Bad, Good and Excellent: An ICAPM with bond risk premia

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Abstract

In this paper I derive an ICAPM model based on an augmented definition of market wealth by incorporating bonds, and by decomposing excess stock return news into bond premia news and the remainder, news in the "true" equity premia. This model which represents an extension of the Bad Beta Good Beta (BBGB) from Campbell and Vuolteenaho (2004), has three factors: Cash flow news, equity premia news and bond premia news. The betas associated with bond premia news are relatively stable across individual assets, in opposition to the equity premia betas. The risk prices estimates of cash flow news (bad beta) are higher relative to equity premia news (good beta) and this one has higher risk prices than bond premia news (excellent beta). Several versions of the model outperform the CAPM and the BBGB models in pricing the size/book-to-market portfolios. An augmented model which incorporates scaled factors related with time-varying risk aversion, shows that risk aversion is negatively correlated with bond premia news. This model has very low pricing errors and is also able to price the value premium, in addition to other ICAPM specifications. Preliminary results show that the momentum factor (UMD) factor is mostly insignificant in the presence of the ICAPM factors, and this suggests that at least partially the ICAPM with time-varying bond premia and risk aversion can take into account momentum.

Keywords: Asset pricing; Asset pricing models; Conditional pricing models; Consumption-based models; Equity premia; ICAPM; Bond risk premia; Linear multifactor models; Predictability of returns; Risk aversion; Time-varying risk aversion; Stock and bond returns; Time-varying returns;
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Following the Merton (1973) ICAPM, state variables that predict market returns, should act as risk factors that price the cross-section of ex-post average returns. Despite this prediction - and the existence of a vast literature showing that the market equity premium is time-varying and predictable at several horizons by a set of state variables linked to short term interest rates, bond yields and financial ratios - there have been not many attempts to test the ICAPM, even in the presence of the CAPM failure to explain the cross section of average returns. Among the papers that implemented empirically testable versions of the original ICAPM, are Campbell (1993, 1996), and more recently Chen (2003), Brennan et al (2004), Guo (2002) and Campbell and Vuolteenaho (2004) (CV hereafter). Using the same framework employed by Campbell (1993, 1996), with an Epstein and Zin utility function, and employing the decomposition for unexpected market returns, CV derive an ICAPM with only two factors: covariance with discount-rate news (good factor) and covariance with cash flow news (bad factor). A decline in future cash flows leads to a decline in current wealth, and investment opportunities are unchanged, thus representing a permanent decrease in wealth. On the other hand, an increase in future discount rates leads to a decline in the current value of wealth, but future investment opportunities improve, since current wealth will be invested at higher future returns, thus we have a transitory decline in wealth. In this sense, CV argue that the risk price (premium) of cash flow news should be higher than the risk price of discount rate news, i.e., investors will demand a higher premium to hold assets that are correlated with cash flow news, than to hold assets that covary with discount rate news. In their model, this relation is valid for the case of a risk-averse investor, with relative-risk aversion coefficient greater than 1. CV have found that growth stocks have higher discount-rate betas and lower cash flow betas than value stocks, in their modern sub-sample. Their model is not rejected, leading CV to conclude that the first order condition of a long-term investor that holds the market portfolio is not violated, and the difference in average returns between value stocks and growth stocks is explained by their different composition of cash flow and discount rate betas, and thus such an investor does not have incentives to overweight value stocks in his portfolio.

In this paper, I extend CV paper in four critical points. First, in response to the Roll (1977) critique that the stock market index is an imperfect measure for total financial wealth, I use a measure of the market portfolio as a weighted average of a stock index and a long maturity government bond. Under this assumption, and using the same framework as in Campbell (1993, 1996) and CV, I derive an ICAPM model with three factors: Cash flow news, excess stock return news and excess bond return news.

Second, I decompose expected excess stock returns into expected excess stock-bond returns and expected bond premia. Since the cash flows associated with stocks are uncertain - as opposed to bonds which have fixed cash flows that are known beforehand - in order to compensate for the risk associated with cash-flows, stocks earn a risk premium over long-term bonds originating higher expected returns, in average. Thus, we can reinterpret excess stock return as being composed by two components: Bond risk premia, used to discount the "certain" part of future stock cash flows, and the stock-bond risk premia used to discount the random or "risky" part of future cash flows, which represents the "true" equity risk premia. Using this decomposition for excess stock returns, news about future excess stock returns can be decomposed into news about future equity premia and news about bond premia. A rise in both news components is associated with an improvement in investment opportunities, since current wealth will be reinvested at higher returns, but while future bond returns are known a priori, since they are used to discount certain cash-flows, future stock returns are uncertain given that they are used to discount uncertain future cash-flows. Thus, a rise in future bond returns represent a "certain" increase in future investment opportunities, whereas the expected increase in future excess stock returns, represents an "uncertain" increase in future financial wealth. Using the "bad beta, good beta" terminology from CV, we can speak of a bad beta, a good beta and an "excellent" beta, which is the covariance with bond premia news. Thus apart from the fact that the risk price (premium) of cash flow news should be higher relative to both equity premia and bond premia news, news on stock-bond excess returns should have a higher risk price (premium) than news on future excess bond returns, due to the uncertainty involved in reinvested wealth. I calculated betas associated with the two components of excess stock return news, and find that bond premia news have relatively stable betas across the book-to-market quintiles, as expected since the type of risk involved as to due with changes in long-term interest rates used to discount riskless cash flows. On the other hand, in the case of the equity premia factor, growth stocks have significantly higher (magnitude) betas than value stocks. I derive the ICAPM associated with this decomposition for news in excess stock returns, and find that the risk price (premium) for stock-bond excess returns is higher relative to the risk price associated with bond premia news. In addition, the model improves slightly the pricing ability for the size/book-to-market portfolios, relative to both the bad beta, good beta (BBGB) model from CV and the CAPM. These results are robust for alternative characteristic portfolios and alternative bond returns. An extension of the benchmark ICAPM that allows for time-varying covariances greatly improves the explanatory power over the cross section, in comparison with the BBGB and benchmark models.

In third place, I derive an unrestricted ICAPM with bond premia - in a heteroskedastic context - which allows the risk prices to be freely estimated, and find that i) bond premia news is a priced factor and ii) the model improves the pricing ability relative to the homoskedastic ICAPM. A heteroskedastic ICAPM with revisions in real interest rates also fits well the cross section of returns and in particular the size/book-to-market portfolios.

In forth place, I derive and estimate a generalized ICAPM that allows for time-varying risk aversion, assuming that risk aversion is explained by the business cycle (dividend yield) and bond premia news. The results show that a rise in bond risk premia is associated with lower current risk aversion, which can be explained by an association between changes in risk aversion and rebalances between bonds and stocks in investors' portfolios. The ICAPM with both time-varying bond premia and risk aversion produces very low average pricing errors for the size/book-to-market portfolios, and the average pricing errors across the book-to-market quintiles are also very small, and similar to those from the Fama-French (1993) model. Thus, several specifications of the ICAPM with bond premia are able to price the value premium. In addition, the momentum factor UMD when added to the ICAPM model, it is only partially significant, and thus the ICAPM takes into account, at least partially, the momentum observed in stock prices.

I. Theoretical framework

A. *Measuring the market wealth*

Roll (1977) argues that we can not test the CAPM with a noisy proxy for the market portfolio, and that the stock market index is an imperfect measure of the market portfolio. To minimize this concern, I assume that the representative investor holds bonds in addition to stocks in his portfolio. Therefore, the market portfolio is a weighted average of a stock market index and a proxy for the bond market, where the weights are given by the respective market values. Data from the NYSE show that the total capitalization of the three Exchanges - NYSE, NASDAQ and AMEX - at the end of the first semester 2005 is around 16.5 trillion usd. In addition, data from the FRED II database available from the St. Louis FED’s website indicate that the value of US Treasury debt at the end of first quarter, 2005 is around 8 trillion usd. Given the existence of corporate bonds in addition to government bonds, I assume that stocks represent 70% of the market portfolio, while bonds represent 30%. This will be the benchmark weights used in the paper.

B. *A four factor ICAPM*

The ICAPM model developed in this paper will make use of the decompositions for excess stock market returns and excess bond returns, derived in the Appendix. Following Campbell and Shiller (1988a), Campbell (1991) and Campbell and Ammer (1993) (CA thereafter) the unexpected excess stock market return can be decomposed as

$$(E_{t+1} - E_t)(r_{m,t+1} - r_{f,t+1}) = r^{CF}_{t+1} - r^{H}_{t+1} - r^{R^*}_{t+1} \qquad (1)$$

where $r^{CF}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j}$, $r^{H}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j (r_{m,t+1+j} - r_{f,t+1+j})$ and $r^{R^*}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=0}^{\infty} \rho^j r_{r,t+1+j}$ represent news about future cash flows, news about future excess stock returns and news about future real interest rates, respectively. This equation says that innovations in current excess stock returns are associated with an increase in expected future cash-flows, a decrease in expected future excess returns or a decrease in expected future real interest rates.

On the other hand, the current unexpected excess bond return can be decomposed as

$$(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1}) = -r^{B}_{t+1} - r^{R}_{t+1} - r^{\Pi}_{t+1} \qquad (2)$$

where $r^{R}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r_{r,t+1+j}$ is the same as $r^{R^*}_{t+1}$ above, (up to the first term in the summation $(E_{t+1} - E_t) r_{r,t+1}$), $r^{B}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j (r_{b,t+1+j} - r_{f,t+1+j})$ represents news about future excess bond returns, and $r^{\Pi}_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j \pi_{t+1+j}$ denotes expectations of future inflation rates. This equation is similar to the bond return decomposition presented in CA, and it shows that a rise in current unexpected excess bond returns is the result of either a decrease in expected future excess bond returns or a decline in future nominal interest rates. Both equations (1) and (2) represent accounting dynamic identities that arise from the definition of stock and bond returns, as shown in the Appendix. Since stocks represent claims on real cash flows, then they should be "neutral" to changes in inflation expectations, and hence, future inflation rates should not help to price the cross section of stock returns. In response to that, I approximate equation (2) by ignoring expectations of future inflation,

$$(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1}) \approx -r^{B}_{t+1} - r^{R}_{t+1} \qquad (3)$$

To derive the equilibrium asset pricing model, I Follow Campbell (1993, 1996) and Campbell and Vuolteenaho (2004) (CV thereafter) and use an Epstein and Zin utility function,

$$U_t = \left\{(1-\delta)C_t^{\frac{1-\gamma}{\theta}} + \delta\left[E_t\left(U_{t+1}^{1-\gamma}\right)\right]^{\frac{1}{\theta}}\right\}^{\frac{\theta}{1-\gamma}} \qquad (4)$$

where $\theta \equiv \frac{1-\gamma}{1-\frac{1}{\psi}}$, ψ is the elasticity of intertemporal substitution, γ is the relative risk aversion parameter, δ is a time discount factor, and C_t denotes consumption. This utility function has the advantage of allowing to separate ψ and γ, contrary to the power utility function where ψ is the reciprocal of γ.

In this context, the intertemporal budget constraint is given by

$$W_{t+1} = R_{p,t+1}(W_t - C_t) \qquad (5)$$

where W_t represents total market wealth and $R_{p,t+1}$ is the simple return on the "market" portfolio. The market portfolio return finances the stream of consumption, and is equal to a weighted average of the returns on a stock market index and a long-maturity bond which represents a proxy for the bond market,

$$R_{p,t+1} = \omega R_{m,t+1} + (1-\omega)R_{b,t+1} \qquad (6)$$

where $R_{m,t+1}$ denotes the simple return on the stock market portfolio and $R_{b,t+1}$ denotes the simple return on a long-maturity bond. As shown in the Appendix, the log market return can be approximated as

$$r_{p,t+1} \approx \omega r_{m,t+1} + (1-\omega)r_{b,t+1} \qquad (7)$$

with $r_{p,t+1} = \ln(R_{p,t+1})$ representing the log market return and similarly $r_{m,t+1}$ and $r_{b,t+1}$ denoting the log returns on stocks and bonds, respectively.[2] Given equation (7) the conditional expected return on total wealth, is given by

$$E_t(r_{p,t+1}) \approx \omega E_t(r_{m,t+1}) + (1-\omega)E_t(r_{b,t+1}) \qquad (8)$$

Following Epstein and Zin (1989, 1991), the objective function (4) has an associated pricing equation in simple returns given by

$$1 = E_t\left\{\left[\delta^\theta\left(\frac{C_{t+1}}{C_t}\right)^{-\frac{\theta}{\psi}}\left(\frac{1}{R^*_{p,t+1}}\right)^{1-\theta} R^*_{i,t+1}\right]\right\} \qquad (9)$$

where the asterisk stands for real returns. The corresponding stochastic discount factor (SDF) is equal to

$$M_{t+1} = \delta^{\theta}\left(\frac{C_{t+1}}{C_t}\right)^{-\frac{\theta}{\psi}}\left(\frac{1}{R^*_{p,t+1}}\right)^{1-\theta} \qquad (10)$$

and a corresponding log SDF given by,

$$m_{t+1} = \theta\ln(\delta) - \frac{\theta}{\psi}\Delta c_{t+1} - (1-\theta)r^*_{p,t+1} \qquad (11)$$

where $\Delta c_{t+1} \equiv \ln\left(\frac{C_{t+1}}{C_t}\right)$ denotes log consumption growth.

Summing and subtracting both $\frac{\theta}{\psi}E_t(\Delta c_{t+1})$ and $(1-\theta)E_t(r^*_{p,t+1})$ yields,

$$m_{t+1} = \theta\ln(\delta) - \frac{\theta}{\psi}E_t(\Delta c_{t+1}) - (1-\theta)E_t(r^*_{p,t+1}) - \frac{\theta}{\psi}(\Delta c_{t+1} - E_t(\Delta c_{t+1}))$$

$$-(1-\theta)(r^*_{p,t+1} - E_t(r^*_{p,t+1}))$$

$$= E_t(m_{t+1}) - \frac{\theta}{\psi}(c_{t+1} - E_t(c_{t+1})) - (1-\theta)(r^*_{p,t+1} - E_t(r^*_{p,t+1})) \qquad (12)$$

where the second equality makes use of the fact that $\Delta c_{t+1} - E_t(\Delta c_{t+1}) = c_{t+1} - E_t(c_{t+1})$. Substituting $c_{t+1} - E_t(c_{t+1})$ by its expression derived in the Appendix, it follows

$$m_{t+1} = E_t(m_{t+1}) - \frac{\theta}{\psi}\left[r^*_{p,t+1} - E_t(r^*_{p,t+1}) + (1-\psi)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r^*_{p,t+1+j}\right]$$

$$-(1-\theta)(r^*_{p,t+1} - E_t(r^*_{p,t+1}))$$

$$= E_t(m_{t+1}) - \gamma(r^*_{p,t+1} - E_t(r^*_{p,t+1})) + (1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r^*_{p,t+1+j} \qquad (13)$$

where the last equality follows from substituting the expression for θ above. By adding and subtracting the real risk-free rate $r_{r,t+1}$, and using the fact that excess nominal returns are equal to excess real returns, one has

$$m_{t+1} = E_t(m_{t+1}) - \gamma(E_{t+1} - E_t)(r_{p,t+1} - r_{f,t+1}) - \gamma(E_{t+1} - E_t)r_{r,t+1}$$

$$+(1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j(r_{p,t+1+j} - r_{f,t+1+j}) + (1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r_{r,t+1+j} \qquad (14)$$

where the absence of asterisk indicates nominal returns, and $r_{f,t+1}$ is the nominal risk-free rate.

By using equation (8), it follows

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega(E_{t+1} - E_t)(r_{m,t+1} - r_{f,t+1}) - \gamma(1-\omega)(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1})$$

$$-\gamma(E_{t+1} - E_t)r_{r,t+1} + \omega(1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j(r_{m,t+1+j} - r_{f,t+1+j})$$

$$+(1-\omega)(1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j(r_{b,t+1+j} - r_{f,t+1+j}) + (1-\gamma)(E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r_{r,t+1+j} \qquad (15)$$

If we employ the decompositions for current unexpected stock and bond excess returns in equations (1) and (3) above, we have,

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega(r^{CF}_{t+1} - r^{H}_{t+1} - r^{R}_{t+1}) - \gamma(1-\omega)(-r^{B}_{t+1} - r^{R}_{t+1}) + \omega(1-\gamma)r^{H}_{t+1}$$

$$+(1-\omega)(1-\gamma)r^{B}_{t+1} + (1-\gamma)r^{R}_{t+1} - \gamma(1-\omega)(E_{t+1} - E_t)r_{r,t+1}$$

$$= E_t(m_{t+1}) - \gamma\omega r^{CF}_{t+1} + \omega r^{H}_{t+1} + (1-\omega)r^{B}_{t+1} + r^{R}_{t+1} \qquad (16)$$

where in the last equality, I assume $(1-\omega)(E_{t+1} - E_t)r_{r,t+1} \approx 0$, or in alternative that the current real interest rate has a negligible role in pricing the cross section of returns.

Making $\mathbf{f}_{t+1} \equiv (r^{CF}_{t+1}, r^{H}_{t+1}, r^{B}_{t+1}, r^{R}_{t+1})'$ and $\mathbf{b} \equiv (-\gamma\omega, \omega, 1-\omega, 1)'$ and using Theorem 1 in the Appendix, we have finally the pricing equation,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,H} - (1-\omega)\sigma_{i,B} - \sigma_{i,R} \qquad (17)$$

where $\sigma_{i,CF} \equiv Cov(r_{i,t+1}, r^{CF}_{t+1})$, $\sigma_{i,H} \equiv Cov(r_{i,t+1}, r^{H}_{t+1})$, $\sigma_{i,B} \equiv Cov(r_{i,t+1}, r^{B}_{t+1})$, and $\sigma_{i,R} \equiv Cov(r_{i,t+1}, r^{R}_{t+1})$ denote the asset covariance with cash flow news, excess stock return news, excess bond return news and real interest rate news, respectively, and $\frac{\sigma_i^2}{2}$ is a Jensen's Inequality adjustment arising from working with log returns.

In the ICAPM model represented in equation (17), there are four factors which help to price assets, and the covariances risk prices are theoretically constrained. The only free parameter to be estimated in the cross-section is the relative risk aversion parameter γ which affects the risk price of covariance with cash flow news. For a risk-averse investor $(\gamma > 1)$ the risk price associated with cash-flow news should be higher than (minus) the risk price of excess stock return news[1]. In addition for $\omega > 0.5$, the risk price of covariance with excess stock return news should be higher (in magnitude) than the risk price of covariance with bond premia news. Equation (17) represents a generalization of the bad beta, good beta model (BBGB) from CV. If we allow $\omega = 1$, i.e. financial wealth is composed only by a stock index, then the BBGB model arises as a special case of (17),

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\sigma_{i,CF} - \sigma_{i,H} - \sigma_{i,R} \qquad (18)$$

This is equivalent to the model in CV, with the only difference being the inclusion of $\sigma_{i,R}$, which is ignored in their paper since they assume that the log real risk-free rate is approximately constant, and therefore revisions in future real interest rates are zero.

C. ICAPM with time-varying *bond premia: Benchmark model*

The specification in (17) ignores the relation between stock and bond returns. In fact, both stocks and bonds share common characteristics, since in both cases the current asset value is the discounted sum of a long stream of future cash flows. Nevertheless, stocks exhibit two key differences relative to long maturity bonds: First, there is an infinite stream of future cash-flows, thus stocks have higher duration risk than bonds, which have fixed maturities. Therefore, given a common discount rate, stocks are more sensible to changes in future discount rates. Second, and most important, the cash flows associated with stocks are uncertain, as opposed to bonds which have fixed cash flows that are known beforehand. To compensate for the risk associated with cash-flows, stocks earn a risk premium over long-term bonds, originating higher returns in average. Thus, we can reinterpret stock excess returns as being composed by two components: Bond risk premia, used to discount the "certain" part of future equity cash flows, and the stock-bond risk premia (stock returns in excess of bond returns) used to discount the "risky" part of future equity cash flows, which represents the "true" equity risk premia.

