increasingly important in industrialized countries in the past 38 years (Tsutsui and Hirayama 2005). In such markets, since the CWR^* has some predictive power for US stock returns (Lettau and Ludvigson 2001a), some movements in Japanese stock returns may also be explained by the CWR^*.

Table 4 presents statistical results of the predictability of Topix returns using the $Term$, CWR, and CWR^*. The stock return equations are estimated by the least squared method with correction to the residual in order to obtain heteroscedasticity and autocorrelation consistent covariance. We have considered the predictability of both simple stock returns (r) and excess returns ($\widetilde{r}$) for several forecasting time horizons (one to eight quarters) since the explanatory variables may contain useful information for prediction in the distant future.

The result suggests clearly that none of our explanatory variables is significant for the prediction for any time horizon, which is also true for the simple and excess returns. This result is in rather contrast to the US where the CWR^* is found useful for both short- and mid-term predictions (Lettau and Ludvigson 2001a). But our findings are similar to those from non-US sources such as Germany (Hamburg, Hoffmann, and Keller 2005). They argue that the limited effect of the German CWR is due to the significant differences in the financial and pension systems in Germany and the US. We share their view about these structural differences likely accounting for the differing findings and moreover believe this will also hold true for comparisons between Japan and the US. After all, only a very small portion (9 percent) of Japanese financial assets is in the form of stocks, compared with 35 percent in the US. However, our results from the simple time-series analysis may be attributable to the limited sample size and our specification which ignores any cross-sectional information. Therefore, we shall next examine the same issue using a group of individual stock data.

3.3.2 Evidence from Cross-sectional Data

In this section, the stock return equation, analogous to the one used in the previous section, will be investigated in the cross-sectional context.[10] Our explanatory variables, therefore, include the CWR, $Term$ and CWR^*. However, the definition of excess returns here is slightly different from that in the previous sub-section as dealing with disaggregated data. Here excess returns are the difference between individual stock price and Topix.

Several specifications are considered here in order to see the robustness of our findings. Our specifications allow us to study the usefulness of the CWR in different time periods and stock portfolios (i.e., by size, PER, PBR, and ROE). Furthermore, the performance of the stock return equation is examined industry by industry. Such equations are estimated using the GMM which allows us to calculate the heteroschedasticity-autocorrelation (HAC) standard errors. Since the GMM can correct for both cross-sectional and serial correlation in the data, this estimation method is more flexible than the Fama-MacBeth approach with the Shankel correction factors intensively used by Lettau and Ludvigson (2001b) in order to correct for the cross-sectional correlation.[11] The appropriateness of our models and instruments are checked using Hansen J statistics and the Anderson-Rubin test.[12]

[10]I am grateful to the referee for directing me to conduct research using cross-sectional data.

[11]See Cochrane (2005) for the appropriateness of the GMM procedure for our analysis.

[12]The importance of examining the appropriateness of instruments has recently gained wide acceptance since the presence of weak instruments or weak identification may bring about distortion in the sampling distribution, resulting in unreliable GMM point estimates, hypothesis tests, and confidence intervals. Stock and Togo (2002) summarize recent developments in this area. Instruments are said to be weak or under-identified when they are weakly correlated with endogenous variables. Stock and Togo use the term, weak

The GMM results from these models are reported in Tables 5-6.[13] Our cross-sectional data analysis is based on the sample period from 1977:1-1991:1, and the one-step ahead forecasting performance is studied and reported in these tables.[14] The end of our sample coincides with that of the CWR, and the starting date is decided by data availability. Earlier Japanese financial data, particularly prior to 1980, are not easily obtainable, and therefore we use data compiled by Nikkei Media Marketing, which are not usually available on the market. In general, we find that the CWR has significant information content in predicting domestic stock returns. Consistent with economic theory, the coefficient of the CWR is positive and significant. This finding is not sensitive to sample period, industry, or the size of the PER, PBR, or ROE. The results here from the cross-sectional analysis are in contrast to those from the simple time-series method. This discrepancy seems to indicate the significant cross-sectional variations among the individual stock prices, and underlines the importance of capturing them when estimating stock return equations. [15]

Interestingly, unlike the Japanese CWR, the US CWR (CWR^*) remains insignificant in the Japanese stock equation. While the positive correlation between stock returns is frequently reported (Nagayasu 2006) and thus one might anticipate that the US CWR may carry relevant information about Japanese stock returns, it appears irrelevant for their prediction. This is consistent with Nitschka's result (2004) from aggregated data, and indicates that Japanese stock returns seem to be strongly affected only by the domestic business cycle. Thus, among industrialized countries, this is a rather unusual feature of the Japanese stock market. With respect to the term spread, as before, it does not seem overall to contain significant information for explaining the stock returns.