If we assume a time-varying stock-bond risk premia k_{t+1}, then expected stock market returns can be represented as,

$$E_t(r_{m,t+1}) = E_t(r_{b,t+1}) + E_t(k_{t+1}) \qquad (19)$$

As shown in the Appendix, this originates that excess stock return news can be split into stock-bond premia news, and excess bond return news,

$$r_{t+1}^H = r_{t+1}^K + r_{t+1}^B \qquad (20)$$

where $r_{t+1}^K \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j k_{t+1+j}$ denotes news about future stock-bond premia, which represent the true equity premia news. These two components have a distinct fundamental interpretation: Bond premia news represent revisions in future discount rates used to discount certain future cash-flows, whereas stock-bond premia news represent revisions in future expected discount rates used to discount uncertain future cash flows.

Substituting (20) in equation (16) above, and ignoring the real interest rate news factor - which has a marginal role in pricing the cross section of returns - the log SDF is given by

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega r^{CF}_{t+1} + \omega r^{K}_{t+1} + r^{B}_{t+1} \qquad (21)$$

Making $\mathbf{f}_{t+1} \equiv (r^{CF}_{t+1}, r^{K}_{t+1}, r^{B}_{t+1})'$ and $\mathbf{b} \equiv (-\gamma\omega, \omega, 1)'$ and using Theorem 1 in the Appendix, one has,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} \qquad (22)$$

where $\sigma_{i,K} \equiv Cov(r_{i,t+1}, r^{K}_{t+1})$ represents covariance with excess stock-bond return news. The model in (22) will be the benchmark ICAPM analyzed in this paper, and the difference to the ICAPM in equation (17), is that now the covariance with excess stock return news $\sigma_{i,K}$ is replaced by the covariance with stock-bond premia news $\sigma_{i,K}$, which has the same risk price given by $-\omega$. Thus, for a conservative investor $(\gamma > 1)$, the risk price associated with cash-flow news should be higher than (minus) the risk price of "true" equity premia news. The second difference to model (17) is that the covariance with bond premia news receives a risk price of -1 compared with $-(1-\omega)$ previously. In consequence, since $\omega < 1$ the risk price of covariance with stock-bond premia news is lower (in magnitude) than the risk price of covariance with bond premia news.

Since most asset pricing models are estimated and evaluated in terms of factor betas' risk prices, we can restate equation (22) in terms of single regression betas, originating the following model,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma^2_{CF}\beta_{i,CF} - \omega\sigma^2_{K}\beta_{i,K} - \sigma^2_{B}\beta_{i,B} \qquad (23)$$

where σ^2_{CF}, σ^2_{K} and σ^2_{B} represent the variances of r^{CF}_{t+1}, r^{K}_{t+1} and r^{B}_{t+1}, respectively. The risk prices for betas can be derived by $\boldsymbol{\lambda} = (\lambda_{CF}, \lambda_K, \lambda_B)' = -\boldsymbol{\sigma}_f\mathbf{b}$, where $\boldsymbol{\sigma}_f$ is a diagonal matrix with the factor variances on its main diagonal. In terms of betas risk prices, it will be the variances of r^K_{t+1} and r^B_{t+1} that will determine whether $\beta_{i,K}$ has a higher (magnitude) risk price than $\beta_{i,B}$ or not.

In addition, the model in covariances (22), can be represented in an expected return-beta form with multiple-regression coefficients, as shown in Theorem 1 in the Appendix,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \boldsymbol{\lambda}^{*\prime}\boldsymbol{\beta}_i = \lambda^*_{CF}\beta_{i,CF} + \lambda^*_K\beta_{i,K} + \lambda^*_B\beta_{i,B} \qquad (24)$$

where $\boldsymbol{\lambda}^* \equiv (\lambda^*_{CF}, \lambda^*_H, \lambda^*_B)' = -Var(\mathbf{f}_{t+1})\mathbf{b}$ denote the vector of factor risk prices, and $\boldsymbol{\beta}_i \equiv Var(\mathbf{f}_{t+1})^{-1}Cov(r_{i,t+1}, \mathbf{f}_{t+1})$ represents the $(3x1)$ vector of multiple-regression betas for asset i. The $\boldsymbol{\lambda}$'s represent the risk prices of multiple-regression beta risk for each of the factors. The risk prices depend on the SDF coefficients γ - as in the case of risk prices of both covariances and single regression betas - but also on the variances and covariances between the factors, since we are working with multiple regression betas. Given $\boldsymbol{\lambda} \equiv -\boldsymbol{\Sigma}_f\mathbf{b}$, $\boldsymbol{\Sigma}_f \equiv Var(\mathbf{f}_{t+1})$, standard errors for the factor risk price estimates can be calculated as,

$$Var(\boldsymbol{\lambda}) = \boldsymbol{\Sigma}_f Var(\mathbf{b})\boldsymbol{\Sigma}_f \qquad (25)$$

since $\boldsymbol{\Sigma}_f = \boldsymbol{\Sigma}_f'$, and given

$$Var(\mathbf{b}) = \begin{bmatrix} Var(\mathbf{b}^*) & \mathbf{0}_{(1X2)} \\ \mathbf{0}_{(2X1)} & \mathbf{0}_{(2X2)} \end{bmatrix} \qquad (26)$$

with $\mathbf{b}^* \equiv -\gamma\omega$ representing the SDF parameters to be estimated in the cross-section. Since some of the risk prices are fixed *a priori* by the model, and hence are not estimated, estimating the model with multiple regression betas, allow us to derive t-statistics for all the individual factors, in order to evaluate whether they are priced.

II. Asset pricing tests

A. *Data*

The testing assets used in the tests and evaluations of the asset pricing models are the Fama-French (1993) 25 portfolios sorted on size and book-to-market (SBV25), and Fama-French (1997) 38 industry sorted portfolios (IND38), all obtained from Prof. Kenneth

French's website. Due to missing observations, the returns associated with five industries - Sanitary Services (GARBG), Public Administration (GOVT), Steam Supply (STEAM), Irrigation Systems (WATER) and the residual class of industries (OTHER) - are excluded from the sample, leading to a total of 33 industry portfolios. The 1 month Treasury bill rate used to calculate excess returns, and data on the book-to-market ratios and returns of small value and small growth portfolios, are also obtained from Prof. French's website. Return data on the value-weighted market index and 10 year Treasury bond are from CRSP, while monthly data on prices and earnings associated with the Standard & Poor's (S&P) Composite Index are obtained from Professor Robert Shiller's website. Macroeconomic and interest rate data, including the Federal funds rate, 10 year and 1 year Treasury bond yields, 3 month Treasury bill rate, and the consumer price index are all obtained from the FRED II database, available from the St. Louis FED's website.

B. *Estimating the news components of stock and bond excess returns: a VAR approach*

Following Campbell (1991) and CA, I rely on a first-order VAR to estimate the news components for both unexpected stock and bond returns - r_{t+1}^{CF}, r_{t+1}^{H}, r_{t+1}^{B} and r_{t+1}^{R}. The VAR[3] equation assumed to govern the behavior of a state vector $\mathbf{X}_t$, which includes the excess stock market return, excess bond return and other variables known in time t - that help to forecast changes in expected stock and bond returns - is given by

$$\mathbf{X}_{t+1} = \mathbf{A}\mathbf{X}_t + \boldsymbol{\epsilon}_{t+1} \qquad (27)$$

I Follow Campbell (1991) and CA in estimating the revisions in expected excess bond returns and real interest rates,

$$r_{t+1}^{R} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r_{r,t+1+j} = \mathbf{e3}'\rho\mathbf{A}(\mathbf{I} - \rho\mathbf{A})^{-1}\boldsymbol{\epsilon}_{t+1} = \boldsymbol{\eta}'\boldsymbol{\epsilon}_{t+1} \qquad (28)$$

$$r_{t+1}^{B} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j (r_{b,t+1+j} - r_{f,t+1+j}) = -(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1}) - r_{t+1}^{R}$$

$$= -(\mathbf{e2} + \boldsymbol{\eta})'\boldsymbol{\epsilon}_{t+1} \qquad (29)$$

Here ρ is a discount coefficient linked to the average log consumption to wealth ratio ρ

$\equiv 1-\exp(E(c_t-w_t))$, or average dividend yield, **e2** and **e3** are indicator vectors that take a value of one in the cell corresponding to the position in the VAR of the excess bond return and real interest rate, respectively, **A** is the VAR coefficient matrix, and $\boldsymbol{\eta}' \equiv \mathbf{e3}'\rho\mathbf{A}(\mathbf{I}-\rho\mathbf{A})^{-1}$ is the function that relates the VAR shocks with real interest rate news. The estimate of r^R_{t+1} differs from Campbell (1991) and CA in that the term $(E_{t+1}-E_t)r_{r,t+1}$ is not included, whereas r^B_{t+1} represents an infinite sum. The existence of a infinite sum in both (28) and (29), relies on the assumption that the representative investor has a very long term horizon, and rolls-over the long maturity bonds on his portfolio. One can think of this assumption in relation to some pension funds which need to have some minimal proportion of bonds in their portfolios, in order to satisfy their payout obligations. In addition, equation (29) is an approximation rather than a exact relation, and includes the parameter ρ contrary to Campbell and Ammer (1993). The difference in my results arises from using a coupon bond as opposed to zero-coupon bonds as in their paper, and from ignoring the inflation component of bond excess returns. This decomposition threats the news in bond excess returns as the residual component of unexpected bond returns, which has the advantage of avoid giving too much weight to interest rate news.

The equity premia news and cash flow news, are estimated in a similar way to Campbell (1991) and CA,

$$r^H_{t+1} \equiv (E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j(r_{m,t+1+j}-r_{f,t+1+j}) = \mathbf{e1}'\rho\mathbf{A}(\mathbf{I}-\rho\mathbf{A})^{-1}\boldsymbol{\epsilon}_{t+1} = \boldsymbol{\varphi}'\boldsymbol{\epsilon}_{t+1} \qquad (30)$$

$$r^K_{t+1} = r^H_{t+1} - r^B_{t+1} = (\mathbf{e2}+\boldsymbol{\eta}+\boldsymbol{\varphi})'\boldsymbol{\epsilon}_{t+1} \qquad (31)$$

$$r^{CF}_{t+1} \equiv (E_{t+1}-E_t)\sum_{j=0}^{\infty}\rho^j\Delta d_{t+1+j} = (E_{t+1}-E_t)(r_{m,t+1}-r_{f,t+1}) + r^K_{t+1} + r^B_{t+1} + r^R_{t+1}$$

$$= (\mathbf{e1}+\boldsymbol{\varphi}+\boldsymbol{\eta})'\boldsymbol{\epsilon}_{t+1} \qquad (32)$$

where **e1** is the indicator vector that assigns a value of one in the cell corresponding to the position of the excess stock market return in the VAR, and $\boldsymbol{\varphi}' \equiv \mathbf{e1}'\rho\mathbf{A}(I-\rho\mathbf{A})^{-1}$ is the function that relates the VAR shocks with revisions in expected future excess stock returns. Treating cash-flow news as the residual component of unexpected stock returns has the advantage that one does not have to model directly the dynamics of dividends. Both stock and bond return decompositions are dynamic accounting identities that arise from the definition of stock and bond returns, and thus are not behavioral models for asset returns. In order to be consistent, with previous work (CV), I assume $\rho = 0.95^{\frac{1}{12}}$, which corresponds to an average consumption to wealth ratio of approximately 5% per year.

The state-vector associated with the first-order VAR is given by $\mathbf{X}_t \equiv [r_{rt}, FFPREM_t, TERM_t, VS_t, EY_t, r_{bt}, r_{mt}]'$, which follows the representations used in CA and CV. The 1 month real Treasury bill rate, $r_{r,t}$ is an indicator of short-term interest rates and it is used to estimate the real interest rate news component. FFPREM represents the spread between the Federal Funds rate and the 3 month Treasury bill rate, and thus it is a measure of both monetary policy actions and short-term interest rates. Its inclusion in the VAR is justified by previous evidence that both monetary policy (Jensen, Mercer and Johnson (1996), Patelis (1997), Bernanke and Kuttner (2005)) and short-term interest rates (Campbell (1991), Hodrick (1992), Ang and Bekaert (2003)) do forecast future expected equity market returns, at least for short term forecasting horizons. In an alternative specification using the relative bill rate (RREL) - employed by Campbell (1991) and Hodrick (1992) - instead of FFPREM, the respective coefficient estimate in the equation for the market return was non significant (t-statistic of -1.384). TERM represents the term structure spread - measured as the difference between the 10 and 1 year Treasury bond yields - which represents a proxy for the yield curve slope, and has been widely used in the predictability of returns literature, since Fama and French (1989) have found that TERM tracks the business cycle. EY denotes the log earnings yield (calculated as the log of the earnings to price ratio associated with the S&P Composite index), used instead of the market dividend yield (Fama and French (1988)), in light of recent evidence that the forecasting power of the dividend yield has decreased since the 90's, which might be related to a possible structural break in firms' dividend policies, causing more firms to paying less dividends (Fama and French (2001)). The value spread, VS, defined as the difference between the log book-to-market ratios of small value and small growth stocks, is used in the VAR system employed by CV, which argue that this spread being related with the value premium - an anomaly not priced by the CAPM - should help to predict market returns, if the ICAPM is true. In a dynamic context, if growth (value) stocks have lower (higher) expected returns than predicted by the CAPM, then it must be the case that the returns of growth (value) stocks forecast lower (higher) expected market returns, or shifts in the investment opportunity set. Thus, a decrease in the book-to-market ratio of growth stocks (equivalent to an increase in the current returns of growth stocks) forecasts lower stock market returns, or equivalently, a increase in the value spread forecasts lower stock market returns. Finally, the sample used in estimating the VAR is 1954.07-2003.12.

Descriptive statistics for the VAR state variables are presented in table I. The first-order autocorrelation coefficients show that TERM, VS and especially EY are very persistent variables, whereas, to a lower degree both FFPREM and the real interest rate exhibit some short term momentum. Furthermore, the VAR state variables are not significantly correlated, with the most relevant correlation occurring between VS and EY (-0.614).

The VAR coefficient estimates and associated Newey-West (1987) t-statistics (calculated with 5 lags) are presented at Table II, Panel A. The bottom row of Panel A shows that FFPREM, EY and r_b have short-term forecasting power over the stock market return: FFPREM predicts negative market excess returns 1 month ahead, consistent with previous evidence (Patelis (1997), Bernanke and Kuttner (2005)), and both EY and r_b predict positive market returns, also consistent with previous evidence (CV, Maio (2005b)). FFPREM and EY are statistically significant at the 1% level, whereas r_b is significant at the 5% level, which is remarkable in the case of EY, given previous evidence that the forecasting power of financial ratios is greater for long-horizon returns (beyond 1 year) (Fama and French (1988, 1989), Hodrick (1992)). On the other hand VS forecasts positive stock returns, but the effect is not statistically significant. In the equation for bond returns, both r_r and TERM predict positive bond returns, in line with previous evidence (CA), whereas VS and EY have also positive predictive power over bond returns. In addition, stock returns strongly forecast negative bond returns. The adjusted R^2 for the stock and bond forecasting regressions are 3.8% and 4.3%, respectively, in line with the values for monthly predictive regressions existent in the literature. Regarding the other equations in the VAR, r_r is close to an AR(1) process, but it is also negatively forecasted by both FFPREM and r_b, and positively forecasted by VS; FFPREM is mainly explained by its lagged value, but both TERM and r_m also have negative forecasting power on it, and r_b positively forecasts FFPREM. TERM and VS are close to AR(1) processes, although EY helps to predict (negatively) VS, and r_b positively forecasts TERM. In the equation for EY, the lagged values for EY and FFPREM forecast a rise in EY, whereas lagged VS, TERM and r_r are negatively correlated with EY. In addition, both bond and stock market returns forecast negatively EY, which in the latter case might be related to mean reversion observed in stock prices.

The results for the estimated "news" components associated with bond and stock excess returns are presented in Table II, Panels B and C respectively, which are similar to the Table 3 presented in CV. News about bond excess returns contribute the most for the variance of unexpected bond returns (0.915), whereas news about future real interest rates have a small contribution to the overall bond variance (0.094). These results confirm previous evidence (CA, Cochrane and Piazzesi (2005)), that the "Expectation theory" of the term structure - which states that bond risk premia should be constant trough time - is not validated by the data.

In respect to the stock return decomposition, equity premia news have the largest weight on the total stock market return variance (0.803), compared to the variance of cash-flow news (0.341), a result that goes in line with previous evidence (Campbell (1991), CA, CV) which emphasizes the fact that excess return news is the main determinant of unexpected equity market return's volatility. In addition, cash flow news is almost uncorrelated with equity premia news, with their covariance having a very small weight on the overall market variance. On the other hand, the covariance between bond premia and equity premia news represents -0.397 of the stock variance. News about future real interest rates have a negligible contribution, representing less than 3% of the stock market variance, also in line with previous evidence (CA), whereas the variance of bond premia news represent more than 20% of the market variance, hence, expectations of future bond premia represent an important component of innovations in current stock returns.

By analyzing the correlations of shocks in the individual VAR state variables with both r_{t+1}^{B} and r_{t+1}^{R}, the most relevant results are that innovations in the real interest rate are strongly positively correlated with r_{t+1}^{R}, which is a signal that real short-term interest rates exhibit some persistency. On the other hand, shocks on excess bond returns are strongly negatively correlated with r_{t+1}^{B}, indicating that bond prices exhibit long term mean reversion, i.e., high bond returns today are followed by lower expected bond returns in the future, a confirmation of the dynamic identity stated in (2) and (3).

From the correlations between individual shocks and both r_{t+1}^{K} and r_{t+1}^{CF}, we can verify that the innovations on VS are weakly negatively correlated with equity premia news, in line with the results obtained in CV. Innovations on EY are strongly positively correlated with r_{t+1}^{K}, confirming that EY forecasts positive stock market returns - in part due to the mean reversion in stock prices - whereas innovations in bond returns are weakly positively correlated with r_{t+1}^{K}, confirming the previous result that bond returns help to predict positive stock market returns. Finally, innovations in stock market returns are strongly negatively correlated with equity premia news, reflecting the existence of long term mean reversion in stock prices, in line with the results produced in CV, and confirming the dynamic identity in (1). Shocks in current market returns are also positively correlated with cash flow news, indicating that the rise in current stock prices, are at least partially, justified by an improvement in future cash-flows or earnings.

C. Estimating factor *betas*

In table III, I present single regression betas for the news components associated with stock and bond returns, for the case of the 25 size/book-to-market portfolios. The cash-flow betas are positive, while the betas associated with both equity premia and bond premia news are negative. Thus, an increase in future aggregate cash-flows and a decrease in both future excess stock market and bond returns lead to higher individual stock returns today, as expected. Comparing the two betas related with discount rate news, equity premia news have higher (magnitude) betas than bond premia news, i.e., the individual assets are more sensible to rises in future excess stock-bond returns than rises in future bond premia. The average betas across the 25 portfolios for the cash flow, equity premia and bond premia factors are 1.062, -0.763 and -0.275 respectively.

In Panels B and C, I present the average betas across book-to-market (BM) and size quintiles. The average betas within the book-to-market quintiles indicate that growth stocks have slightly higher cash-flow betas than value stocks (1.222 for BV1 versus 1.055 for BV5, representing a difference of 0.168), and there is a monotonic relation between book-to-market and cash flow betas. On the other hand, growth stocks have higher (absolute) equity premia news betas, relative to value stocks (-1.008 for BV1 versus -0.678 for BV5), with the relation between betas and book-to-market being close to monotonic. The findings for cash-flow contradict the results in CV, which have found in their modern sub-sample that value stocks have higher cash flow betas relative to growth stocks, although the relation between book-to-market and equity premia betas confirm their results that growth stocks have higher (magnitude) discount rate betas than value stocks. The difference in results to CV regarding the cash flow betas might be related to the longer sample employed in their VAR. The bond premia betas for growth stocks have slightly higher magnitudes relative to value stocks (-0.291 for BV1 versus -0.238 for BV5), but the relation between betas and book-to-market is not monotonic in this case. An important finding in these results, is that there is much more dispersion across the quintiles, for the equity premia betas than the bond news betas (absolute difference between BV1 and BV5 of 0.330 for equity premia beta versus 0.052 for the bond premia beta), thus the betas associated with bond news are much more stable across portfolios. This result shows that the risk premium (beta times risk price) associated with news in future bond excess returns is approximately the same across the individual stocks, while the risk premium associated with news in future equity premia presents sharp differences within the cross-section. This goes in line with the proposition that the type of risks measured by bond premia news - changes in discount rates used to discount certain cash-flows in the future - should be similar across individual stocks. The fact that growth stocks have marginally higher bond betas than value stocks has to due with their higher duration risk, i.e., since they discount more distant cash flows into the future, they are more sensible to rises in future long term interest rates. On the other hand, the risky component of future cash flows represents a larger share of the total cash flows for growth stocks in comparison with value stocks - which have more stable cash flows - and hence growth stocks should be more sensible to changes in discount rates (equity premia) used to discount those risky cash flows, in comparison to value stocks.

The average betas associated with size quintiles, indicate that small stocks have slightly higher cash-flow betas than large stocks (1.058 for S1 versus 0.993 for S5). In what concerns the equity premia beta, small stocks have higher absolute betas than big caps (-0.892 for S1 versus -0.601 for S5), while the opposite relation holds for bond premia news betas (-0.158 for S1 versus -0.321 for S5). Therefore, and contrary to the case of growth relative to value stocks - where growth stocks were riskier than value stocks, in terms of cash flow, equity premia and bond premia betas - small caps are not unambiguously riskier than big caps, since small stocks have lower (absolute) bond premia betas. The absolute difference between S1 and S5 for bond premia beta is 0.163, but still significantly lower than the dispersion for equity premia beta (0.291), and thus the bond premia betas are relatively more stable than equity premia betas, across the size quintiles.

The single regression betas associated with the industry portfolios, presented in Table IV show that there is also wide dispersion in betas across industries. In general, the betas of equity premia news have higher magnitudes than the betas for bond premia news, with the exception of Telephone and Telegraph communication (PHONE), Tobacco products (SMOKE), Electric, Gas and Water supply (UTILS) and Finance, Insurance and Real estate (MONEY) industries. The average betas across the industry portfolios for the cash flow, equity premia and bond premia factors are 1.049, -0.728 and -0.296, respectively, which represent similar values relative to the average betas across the book-to-market portfolios.

ELCTR (UTILS) have the highest (lowest) cash flow beta (1.401 versus 0.617), whereas Services (SRVC) have the highest (magnitude) equity premia beta (-1.001) compared to -0.218 for UTILS on the other extreme. In terms of bond premia betas, and excluding 3 outliers which have positive betas, MONEY has the largest (magnitude) beta (-0.601) compared to -0.107 for Petroleum and Coal products (PTRLM), and this spread is lower than the dispersion for the equity premia beta. Therefore, the bond premia betas are more stable across industries than the equity premia beta.

D. *Estimating the factor risk premia*

The natural econometric framework to estimate and test the asset pricing models presented in the previous section, is the two stage GMM procedure, which uses as weighting matrixes, the identity matrix in the first stage and the inverse of the spectral density matrix, S^{-1} in the second stage. The N sample moments correspond to the pricing errors for each of the N test assets at hand,

$$g_T(\mathbf{b}^*) \equiv \frac{1}{T}\sum_{t=1}^{T}(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} - \gamma\omega\sigma_{i,CF} + \omega\sigma_{i,K} + \sigma_{i,B} = 0$$

$$i = 1,\ldots,N \qquad (33)$$

where the covariances and variances were previously estimated, and $\mathbf{b}^* \equiv \gamma$ represent the parameter to be estimated. This GMM system - which will be denoted by GMM I - does not account for the measurement error in the variances of returns and covariances between returns and factors. To address this issue, an additional GMM system is used - denoted by GMM II -

$$g_T(\mathbf{b}^*) \equiv$$

$$\frac{1}{T}\sum_{t=1}^{T}\{(r_{i,t+1} - r_{f,t+1}) + \frac{1}{2}(r_{i,t+1} - \mu_i)^2 - \gamma\omega(r_{i,t+1} - \mu_i)r_{t+1}^{CF} + \omega(r_{i,t+1} - \mu_i)r_{t+1}^{K} + (r_{i,t+1} - \mu_i)r_{t+1}^{B}\} = 0$$

$$i = 1, \ldots, N \qquad (34)$$

where $\mu_i \equiv E(r_{i,t+1})$, represents the average return for asset i.[4] Both systems (33) and (34) produce the same point estimates for $\mathbf{b}^*$, although the respective standard errors in system (34) are corrected from the measurement error in covariances, which is not accounted for in system (33).

The standard errors for the parameter estimates and moments are presented in the Appendix, and the asymptotic test that the pricing errors are jointly zero, with $\hat{\boldsymbol{\alpha}} \equiv g_T(\hat{\mathbf{b}}^*)$, is given by

$$\hat{\boldsymbol{\alpha}}' var(\hat{\boldsymbol{\alpha}})^{-1}\hat{\boldsymbol{\alpha}} \sim \boldsymbol{\chi}^2(N-1) \qquad (35)$$

with $N-1$ denoting the number of overidentifying conditions.

Following Cochrane (1996, 2001), and given the fact that $var(\hat{\boldsymbol{\alpha}})$ is singular in most of the cases, I perform a eigenvalue decomposition of the moments' variance-covariance matrix, $var(\hat{\boldsymbol{\alpha}})= \mathbf{Q}\boldsymbol{\Lambda}\mathbf{Q}'$, where $\mathbf{Q}$ is a matrix containing the eigenvectors of $var(\hat{\boldsymbol{\alpha}})$ on its columns, and $\boldsymbol{\Lambda}$ is a diagonal matrix of eigenvalues, and then only the non-zero eigenvalues of $\boldsymbol{\Lambda}$ are inverted, producing a generalized inverse of $var(\hat{\boldsymbol{\alpha}})$.

In Table V (Panel A), I present the estimation and evaluation results for the ICAPM model of equations (22) and (23) above, estimated with first stage GMM, and for three alternative values for ω ($\omega = 0.7, 0.6, 0.5$).

Following Lo and Mackinlay (1990), who argue against testing asset-pricing models by using returns on portfolios sorted on some characteristic associated with returns themselves, I use the combination of size/book-to-market and industry portfolios (SBV25+IND38) as an additional group of test assets. I also present the risk prices for multiple regression betas in addition to single regression betas.

In terms of single regression betas, the estimates for both λ_K and λ_B are the same across the two classes of portfolios, since they are constrained a priori by the model. λ_K have higher magnitudes than λ_B as a result of the higher variance of equity premia news relative to bond premia news. λ_{CF} is much higher than the negative of λ_K across the two classes of test assets, confirming that cash-flow news has a higher risk price than equity premia news. In terms of average risk premium (average beta times risk price), cash flow news have a higher risk premium than the equity premia factor (0.647 versus 0.078 for SBV25 and 0.570 versus 0.076 for SBV25+IND38), and this factor in turn has a higher average premium than the bond premia factor (0.011 and 0.012 for SBV25 and SBV25+IND38, respectively). Thus, as predicting by the model, cash flow news (bad beta) have a higher risk price (premium) than (minus) equity premium news (good beta), and the equity premia factor has a higher risk price (premium) than bond premia news (excellent beta).

The risk aversion parameter γ is clearly greater than 1 - indicating that the average "real" investor is risk averse - and assumes higher values for SBV25 than for SBV25+IND38 (13.961 versus 12.387). In terms of statistical significance, γ is highly significant for SBV25 and the combined portfolios - at 1% and 5% levels with GMM I and GMM II standard errors, respectively. The ICAPM model is not rejected by the asymptotic χ^2 test, for both classes of test assets.

The average pricing error (root mean square error) given by

$$RMSE = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\hat{\alpha}_i^2} \qquad (36)$$

is higher for SBV25 than for the combined portfolios (0.272 versus 0.237), due to the high volatility in the returns of the size/book-to-market portfolios relative to the industry portfolios.

Following Lettau and Ludvigson (2001), the cross-sectional R^2 is computed as,

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \hat{\alpha}_i^2}{\sum_{i=1}^{N} \bar{r}_i^2} \qquad (37)$$

where $\bar{r}_i \equiv E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2}$. This goodness of fit measure assumes reasonable high values - 0.881 for SBV25 and 0.887 for SBV25+IND38.

By looking at the risk prices associated with multiple regression betas, λ_B is strongly significant in both classes of portfolios (1% level), whereas λ_K is not significant in the test with SBV25 portfolios.

The estimation results for alternative weights of the stock index in the market portfolio are reported in Panels B ($\omega = 0.6$) and C ($\omega = 0.5$). Given the lower value of ω, the risk price of equity premia news decreases in magnitude relative to Panel A (–0.088 and -0.073 versus -0.103). Nevertheless, the equity premia factor still has higher (magnitude) risk prices than the bond premia factor, given the higher variance of equity premia news relative to bond premia news. The estimates of γ increase relative to Panel A - 16.573 and 20.228 for $\omega = 0.6$ and $\omega = 0.5$ respectively, in the case of SBV25 - and in consequence the estimates of λ_{CF} are now higher, for both classes of portfolios. The risk price of the bond premia factor continues to be significant in terms of multiple regression betas, whereas λ_K is not priced. Overall, the average pricing errors are sensibly the same than for the benchmark case with $\omega = 0.7$.

The estimation results associated with second stage GMM - where the weighting matrix is the inverse of the spectral density matrix S^{-1} - are presented in Table VI. The estimates of γ have slightly lower values relative to the first stage estimates, and hence the cash flow risk price is lower than in Panel A. Nevertheless, the statistical significance improves relative to Panel A, with γ and the risk prices of cash flow and bond premia factors being significant at the 1% level. In addition, λ_K is significant at the 10% (SBV25) and 5% (SBV25+IND38) levels, in the case with $\omega = 0.6$.

E. *Alternative portfolios*

I perform the estimation of model (22) for alternative sets of portfolios sorted on individual characteristics - 10 portfolios sorted on the earnings to price ratio (E/P); 10 portfolios sorted on the cash flow to price ratio (CF/P) and 10 portfolios sorted on the dividend to price ratio (D/P) - from Fama and French (1996).

The factor loading estimates presented in Table VII, show that cash flow betas are positive and both equity and bond premia betas are negative, similarly to the SBV25 and IND38 portfolios. Furthermore, both cash flow and bond premia betas are almost flat across the extreme deciles, for both E/P and CF/P portfolios. On the other hand, the equity premia betas are significantly higher (in magnitude) for the lowest decile in comparison with the highest decile portfolio (absolute differences of 0.283 and 0.253 for E/P and CF/P, respectively). In respect to the D/P portfolios, the portfolio containing stocks with the lowest dividend yield has higher cash flow betas than stocks with the highest dividend yield (difference of 0.532). In addition, the lowest decile portfolio has lower absolute bond premia betas than the largest decile, although the difference is not as significant as for the equity premia betas (0.168 versus 0.643). Overall, these results confirm that the equity premia betas have much higher dispersion across assets, than bond premia betas.

The risk price estimates (from efficient GMM) for the alternative portfolios - reported in Table VIII - show that the estimates for both γ and λ_{CF} increase relative to the estimates associated with the SBV25 and industry portfolios, reported in Table VI. In terms of statistical significance, both the RRA parameter and the beta risk prices are significant in most cases, the exception being the equity premia risk price, which is significant only at the 10% level, for the CF/P and D/P portfolios. On the other hand, the cross sectional R^2 indicate higher values in comparison with both SBV25 and SBV25+IND38 in Table VI, thus confirming that the ICAPM with bond premia has a greater explanatory power over the returns of the characteristic-sorted portfolios, and in particular for the D/P portfolios (R^2 of 0.922).

The results for the combined portfolios (SBV25 plus the 30 characteristic portfolios) show that the R^2 is higher relative to all SBV25, SBV25+IND38 and E/P, but lower than for CF/P and D/P. In addition, all the beta risk prices are strongly significant. In the case of the 55 characteristic portfolios, the average risk premium associated with the cash flow, equity premia and bond premia factors are 0.624, 0.071 and 0.013 respectively, similar to the values obtained for the SBV25 portfolios.

F. *Alternative bond returns*

The model (22) is also tested by using alternative proxies for the bond return in addition to the 10 year Treasury bond. The additional bond returns are the Moody's seasoned AAA and BAA corporate bond returns and the return on an equally weighted portfolio containing the 3, 5 and 10 year Treasury bonds. Following Campbell, Lo and Mackinlay (1997) and Campbell, Chan and Viceira (2003), the log bond returns are calculated from the respective yields to maturity, using the following log linear approximation,

$$r_{n,t+1} \approx D_{nt} y_{nt} - (D_{nt} - 1) y_{n,t+1} \qquad (38)$$

with the duration of a n maturity bond being approximated as

$$D_{nt} \approx \frac{1-(1+Y_{nt})^{-n}}{1-(1+Y_{nt})^{-1}} \qquad (39)$$

where $y_{n,t+1} = \ln(1 + Y_{nt})$ denotes the log bond yield[5]. In the case of corporate bonds (AAA and BAA), n is set to 20 (years), and in the case of the Treasury bonds, n is set to 3, 5 and 10 years.

The estimation results for these alternative returns are presented in Table IX. We can see that the estimates for the RRA parameter and cash flow risk price are very similar across the three types of bond returns. In comparison with Table VI, Panel A, the estimates for γ and λ_{CF} are only slighter higher for the alternative returns, whereas the R^2 achieves similar values relative to the benchmark bond return.

In sum, the results for the three alternative bond returns are sensibly the same to those obtained previously with the 10 year Treasury bond.

G. *Time-varying covariances*

A conditional representation of model (22) can be presented as

$$E_t(r_{i,t+1}) - r_{f,t+1} + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K,t} - \sigma_{i,B,t} \qquad (40)$$

where $\sigma_{i,K,t} \equiv Cov_t(r_{i,t+1}, r_{t+1}^K)$ and $\sigma_{i,B,t} \equiv Cov_t(r_{i,t+1}, r_{t+1}^B)$ represent the conditional covariances with equity premia and bond premia news, respectively, whereas the variance of individual returns and the covariance with cash flow news, are assumed to be conditionally homoskedastic.[6]

In order to obtain an analytic expression for the time-varying covariances, I assume that the product of individual returns with a factor f_{t+1}, is governed by the following AR(1) process,

$$r_{i,t+1}f_{t+1} = r_{it}f_t + br_{it}f_tx_t + u_{i,t+1} \qquad (41)$$

where $u_{i,t+1}$ represents an error term with $E_t(u_{i,t+1}) = 0$, and x_t denotes a state variable known in period t. Given (41), the conditional covariances in (40) are equal to

$$\sigma_{i,K,t} \equiv r_{it}r_t^K + b_Kr_{it}r_t^Kx_t$$

$$\sigma_{i,B,t} \equiv r_{it}r_t^B + b_Br_{it}r_t^Bx_t \qquad (42)$$

Substituting (42) in (40) originates the following conditional model

$$E_t(r_{i,t+1}) - r_{f,t+1} + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega r_{it}r_t^K - \omega b_Kr_{it}r_t^Kx_t - r_{it}r_t^B - b_Br_{it}r_t^Bx_t \qquad (43)$$

By applying the law of iterated expectations and noting that

$$E(r_{it}r_t^jx_t) = Cov(r_{it}, r_t^jx_t) \approx Cov(r_{i,t+1}, r_{t+1}^Kx_t), j = K, B$$

we have the following approximated unconditional model

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} \approx \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} - \omega b_K\sigma_{i,K,x} - b_B\sigma_{i,B,x} \qquad (44)$$

where $\sigma_{i,K,x} \equiv Cov(r_{i,t+1}, r_{t+1}^Kx_t)$ and $\sigma_{i,B,x} \equiv Cov(r_{i,t+1}, r_{t+1}^Bx_t)$ represent the covariances with the scaled factors that measure time variation in the covariances with equity and bond premia news. By imposing $b_K = b_B = 0$, one obtains model (22) as a special case of (44).

The results for the augmented ICAPM with time-varying covariances are displayed in Table X. The scaling variables that determine the covariances, are the market dividend yield (DY), the smoothed log earnings yield (EY*) and the default spread (DEF)[7]. These variables have been used in the literature as forecasters of future market returns (Keim and Stambaugh

(1986), Fama and French (1988, 1989), Hodrick (1992), CV, among others). Panels A and D present the results for DY, Panels B and E display the results for EY*, and Panels C and F for DEF. In the models with DY and EY*, the estimates for both b_K and b_B are positive, indicating that the scaling variables DY and EY* forecast positive covariances of individual returns with both equity and bond premia news. While b_B is in general non significant, b_K is statistically significant for both DY and EY* models and for the SBV25 portfolios (both first and second stage estimation) and SBV25+IND38 (only with efficient GMM estimates). In the specification scaled by DEF, the estimates for both b_K and b_B are negative, hence DEF forecasts negative covariances between individual returns and both equity and bond premia news. In the model scaled by EY* and DEF, the estimates of the RRA parameter and cash flow risk price produced by SBV25 are significantly higher than the corresponding estimates in Tables V and VI, Panel A.

Overall, the average pricing errors compare favorably with the benchmark model of Tables V and VI, in special for the SBV25 portfolios - in the DY model, RMSE (R^2) achieve values of 0.223 (0.913) compared with 0.272 (0.881) in Table V.

III. A heteroskedastic ICAPM with bond risk premia

A. *An ICAPM with revisions in the variances of returns*

The ICAPM models of equations (22) and (23) are derived under the assumption that log consumption growth and log market returns are jointly homoskedastic, an assumption that allows to substitute log consumption growth from the log SDF, as shown in the Appendix. I show in the Appendix G.1 that with jointly heteroskedastic log consumption growth and market returns, the pricing equation (22) becomes,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + 0.5\theta^2(\omega^2\sigma_{i,Vm} + (1-\omega)^2\sigma_{i,Vb}) \qquad (45)$$

where $\sigma_{i,Vm} \equiv Cov(r_{i,t+1}, V_{t+1}^m)$, $\sigma_{i,Vb} \equiv Cov(r_{i,t+1}, V_{t+1}^b)$. $V_{t+1}^m \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty}\rho^j r_{m,t+1+j}^2$ and

$V^b_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r^2_{b,t+1+j}$ represent proxies for revisions in future stock and bond return volatilities, respectively. This model says that upward revisions in the variance of future stock and bond returns, earn a positive risk price, which increases with $\theta \equiv \frac{1-\gamma}{1-\frac{1}{\psi}}$. In addition, the risk price associated with $\sigma_{i,Vm}$ should be higher than the risk price for $\sigma_{i,Vb}$, with $\omega > 0.5$.

The estimation results of model (45) are reported in Table XI, Panels A and B. The parameter estimated in the cross section, $\lambda_V = 0.5\theta^2$, and the risk prices associated with the stock and bond volatility news factors ($\lambda_{VM} = \omega^2\lambda_V$, $\lambda_{VB} = (1-\omega)^2\lambda_V$), are not robust in sign, presenting either positive and negative estimates. Furthermore, the estimates of those parameters are not significant, being only marginally significant (10%) for SBV25+IND38 and the 55 characteristic portfolios, with efficient GMM.

Panels C and D present the results for the reduced model

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + 0.5\theta^2\omega^2\sigma_{i,Vm} \qquad (46)$$

which assumes that the variance of bond returns is homoskedastic, and hence only revisions in the variance of stock market returns are priced. Again, the results are not robust, with λ_V being positive and significant in the case of SBV25 and first stage GMM, and negative and significant for the combined portfolios in the second stage estimation. We can also see that the RMSE and R^2 are almost the same as in the benchmark model presented in Tables V, VI and VIII, so the model with news in variances does not add significant additional explanatory power for the cross section. These results seem to suggest that changes in volatility are less persistent than changes in expected returns, and thus have a minor pricing power for the cross-section of returns, in the context of a dynamic model.

B. *An unrestricted ICAPM with bond risk premia*

Following Campbell (1993), I derive an alternative model in the presence of joint heteroskedasticity for consumption and market returns, with the time-varying intercept of consumption being linearly related with the expected returns on both stocks and bonds,

$$E_t(\Delta c_{t+1}) = \mu_{p,t} + \psi E_t(r_{p,t+1}) \qquad (47)$$

$$\mu_{p,t} \equiv \mu_0 + \phi_1 \omega E_t(r_{m,t+1}) + \phi_2(1-\omega)E_t(r_{b,t+1}) \qquad (48)$$

The assumption (48) is the same as the condition in Campbell (1993), $\mu_{p,t} \equiv \mu_0 + \phi E_t(r_{p,t+1})$, with the difference that the expected returns on stocks and bonds have different impacts on the time-varying intercept.[8] $\mu_{p,t}$ reflects the influence of time-varying risk - variance of consumption growth relative to the return on the market - on saving decisions (Campbell (1993)).