In short, we obtain results from Japanese cross-sectional data, consistent with Lettau and Ludvigson (2001a), and our results can be interpreted as weak consumption being attributable to the poor performance of stock returns. The latter conclusion seems reason-

instruments, for the linear GMM, and weak identification for the nonlinear model and/or the model with heteroscedastic and serially correlated errors.

[13]The US CWR is dropped in the analysis here in order to focus on domestic factors.

[14]The result is more or less consistent even when slightly longer forecasting periods are considered. Furthermore, we considered the PER and PBR as determinants of stock returns, but they were found to be insignificant. The DPR is not considered due to the absence of data for individual stocks from 1977.

[15]Obviously, the small sample and different definitions of excess returns in our early study may be another factor contributing to this different outcome.

able since the depressed Japanese stock market during the post bubble period co-existed with deterioration of the economy (consumption). (This point will be elaborated further in the next subsection.) Our finding is consistent with conventional understanding of this subject, but it is the first time that this relationship has been vigorously analyzed and is proven to exist.

3.3.3 Some Evidence from the CAPM

Because Japanese CWR seems to contain significant information about expectations of its stock returns, this section uses this variable to extend the standard (unconditional) CAPM that assumes the constant risk premia. Lettau and Ludvigson (2001b) propose the CWR as a proxy for summarizing the time-varying risk premia, and discuss that the conditional CAPM (conditional upon CWR) should improve model performance as it allows for time-varying risk premia. Such an analysis is interesting since, as in other countries, there is some empirical evidence against the standard CAPM using Japanese data (Nakano and Saito 1998).

Lettau and Ludvigson (2001b) argue that there is a strong relationship between risk premia and CWR. The risk premia tend to increase (decrease) at times of high (low) CWR. Their analysis is in line with some previous studies used other conditioning variables such as labor income (Jagannathan and Wang, 1996), industrial production and inflation (Chen, Roll and Ross, 1986), and investment growth (Cochrane, 1996). Time-varying risk premia are also consistent with the habitat formation model where non-constant risk premia exist because of the risk aversion of investors. Such conditional models seem to outperform unconditional ones in cross-sectional asset pricing analysis in the US (Campbell and Cochrane 2000).

More formally, for any assets with a net return at time t ($R_{i,t+1}$), the following equation is expected to hold in the absence of arbitrage,

$$1 = E_t[M_{t+1}(1 + R_{i,t+1})] \tag{5}$$

where E is an expectation operator and M is a discount factor ($M_{t+1} = a + bR_{mv,t+1}$ where $R_{mv,t+1}$ is the mean-variance efficient return.[16] This is the standard unconditional linear

[16] $R_{mv,t+1}$ is a return on the assets that lie on the mean-variance frontier. These assets are perfectly

factor model (Ross 1976) which hinges on the assumption of the constant risk premia reflected in the constant a and b. More generally, the discount factor can be written as:

$$M_{t+1} = k' F_{t+1} \tag{6}$$

where k is the coefficient vector and $F_{t+1} = (1, R_{mv,t+1})$ in this case.

As used by Lettau and Ludvigson (2001b), the multifactor beta form of the CAPM can be expressed as:

$$E[R_{i,t+1}] = \gamma + \beta' \lambda \tag{7}$$

where β is a vector of parameters, and γ is the zero-beta rate and equals the risk free rate if such exists. The λ is a vector of factor risk premia. One variant of this general model is the consumption CAPM (CCAPM). The CCAPM assumes the discount factor is a function of consumption growth rather than the stock return. Thus, in this case, the discount factor can be shown as $M_{t+1} = a + b\Delta c_{t+1}$.[17]

The conditional factor models can be derived by relaxing the assumption for a and b from the unconditional model by making these parameters time-variant, i.e., $M_{t+1} = a_t + b_t R_{mv,t+1}$. Similarly, the conditional CCAPM can be obtained by multiplying the explanatory variable by the conditional factor, z_t, i.e., $F_{t+1} = (1, z_t, \Delta c_{t+1}, \Delta c_{t+1} z_t)'$.

Our GMM results for the conditional CCAMP are reported in Table 7. The stock return specifications used for this table correspond to those for Table 6 in Lettau and Ludvigson (2001b).[18] In our Table 7, while Japanese CWR remains significant, we report evidence of insignificant conditional variables (i.e., $\Delta c{*}CWR$), indicating that they do not contain additive information. This result is valid even when different economic states are analyzed. We considered two states, classified according to the sign of consumption growth. A consumption boom may be characterized by positive growth, while weak consumption by negative consumption growth. However, despite these distinctions, there are no prominent differences in the result.

correlated with one another and with the discount factor (Cochrane 2005).

[17]The other variant is the human capital model (Mayers 1972, Jagammathan and Wang 1996) which uses income growth.

[18]Here, following Lettau and Ludvigson (2001b), the conditioning variable is demeaned. We have also examined the three factor model including the BMS (difference in big and small stock returns) and the HML (difference in the book-market value stock returns). However, these results are not reported here since the parameters are found to be insignificant.