In the Appendix I show that the ICAPM pricing equation in this framework is given by

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_K\sigma_{i,K} + b_B\sigma_{i,B} \qquad (49)$$

with the 3 parameters (b_{CF}, b_K, b_B) freely estimated by the GMM system, being related with the original preference parameters in the following way,

$$\begin{cases} b_{CF} \equiv \gamma\omega \\ b_K \equiv -\omega\left(1 + \frac{1-\gamma}{\psi-1}\phi_1\right) \\ b_B \equiv -1 - \frac{1-\gamma}{\psi-1}(\phi_1\omega + \phi_2(1-\omega)) \end{cases} \qquad (50)$$

By making $\phi_1 = \phi_2 = 0$, one obtains the homoskedastic ICAPM (22) as a special case of the unrestricted ICAPM (49). The inclusion of the additional terms $-\frac{1-\gamma}{\psi-1}\omega\phi_1$ and $-\frac{1-\gamma}{\psi-1}(1-\omega)\phi_2$ that appear on the covariance risk prices, relies on the fact that a 1% increase in equity and bond premia news translates into a reduction in consumption (due to the effect of changing risk on saving) of $\omega\phi_1$ and $\omega\phi_1 + (1-\omega)\phi_2$, respectively, as shown by the following decomposition for innovations in consumption, derived in the Appendix,

$$(E_{t+1} - E_t)c_{t+1} = \omega(E_{t+1} - E_t)r_{m,t+1} + (1-\omega)(E_{t+1} - E_t)r_{b,t+1} + \omega(1 - \psi - \phi_1)r_{t+1}^K$$
$$+[1 - \psi - \omega\phi_1 - (1-\omega)\phi_2]r_{t+1}^B \qquad (51)$$

as a function of innovations on stock and bond returns, and future equity and bond premia news. Given that the risk price of log consumption growth is given by $\frac{\theta}{\psi} = \frac{1-\gamma}{\psi-1}$, it follows that the covariance risk prices of equity and bond premia news are adjusted by the terms $-\frac{1-\gamma}{\psi-1}\omega\phi_1$

and $-\frac{1-\gamma}{\psi-1}(\phi_1\omega+\phi_2(1-\omega))$.[9]

The estimation results for model (49) are presented in Table XII for both first stage (Panel A) and second stage GMM (Panel B). The covariance risk prices for both equity and bond premia news, (b_K, b_B), are both positive and statistically significant - especially in the case of b_B - for SBV25 and the 55 characteristic portfolios. The estimates of b_B are higher in magnitude compared to b_K, given the lower variance of bond premia news. On the other hand, the estimates of the RRA parameter - and hence the beta risk price of cash flow news - are higher than in the benchmark ICAPM in Tables V, VI and VIII, for the case of the characteristic portfolios. The average risk premium in the case of SBV25 associated with the cash flow, equity premia and bond premia factors are 2.502, -1.217 and -0.543, respectively, whereas for the 55 portfolios, the same average risk premiums are 2.450, -1.251 and -0.503. The heteroskedastic ICAPM is not rejected by the asymptotic χ^2 test, and both the RMSE and cross sectional R^2 indicate a higher explanatory power over the returns of SBV25, E/P, CF/P and D/P portfolios, relative to the benchmark ICAPM.

The implied estimates of ϕ_1 and ϕ_2 are obtained from the following equalities,

$$\begin{cases} \gamma = \frac{b_{CF}}{\omega} \\ \phi_1 = \frac{\psi-1}{b_{CF}-\omega}(b_K+\omega) \\ \phi_2 = \frac{(\psi-1)\omega}{b_{CF}-\omega}\left(\frac{b_B-b_K}{1-\omega}+1\right) \end{cases} \tag{52}$$

by imposing $\omega = 0.7$ and $\psi = 0.9$. Standard errors for both ϕ_1 and ϕ_2 can be obtained by using the delta method.[10] The estimates of both ϕ_1 and ϕ_2 are negative and statistically significant for the models estimated with SBV25 and SBV25+E/P+CF/P+D/P portfolios. In addition, the estimates of ϕ_2 are higher in magnitude than ϕ_1, given the higher values of b_B relative to b_K. This means that a rise of the same magnitude in equity and bond premia news produces a bigger decline in expected consumption growth due to future bond excess returns, as illustrated by equations (47) and (48).

C. *An ICAPM with revisions in the VAR state variables*

A third possible specification for the heteroskedastic ICAPM, is to assume that the time-varying intercept of consumption is a linear function of the expectation of the remaining state VAR variables - which help to forecast future stock and bond returns -,

$$\mu_{p,t} \equiv \mu_0 + \phi E_t(y_{t+1}) \qquad (53)$$

where $y_{t+1} \equiv r_{rt+1}, FFPREM_{t+1}, TERM_{t+1}, VS_{t+1}, EY_{t+1}$. Following Campbell (1993) and Guo (2002), the condition (53) can be verified if the variances of both asset returns and discount rate news (and the covariance between the two) are linear functions of the expectation of each state variable. Given (53), the following pricing equation is derived in the Appendix,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + \gamma_Y\sigma_{i,y} \qquad (54)$$

where $\sigma_{i,y} \equiv Cov(r_{i,t+1}, r_{t+1}^y)$ represents the covariance with revisions in the state variable, $r_{t+1}^y \equiv (E_{t+1} - E_t)\sum_{j=0}^{\infty}\rho^j y_{t+1+j}$. The risk price of news in the state variable, $\gamma_Y \equiv -\frac{\theta}{\psi}\phi$ represents the second parameter to be estimated in the cross section.

Following the reasoning given in the previous subsection, a 1% increase in revisions on the state variable y_{t+1} corresponds to a reduction in consumption (due to the effect of changing risk on saving) of ϕ, and given the risk price of consumption equal to $\frac{\theta}{\psi}$, the risk price of $\sigma_{i,y}$ is given by $-\frac{\theta}{\psi}\phi$.

The estimation results (from efficient GMM) for model (54) are presented in Table XIII. The parameter of interest γ_Y is positive for the FFPREM and EY models, being negative for the models with revisions on TERM, VS and r_r. In terms of statistic significance, γ_Y is in general significant in the estimation with the SBV25+E/P+CF/P+D/P portfolios, whereas in the case of SBV25, γ_Y is significant in the models with revisions in TERM, VS and r_r. In the case of SBV25+IND38, γ_Y is significant only in the ICAPM with news in the real interest rate. Given these estimates for γ_Y, the implied original coefficient ϕ is negative for both FFPREM and EY, and positive for the ICAPM with TERM, VS and r_r, and the statistic significance is similar to the corresponding estimates of γ_Y.[11] Hence, a rise in the revisions associated with both FFPREM and EY, and a decline in the news for TERM, VS and r_r, lead to a decline in expected consumption growth, as indicated by equation (53).

The average pricing errors in the case of both SBV25 and the 55 characteristic portfolios, are lower than the corresponding values in Tables VI (Panel A) and VIII, and this is especially relevant for the ICAPM with revisions in the real interest rate (RMSE of 0.196 versus 0.310 for the benchmark ICAPM, in the case of SBV25). Similarly, the adjusted cross sectional R^2 are slightly higher than in the benchmark ICAPM, in the case of the characteristic portfolios.

IV. Time-varying risk aversion

A. *An ICAPM with cyclical risk aversion*

Campbell and Cochrane (1999) present a theoretical model where risk aversion is countercyclical, being negatively correlated with the surplus consumption ratio, which represents the difference between current and past consumption. Time-varying risk aversion can also prevent investors of timing the market (for example overweighting value stocks given their higher expected return), thus allowing the general equilibrium interpretation of the asset pricing model. Maio (2005a) explores this idea within the framework of Campbell (1993) and CV, by imposing a time-varying relative risk aversion coefficient γ_t and derive an ICAPM model containing a factor related with cyclical risk aversion. This model is exact if the elasticity of intertemporal substitution (ψ) is close to 1. By using a number of different scaling variables related with the business cycle, the estimation results for the ICAPM show that γ_t is strongly countercyclical. The economic intuition is that in recessions or in times of sustained declining stock prices (bear stock market) the investors' risk tolerance should be low, and the converse should happen in economic expansions or within a bull equity market. Hence, time-varying risk aversion can be interpreted as a recession risk factor that causes marginal utility and required returns to be high in recessions and low in economic expansions. Thus, risk aversion is a deterministic function of a state variable z_t linked to the business cycle or financial wealth,

$$\gamma_t = \gamma_0 + \gamma_1 z_t \qquad (55)$$

By substituting equation (55) in the log SDF of equation (21) above, with γ_t in place of γ, we have

$$m_{t+1} = E_t(m_{t+1}) - \gamma_0 \omega r_{t+1}^{CF} - \gamma_1 \omega r_{t+1}^{CF} z_t + \omega r_{t+1}^{K} + r_{t+1}^{B} \qquad (56)$$

Making $\mathbf{f}_{t+1} \equiv (r_{t+1}^{CF}, r_{t+1}^{CF} z_t, r_{t+1}^{K}, r_{t+1}^{B})'$ and $\mathbf{b} \equiv (-\gamma_0\omega, -\gamma_1\omega, \omega, 1)'$ and using Theorem 1 in the Appendix, one has the following ICAPM model with time-varying risk aversion,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma_0 \omega \sigma_{i,CF} + \gamma_1 \omega \sigma_{i,CFz} - \omega \sigma_{i,K} - \sigma_{i,B} \qquad (57)$$

where $\sigma_{i,CFz} \equiv Cov(r_{i,t+1}, r_{t+1}^{CF} z_t)$ represents the covariance with the scaled factor. The innovation in (57) relative to the "static" ICAPM in equation (22) is the presence of $\sigma_{i,CFz}$, the covariance with the factor associated with time-varying risk-aversion.

One of the state variables used in Maio (2005a) to explain time-varying risk aversion is the market dividend yield (DY), which is negatively correlated with the business cycle - being high in recession and low in economic expansions. The specification in (57) becomes

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma_0 \omega \sigma_{i,CF} + \gamma_1 \omega \sigma_{i,CFDY} - \omega \sigma_{i,K} - \sigma_{i,B} \qquad (58)$$

where $\sigma_{i,CFDY} \equiv Cov(r_{i,t+1}, r_{t+1}^{CF} DY_t)$ represent the covariance with the scaled factor $r_{t+1}^{CF} DY_t$ that measures time-varying risk aversion.

The estimation results for the asset pricing model (58) are given in Table XIV, with both first stage (Panel A) and second stage estimation (Panel B). The results in Panel A show that γ_1 is positive and statistically significant for all the portfolios, and especially for both SBV25 and the 55 characteristic portfolios, thus confirming the results in Maio (2005a), that the market dividend yield is positively correlated with risk aversion. The estimates of the constant component of risk aversion, γ_0, and the beta risk price of cash flow news are slightly below the corresponding estimates in Table V, but still significant. The average pricing errors are significantly lower than in the benchmark ICAPM of Table V (0.161 versus 0.272 for SBV25), whereas the cross sectional R^2 increases (0.956 versus 0.881 in the case of SBV25). These findings confirm the results in Maio (2005a), that by incorporating time variation in γ that is related with the dividend yield, the ICAPM performance improves substantially.

The results for efficient GMM in Panel B indicate lower estimates for γ_1 compared to first stage GMM estimates, although the estimates of both γ_0 and γ_1 even increase in terms of statistical significance - γ_1 is now significant at the 1% level, for the 3 classes of portfolios. The average pricing error and adjusted R^2 also compare favorably with the corresponding values for the benchmark ICAPM in Tables VI and VIII.

B. *Risk aversion linked with bond premia*

Apart from being influenced by lagged state variables, current risk aversion can be correlated with the current period unknown returns. In fact, the risk aversion of the representative investor, affects both his demand and valuation for stocks and bonds, thus affecting expected and unexpected stock and bond returns and their implied news components, including expectations about future excess bond returns r_{t+1}^{B}. This relation might be reinforced, as a consequence of the interaction between portfolio rebalances and risk aversion: A decrease in risk aversion in the beginning of period $t+1$ - as a result of a positive impact on either labor income or financial wealth, in period t - is associated with an investment flow from bonds to all stocks in general, in investors' portfolios, since stocks are riskier than bonds. This leads to a decrease in the demand for bonds, leading to lower current bond prices and returns. Given the mean reversion of bond returns stated in equation (2) above, lower current bond returns are associated with higher future excess bond returns, originating a negative correlation between current risk aversion and news on future bond premia.

Hence, I assume that the relative risk aversion coefficient is governed by,

$$\gamma_t = \gamma_0 + \gamma_1 r_{t+1}^{B} \qquad (59)$$

leading to the following model,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma_0 \omega \sigma_{i,CF} + \gamma_1 \omega \sigma_{i,CFB} - \omega \sigma_{i,K} - \sigma_{i,B} \qquad (60)$$

where $\sigma_{i,CFB} \equiv Cov(r_{i,t+1}, r_{t+1}^{CF} r_{t+1}^{B})$ represents the covariance with the scaled factor, and we postulate γ_1 to be negative.

The estimation results for the asset pricing model (60) are given in Table XV. In the first stage GMM estimation, γ_1 is negative and statistically significant for SBV25 and SBV25+E/P+CF/P+D/P portfolios, whereas it is not significant for SBV25+IND38, given the poor fitting of the model for the industry portfolios. The model is not rejected by the asymptotic χ^2, and the average pricing error for the SBV25 portfolios is lower than for the benchmark ICAPM (0.228 versus 0.272). The estimates of the constant element of RRA decrease relative to the benchmark model, with γ_0 presenting a slightly negative estimate in the estimation with SBV25. The second stage estimation results (Panel B) show that γ_1 declines in magnitude relative to the first stage estimates, but nevertheless it is still highly significant, for SBV25 and the 55 characteristic portfolios. In addition, the estimate associated with γ_0 for SBV25 is now positive. Furthermore, as in the case of the ICAPM scaled by DY, the average pricing error and adjusted R^2 co with the corresponding values in Table VI and VIII, in respect to the SBV25 and SBV25+E/P+CF/P+D/P portfolios.

Hence, at least for the SBV25 and 55 characteristic portfolios, a rise in bond risk premia news is associated with lower risk aversion. With these results, bond premia news are not only a better "beta" relative to news in future excess stock-bond returns - due to representing a certain increase in reinvested future wealth - but it also has a second order effect associated with declining risk aversion, which is a consequence of the interaction between risk aversion and portfolio rebalance between stocks and bonds.

C. *The unrestricted ICAPM with time-varying risk aversion*

If we allow time-variation in RRA in the context of the unrestricted ICAPM (49), we obtain the following unrestricted ICAPM with time-varying RRA,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFDY}\sigma_{i,CFDY} + b_K\sigma_{i,K} + b_B\sigma_{i,B} \qquad (61)$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFB}\sigma_{i,CFB} + b_K\sigma_{i,K} + b_B\sigma_{i,B} \qquad (62)$$

where the two parameters (b_{CF}, b_{CFz}) are related with the RRA parameters by the following equalities,

$$\begin{cases} b_{CF} \equiv \gamma_0 \omega \\ b_{CFz} \equiv \gamma_1 \omega \end{cases}, z = DY, B \qquad (63)$$

The results (from first stage GMM) for models (61) and (62) are displayed in Table XVI, Panels A (DY) and B (bond premia news). In the case of the ICAPM scaled by DY, γ_1 is significantly positive in all sets of portfolios, similar to Table XIV, whereas the risk price of bond premia news b_B is significant in the case of SBV25 and the 55 characteristic portfolios. In the ICAPM scaled by bond premia news, γ_1 is negative and significant for SBV25 and the characteristic portfolios with standard errors from GMM I, although the standard errors from GMM II are large. In addition, bond premia news is priced in the presence of the scaled factor $r_{t+1}^{CF} r_{t+1}^{B}$. The average pricing errors for both ICAPM scaled by DY and bond premia, are lower than in the corresponding "reduced" scaled ICAPM of Tables XIV and XV, and also lower than in the unrestricted ICAPM of Table XII. In addition, the adjusted R^2 is higher in comparison with the values in Tables XIV, XV and XII. In the second stage estimation (Panels C and D), both γ_1 and b_B improve in terms of statistical significance relative to first stage estimation, for both models - DY and r_{t+1}^{B}.

V. Discussion

A. Assessing *individual pricing errors*

The ICAPM models estimated in the previous two sections were not rejected using the asymptotic χ^2 test of joint nullity of the pricing errors. As emphasized before (Cochrane (1996, 2001), Hodrick and Zhang (2001)), inference using this test can be misleading due to the singularity of $var(\hat{\boldsymbol{\alpha}})$, and the inherent problems in inverting it. As a consequence I have opted for a generalized inverse as described in Section II. Nevertheless, it could be that the low test values, are not so much the result of individual low pricing errors - what we want - but rather the economic uninteresting result of low values for $var(\hat{\boldsymbol{\alpha}})^{-1}$. To address this issue, it is helpful to pursue an analysis of the individual pricing errors.

In addition, I compare the ICAPM individual pricing errors with those associated with the CAPM. Following Campbell (1993), I show in Appendix H that in the framework of Section I and for the case of a investor with log utility ($\gamma = 1$), a logarithmic version of the CAPM arises as a special case of the ICAPM in equation (17),

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \omega\sigma_{i,m} + (1 - \omega)\sigma_{i,b} \qquad (64)$$

where $\sigma_{i,m} \equiv Cov(r_{i,t+1}, (E_{t+1} - E_t)r_{m,t+1})$ and $\sigma_{i,b} \equiv Cov(r_{i,t+1}, (E_{t+1} - E_t)r_{b,t+1})$ denote the covariances with stock market and bond returns, respectively. Equation (64) represents a generalized CAPM for the case where the market portfolio is composed of both stocks and bonds, and I will denote it as the 2 beta CAPM (CAPM2). The standard CAPM can be recovered as a special case of (64) by imposing $\omega = 1$,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \sigma_{i,m} \qquad (65)$$

Often in the empirical implementation of the CAPM and multifactor models, the market risk price is freely estimated in the cross-section, then the 2 beta CAPM in equation (64) becomes,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_p\omega\sigma_{i,m} + b_p(1 - \omega)\sigma_{i,b} \qquad (66)$$

and the standard unrestricted CAPM is obtained by making $\omega = 1$,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_p\sigma_{i,m} \qquad (67)$$

Figure 1 presents a picture of the pricing errors for the SBV25 portfolios, associated with the bad beta, good beta (BBGB) model in equation (18), the CAPM and 2 beta CAPM of equations (64), (65), (66) and (67), and several ICAPM specifications. ICAPM I denotes the homoskedastic benchmark ICAPM of equation (22); ICAPM II and III denote the benchmark ICAPM with time-varying covariances of equation (44), scaled by DY and EY*, respectively; ICAPM IV is the unrestricted ICAPM of equation (49); ICAPM V denotes the ICAPM with revisions in the real interest rate of equation (54); ICAPM VI and VII refer to the standard ICAPM with time-varying RRA of equations (58) and (60), respectively; and finally, ICAPM VIII and IX refer to the unrestricted ICAPM with time-varying RRA presented in equations (61) and (62).

The graphs in Panels A and B, show that all ICAPM models have lower pricing errors than both (unrestricted) CAPM and 2 beta CAPM. The out performance of the several ICAPM models is even more accentuated relative to the restricted CAPM and 2 beta CAPM, as shown in Panels C and D. On the other hand, most of the ICAPM models with bond risk premia have lower pricing errors than the BBGB model.

Furthermore, the CAPM individual errors have a robust pattern across size quintiles: within each size quintile, the growth portfolio has large negative pricing errors and the value portfolio has large positive errors. This has been referred as the value premium, and has been originally documented for the CAPM (Fama and French (1992, 1993)). This pattern is strongly attenuated, and in some cases non-existent for the several specifications of the ICAPM, which in addition present significantly lower individual errors when compared with both versions of the CAPM within each size quintile.

These findings also seem to suggest, that by augmenting the definition of market wealth - by adding a long maturity bond an deriving a 2 beta CAPM - one does not improve the CAPM pricing ability for the cross section of returns, confirming the results in Shanken (1987). Thus, we need a dynamic model like the ICAPM, to price the SBV25 portfolios more accurately and in particular growth and value stocks.

In Table XVII, Panel A, I complement this analysis by presenting the average pricing errors (on a monthly and annual basis) and the cross sectional adjusted R^2 associated with the BBGB model, the unrestricted CAPM and 2 beta CAPM, and the various ICAPM specifications.

We can see that all ICAPM models, including BBGB, have lower RMSE and higher R^2 than both CAPM models, whereas both CAPM and CAPM2 have similar RMSE. In addition, whereas the benchmark homoskedastic ICAPM I does not improve relative to the BBGB model, all the other ICAPM specifications with bond premia, have both lower RMSE and higher adjusted R^2 than the BBGB model.

I also present the goodness-of-fit measures associated with the Fama and French (1993) 3 factor model (FF3) that earned great acceptance and can be rationalized in an APT context (Cochrane (2001)). Although the FF3 model has lower pricing errors, some of the ICAPM models - ICAPM V, VI and VIII - have very approximate values for both RMSE and R^2 relative to the FF3 model (the RMSE of ICAPM V and VII are 0.146 and 0.152 respectively, compared to 0.137 for FF3).

B. *The Value Premium*

As mentioned above, the value premium refers to the anomaly associated with the CAPM in that growth (value) stocks have significantly lower (higher) pricing errors than predicted by the model. In Table XVII Panel B, I analyze how the several ICAPM models derived in this paper are able to price the book-to-market quintiles associated with the SBV25 portfolios. For each model, I present the average pricing errors per quintile.

The results let us to conclude that the 2 beta CAPM does not improve the traditional CAPM in pricing the book-to-market quintiles. For both models, the extreme quintiles (BV1 and BV5) still have large negative and positive errors, respectively. The results for the BBGB model and the homoskedastic ICAPM with bond risk premia (ICAPM I) show some improvement in the pricing ability of the extreme book-to-market quintiles, although growth stocks (BV1) still have an annualized pricing error of -4.69%, which is economically large. On the other hand, the ICAPM with covariances scaled by the dividend yield and smoothed earnings yield (ICAPM II and III) have low pricing errors across all the quintiles. The unrestricted ICAPM (ICAPM IV) and especially the ICAPM with revisions in the real interest rate (ICAPM V), are also able to price the value premium. The ICAPM with risk aversion scaled by the dividend yield (ICAPM VI and VIII) and bond premia news (ICAPM VII and IX), also present a large reduction in the pricing errors associated with all book-to-market quintiles, and especially for the extreme quintiles, in comparison with the CAPM and BBGB models.

All the models ICAPM II-IX have economically low pricing errors for all quintiles and in particular for both growth and value stocks, and this is especially relevant in the case of ICAPM V, VI and VIII. The annual average pricing errors for BV1 are -0.82%, -1.22% and -1.00% for ICAPM V, VI and VIII respectively, compared to -5.12% for the CAPM. In the case of BV5, the annual average pricing errors are -0.45%, 0.43% and -0.33% for ICAPM V, VI and VIII, respectively, in comparison with 3.41% for the CAPM. The pricing errors associated with those 3 models are approximately as low as those arising from the Fama and French (1993) model.

Overall, these results show that several alternative specifications for the ICAPM with bond premia - the homoskedastic ICAPM with time-varying RRA (as in Maio (2005a)), a heteroskedastic ICAPM with revisions in the real interest rate, and a heteroskedastic ICAPM with and without time-varying RRA - can price the value premium. This provides a fundamental alternative explanation relative to the less theoretical based FF3 model, which uses the HML factor (return on value stocks minus the return on growth stocks) in order to explain the CAPM negative (positive) pricing errors for growth (value) stocks.

C. Addressing momentum

Momentum or short term positive autocorrelation in stock prices (Jegadeesh and Titman (1993)) represents one of the biggest challenges for existing asset pricing models, and is not explained by the FF3 model (Fama and French (1996)).

A possible test to be made is to analyze whether the momentum factor UMD (returns on past winners minus the returns on past losers) (Carhart (1997)) is still significant after accounting for the factors present in the ICAPM. I extend the ICAPM specifications of equations (49), (61) and (62) by adding UMD, leading to

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \qquad (68)$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFDY}\sigma_{i,CFDY} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \qquad (69)$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFB}\sigma_{i,CFB} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \qquad (70)$$

with $\sigma_{i,UMD} \equiv Cov(r_{i,t+1}, UMD_t)$.

The results reported in Table XVIII, show that b_{UMD} is not robust in terms of sign and statistical significance for all three specifications above. In the case of SBV25, b_{UMD} is statistically significant in the first stage GMM estimation, although not significant with efficient GMM, whereas for SBV25+IND38, it is strongly insignificant. In the case of SBV25+E/P+CF/P+D/P portfolios, b_{UMD} is significant for models (68) and (70), but not significant in the case of model (69).

Hence, these results suggest that the momentum observed in stock returns, might be at least partially explained by an ICAPM model with either bond risk premia or time-varying risk aversion.

VI. Conclusion

In this paper, using an identical framework to Campbell (1993) and Campbell and Vuolteenaho (2004), I derive an ICAPM model which expands the definition of market wealth by incorporating bonds and in addition decomposes news on future excess stock returns into news on future excess stock-bond returns and bond premia news. The ICAPM model has three factors: Cash flow news, excess stock-bond return (or equity premia) news and excess bond return news. A rise in both equity and bond premia news components is associated with an improvement in investment opportunities, since current wealth will be reinvested at higher returns, but while future bond returns are known a priori since they are used to discount certain cash-flows, future stock returns are uncertain given that they are used to discount uncertain future cash-flows. Using the "bad beta good beta" terminology from CV, we can speak of a bad beta, a good beta and an "excellent" beta, which is the covariance with bond premia news. Thus, apart from the fact that the risk price and risk premium of cash flow news should be higher relative to both equity premia and bond premia news, news on future equity premia should have a higher risk price (premium) than news on future excess bond returns, due to the uncertainty involved in reinvested wealth. I calculated betas associated with the two components of excess stock return news, and find that bond premia news have relatively stable betas across the book-to-market quintiles, as expected since the type of risk involved has to due with changes in long-term interest rates used to discount certain future cash flows, which have no cash-flow risk involved. On the other hand, in the case of the equity premia factor, growth stocks have significantly higher (magnitude) betas than value stocks. The test of the asset pricing model show that the risk price for equity premia news is higher relative to the risk price associated with bond premia news, and in addition, the model slightly improves the pricing ability of the size/book-to-market portfolios, relative to the traditional CAPM. These results are robust for alternative characteristic portfolios and alternative bond returns. An extension of the benchmark ICAPM that allows for time-varying covariances greatly improves the explanatory power over the cross section, in comparison with the BBGB and benchmark models.

In addition, I derive an unrestricted ICAPM with bond premia - in a heteroskedastic context - which allows the risk prices to be freely estimated, and find that i) bond premia news is a priced factor and ii) the model improves the pricing ability relative to the homoskedastic ICAPM. A heteroskedastic ICAPM with revisions in real interest rates also fits well the cross section of returns and in particular the size/book-to-market portfolios.

Furthermore, I estimate a generalized ICAPM that allows for time-varying risk aversion, assuming that risk aversion is explained by the market dividend yield and bond premia news. The results show that a rise in bond risk premia is associated with lower current risk aversion, which can be explained by an association between changes in risk aversion and rebalances between bonds and stocks in investors' portfolios. The ICAPM with both time-varying bond premia and risk aversion produces very low average pricing errors for the size/book-to-market portfolios, and the average pricing errors across the book-to-market quintiles are also very small. Thus, several specifications of the ICAPM with bond premia are able to price the value premium, almost as well as the Fama and French (1993) 3 factor model. In addition, the momentum factor UMD, when added to the ICAPM model, it is only partially significant, and thus the ICAPM takes into account at least partially, the momentum observed in stock prices.

Given these results some interesting extensions and robustness checks for the current paper are in place for future research. First, one should investigate, with more detail, whether changes in risk aversion are associated with an investment flow between bonds and stocks, as suggested by the results. A second possible extension for this model is to analyze in more detail, whether the ICAPM with both bond risk premia and time-varying risk aversion can explain momentum. Third, one can calculate cash flow, equity premia and bond premia betas for individual stocks and analyze how they correlate with aggregate betas, following Campbell, Polk and Vuolteenaho (2005).

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Notes

1 The difference to CV is that σ_{iH} appear with a minus sign in the pricing equation, since they use the negative of discount-rate news, i.e. "good" news in future discount rates.

2 I use the convention that lowercase letters denote the logs of uppercase letters.

3 Any P order VAR, with $P > 1$, can be restated as a first order VAR, if the state vector is expanded by including lagged state variables, with A denoting the VAR companion matrix.

4 One can use an alternative system where the means of the returns are parameters to be jointly estimated within the GMM system, as in Cochrane (2001, chapter 13),

$$g_T(\mathbf{b}^*) \equiv \begin{cases} \frac{1}{T}\sum_{t=1}^{T}\{(r_{i,t+1} - r_{f,t+1}) + \frac{1}{2}(r_{i,t+1} - \mu_i)^2 - \gamma\omega(r_{i,t+1} - \mu_i)r_{t+1}^{CF} + \omega(r_{i,t+1} - \mu_i)r_{t+1}^{K} + (r_{i,t+1} - \mu_i)r_{t+1}^{B}\} \\ \frac{1}{T}\sum_{t=1}^{T} r_{i,t+1} - \mu_i \end{cases}$$

$$= \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$i = 1, \ldots, N$$

although the results should be similar, and in addition this system is non-linear.

5 Following Campbell, Chan and Viceira (2003), $y_{n-1,t+1}$ is approximated by $y_{n,t+1}$.

6 Given that cash flow news represent the residual component of market returns, and hence are not so sensitive to innovations in the VAR state variables, it is likely that the covariance with cash flow news is more stable.

7 The Default spread (DEF) represents the difference between BAA and AAA corporate bond yields and the smoothed log earnings yield (EY*) is the log ratio of a 10 year moving-average of S&P 500 earnings relative to the index, as in CV.

8 Campbell (1993) argues that the condition $\mu_{p,t} \equiv \mu_0 + \phi E_t(r_{p,t+1})$ holds if the variances of both market returns and discount rate news (and the covariance between the two) are linear functions of the expected market return.

9 Given the original log SDF

$$m_{t+1} = E_t(m_{t+1}) - \frac{\theta}{\psi}(c_{t+1} - E_t(c_{t+1})) - (1-\theta)(r_{p,t+1} - E_t(r_{p,t+1}))$$

and the corresponding pricing equation

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \frac{\theta}{\psi}\sigma_{i,c} + (1-\theta)\sigma_{i,p}$$

where $\sigma_{i,c} \equiv Cov(r_{i,t+1}, c_{t+1} - E_t(c_{t+1}))$, $\sigma_{i,p} \equiv Cov(r_{i,t+1}, r_{p,t+1} - E_t(r_{p,t+1}))$, the price of risk for log consumption is given by $\frac{\theta}{\psi}$.

10 More specifically,

$$Var(\phi_j) = \frac{\partial\phi_j(\mathbf{b})}{\partial\mathbf{b}'} Var(\mathbf{b}) \frac{\partial\phi_j(\mathbf{b})}{\partial\mathbf{b}}, j = 1,2$$

with $\mathbf{b} \equiv (b_{CF}, b_K, b_B)$.

11 The implied parameter is equal to $\phi = \frac{\psi-1}{\gamma-1}\gamma_Y$.

$a1$ In alternative we can assume joint log-normality for the SDF and asset return.

Appendices

A. *Decomposition for unexpected excess stock return*

Following Campbell and Shiller (1988a) and Campbell (1991), the decomposition for unexpected real stock returns is given by

$$(E_{t+1} - E_t) r^*_{m,t+1} = (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j} - (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r^*_{m,t+1+j} \qquad (A.1)$$

By adding and subtracting the real risk free interest rate, it follows

$$(E_{t+1} - E_t)(r^*_{m,t+1} - r_{r,t+1}) = (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j}$$

$$-(E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j (r^*_{m,t+1+j} - r_{r,t+1+j}) - (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j r_{r,t+1+j} \qquad (A.2)$$

By noting that excess nominal returns are equal to excess real returns, since the inflation rate cancels out, we have,

$$(E_{t+1} - E_t)(r_{m,t+1} - r_{f,t+1}) = r^{CF}_{t+1} - r^{H}_{t+1} - r^{R^*}_{t+1} \qquad (A.3)$$

with $r^{CF}_{t+1} \equiv (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+1+j}$, $r^{H}_{t+1} \equiv (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j (r_{m,t+1+j} - r_{f,t+1+j})$ and $r^{R^*}_{t+1} \equiv (E_{t+1} - E_t) \sum_{j=0}^{\infty} \rho^j r_{r,t+1+j}$, denoting the revisions in future cash-flows, excess stock returns and real interest rates, respectively, and $r_{m,t+1} - r_{f,t+1}$ representing the excess nominal stock market return relative to the nominal risk-free rate.

B. *Decomposition for unexpected excess bond return*

Following Campbell (1993) and CA, the log nominal return on a perpetuity bond with nominal coupon C and price $P_{b,t}$ at time t is given by

$$r_{b,t+1} = \ln\left(\frac{C+P_{b,t+1}}{P_{b,t}}\right) = \ln(C + \exp(p_{b,t+1})) - p_{b,t} = k_b + \rho_b p_{b,t+1} - p_{b,t} \qquad (B.1)$$

where the last equality follows from a first order Taylor expansion around the mean of $\ln(C + \exp(p_{b,t+1}))$, with

$$k_b \equiv \ln(C + \exp(E(p_{b,t+1}))) - E(p_{b,t+1}) \frac{\exp(E(p_{b,t+1}))}{C+\exp(E(p_{b,t+1}))} \qquad (B.2)$$

being a linearization constant that plays no role on the analysis, and

$$\rho_b \equiv \frac{\exp(E(p_{b,t+1}))}{C+\exp(E(p_{b,t+1}))} \approx \frac{E(P_{b,t+1})}{C+E(P_{b,t+1})} \approx \frac{E(P_{b,t})}{C+E(P_{b,t+1})} = \frac{1}{E(R_{b,t+1})} \qquad (B.3)$$

is approximately equal to the inverse of the average simple bond return, $R_{b,t+1} \equiv \frac{C+P_{b,t+1}}{P_{b,t}}$.

Equation $(B.1)$ is a difference equation on the log bond price $p_{b,t}$. Solving forward, imposing a transversality condition $\lim_{j\infty} \rho_b^j p_{b,t+j} = 0$, and taking conditional expectations at time t leads to,

$$p_{b,t} \equiv -E_t \sum_{j=0}^{\infty} \rho_b^j r_{b,t+1+j} \qquad (B.4)$$

By substituting equation $(B.4)$ back into equation $(B.1)$, it follows that unexpected current returns are negatively linked to revisions in future expected bond returns. If in addition we assume that $\rho_b = \rho$, i.e., the linearization coefficient for bonds is approximately equal to the linearization coefficient for the intertemporal budget constraint - which is linked to the average consumption to wealth ratio or market dividend yield - then it follows

$$(E_{t+1} - E_t) r_{b,t+1} = -(E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{b,t+1+j} \qquad (B.5)$$

In order to work with excess bond returns, I add and subtract the risk free interest rate and making use of $(E_{t+1} - E_t) r_{f,t+1} = 0$, one has the decomposition for innovations in current excess bond returns,

$$(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1}) = -r_{t+1}^B - r_{t+1}^Y \qquad (B.6)$$

where $r_{t+1}^B \equiv (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j (r_{b,t+1+j} - r_{f,t+1+j})$ denotes the revisions in future excess bond returns, and $r_{t+1}^Y \equiv (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{f,t+1+j}$ represents expectations of future nominal interest rates. By decomposing nominal interest rates into real interest rates and inflation, $r_{f,t+1} = r_{r,t+1} + \pi_{t+1}$, one has

$$(E_{t+1} - E_t)(r_{b,t+1} - r_{f,t+1}) = -r_{t+1}^B - r_{t+1}^R - r_{t+1}^{\Pi} \qquad (B.7)$$

where $r_{t+1}^{\Pi} \equiv (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j \pi_{t+1+j}$ denotes expectations of future inflation rates and $r_{t+1}^R \equiv (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{r,t+1+j}$ is the same as $r_{t+1}^{R^*}$ above, up to the first term in the summation $(E_{t+1} - E_t) r_{r,t+1}$.

C. *The log market return*

The return on financial wealth is a weighted average of the return on stocks and bonds,

$$R_{p,t+1} = \omega R_{m,t+1} + (1-\omega)R_{b,t+1} \qquad (C.1)$$

The simple market return can be approximated as $R_{p,t+1} \approx 1 + r_{p,t+1}$, and similarly for the return on stocks and bonds, and thus we can write the log market return as a weighted average of the log returns on the stock index and benchmark bond,

$$r_{p,t+1} \approx \omega r_{m,t+1} + (1-\omega)r_{b,t+1} \qquad (C.2)$$

Given $(C.2)$, the conditional expected log return on the market portfolio is equal to

$$E_t(r_{p,t+1}) = \omega E_t(r_{m,t+1}) + (1-\omega)E_t(r_{b,t+1}) \qquad (C.3)$$

and the conditional variance is given by

$$\sigma_{p,t}^2 \equiv Var_t(r_{p,t+1}) = Var_t(r_{p,t+1} - E_t(r_{p,t+1})) = \omega^2\sigma_{m,t}^2 + (1-\omega)^2\sigma_{b,t}^2 + 2\omega(1-\omega)\sigma_{m,b,t} \qquad (C.4)$$

with $\sigma_{m,t}^2 \equiv Var_t(r_{m,t+1} - E_t(r_{m,t+1}))$, $\sigma_{b,t}^2 \equiv Var_t(r_{b,t+1} - E_t(r_{b,t+1}))$ and $\sigma_{m,b,t} \equiv Cov_t(r_{m,t+1} - E_t(r_{m,t+1}), r_{b,t+1} - E_t(r_{b,t+1}))$.

D. *Theorem 1*

Given the asset pricing model

$$1 = E_t(M_{t+1}R_{i,t+1}) \qquad (D.1)$$

and with the assumption that the log SDF $m_{t+1} \equiv \ln(M_{t+1})$ is a linear function of K risk factors $\mathbf{f}_{t+1}$,

$$m_{t+1} = a + \mathbf{b}'\mathbf{f}_{t+1} \qquad (D.2)$$

the unconditional model in expected return-covariance form for log returns $r_{i,t+1} \equiv \ln(R_{i,t+1})$ can be represented as,

$$E(r_{i,t+1} - r_{f,t+1}) + 0.5\sigma_i^2 = -\mathbf{b}'Cov(r_{i,t+1}, \mathbf{f}_{t+1}) \qquad (D.3)$$

which corresponds to the following expected return-beta representation

$$E(r_{i,t+1} - r_{f,t+1}) + 0.5\sigma_i^2 = \boldsymbol{\lambda}'\boldsymbol{\beta}_i \qquad (D.4)$$

where $\boldsymbol{\lambda} \equiv -Var(\mathbf{f}_{t+1})\mathbf{b}$ and $\boldsymbol{\beta}_i \equiv Var(\mathbf{f}_{t+1})^{-1}Cov(r_{i,t+1}, \mathbf{f}_{t+1})$.