This point is also confirmed using the other criterion. Lettau and Ludvigson (2001b) propose the distance criterion in the GMM framework. This criterion can be calculated during the first stage of the GMM estimation and is equivalent to the square root of the minimized objective function. Since the moment conditions can be considered as pricing errors, small distance (i.e., small pricing errors) indicates small errors, and thus becomes evidence of an appropriate model (Cochrane 2005).

The distance statistics in terms of p-values are reported in Table 8 where we examine the performance of three models; the unconditional CCAPM, the unconditional CCAPM with CWR, and the conditional CCAPM. This table suggests that, like the US case, the conditional CCAPM seems to outperform the simple unconditional model in Japan. However, we note that this improvement in performance is largely attributable to the introduction of the CWR, but not as conditioning variable, since the simple unconditional CCAPM is found to be as good as the the simple conditional CCAPM. To conclude, the CWR is not an appropriate indicator summarizing the risk taking behavior of investors in Japan.[19]

4 Summary

This paper constructs a CWR based on the 1963 SNA and analyzes whether it contains useful information about investors' expectations about future Japanese stock returns. The relevance of the CWR in predicting stock returns particularly in the short-time horizon is shown by Lettau and Ludvigson (2001a) using US data. Furthermore, we have analyzed whether the CWR can represent time-varying risk factors that are absent from the standard asset pricing model.

Using Topix returns as well as the Japanese and US CWR and term spread as explanatory variables, we first show the relevance of the Japanese CWR for predicting domestic stock returns while the US CWR and term spread are found to be irrelevant. This conclusion is drawn from our cross-sectional study which is based on a large number of observations containing the information of heterogenous movements of each stock.

[19]Note that our model cannot investigate whether or not time-varying risk premia exist. Our findings may be attributable to the absence of time-varying risk premia.

Our finding of the positive and significant correlation between Japanese stock returns and local CWR is consistent with the conventional understanding of the relationship between stock performance and local economic conditions. Thus, our results suggest that weak economic conditions (negative consumption growth) explain the poor performance of the Topix over recent years, and strong stock performance often coincides with favorable economic conditions (positive consumption growth). Therefore, our findings provide evidence of weak consumption being one explanation for the recent long stagnant stock market in Japan.

However, while the significant information content of the CWR is confirmed in Japan, no evidence is obtained that it improves the performance of the standard CAPM. The extended CAPM models are examined by introducing time-varying risk factors using the CWR as a conditioning variable. The existence of time-varying risk premia is noted by Nakano and Saito (1998) using Japanese data. However, unlike the US experience, the CWR is found to be a poor proxy for the time-varying elements in risk premia. In this connection, further research could be usefully conducted to search for some macroeconomic data summarizing Japanese risk factors.

Appendix I.

The consumption data are non-durable consumption and services, and exclude shoes and clothing. The labor earnings are based on wages, incomes, and other incomes (*Koyoushashotoku*). These two types of data are obtained from the Nikkei Needs dataset. Wealth data are the stocks of "personal" financial assets based on the Flow of Funds Accounts compiled by the BOJ. Furthermore, in order to obtain as long time series data as possible, this paper uses data compiled following the old SNA (System of National Accounts) methodology. The BOJ disseminates the Flow of Funds Accounts data using two SNA standards (the 1968 and 1993 System of National Accounts). The international standard is the 1993 SNA. These two datasets are very difficult to reconcile because of the different statistical methodologies (i.e., classification and valuation) used in their compilation. All these data are converted to real terms using GDP deflators for household goods.

Appendix II.

In order to estimate equation (3), we employ Johansen's multivariate co-integration method that is based on the vector auto-regressor (VAR). Lettau and Ludvigson (2001) also use this statistical method to obtain the CWR along with the Stock-Watson method. See footnote 8 in their paper. In this methodology, the general form for y_t $(K \times T)$ which is assumed to be $I(1)$ is based on the VAR(p) where p refers to a lag order.

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \mu + \phi D_t + \varepsilon_t \tag{8}$$

where $t = 1, 2, ..., T$ and $\varepsilon_t \sim N(0, \Sigma_\varepsilon)$. The term, D_t, contains deterministic terms. Furthermore, for this equation to be stable, we assume $\det(I_k - A_1 z - \cdots - A_p z^p) \neq 0$ for $|z| \leq 1$. We shall consider a statistical model that includes the constant and linear trend in the co-integrating vector and that is statistically more general than one used by Lettau and Ludvigson (2001) who consider only the constant term in the co-integrating vector. Inclusion of the trend term in our model is due to possible measurement errors in our wealth data that do not include the wealth of non-profit organizations. Thus, when $D_t = t$, equation (4) can be transformed to the form of Vector Error Correction Model (VECM):