Proof:

By taking logs of $(D.1)$ one gets the pricing equation in the log form,

$$0 = \ln[E_t(\exp(m_{t+1} + r_{i,t+1})] \qquad (D.5)$$

Since the log is a non-linear function, one can use a second-order Taylor expansion to the right hand side of $(D.5)$, leading to the following approximation[a1]

$$0 = E_t(m_{t+1} + r_{i,t+1}) + 0.5Var_t(m_{t+1} + r_{i,t+1}) \qquad (D.6)$$

By expanding and rearranging $(D.6)$ one obtains,

$$E_t(r_{i,t+1}) + 0.5Var_t(r_{i,t+1}) = -E_t(m_{t+1}) - 0.5Var_t(m_{t+1}) - Cov_t(m_{t+1}, r_{i,t+1}) \qquad (D.7)$$

Applying the pricing equation $(D.7)$ to the risk-free rate $r_{f,t+1}$ and noting that $Var_t(r_{f,t+1}) = Cov_t(m_{t+1}, r_{f,t+1}) = 0$, one has,

$$r_{f,t+1} = -E_t(m_{t+1}) - 0.5Var_t(m_{t+1}) \qquad (D.8)$$

Subtracting $(D.8)$ from $(D.7)$ we obtain,

$$E_t(r_{i,t+1}) - r_{f,t+1} + 0.5Var_t(r_{i,t+1}) = -Cov_t(m_{t+1}, r_{i,t+1}) \qquad (D.9)$$

Given the assumption that the log SDF is linear in the risk factors $m_{t+1} = a + \mathbf{b}'\mathbf{f}_{t+1}$, and substituting in $(D.9)$, we have the following conditional pricing equation for excess returns,

$$E_t(r_{i,t+1}) - r_{f,t+1} + 0.5Var_t(r_{i,t+1}) = -\mathbf{b}'Cov_t(r_{i,t+1}, \mathbf{f}_{t+1}) \qquad (D.10)$$

By applying the law of iterated expectations to equation $(D.10)$, one has the following unconditional pricing model

$$E(r_{i,t+1} - r_{f,t+1}) + 0.5\sigma_i^2 = -\mathbf{b}'Cov(r_{i,t+1}, \mathbf{f}_{t+1}) = \sum_{k=1}^{K} -b_k \sigma_{i,k} \qquad (D.11)$$

where $\sigma_i^2 \equiv Var(r_{i,t+1})$, $\sigma_{i,k} \equiv Cov(r_{i,t+1}, f_{k,t+1}), k = 1, \ldots, K$ and $f_{k,t+1}$ denotes the kth factor.

The equation in the expected return-covariance form $(D.11)$ can be translated into an equivalent expected return-beta model in the following way,

$$E(r_{i,t+1} - r_{f,t+1}) + 0.5\sigma_i^2 = -\mathbf{b}'Cov(r_{i,t+1}, \mathbf{f}_{t+1})$$

$$= -\mathbf{b}'Var(\mathbf{f}_{t+1})Var(\mathbf{f}_{t+1})^{-1}Cov(r_{i,t+1}, \mathbf{f}_{t+1}) = \boldsymbol{\lambda}'\boldsymbol{\beta}_i \qquad (D.12)$$

where $\boldsymbol{\lambda} \equiv -Var(\mathbf{f}_{t+1})\mathbf{b}$ denote the vector of factor risk prices, and $\boldsymbol{\beta}_i \equiv Var(\mathbf{f}_{t+1})^{-1}Cov(r_{i,t+1}, \mathbf{f}_{t+1})$ is a vector containing the K betas for asset i.

Equation $(D.12)$ can be restated in a vector form for the vector of N excess log returns $\mathbf{r}_{t+1}$,

$$E(\mathbf{r}_{t+1} - r_{f,t+1}\mathbf{1}_N) + 0.5 diag(Var(\mathbf{r}_{t+1})) = \boldsymbol{\beta\lambda} \qquad (D.13)$$

where $\boldsymbol{\beta} \equiv Cov(\mathbf{r}_{t+1}, \mathbf{f}_{t+1})Var(\mathbf{f}_{t+1})^{-1}$ is a (NxK) factor beta matrix with row i containing the K factor loadings for asset i, and $\mathbf{1}_N$ is a N-dimension vector of ones.

Theorem 1 represents a straightforward generalization of the theorem in section 6.3 of Cochrane (2001), for the case in which the SDF is nonlinear but the log SDF is a linear function of the factors.

E. *Substituting out consumption as in Campbell (1993)*

Using the Epstein and Zin utility function,

$$U_t = \left\{(1-\delta)C_t^{\frac{1-\gamma}{\theta}} + \delta\left[E_t\left(U_{t+1}^{1-\gamma}\right)\right]^{\frac{1}{\theta}}\right\}^{\frac{\theta}{1-\gamma}} \qquad (E.1)$$

where $\theta \equiv \frac{1-\gamma}{1-\frac{1}{\psi}}$, ψ is the elasticity of intertemporal substitution, γ is the relative risk aversion coefficient, and C_t denotes consumption. The corresponding SDF is given by

$$M_{t+1} = \delta^\theta\left(\frac{C_{t+1}}{C_t}\right)^{-\frac{\theta}{\psi}}\left(\frac{1}{R_{p,t+1}}\right)^{1-\theta} \qquad (E.2)$$

where $R_{p,t+1}$ is the simple return on the market portfolio or total wealth. The corresponding log SDF is equal to

$$m_{t+1} = \theta\ln(\delta) - \frac{\theta}{\psi}E_t(\Delta c_{t+1}) - (1-\theta)E_t(r_{p,t+1})$$
$$-\frac{\theta}{\psi}(\Delta c_{t+1} - E_t(\Delta c_{t+1})) - (1-\theta)(r_{p,t+1} - E_t(r_{p,t+1})) \qquad (E.3)$$

By applying the conditional log pricing equation $(D.7)$ to the market portfolio log return $r_{p,t+1}$, leads to

$$E_t(r_{p,t+1}) + 0.5Var_t(r_{p,t+1}) = -E_t(m_{t+1}) - 0.5Var_t(m_{t+1}) - Cov_t(m_{t+1}, r_{p,t+1}) \qquad (E.4)$$

By substituting the expressions for $E_t(m_{t+1})$, $Var_t(m_{t+1})$ and $Cov_t(m_{t+1}, r_{p,t+1})$, and using the fact that $Cov_t(m_{t+1}, r_{p,t+1}) = Cov_t(m_{t+1}, r_{p,t+1} - E_t(r_{p,t+1}))$ and $Var_t(r_{p,t+1}) = Var_t(r_{p,t+1} - E_t(r_{p,t+1}))$, we have

$$E_t(r_{p,t+1}) + 0.5\sigma_{p,t}^2 = -\theta\ln(\delta) + \frac{\theta}{\psi}E_t(\Delta c_{t+1}) + (1-\theta)E_t(r_{p,t+1})$$
$$-0.5\left[\left(\frac{\theta}{\psi}\right)^2\sigma_{c,t}^2 + (1-\theta)^2\sigma_{p,t}^2 + 2\frac{\theta}{\psi}(1-\theta)\sigma_{c,p,t}\right] + \frac{\theta}{\psi}\sigma_{c,p,t} + (1-\theta)\sigma_{p,t}^2 \qquad (E.5)$$

where $\sigma^2_{c,t} \equiv Var_t(\Delta c_{t+1} - E_t(\Delta c_{t+1}))$, $\sigma^2_{p,t} \equiv Var_t(r_{p,t+1} - E_t(r_{p,t+1}))$ and $\sigma_{c,p,t} \equiv Cov_t(\Delta c_{t+1} - E_t(\Delta c_{t+1}), r_{p,t+1} - E_t(r_{p,t+1}))$ represent the variance of consumption growth, variance of market return and covariance between consumption growth and market return, respectively.

Solving for $E_t(\Delta c_{t+1})$, it follows,

$$E_t(\Delta c_{t+1}) = \psi \ln(\delta) + 0.5\theta[\tfrac{1}{\psi}\sigma^2_{c,t} + \psi\sigma^2_{p,t} - 2\sigma_{c,p,t}] + \psi E_t(r_{p,t+1}) \qquad (E.6)$$

If in addition, we impose joint conditional homoskedasticity for log consumption growth and log market returns, then we have

$$E_t(\Delta c_{t+1}) = \psi \ln(\delta) + 0.5\theta[\tfrac{1}{\psi}\sigma^2_{c} + \psi\sigma^2_{p} - 2\sigma_{c,p}] + \psi E_t(r_{p,t+1})$$

$$= \mu_p + \psi E_t(r_{p,t+1}) \qquad (E.7)$$

where $\sigma^2_c \equiv Var(\Delta c_{t+1} - E_t(\Delta c_{t+1}))$, $\sigma^2_p \equiv Var(r_{p,t+1} - E_t(r_{p,t+1}))$, $\sigma_{c,p} \equiv Cov(\Delta c_{t+1} - E_t(\Delta c_{t+1}), r_{p,t+1} - E_t(r_{p,t+1}))$, and $\mu_p \equiv \psi \ln(\delta) + 0.5\theta[\tfrac{1}{\psi}\sigma^2_c + \psi\sigma^2_p - 2\sigma_{c,p}]$.

Building on a relation similar to equation $(E.7)$, Campbell (1993) shows that innovations in log consumption and log market returns are related by the following expression,

$$c_{t+1} - E_t(c_{t+1}) = r_{p,t+1} - E_t(r_{p,t+1}) + (1-\psi)(E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r_{p,t+1+j} \qquad (E.8)$$

F. *Separating bond premia from excess stock returns*

Giving the relation between expected stock and bond returns,

$$E_t(r_{m,t+1}) = E_t(r_{b,t+1}) + E_t(k_{t+1}) \qquad (F.1)$$

and substituting $(F.1)$ in the expression for excess stock return news, we have

$$r^H_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j (r_{m,t+1+j} - r_{f,t+1+j})$$

$$= (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j k_{t+1+j} + (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j (r_{b,t+1+j} - r_{f,t+1+j}) = r^K_{t+1} + r^B_{t+1} \qquad (F.2)$$

where $r^K_{t+1} \equiv (E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j k_{t+1+j}$ represents news about future stock-bond premia. Given $(F.2)$ one can rewrite the innovations in current stock returns presented in $(A.3)$ as

$$(E_{t+1} - E_t)(r_{m,t+1} - r_{f,t+1}) = r^{CF}_{t+1} - r^K_{t+1} - r^B_{t+1} - r^{R^*}_{t+1} \qquad (F.3)$$

G. *Relaxing joint conditional homoskedasticity assumption for consumption and market* *returns*

G.1. *A model with news in variances*

We can rewrite equation $(E.6)$ as

$$E_t(\Delta c_{t+1}) = \mu_{p,t} + \psi E_t(r_{p,t+1}) \qquad (G.1)$$

with

$$\mu_{p,t} \equiv \psi \ln(\delta) + 0.5\theta[\tfrac{1}{\psi}\sigma^2_{c,t} + \psi\sigma^2_{p,t} - 2\sigma_{c,p,t}] \qquad (G.2)$$

Given equation $(G.1)$, the log consumption growth can be represented as,

$$\Delta c_{t+1} = \mu_{p,t} + \psi r_{p,t+1} + v_{t+1} \qquad (G.3)$$

with $E_t(v_{t+1}) = 0$, $Var_t(v_{t+1}) = \sigma^2_v$ and $Cov_t(r_{p,t+1}, v_{t+1}) = 0$. Using these assumptions and the definition for the market return in equation $(C.2)$, we can derive the following conditional covariances and variances,

$$\sigma_{c,b,t} \equiv Cov_t((E_{t+1} - E_t)\Delta c_{t+1}, (E_{t+1} - E_t)r_{b,t+1}) = \psi Cov_t((E_{t+1} - E_t)r_{p,t+1}, (E_{t+1} - E_t)r_{b,t+1})$$

$$= \psi\omega\sigma_{m,b,t} + \psi(1-\omega)\sigma^2_{b,t} \qquad (G.4)$$

$$\sigma_{c,m,t} \equiv Cov_t((E_{t+1} - E_t)\Delta c_{t+1}, (E_{t+1} - E_t)r_{m,t+1}) = \psi\omega\sigma^2_{m,t} + \psi(1-\omega)\sigma_{m,b,t} \qquad (G.5)$$

Substituting $(C.2)$, $(C.4)$, $(G.4)$ and $(G.5)$ into $(G.2)$, leads to

$$\mu_{p,t} \equiv \psi \ln(\delta) + 0.5\theta[\tfrac{1}{\psi}\sigma^2_{c,t} + \psi\omega^2\sigma^2_{m,t} + \psi(1-\omega)^2\sigma^2_{b,t} + 2\psi\omega(1-\omega)\sigma_{m,b,t}$$

$$-2\omega(\psi\omega\sigma^2_{m,t} + \psi(1-\omega)\sigma_{m,b,t}) - 2(1-\omega)(\psi\omega\sigma_{m,b,t} + \psi(1-\omega)\sigma^2_{b,t})] \qquad (G.6)$$

Assuming that consumption growth is conditionally homoskedastic, $\sigma^2_{c,t} = \sigma^2_c$, and that the covariance between stock market and bond returns is also constant trough time, $\sigma_{m,b,t} = \sigma_{m,b}$, and by rearranging, $\mu_{p,t}$ can be represented as

$$\mu_{p,t} \equiv \mu_0 - 0.5\theta\psi(\omega^2\sigma^2_{m,t} + (1-\omega)^2\sigma^2_{b,t}) \qquad (G.7)$$

with $\mu_0 \equiv \psi \ln(\delta) + 0.5\theta(\frac{1}{\psi}\sigma^2_c - 2\omega(1-\omega)\psi\sigma_{m,b})$.

Since $\sigma^2_{m,t} = E_t(r^2_{m,t+1})$, $\sigma^2_{b,t} = E_t(r^2_{b,t+1})$, equation $(G.7)$ can be restated as

$$\mu_{p,t} \equiv \mu_0 - 0.5\theta\psi[\omega^2 E_t(r^2_{m,t+1}) + (1-\omega)^2 E_t(r^2_{b,t+1})] \qquad (G.8)$$

Giving an expression similar to $(G.1)$, Campbell (1993) shows that innovations in consumption are related with innovations in the market return, in the following way,

$$(E_{t+1}-E_t)\Delta c_{t+1} = (E_{t+1}-E_t)r_{p,t+1} + (1-\psi)(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{p,t+1+j}$$

$$-(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j \mu_{p,t+j} \qquad (G.9)$$

where the last term refers to revisions in the future values of the time-varying intercept $\mu_{p,t}$. Substituting $(G.8)$ in $(G.9)$, it follows,

$$(E_{t+1}-E_t)\Delta c_{t+1} = (E_{t+1}-E_t)r_{p,t+1} + (1-\psi)(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{p,t+1+j} +$$

$$0.5\theta\psi\omega^2(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{m,t+1+j}^2 + 0.5\theta\psi(1-\omega)^2(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{b,t+1+j}^2 \qquad (G.10)$$

Substituting $(G.10)$ in the log SDF of equation (12), $m_{t+1} = E_t(m_{t+1}) - \frac{\theta}{\psi}(c_{t+1} - E_t(c_{t+1})) - (1-\theta)(r_{p,t+1} - E_t(r_{p,t+1}))$, and using the identities $(A.3)$, 3, $(F.2)$ and $(F.3)$ we have

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega r_{t+1}^{CF} + \omega r_{t+1}^{K} + r_{t+1}^{B} - 0.5\theta^2\omega^2 V_{t+1}^{m} - 0.5\theta^2(1-\omega)^2 V_{t+1}^{b} \qquad (G.11)$$

with $V_{t+1}^{m} \equiv (E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{m,t+1+j}^2$ and $V_{t+1}^{b} \equiv (E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{b,t+1+j}^2$ representing news about the volatility of stock and bond returns, respectively.

Making $\mathbf{f}_{t+1} \equiv (r_{t+1}^{CF}, r_{t+1}^{K}, r_{t+1}^{B}, V_{t+1}^{m}, V_{t+1}^{b})'$ and $\mathbf{b} \equiv (-\gamma\omega, \omega, 1, -0.5\theta^2\omega^2, -0.5\theta^2(1-\omega)^2)'$ and using Theorem 1 above, one has,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + 0.5\theta^2\omega^2\sigma_{i,Vm}$$

$$+0.5\theta^2(1-\omega)^2\sigma_{i,Vb} \qquad (G.12)$$

where $\sigma_{i,Vm} \equiv Cov(r_{i,t+1}, V_{t+1}^{m})$, $\sigma_{i,Vb} \equiv Cov(r_{i,t+1}, V_{t+1}^{b})$, represent the covariances with the volatility news.

As stated in Campbell (1993), θ is infinite when ψ is near one, and hence the expression containing variances and covariances in $(G.2)$ must be zero, in order to have finite expected consumption growth. If we make the assumption that $\psi \approx 1$, then it follows that $\mu_{p,t} \approx \mu_0$, and the relation $E_t(\Delta c_{t+1}) = \mu_p + \psi E_t(r_{p,t+1})$ continues to hold, so that the standard ICAPM remains valid in the presence of heteroskedasticity.

In order to identify V_{t+1}^{m} and V_{t+1}^{b}, I use the following approximations,

$$V^m_{t+1} = \mathbf{e1}'\rho\mathbf{A}(\mathbf{I}-\rho\mathbf{A})^{-1}\boldsymbol{\epsilon}^2_{t+1}$$

$$V^b_{t+1} = \mathbf{e2}'\rho\mathbf{A}(\mathbf{I}-\rho\mathbf{A})^{-1}\boldsymbol{\epsilon}^2_{t+1} \qquad (G.13)$$

G.2. *An unrestricted ICAPM*

Given the assumption that the time-varying intercept is related with the expected returns on the stock index and benchmark bond,

$$\mu_{p,t} \equiv \mu_0 + \phi_1\omega E_t(r_{m,t+1}) + \phi_2(1-\omega)E_t(r_{b,t+1}) \qquad (G.14)$$

and using equation $(G.9)$, innovations in log consumption are given by the following expression,

$$(E_{t+1}-E_t)c_{t+1} = (E_{t+1}-E_t)r_{p,t+1} + (1-\psi)(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{p,t+1+j} - \phi_1\omega(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{m,t+1+j}$$

$$-\phi_2(1-\omega)(E_{t+1}-E_t)\sum_{j=1}^{\infty}\rho^j r_{b,t+1+j} \qquad (G.15)$$

By employing the identities $(C.3)$, 3, $(F.2)$ and $(F.3)$ and simplifying, it follows

$$(E_{t+1}-E_t)c_{t+1} = (E_{t+1}-E_t)r_{p,t+1} + \omega(1-\psi-\phi_1)r^K_{t+1}$$

$$+[1-\psi-\omega\phi_1-(1-\omega)\phi_2]r^B_{t+1} \qquad (G.16)$$

Substituting $(G.16)$ in the log SDF of equation (12), $m_{t+1} = E_t(m_{t+1}) - \frac{\theta}{\psi}(c_{t+1}-E_t(c_{t+1})) - (1-\theta)(r_{p,t+1}-E_t(r_{p,t+1}))$, and simplifying, we have

$$m_{t+1} = E_t(m_{t+1}) - \gamma(r_{p,t+1}-E_t(r_{p,t+1})) - \omega\frac{\theta}{\psi}(1-\psi-\phi_1)r^K_{t+1}$$

$$-\frac{\theta}{\psi}[1-\psi-\omega\phi_1-(1-\omega)\phi_2]r^B_{t+1} \qquad (G.17)$$

By adding and subtracting the real risk-free rate $r_{r,t+1}$, using the fact that excess nominal returns are equal to excess real returns and ignoring the terms related with real interest rates, we have

$$m_{t+1} = E_t(m_{t+1}) - \gamma(E_{t+1}-E_t)(r_{p,t+1}-r_{f,t+1}) - \omega\frac{\theta}{\psi}(1-\psi-\phi_1)r^K_{t+1}$$

$$-\frac{\theta}{\psi}[1-\psi-\omega\phi_1-(1-\omega)\phi_2]r^B_{t+1} \qquad (G.18)$$

Using equation $(C.3)$ above leads to

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega(E_{t+1}-E_t)(r_{m,t+1}-r_{f,t+1}) - \gamma(1-\omega)(E_{t+1}-E_t)(r_{b,t+1}-r_{f,t+1})$$

$$-\omega\frac{\theta}{\psi}(1-\psi-\phi_1)r^K_{t+1} - \frac{\theta}{\psi}[1-\psi-\omega\phi_1-(1-\omega)\phi_2]r^B_{t+1} \qquad (G.19)$$

Using again the identities $(A.3)$, 3, $(F.2)$ and $(F.3)$ and simplifying, it follows

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega r_{t+1}^{CF} + \omega\left(1 + \tfrac{1-\gamma}{\psi-1}\phi_1\right) r_{t+1}^{K} + \left[1 + \tfrac{1-\gamma}{\psi-1}(\phi_1\omega + \phi_2(1-\omega))\right] r_{t+1}^{B} \qquad (G.20)$$