$$\Delta y_t = \Pi y_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + \mu + \delta t + \varepsilon_t \tag{9}$$

where $\Pi = \alpha\beta'$ with rank r. The size of r corresponds to the number of co-integrating relationships. Furthermore, $\Pi = -(I_k - A_1 - \cdots - A_p)$ and $\Gamma_i = -(A_{i+1} + \cdots + A_p)$ for $i = 1, ..., p-1$. The terms, α and β, are known as co-integrating and loading vectors respectively. Decomposing $\mu = \alpha\mu_1 + \alpha_\perp\mu_2$, equation (5) can be expressed as:

$$\Delta y_t = \alpha \begin{pmatrix} \beta \\ \mu_1 \\ \delta \end{pmatrix}' \tilde{y}_{t-1} + \alpha_\perp \mu_2 + \varepsilon_t \tag{10}$$

where $\tilde{y}'_{t-1} = (y'_{t-1}, 1, t)$. The null hypothesis of no co-integration, for instance, can be evaluated using the likelihood ratio type test known as the trace statistic:

$$Trace(r) = -T \sum_{j=r+1}^{k} \ln(1 - \lambda_j) \tag{11}$$

where λ_j is the eigenvalue. The critical values for this statistic are provided in Johansen (1995). The presence of co-integration, i.e., $r > 0$, provides one necessary condition for the stationary CWR.

References

Aggarwal, R., Rao, R. P., Hiraki,T., 1990, Regularities in Tokyo Stock Exchange security returns: P/E, size, and seasonal Influences. Journal of Financial Research 13(3), 249–263.

Aggarwal, R., Hiraki, T., Rao, R. P., 1992, Price/book value ratios and equity returns on the Tokyo Stock Exchange: Empirical evidence of an anomalous regularity. Financial Review 27(4), 589–605.

Campbell, J. Y., Cochrane, J. H., 2000, Explaining the poor performance of consumption-based asset pricing models. Journal of Finance 55, 2863-2878.

Campbell, J. Y., Lo, A. W., MacKinlay, A. C., 1997, The Econometrics of financial markets, Princeton University Press, Princeton.

Campbell, J. Y., Shiller, R., 1988, The dividend-price ratio and expectations of future dividends and discount factors. Review of Financial Studies 1, 195–227.

Chan, L. K. C., Hamao, Y., Lakonishok, J., 1991, Fundamentals and stock returns in Japan. Journal of Finance 46(5), 1739-1764.

Chen, N-F., Roll, R., Ross, S. A., 1986, Economic forces and the stock market. Journal of Business 59, 383-403.

Cochrane, J. H., 1996, A cross-sectional test of an investment-based asset pricing model. Journal of Political Economy 104, 572-621.

Cochrane, J. H., 2005, Asset pricing, 2nd ed., Princeton University Press, Princeton.

Engle, R. F., 1982, Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica 50(4), 987-1006.

Engle, R. F., Granger, C. W. J., 1987, Dynamic model specification with equilibrium constraints: Co-integration and error correction. Econometrica 55(2), 251-276.

Fama, E., 1991, Efficient capital markets: II. Journal of Finance 46(5), 1575–1617.

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

Hansen, H., Johansen, S., 1999, Some tests for parameter constancy in cointegrated VAR-models. Econometric Journal 2, 306-333.

Hamburg, B., Hoffmann, M., Keller, J., 2005, Consumption, wealth, and business cycles: Why is Germany different?" Deutsche Bundesbank Discussion Paper Series 1: Economic Studies No. 16.

Ho, T-W., 2004, Cointegration, government spending and private consumption: evidence from Japan. Japanese Economic Review 55(2), 162-74

Jagannathan, R., Wang, Z., 1996, The conditional CAPM and the cross section of expected returns. Journal of Finance 51, 3-53.

Johansen, S., 1995, Likelihood-based inference in cointegrated vector auto-regressive models. Oxford University Press, Oxford.

Lettau, M., Ludvigson, S., 2001a, Consumption, aggregate wealth, and expected stock returns. Journal of Finance 56(3), 815–849.

Lettau, M., Ludvigson, S., 2001b, Resurrecting the (C)CAPM: a cross-sectional test when risk premia are time-varying, Journal of Political Economy 109(6), 1238–1287.

Nakano, K., Saito, M., 1998, Communication: asset pricing in Japan. Journal of the Japanese and International Eonomies 12, 151–166.

Nagayasu, J., 2003, The efficiency of the Japanese equity market. International Finance Review 4, 155–171.

Nagayasu, J., 2006, Financial market integration: evidence from stock and bond markets in Japan and the US. Batten, J.A., Fetherston, T.A., Szilagyi, P.G, Japanese Fixed Income Markets: Money, Bond, and Interest Rate Derivatives (Elsevier)

Nitschka, T., 2004, The U.S. consumption wealth ratio and the predictability of international stock markets: Evidence from the G7. Mimeo, University of Dortmund.

Rao, R. P., Aggarwal, R., Hiraki, T., 1992, Dividend yields and stock returns: Evidence from the Tokyo Stock Exchange. Journal of Economics and Business 44, 187-200.

Ross, S. A., 1976, The arbitrage theory of capital asset pricing. Journal of Economic Theory 13, 341-360.

Sekine, T., 1998, Financial liberalization, the wealth effect, and the demand for broad money in Japan. Bank of Japan Monetary and Economic Studies 16(1), 35-55.

Stock, J.H., Wright, J.H., Yogo, M., 2002, A survey of weak instruments and weak identification in generalized method of moments, Journal of Business and Economic Statistics Vol. 20(4) 518-529.

Stock, J.H., Yogo, M., 2005, Testing for weak instruments in linear LV regression, in Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothemberg, Andrews, D.W.K., J.H. Stock eds. Cambridge University Press.

Teräsvirta, T., 1994, Specification, estimation, and evaluation of smooth transition autoregressive models. Journal of the American Statistical Association 89, 208-218.

Tsutsui, Y., Hirayama, K., 2005, Estimation of the common and country-specific stock to stock prices. Journal of the Japanese and International Economics 19, 322-337.

Table 1: **The Time-Series Properties of Stock Returns (r)**

	1970:3-1999:1
Mean	1.723E-2
Std. Dev	7.752E-2
Skewness	-0.055
Kurtosis	3.011
Min	-1.652E-1
Max	1.972E-1
Normality test χ^2 (2)=	0.062 (0.970)
ARCH (5) test χ^2 (2)=	8.474 (0.132)

Note: The statistics in parentheses are p-values. The ARCH test is based on Engle (1982).

Table 2: **Unit Root Tests**

	DF-GLS		ADF	
p	-0.044 [3]		-1.976 [3]	
c	1.128 [3]		-2.689 [3]	
y	0.954 [5]		-2.116 [5]	
w	0.045 [5]		-2.655 [5]	
Stock returns (r)	-3.253 [2]	**	-4.610 [2]	**
Excess returns ($\widetilde{r}$)	-4.811 [2]	**	-6.850 [4]	**
$Term$	-3.017 [1]	**	-4.009 [1]	**

Note: Full sample. The numbers in brackets indicate the lag length used in the test. The critical values are drawn from MacKinnon (1996). With a maximum of five lags, the appropriate lag lengths are determined using the Akaike Information Criterion.

Table 3: **The Johansen Co-integration Test**

	Trace statistics
H_0: Rank	
0	70.400 (0.000)
1	21.100 (0.178)
2	7.600 (0.295)
Cointegrating parameters (β)	
c_t	1.000 [—-]
a_t	-0.370 [0.051]
y_t	-0.280 [0.075]
$Const$	-6.499 [0.370]
$Trend$	0.001 [0.001]
Endogenous variables in VECM	Adjustment parameters (α)
Δc_t	-0.437 [0.133]
Δa_t	-0.254 [0.183]
Δy_t	-0.282 [0.167]
lag	6

Note: Full sample. Excess returns are calculated by subtracting moving average components from the Topix data (see details in the main text). The statistics in parentheses are p-values, and those in brackets are standard errors. The lag length is determined by the Akaike Information Criterion.

Table 4: **Stock Returns and** CWR

Stock returns	$Const$	CWR	$Term$	CWR^*
i =1	0.022 [0.007]	0.219 [0.514]	0.003 [0.004]	-0.892 [0.261]
2	0.022 [0.009]	0.305 [0.496]	0.004 [0.005]	-0.620 [0.686]
3	0.022 [0.009]	0.337 [0.487]	0.004 [0.005]	-0.932 [0.655]
4	0.026 [0.008]	0.580 [0.502]	-0.001 [0.004]	-0.637 [0.765]
5	0.024 [0.008]	0.545 [0.493]	-0.003 [0.004]	-0.394 [0.807]
6	0.022 [0.008]	0.307 [0.465]	4.47E-6 [0.004]	-0.665 [0.849]
7	0.029 [0.008]	0.798 [0.504]	0.002 [0.003]	-0.743 [0.812]
8	0.029 [0.009]	0.698 [0.515]	0.001 [0.003]	-0.746 [0.589]
Excess returns				
i =1	0.009 [0.005]	0.713 [0.360]	-0.004 [0.002]	0.630 [0.553]
2	0.005 [0.005]	0.653 [0.358]	-0.003 [0.003]	0.844 [0.470]
3	0.002 [0.005]	0.361 [0.309]	-0.001 [0.003]	0.214 [0.459]
4	0.002 [0.005]	0.325 [0.282]	-0.004 [0.003]	0.325 [0.462]
5	0.000 [0.006]	0.230 [0.347]	-0.004 [0.003]	0.481 [0.512]
6	-0.003 [0.004]	-0.152 [0.362]	-0.000 [0.003]	0.011 [0.516]
7	0.004 [0.005]	0.252 [0.302]	0.002 [0.002]	-0.219 [0.474]
8	0.000 [0.005]	-0.142 [0.314]	0.000 [0.002]	-0.321 [0.480]