Making $\mathbf{f}_{t+1} \equiv (r_{t+1}^{CF}, r_{t+1}^{K}, r_{t+1}^{B})'$ and $\mathbf{b} \equiv (-b_{CF}, -b_K, -b_B)'$ and using Theorem 1, one has the following pricing equation,

$$E(r_{i,t+1} - r_{f,t+1}) + \tfrac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_K\sigma_{i,K} + b_B\sigma_{i,B} \qquad (G.21)$$

with the risk prices estimated in the cross section being related with the original parameters in the following way,

$$\begin{cases} b_{CF} \equiv \gamma\omega \\ b_K \equiv -\omega\left(1 + \tfrac{1-\gamma}{\psi-1}\phi_1\right) \\ b_B \equiv -1 - \tfrac{1-\gamma}{\psi-1}(\phi_1\omega + \phi_2(1-\omega)) \end{cases} \qquad (G.22)$$

G.3. *An ICAPM with news in the VAR state variables*

Given the assumption that the time-varying intercept is related with the expectation of the VAR state variables,

$$\mu_{p,t} \equiv \mu_0 + \phi E_t(y_{t+1}) \qquad (G.23)$$

and substituting $(G.23)$ in $(G.9)$, we get

$$(E_{t+1} - E_t)c_{t+1} = (E_{t+1} - E_t)r_{p,t+1} + (1-\psi)(E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j r_{p,t+1+j}$$

$$-\phi(E_{t+1} - E_t)\sum_{j=1}^{\infty} \rho^j y_{t+j} \qquad (G.24)$$

Substituting $(G.24)$ in the log SDF of equation (12), $m_{t+1} = E_t(m_{t+1}) - \frac{\theta}{\psi}(c_{t+1} - E_t(c_{t+1})) - (1-\theta)(r_{p,t+1} - E_t(r_{p,t+1}))$, and simplifying, we have

$$m_{t+1} = E_t(m_{t+1}) - \gamma(r_{p,t+1} - E_t(r_{p,t+1})) + (1-\gamma)\omega r_{t+1}^{H} + (1-\gamma)(1-\omega) r_{t+1}^{B} + \tfrac{\theta}{\psi}\phi r_{t+1}^{y} \qquad (G.25)$$

with $r_{t+1}^{y} \equiv (E_{t+1} - E_t)\sum_{j=0}^{\infty} \rho^j y_{t+1+j}$ representing the revisions in the state variable y_{t+1}. By using the identities $(A.3)$, 3, $(C.3)$, $(F.2)$ and $(F.3)$, ignoring the real interest rate terms and simplifying, it follows

$$m_{t+1} = E_t(m_{t+1}) - \gamma\omega r_{t+1}^{CF} + \omega r_{t+1}^{K} + r_{t+1}^{B} + \tfrac{\theta}{\psi}\phi r_{t+1}^{y} \qquad (G.26)$$

Making $\mathbf{f}_{t+1} \equiv (r_{t+1}^{CF}, r_{t+1}^{K}, r_{t+1}^{B}, r_{t+1}^{y})'$ and $\mathbf{b} \equiv (-\gamma\omega, \omega, 1, -\gamma_Y)'$ and using Theorem 1, one has the following pricing equation,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + \gamma_Y\sigma_{i,y} \qquad (G.27)$$

with $\sigma_{i,y} \equiv Cov(r_{i,t+1}, r_{t+1}^{y})$ and $\gamma_Y \equiv -\frac{\theta}{\psi}\phi$ denotes the second parameter to be estimated in the cross section.

The revisions in the state variable y_{t+1} are identified in a similar way to equity and bond premia news,

$$r_{t+1}^{y} = \mathbf{ey}'\rho\mathbf{A}(\mathbf{I} - \rho\mathbf{A})^{-1}\boldsymbol{\epsilon}_{t+1} \qquad (G.28)$$

where **ey** denotes the indicator vector associated with state variable y_{t+1}.

H. *The CAPM as a special case of the ICAPM*

For the case of a log-investor ($\gamma = 1$), the CAPM arises as a special case of the ICAPM in equation (17). Using equation (13) and imposing $\gamma = 1$, we have

$$\begin{aligned} m_{t+1} &= E_t(m_{t+1}) - (E_{t+1} - E_t)r_{p,t+1} \\ &= E_t(m_{t+1}) - \omega(E_{t+1} - E_t)r_{m,t+1} - (1-\omega)(E_{t+1} - E_t)r_{b,t+1} \qquad (H.1) \end{aligned}$$

where the second equality makes use of the expected market return in equation $(C.3)$. By Imposing $\mathbf{f}_{t+1} \equiv ((E_{t+1} - E_t)r_{m,t+1}, (E_{t+1} - E_t)r_{b,t+1})'$ and $\mathbf{b} \equiv (-\omega, -(1-\omega))'$ and using Theorem 1, one has,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \omega\sigma_{i,m} + (1-\omega)\sigma_{i,b} \qquad (H.2)$$

where $\sigma_{i,m} \equiv Cov(r_{i,t+1}, (E_{t+1} - E_t)r_{m,t+1})$ and $\sigma_{i,b} \equiv Cov(r_{i,t+1}, (E_{t+1} - E_t)r_{b,t+1})$ denote the covariances with stock market return and bond return, respectively. Equation $(H.2)$ represents an generalized CAPM for the case where the market portfolio is composed of both stocks and bonds. The standard CAPM can be recovered as a special case of $(H.2)$ by imposing $\omega = 1$,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \sigma_{i,m} \qquad (H.3)$$

If we allow the market risk price to be freely estimated in the cross-section, then the 2 beta CAPM in equation $(H.2)$ becomes,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_p\omega\sigma_{i,m} + b_p(1-\omega)\sigma_{i,b} \qquad (H.4)$$

and the standard unrestricted CAPM is obtained by making $\omega = 1$,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_p \sigma_{i,m} \qquad (H.5)$$

I. GMM *standard errors formulas for parameter estimates and moments*

The parameter estimates $\hat{\mathbf{b}}^*$ associated with GMM systems in Section II.D, have variance formulas for first stage and second stage given respectively by,

$$Var(\hat{\mathbf{b}}^*) = \frac{1}{T}(\mathbf{d}'\mathbf{I}_N\mathbf{d})^{-1}\mathbf{d}'\mathbf{I}_N\hat{\mathbf{S}}\mathbf{I}_N\mathbf{d}(\mathbf{d}'\mathbf{I}_N\mathbf{d})^{-1} \qquad (I.1)$$

$$Var(\hat{\mathbf{b}}^*) = \frac{1}{T}(\mathbf{d}'\hat{\mathbf{S}}^{-1}\mathbf{d})^{-1} \qquad (I.2)$$

where $\mathbf{I}_N$ is a N order Identity matrix, $\mathbf{d} \equiv \frac{\partial g_T(\mathbf{b}^*)}{\partial \mathbf{b}^{*\prime}}$ represents the matrix of moments' sensitivities to the parameters, and $\hat{\mathbf{S}}$ is a estimator for the spectral density matrix $\mathbf{S}$, derived under the Newey-West procedure with 5 lags. The variance-covariance matrix for the moments is given by,

$$Var(\hat{\boldsymbol{\alpha}}) = \frac{1}{T}(\mathbf{I}_N - \mathbf{d}(\mathbf{d}'\mathbf{I}_N\mathbf{d})^{-1})\mathbf{d}'\mathbf{I}_N)\hat{\mathbf{S}}(\mathbf{I}_N - \mathbf{I}_N\mathbf{d}(\mathbf{d}'\mathbf{I}_N\mathbf{d})^{-1})\mathbf{d}') \qquad (I.3)$$

$$Var(\hat{\boldsymbol{\alpha}}) = \frac{1}{T}(\mathbf{I}_N - \mathbf{d}(\mathbf{d}'\hat{\mathbf{S}}^{-1}\mathbf{d})^{-1})\mathbf{d}'\hat{\mathbf{S}}^{-1})\hat{\mathbf{S}}(\mathbf{I}_N - \hat{\mathbf{S}}^{-1}\mathbf{d}(\mathbf{d}'\hat{\mathbf{S}}^{-1}\mathbf{d})^{-1})\mathbf{d}') \qquad (I.4)$$

for first-stage and second-stage GMM, respectively.

Table I
Descriptive statistics for the VAR state variables

This table reports descriptive statistics for the state variables used to predict stock market and bond returns in the VAR presented in Section II. The VAR state variables are the log real 1 month Treasury bill rate (r_r), FED funds premium (FFPREM), term structure spread (TERM), value spread (VS), log earnings yield (EY), log excess bond return (r_{bt}), and the log excess stock market return (r_{mt}). The original sample is 1954:07- 2003:12. Autocorr. designates the first order autocorrelation. The correlations between the state variables are presented in Panel B. For details on the construction of the variables refer to Section II.

Panel A

	Mean	Stdev.	Min.	Max.	Autocorr.
$r_{r,t}$	0.013	0.020	-0.062	0.075	0.914
$FFPREM_t$	0.005	0.008	-0.011	0.054	0.878
$TERM_t$	0.008	0.011	-0.031	0.033	0.967
VS_t	1.563	0.158	1.200	2.231	0.938
EY_t	-2.783	0.378	-3.660	-1.950	0.997
$r_{b,t}$	0.001	0.022	-0.078	0.089	0.066
$r_{m,t}$	0.005	0.044	-0.261	0.148	0.073

Panel B

	$r_{r,t}$	$FFPREM_t$	$TERM_t$	VS_t	EY_t	$r_{b,t}$	$r_{m,t}$
$r_{r,t}$	1.000	0.049	-0.083	0.025	-0.108	0.112	-0.038
$FFPREM_t$		1.000	-0.441	-0.074	0.434	0.028	-0.129
$TERM_t$			1.000	0.189	-0.368	0.115	0.137
VS_t				1.000	-0.614	0.046	0.042
EY_t					1.000	-0.005	-0.005
$r_{b,t}$						1.000	0.159
$r_{m,t}$							1.000

Table II

Estimating the news components of stock and bond excess returns: a VAR approach

Panel A presents the estimated coefficients (first row of each variable) and associated Newey-West t-statistics calculated with 5 lags (second row) for the first-order VAR estimated in Section II. The VAR state vector is given by $[r_{rt}, FFPREM_t, TERM_t, VS_t, EY_t, r_{bt}, r_{mt}]'$ where r_r is the log real 1 month Treasury bill rate, FFPREM is the FED funds premium, TERM is the term structure spread, VS is the value spread, EY is the log earnings yield, r_{bt} is the log excess bond return, and r_{mt} is the log excess stock market return. The original sample is 1954:08-2003:12. Underlined (bold) t-statistics denote statistical significance at the 5% (1%) level. Adj. R^2 is the adjusted R^2.

Panel B shows the variance decomposition associated with bond excess returns, where r^B_{t+1} and r^R_{t+1} denote the excess bond return news and real interest rate news, respectively, which are implied by the VAR model of panel A. The upper-right section shows the correlations between r^B_{t+1} and r^R_{t+1} (above the diagonal), whereas the respective variances and covariances are presented in the diagonal and below the diagonal. Below each correlation and covariance coefficient, it is reported the respective standard error. The upper-left section reports the variance decomposition of excess bond returns, in terms of both news components. The lower section shows the correlations between shocks in each of the variables used in the VAR, with both r^B_{t+1} and r^R_{t+1}, with s.e. denoting the respective standard errors.

Panel C shows the variance decomposition associated with excess stock market returns, where r^K_{t+1} and r^{CF}_{t+1} denote the equity premia news and cash flow news, respectively, implied by the VAR model of panel A. The upper-right section shows the correlations between r^{CF}_{t+1}, r^K_{t+1}, $r^B_{t+1}$and r^R_{t+1}(above the diagonal), whereas the respective variances and covariances are presented in the diagonal and below the diagonal. Below each correlation and covariance coefficient, it is reported the respective standard error. The upper-left section reports the variance decomposition of excess stock market returns, in terms of all news components. The lower section shows the correlations between shocks in each of the variables used in the VAR, with both r^K_{t+1} and r^{CF}_{t+1}, with s.e. denoting the respective standard errors. All the standard errors are computed in Panels B and C from 10,000 bootstrapping simulations of the VAR. For further details refer to Section II.

Panel A (VAR coefficient estimates)

	$r_{r,t}$	$FFPREM_t$	$TERM_t$	VS_t	EY_t	$r_{b,t}$	$r_{m,t}$	Adj. R^2
$r_{r,t+1}$	0.931	-0.185	-0.027	0.006	0.003	-0.090	0.002	0.845
	55.281	<u>-2.332</u>	-0.863	<u>2.235</u>	1.900	**-4.011**	0.200	
$FFPREM_{t+1}$	0.012	0.798	-0.078	0.001	0.001	0.021	-0.010	0.786
	1.231	**17.425**	**-3.381**	0.884	1.563	<u>2.495</u>	<u>-2.227</u>	
$TERM_{t+1}$	0.014	0.021	0.971	0.001	0.000	0.029	-0.003	0.934
	1.711	0.586	**74.513**	0.897	0.456	<u>2.370</u>	-1.231	
VS_{t+1}	-0.122	0.516	0.061	0.904	-0.025	-0.166	-0.017	0.882
	-1.013	1.249	0.260	**35.313**	<u>-2.057</u>	-1.757	-0.387	
EY_{t+1}	-0.142	0.602	-0.377	-0.038	0.977	-0.183	-0.401	0.993
	<u>-1.990</u>	<u>2.438</u>	<u>-2.378</u>	**-2.578**	**147.446**	**-2.954**	**-13.092**	
$r_{b,t+1}$	0.124	-0.245	0.215	0.017	0.009	0.065	-0.081	0.043
	<u>2.278</u>	-1.531	<u>1.977</u>	<u>2.262</u>	<u>2.383</u>	1.392	**-3.740**	
$r_{m,t+1}$	0.049	-0.942	0.326	0.013	0.022	0.206	0.025	0.038
	0.536	**-2.822**	1.818	0.805	**2.595**	<u>2.237</u>	0.572	

Panel B (Bond return decomposition)

Variance decomposition		Correlations		
$Var(r^B_{t+1})$	0.915		r^B_{t+1}	r^R_{t+1}
$Var(r^R_{t+1})$	0.094	r^B_{t+1}	0.0004	-0.017
$2Cov(r^B_{t+1},r^R_{t+1})$	-0.010		0.00005	0.144
Sum	1.000	r^R_{t+1}	-0.000002	0.00004
			0.00003	0.00002

Shock correlations

	r^B_{t+1}	s.e.	r^R_{t+1}	s.e.
$r_{r,t+1}$	-0.333	0.071	0.859	0.099
$FFPREM_{t+1}$	-0.051	0.067	-0.246	0.146
$TERM_{t+1}$	-0.016	0.099	-0.298	0.256
VS_{t+1}	-0.080	0.094	0.189	0.250
EY_{t+1}	0.067	0.093	0.056	0.238
$r_{b,t+1}$	-0.952	0.024	-0.291	0.109
$r_{m,t+1}$	-0.145	0.093	-0.021	0.230

Panel C (Equity return decomposition)

Variance decomposition			Correlations			
$Var(r^K_{t+1})$	0.803		r^K_{t+1}	r^{CF}_{t+1}	r^R_{t+1}	r^B_{t+1}
$-2Cov(r^K_{t+1},r^{CF}_{t+1})$	-0.046	r^K_{t+1}	0.001	0.044	-0.067	-0.471
$2Cov(r^K_{t+1},r^R_{t+1})$	-0.018		0.0005	0.178	0.231	0.129
$2Cov(r^K_{t+1},r^B_{t+1})$	-0.397	r^{CF}_{t+1}	0.00004	0.001	0.107	-0.172
$Var(r^{CF}_{t+1})$	0.341		0.0003	0.0002	0.229	0.118
$-2Cov(r^{CF}_{t+1},r^R_{t+1})$	-0.019	r^R_{t+1}	-0.00002	0.00002	0.00004	-0.017
$-2Cov(r^{CF}_{t+1},r^B_{t+1})$	0.094		0.0001	0.0001	0.00002	0.144
$Var(r^R_{t+1})$	0.023	r^B_{t+1}	-0.0004	-0.0001	0.00000	0.0004
$2Cov(r^B_{t+1},r^R_{t+1})$	-0.002		0.0001	0.0001	0.00003	0.00005
$Var(r^B_{t+1})$	0.221					
Sum	1.000					

Shock correlations

	r^K_{t+1}	s.e.	r^{CF}_{t+1}	s.e.
$r_{r,t+1}$	0.157	0.120	0.043	0.164
$FFPREM_{t+1}$	-0.064	0.098	-0.304	0.117
$TERM_{t+1}$	0.098	0.169	0.283	0.222
VS_{t+1}	-0.364	0.146	-0.143	0.255
EY_{t+1}	0.749	0.098	0.016	0.224
$r_{b,t+1}$	0.471	0.103	0.132	0.099
$r_{m,t+1}$	-0.639	0.102	0.609	0.198

Table III

ICAPM with bond risk premia: Single-regression beta estimates for the 25 size/book-to-market portfolios

This table reports in Panel A the single regression beta estimates associated with the Benchmark ICAPM with bond premia estimated in sub-section II.D, for the 25 size/book-to-market portfolios (SBV25). r^{K}_{t+1}, r^{CF}_{t+1} and r^{B}_{t+1} denote the revisions in future equity premia, cash-flows and bond premia, respectively. SBVij denotes the portfolio with ith size and jth book-to-market quintiles. Average betas across the book-to-market and size quintiles are reported in Panels B and C, respectively. S1 and BV1 denote the lowest size and book-to-market quintiles, respectively. The sample is 1954:08-2003:12. For further details, refer to Section II.

Panel A (SBV25)			
	r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}
SBV11	1.298	-1.154	-0.198
SBV12	1.120	-0.985	-0.118
SBV13	0.962	-0.809	-0.209
SBV14	0.931	-0.749	-0.155
SBV15	0.980	-0.764	-0.111
SBV21	1.318	-1.136	-0.256
SBV22	1.101	-0.885	-0.278
SBV23	0.985	-0.743	-0.279
SBV24	0.967	-0.694	-0.244
SBV25	1.062	-0.763	-0.231
SBV31	1.253	-1.057	-0.313
SBV32	1.071	-0.796	-0.281
SBV33	1.011	-0.670	-0.304
SBV34	0.964	-0.620	-0.296
SBV35	1.079	-0.664	-0.300
SBV41	1.209	-0.945	-0.336
SBV42	1.103	-0.730	-0.360
SBV43	1.046	-0.653	-0.334
SBV44	1.007	-0.590	-0.365
SBV45	1.121	-0.650	-0.312
SBV51	1.034	-0.747	-0.351
SBV52	1.025	-0.652	-0.340
SBV53	0.941	-0.554	-0.359
SBV54	0.934	-0.505	-0.317
SBV55	1.031	-0.548	-0.238

Panel B (BM quintiles)			
	r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}
BV1	1.222	-1.008	-0.291
BV2	1.084	-0.810	-0.276
BV3	0.989	-0.686	-0.297
BV4	0.961	-0.632	-0.276
BV5	1.055	-0.678	-0.238

Panel C (Size quintiles)			
	r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}
S1	1.058	-0.892	-0.158
S2	1.087	-0.844	-0.258
S3	1.076	-0.761	-0.299
S4	1.097	-0.714	-0.341
S5	0.993	-0.601	-0.321

Table IV

ICAPM with bond risk premia: Single-regression beta estimates for the the 38 industry portfolios

This table reports the single regression beta estimates associated with the Benchmark ICAPM estimated in sub-section II.D, for the 38 industry portfolios (IND38). r^{K}_{t+1}, r^{CF}_{t+1} and r^{B}_{t+1}denote the revisions in future equity premia, cash-flows and bond premia, respectively. The sample is 1954:08-2003:12. For further details, refer to Section II.

	r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}		r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}
AGRIC	0.996	-0.703	-0.337	**OIL**	1.136	-0.730	-0.194
APPRL	1.073	-0.871	-0.275	**PAPER**	1.023	-0.682	-0.289
CARS	1.098	-0.695	-0.220	**PHONE**	0.897	-0.427	-0.456
CHAIR	0.996	-0.663	-0.420	**PRINT**	0.948	-0.716	-0.435
CHEMS	0.888	-0.649	-0.343	**PTRLM**	0.775	-0.548	-0.107
CNSTR	1.318	-0.843	-0.586	**RTAIL**	0.997	-0.725	-0.346
ELCTR	1.401	-1.000	-0.203	**RUBBR**	1.093	-0.813	-0.220
FOOD	0.739	-0.480	-0.417	**SMOKE**	0.715	-0.406	-0.549
GLASS	1.201	-0.878	-0.258	**SRVC**	1.347	-1.001	-0.400
INSTR	1.035	-0.805	-0.227	**STONE**	0.850	-0.839	0.151
LETHR	1.033	-0.744	-0.229	**TRANS**	1.236	-0.730	-0.305
MACHN	1.213	-0.942	-0.118	**TV**	1.188	-0.836	-0.393
MANUF	0.987	-0.850	-0.320	**TXTLS**	0.957	-0.775	-0.122
METAL	1.387	-0.884	0.039	**UTILS**	0.617	-0.218	-0.587
MINES	0.980	-0.761	0.103	**WHLSL**	1.123	-0.764	-0.407
MONEY	1.085	-0.571	-0.601	**WOOD**	1.269	-0.782	-0.378
MTLPR	1.001	-0.694	-0.316				

Table V

ICAPM with bond risk premia: Estimating factor risk prices

This table reports the estimation and evaluation results of the ICAPM presented in sub-section II.D,

$$E(r_{i,t+1}-r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF}-\omega\sigma_{i,K}-\sigma_{i,B}$$

Panels A, B and C presents the results for the cases with ω=0.7, 0.6 and 0.5, respectively. There are 2 sets of test assets - the 25 size/book-to-market portfolios (SBV25) and the combination of these with 38 industry portfolios (SBV25+IND38). Each panel reports the risk prices for both single regression betas (rows 1 and 3) and multiple regression betas (rows 2 and 4), arising from first stage GMM estimation. λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. γ denotes the relative risk aversion coefficient. Below the parameter estimates are reported the associated Newey-West t-statistics calculated with 5 lags, and standard errors I and II, respectively. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section II.