Note: Full sample. Dependent variables are daily stock returns, $\Delta r_{t=i}$, and the estimation for stock returns is based on: $\Delta r_{t+i} = \beta_0 + \beta_1 CWR_t + \beta_2 Term_t + \beta_3 CWR_t^* + u_t$ where $i = 1, ..., 8$. The heteroscedasticity and autocorrelation consistent standard errors and covariance are obtained using the Newey-West Method. The estimation for excess returns replaces r_t with $\widetilde{r}_t$.

Table 5: The GMM Results

	All ind. (full)	All ind. (1977:1-1985:2)	All ind. (1985:3-1989:4)	All ind. (1990:1-1991:1)
CWR	0.008 (0.000)	0.008 (0.000)	0.008 (0.000)	0.008 (0.000)
$Term$	0.000 (0.996)	0.000 (0.993)	0.000 (0.990)	-0.000 (0.998)
Obs	72123	26528	14922	30673
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.997)	(0.998)	(0.999)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	All ind. (full)	All ind. (1977:1-1985:2)	All ind. (1985:3-1989:4)	All ind. (1990:1-1991:1)
CWR	0.008 (0.000)	0.008 (0.000)	0.008 (0.000)	0.008 (0.000)
CWR^*	0.003 (0.977)	0.001 (0.981)	0.001 (0.999)	-0.000 (0.999)
$Term$	0.000 (0.997)	0.000 (0.991)	0.000 (0.997)	0.000 (0.990)
Obs	72123	26528	14922	30673
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.999)	(0.997)	(0.999)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	PER (all)	$PER < 50$	$50 \leq PER \leq 600$	$PER > 600$
CWR	0.007 (0.000)	0.003 (0.091)	0.009 (0.000)	0.008 (0.000)
$Term$	0.000 (0.997)	0.007 (0.195)	-0.003 (0.517)	-0.007 (0.021)
Obs	53940	12267	27753	13920
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.395)	(0.361)	(0.528)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	PBR (all)	$PBR < 150$	$150 \leq PBR \leq 250$	$PBR > 250$
CWR	0.009 (0.000)	0.012 (0.000)	0.009 (0.000)	0.007 (0.000)
$Term$	0.000 (0.992)	0.010 (0.046)	-0.006 (0.266)	-0.005 (0.298)
Obs	57072	20967	19314	16791
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.479)	(0.675)	(0.183)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)

Table continued.

	ROE (All)	$ROE < 5$	$5 \leq ROE \leq 10$	$ROE > 10$
CWR	0.009 (0.000)	0.014 (0.000)	0.010 (0.000)	0.006 (0.004)
$Term$	0.000 (0.996)	0.007 (0.329)	-0.002 (0.323)	-0.010 (0.180)
Obs	57072	11658	34365	11049
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.752)	(0.656)	(0.591)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)

Note. The independent variable is excess returns which are equal to individual stock prices minus Topix prices. Here, their one-period-ahead forecasts are estimated. Full sample (1977:1-1991:1). The fixed terms are not reported here. Having attempted to equalize the size of observations across categories, the threshold points used for the PER, PBR, and ROE are rather arbitrary. These threshold points are chosen because the results pass diagnostic tests. The p-values are reported in parentheses. The instrumental variables are the first and second lagged $Term$ and the second lagged CWR. The F test examines the joint null hypothesis of all the explanatory variables being zero. Hansen J statistics analyzes the fitness of the model to the data and is the over-identification test. The Anderson-Robin tests investigate the weakness of the instrumental variables. All the statistics are calculated by STATA.

Table 6: GMM Results by Industry

	Fishery, Agri,	Mining	Pharmaceutical	Oil, coal
CWR	0.010 (0.000)	0.015 (0.000)	0.008 (0.000)	0.006 (0.088)
Term	-0.021(0.124)	-0.056 (0.002)	0.000 (0.990)	0.134 (0.507)
Obs	435	609	2001	609
F	(0.001)	(0.000)	(0.000)	(0.000)
Hansen J	(0.398)	(0.999)	(0.521)	(0.350)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	Rubber	Glass, ceramics	Iron, steel	Nonferrous metal
CWR	0.005 (0.029)	0.007 (0.000)	0.007 (0.000)	0.007 (0.002)
Term	0.019 (0.082)	0.007 (0.230)	0.012 (0.079)	0.016 (0.053)
Obs	609	2001	2523	1827
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.089)	(0.871)	(0.547)	(0.225)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	Metal prod.	Machinery	Electric appliances	Precision instr
CWR	0.010 (0.000)	0.006 (0.000)	0.006 (0.000)	0.088 (0.000)
Term	-0.021 (0.102)	0.012 (0.046)	0.015 (0.001)	-0.016 (0.168)
Obs	1392	6090	7308	1044
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.383)	(0.177)	(0.753)	(0.654)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	Elec power, gas	Land trans	Marine trans	Air trans
CWR	0.007 (0.000)	0.007 (0.000)	0.010 (0.001)	0.030 (0.001)
Term	0.013 (0.098)	0.010 (0.179)	-0.019 (0.251)	-0.201 (0.000)
Obs	1218	1827	957	261
F	(0.000)	(0.000)	(0.000)	(0.000)
Hansen J	(0.937)	(0.588)	(0.237)	(0.056)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)

Table 6 Continued.

	Warehouse, harbor	Info, communi	Wholesale trade	Retail trade
CWR	0.004 (0.048)	0.030 (0.072)	0.011 (0.000)	0.007 (0.000)
Term	0.040 (0.000)	-0.189 (0.022)	-0.026 (0.000)	0.010 (0.917)
Obs	783	87	3393	1827
F	(0.000)	(0.054)	(0.000)	(0.000)
Hansen J	(0.897)	(0.550)	(0.517)	(0.894)
Anderson-Rubin	(0.000)	(0.000)	(0.000)	(0.000)
	Insurance	Other fin business	Services	
CWR	0.010 (0.000)	0.007 (0.096)	0.012 (0.002)	
Term	-0.021 (0.026)	0.003 (0.892)	-0.030 (0.004)	
Obs	870	348	1392	
F	(0.000)	(0.142)	(0.000)	
Hansen J	(0.904)	(0.947)	(0.459)	
Anderson-Rubin	(0.000)	(0.000)	(0.000)	

Note. Full sample (1977:1-1991:1). The independent variable is excess returns which are equal to individual stock prices minus Topix prices. Here, their one-step-ahead forecasts are analyzed. The fixed terms are not reported here either. The p-values are reported in parentheses. The instrumental variables are the first and second lagged $Term$ and the second lagged CWR.

Table 7: The Conditional CAMP

	Full sample	$\Delta c_{t-1} > 0$	$\Delta c_{t-1} \leq 0$
Δc	-0.155 (0.929)	-0.115 (0.963)	0.283 (0.913)
$\Delta c * CWR$	0.002 (0.930)	0.002 (0.965)	-0.04 (0.913)
CWR	0.009 (0.000)	0.009 (0.000)	0.009 (0.000)
Obs	57072	48544	8528
F	(0.000)	(0.000)	(0.000)
Hansen J	(0.998)	(0.998)	(0.997)
Anderson-Rubin	(0.000)	(0.000)	(0.000)

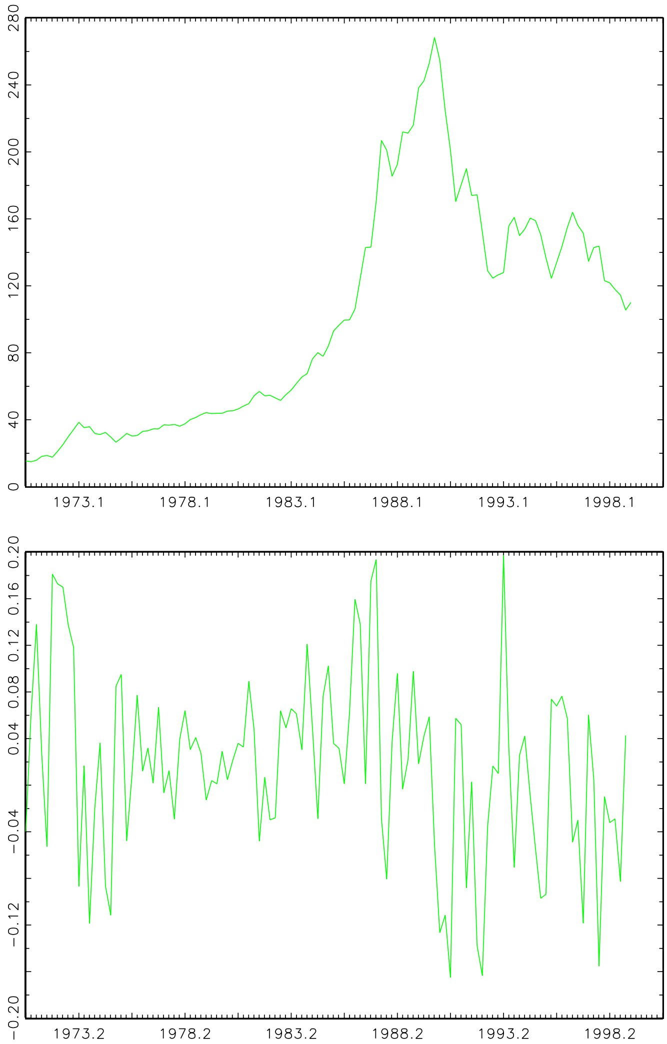
Note. The independent variable is excess returns which are equal to individual stock prices minus Topix prices. Full sample (1977:1-1991:1). The fixed terms are not reported here either. The p-values are reported in parentheses. The instrumental variables are the first and second lagged $Term$ and income growth, and the second lagged CWR.

Table 8: Comparison of Model Performance

	Unconditional CCAPM	Unconditional CCAPM+CWR	Conditional CCAPM+CWR
Distance	(0.000)	(0.998)	(0.997)
F	(0.000)	(0.000)	(0.000)

Note. The independent variable is excess returns which are equal to individual stock prices minus Topix prices. Full sample (1977:1-1991:1). The fixed terms are not reported here either. The p-values are reported in parentheses. The instrumental variables are the first and second lagged $Term$ and income growth, and the second lagged CWR.

Figure 1: **Topix, 1970Q3–1999Q1** (Measured in yen)



Top figure, Topix measured in yen, and bottom figure, the growth rate of Topix in log.

Figure 2: **The Consumption-Wealth Ratio**

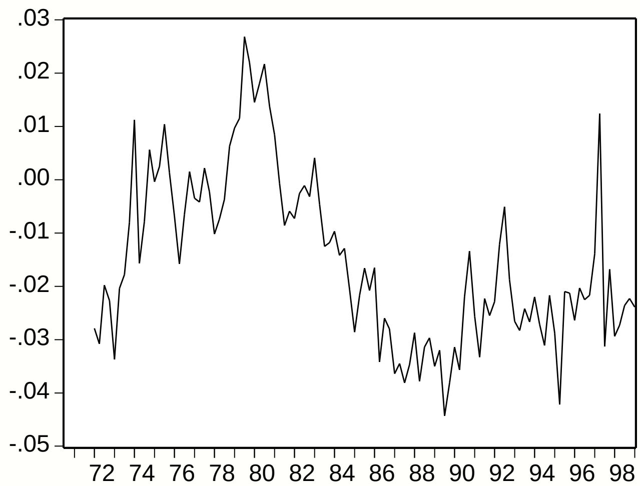
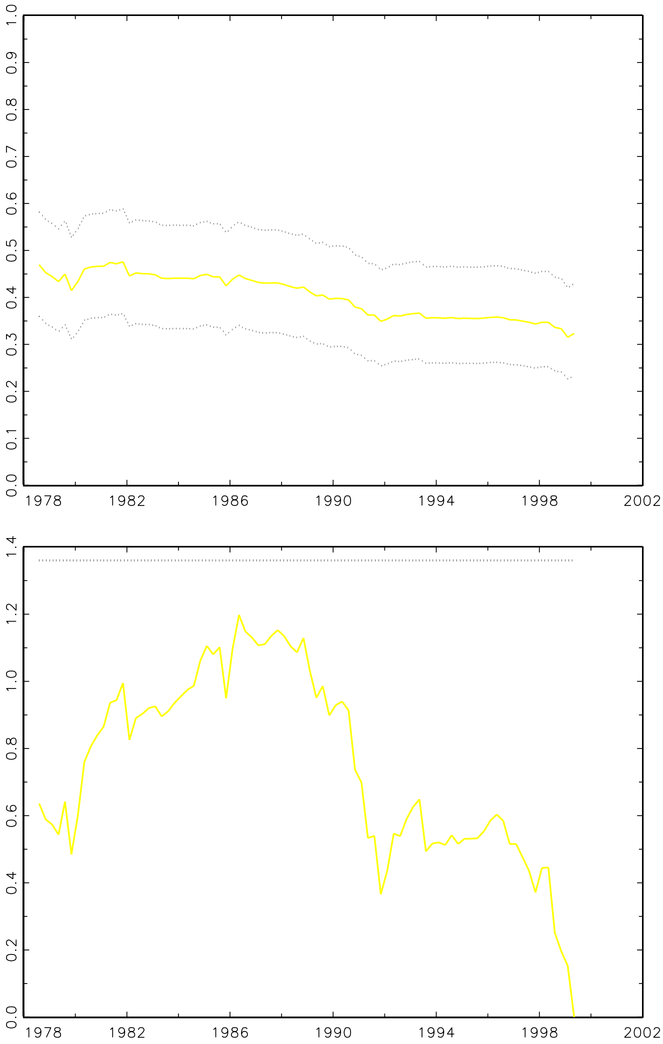


Figure 3: **Parameter Instability**



Note: Top figure, recursive eigenvalues, and bottom figure, tau-statistics.