Panel A (ω=0.7)							
Row	**λ_{CF}**	**λ_K**	**λ_B**	**γ**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25							
1	0.610	-0.103	-0.040	13.961	22.480	0.272	0.881
	2.951			**2.951**	0.551		
	<u>2.500</u>			<u>2.500</u>			
2	0.615	-0.026	-0.099		33.887		
	2.978	*-1.865*	**-3.474**		0.087		
	<u>2.524</u>	-1.581	**-2.943**				
SBV25 + IND38							
3	0.541	-0.103	-0.040	12.387	63.221	0.237	0.887
	2.727			**2.727**	0.266		
	<u>2.360</u>			<u>2.360</u>			
4	0.547	-0.030	-0.090		60.569		
	2.756	<u>-2.290</u>	**-3.272**		0.348		
	<u>2.385</u>	<u>-1.981</u>	**-2.831**				

Panel B (ω=0.6)							
Row	**λ_{CF}**	**λ_K**	**λ_B**	**γ**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25							
1	0.620	-0.088	-0.040	16.573	22.444	0.271	0.882
	3.002			**3.002**	0.553		
	2.542			2.542			
2	0.626	-0.010	-0.104		33.794		
	3.032	-0.751	**-3.652**		0.088		
	2.567	-0.636	**-3.092**				
SBV25 + IND38							
3	0.551	-0.088	-0.040	14.730	63.263	0.237	0.887
	2.779			**2.779**	0.265		
	2.404			2.404			
4	0.557	-0.015	-0.095		60.485		
	2.810	-1.130	**-3.457**		0.351		
	2.430	-0.977	**-2.989**				

Panel C (ω=0.5)							
Row	**λ_{CF}**	**λ_K**	**λ_B**	**γ**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25							
1	0.631	-0.073	-0.040	20.228	22.410	0.271	0.882
	3.054			**3.054**	0.555		
	2.583			**2.583**			
2	0.637	0.005	-0.110		33.698		
	3.085	0.364	**-3.831**		0.090		
	2.610	0.308	**-3.241**				
SBV25 + IND38							
3	0.562	-0.073	-0.040	18.009	63.306	0.237	0.887
	2.832			**2.832**	0.264		
	2.448			2.448			
4	0.568	0.000	-0.100		60.399		
	2.865	0.030	**-3.641**		0.354		
	2.476	0.026	**-3.147**				

Table VI

ICAPM with bond risk premia: Estimating factor risk prices by efficient GMM

This table reports the estimation and evaluation results of the ICAPM presented in sub-section II.D,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B}$$

Panels A, B and C presents the results for the cases with ω=0.7, 0.6 and 0.5, respectively. There are 2 sets of test assets - the 25 size/book-to-market portfolios (SBV25) and the combination of these with 38 industry portfolios (SBV25+IND38). Each panel reports the risk prices for both single regression betas (rows 1 and 3) and multiple regression betas (rows 2 and 4), arising from second stage GMM estimation (GMM II system). λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. γ denotes the relative risk aversion coefficient. Below the parameter estimates are reported the associated Newey-West t-statistics calculated with 5 lags. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section II.

Panel A (ω=0.7)							
Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	**RMSE**	R^2
SBV25							
1	0.471	-0.103	-0.040	10.779	34.154	0.310	0.846
	2.698			**2.698**	0.082		
2	0.476	-0.035	-0.080				
	2.730	**-3.006**	**-3.317**				
SBV25 + IND38							
3	0.421	-0.103	-0.040	9.642	60.940	0.270	0.854
	2.915			**2.915**	0.336		
4	0.427	-0.038	-0.073				
	2.954	**-3.974**	**-3.663**				

Panel B (ω=0.6)							
Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	**RMSE**	R^2
SBV25							
1	0.480	-0.088	-0.040	12.831	34.064	0.310	0.846
	2.750			**2.750**	0.084		
2	0.486	-0.020	-0.085				
	2.785	*-1.690*	**-3.519**				
SBV25 + IND38							
3	0.431	-0.088	-0.040	11.511	60.838	0.270	0.854
	2.982			**2.982**	0.339		
4	0.437	-0.023	-0.078				
	3.024	-2.385	**-3.912**				

Panel C (ω=0.5)							
Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	**RMSE**	R^2
SBV25							
1	0.490	-0.073	-0.040	15.704	33.974	0.310	0.846
	2.803			**2.803**	0.085		
2	0.496	-0.004	-0.090				
	2.840	-0.377	**-3.721**				
SBV25 + IND38							
3	0.441	-0.073	-0.040	14.128	60.736	0.270	0.854
	3.049			**3.049**	0.343		
4	0.447	-0.008	-0.083				
	3.094	-0.796	**-4.160**				

Table VII

ICAPM with bond risk premia: Single-regression beta estimates for additional characteristic-sorted portfolios

This table reports the single regression beta estimates associated with the Benchmark ICAPM with bond premia, for the 10 portfolios sorted on earnings to price ratio (Panel A), 10 portfolios sorted on cash flow to price ratio (Panel B) and 10 portfolios sorted on dividend to price ratio (Panel C). r^{K}_{t+1}, r^{CF}_{t+1} and r^{B}_{t+1} denote the revisions in future equity premia, cash-flows and bond premia, respectively. EP1, CFP1 and DP1 denote the portfolios containing stocks with financial ratios in the lowest decile, whereas EP10, CFP10 and DP10 denote the portfolios containing stocks with the highest financial ratios. DIF. denotes the difference in betas across extreme deciles. The sample is 1954:08-2003:12. For further details, refer to Section II.

Panel A (E/P)				**Panel B (CF/P)**				**Panel C (D/P)**			
	r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}		r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}		r^{CF}_{t+1}	r^{K}_{t+1}	r^{B}_{t+1}
EP1	1.175	-0.938	-0.274	**CFP1**	1.151	-0.912	-0.327	**DP1**	1.215	-0.922	-0.282
EP2	1.041	-0.735	-0.312	**CFP2**	1.040	-0.726	-0.320	**DP2**	1.057	-0.825	-0.274
EP3	0.965	-0.649	-0.375	**CFP3**	0.985	-0.638	-0.435	**DP3**	1.027	-0.733	-0.296
EP4	0.969	-0.616	-0.381	**CFP4**	1.041	-0.665	-0.381	**DP4**	1.049	-0.653	-0.368
EP5	1.014	-0.622	-0.402	**CFP5**	0.990	-0.632	-0.314	**DP5**	0.993	-0.577	-0.412
EP6	0.952	-0.604	-0.307	**CFP6**	0.955	-0.567	-0.452	**DP6**	0.957	-0.556	-0.378
EP7	0.967	-0.569	-0.356	**CFP7**	0.927	-0.607	-0.303	**DP7**	0.951	-0.552	-0.342
EP8	0.912	-0.574	-0.368	**CFP8**	0.902	-0.560	-0.312	**DP8**	0.931	-0.511	-0.319
EP9	1.013	-0.593	-0.291	**CFP9**	0.925	-0.572	-0.239	**DP9**	0.834	-0.447	-0.341
EP10	1.113	-0.654	-0.332	**CFP10**	1.091	-0.659	-0.229	**DP10**	0.683	-0.279	-0.451
DIF.	0.062	-0.283	0.058	**DIF.**	0.060	-0.253	-0.099	**DIF.**	0.532	-0.643	0.168

Table VIII

ICAPM with bond risk premia: Estimating factor risk prices for alternative characteristic portfolios

This table reports the estimation and evaluation results of the ICAPM presented in sub-section II.D,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B}$$

for additional characteristic portfolios. The test assets are the 10 portfolios sorted on earnings to price ratio (E/P, Panel A), 10 portfolios sorted on cash flow to price ratio (CF/P, Panel B) and 10 portfolios sorted on dividend to price ratio (D/P, Panel C), and the combination of these 30 portfolios with the 25 size/book-to-market portfolios (Panel D). Each panel reports the risk prices for both single regression betas (row 1) and multiple regression betas (row 2), arising from second stage GMM estimation (GMM II system). λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. γ denotes the relative risk aversion coefficient. Below the parameter estimates are reported the associated Newey-West t-statistics calculated with 5 lags. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section II.

Panel A (E/P)

Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
1	0.548	-0.103	-0.040	12.560	14.930	0.251	0.882
	2.812			**2.812**	0.093		
2	0.554	-0.030	-0.091				
	2.841	<u>-2.290</u>	**-3.366**				

Panel B (CF/P)

Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
1	0.639	-0.103	-0.040	14.626	12.548	0.212	0.905
	3.108			**3.108**	0.184		
2	0.644	-0.024	-0.103				
	3.136	*-1.734*	**-3.634**				

Panel C (D/P)

Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
1	0.651	-0.103	-0.040	14.907	8.043	0.175	0.922
	3.253			**3.253**	0.530		
2	0.657	-0.023	-0.105				
	3.282	*-1.720*	**-3.794**				

Panel D (SBV25+E/P+CF/P+D/P)

Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
1	0.608	-0.103	-0.040	13.936	33.505	0.238	0.895
	4.232			**4.232**	0.987		
2	0.614	-0.026	-0.099				
	4.272	**-2.688**	**-4.984**				

Table IX

ICAPM with bond risk premia: Estimating factor risk prices with alternative bond returns

This table reports the estimation and evaluation results of the ICAPM presented in sub-section II.D,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B}$$

using alternative bond returns. The bond returns are the corporate bond AAA average (Panel A), corporate bond BAA average (Panel B), and an equal weighted portfolio of 3, 5 and 10 year maturity Treasury bonds (Panel C). There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Each panel reports the risk prices for both single regression betas (rows 1, 3, 5) and multiple regression betas (rows 2, 4, 6), arising from second stage GMM estimation (GMM II system). λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. γ denotes the relative risk aversion coefficient. Below the parameter estimates are reported the associated Newey-West t-statistics calculated with 5 lags. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section II.

Panel A (AAA)							
Row	λ_{CF}	λ_K	λ_B	γ	$\alpha'\Sigma^{-1}\alpha$	**RMSE**	R^2
SBV25							
1	0.489	-0.097	-0.027	11.484	33.644	0.305	0.850
	2.709			**2.709**	0.091		
2	0.493	-0.019	-0.080				
	2.731	-0.924	**-3.126**				
SBV25 + IND38							
3	0.455	-0.097	-0.027	10.700	60.523	0.259	0.866
	3.093			**3.093**	0.350		
4	0.459	-0.023	-0.075				
	3.119	-1.359	**-3.604**				
SBV25+E/P+CF/P+D/P							
5	0.633	-0.097	-0.027	14.865	33.002	0.231	0.900
	4.143			**4.143**	0.989		
6	0.636	-0.003	-0.100				
	4.167	-0.149	**-4.635**				

Panel B (BAA)							
Row	**λ_{CF}**	**λ_K**	**λ_B**	**γ**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25							
1	0.480	-0.091	-0.021	11.247	34.530	0.304	0.851
	2.681			**2.681**	0.076		
2	0.485	-0.033	-0.077				
	2.708	-2.105	**-3.031**				
SBV25 + IND38							
3	0.438	-0.091	-0.021	10.275	60.806	0.262	0.862
	2.996			**2.996**	0.341		
4	0.443	-0.036	-0.071				
	3.030	**-2.857**	**-3.424**				
SBV25+E/P+CF/P+D/P							
5	0.617	-0.091	-0.021	14.458	33.309	0.232	0.900
	4.039			**4.039**	0.988		
6	0.622	-0.021	-0.096				
	4.071	-1.569	**-4.449**				

Panel C (GB)							
Row	**λ_{CF}**	**λ_K**	**λ_B**	**γ**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25							
1	0.498	-0.090	-0.013	11.536	34.334	0.305	0.850
	2.752			**2.752**	0.079		
2	0.501	-0.034	-0.064				
	2.771	-2.109	**-2.983**				
SBV25 + IND38							
3	0.456	-0.090	-0.013	10.566	60.879	0.261	0.864
	3.083			**3.083**	0.338		
4	0.460	-0.038	-0.059				
	3.106	**-2.863**	**-3.365**				
SBV25+E/P+CF/P+D/P							
5	0.631	-0.090	-0.013	14.615	33.517	0.234	0.898
	4.117			**4.117**	0.987		
6	0.634	-0.022	-0.080				
	4.140	-1.624	**-4.390**				

Table X

ICAPM with bond risk premia: Estimating factor risk prices with time-varying covariances

This table reports the estimation and evaluation results of the ICAPM with time-varying covariances presented in sub-section II.G,

$$E(r_{i,t+1}-r_{f,t+1})+\frac{\sigma_i^2}{2}=\gamma\omega\sigma_{i,CF}-\omega\sigma_{i,K}-\omega b_K\sigma_{i,K,x}-\sigma_{i,B}-b_B\sigma_{i,B,x}$$

The scaling variables are the market dividend yield (DY), smoothed log earnings yield (EY*) and default spread (DEF). Panels A, B and C present the results from first stage GMM, whereas Panels D, E and F show the results from second stage GMM. There are 2 sets of test assets - the 25 size/book-to-market portfolios (SBV25) and the combination of these with 38 industry portfolios (SBV25+IND38). Each panel from A to C reports the risk prices for single regression betas in the first row, and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third row, respectively. λ_{CF}, λ_K, λ_B, λ_{Kx} and λ_{Bx} denote the beta risk prices estimates for the cash-flow news, equity premia news, bond premia news, and the scaled factors, respectively. γ denotes the relative risk aversion coefficient. In panels D to F, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section II.

Panel A (DY)										
λ_{CF}	λ_K	λ_B	λ_{KDY}	λ_{BDY}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
0.590	-0.103	-0.040	-0.031	-0.009	13.519	2312.776	1975.638	20.276	0.223	0.913
2.513			**-2.816**	-1.591	**2.513**	**2.816**	1.591	0.566		
1.822			*-1.784*	-1.215	*1.822*	*1.784*	1.215			
SBV25 + IND38										
0.533	-0.103	-0.040	-0.009	-0.002	12.214	689.795	485.824	58.309	0.226	0.894
2.441			-1.576	-0.339	2.441	1.576	0.339	0.355		
2.213			-1.530	-0.318	2.213	1.530	0.318			
Panel B (EY*)										
λ_{CF}	λ_K	λ_B	λ_{KEY}	λ_{BEY}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
1.000	-0.103	-0.040	-1.081	0.290	22.913	49.054	-32.524	19.640	0.223	0.913
3.207			-2.121	0.938	**3.207**	2.121	-0.938	0.606		
1.968			-1.186	0.616	1.968	1.186	-0.616			
SBV25 + IND38										
0.513	-0.103	-0.040	-0.363	-0.110	11.753	16.445	12.364	60.130	0.227	0.893
2.253			-1.499	-0.442	2.253	1.499	0.442	0.295		
2.048			-1.449	-0.426	2.048	1.449	0.426			
Panel C (DEF)										
λ_{CF}	λ_K	λ_B	λ_{KDEF}	λ_{BDEF}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
1.356	-0.103	-0.040	0.013	0.016	31.068	-6814.873	-12370.164	16.682	0.249	0.891
3.821			2.337	**2.934**	**3.821**	-2.337	**-2.934**	0.781		
2.152			1.187	*1.697*	2.152	-1.187	*-1.697*			
SBV25 + IND38										
0.547	-0.103	-0.040	0.001	0.000	12.533	-546.407	12.181	56.428	0.237	0.883
2.695			0.227	-0.006	**2.695**	-0.227	0.006	0.421		
2.368			0.207	-0.005	2.368	-0.207	0.005			

Panel D (DY, efficient GMM)

λ_{CF}	λ_K	λ_B	λ_{KDY}	λ_{BDY}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
0.461	-0.103	-0.040	-0.017	-0.006	10.551	1262.218	1279.552	23.660	0.262	0.879
2.392			-2.520	-1.382	2.392	2.520	1.382	0.365		
0.317	-0.103	-0.040	-0.020	-0.010	7.266	1524.091	2255.709	30.631	0.279	0.863
1.277			-2.236	-2.094	1.277	2.236	2.094	0.104		
SBV25 + IND38										
0.435	-0.103	-0.040	-0.007	-0.002	9.974	538.177	423.450	65.278	0.247	0.873
2.903			-2.409	-0.705	**2.903**	2.409	0.705	0.162		
0.390	-0.103	-0.040	-0.008	-0.003	8.937	579.780	616.666	59.926	0.257	0.863
2.504			-2.433	-1.074	2.504	2.433	1.074	0.302		

Panel E (EY*, efficient GMM)

λ_{CF}	λ_K	λ_B	λ_{KEY}	λ_{BEY}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
0.579	-0.103	-0.040	-0.432	0.019	13.257	19.611	-2.095	24.342	0.276	0.866
2.779			-1.569	0.096	**2.779**	1.569	-0.096	0.330		
0.251	-0.103	-0.040	-0.548	-0.300	5.743	24.850	33.675	26.636	0.364	0.768
0.785			-1.447	-1.197	0.785	1.447	1.197	0.225		
SBV25 + IND38										
0.394	-0.103	-0.040	-0.258	-0.126	9.019	11.697	14.153	65.693	0.249	0.871
2.634			*-1.953*	-1.129	**2.634**	*1.953*	1.129	0.153		
0.335	-0.103	-0.040	-0.273	-0.156	7.666	12.405	17.473	61.144	0.270	0.849
2.107			-1.962	-1.473	2.107	1.962	1.473	0.265		

Panel F (DEF, efficient GMM)

λ_{CF}	λ_K	λ_B	λ_{KDEF}	λ_{BDEF}	γ	b_K	b_B	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25										
0.795	-0.103	-0.040	0.011	0.007	18.209	-5625.731	-5227.675	25.467	0.313	0.828
3.795			**4.169**	2.158	**3.795**	**-4.169**	-2.158	0.275		
0.364	-0.103	-0.040	0.009	0.001	8.336	-4730.567	-744.737	14.510	0.460	0.629
1.016			*1.647*	0.170	1.016	*-1.647*	-0.170	0.882		
SBV25 + IND38										
0.434	-0.103	-0.040	0.002	0.000	9.942	-1106.425	-73.308	64.943	0.272	0.846
3.125			1.113	0.062	**3.125**	-1.113	-0.062	0.169		
0.402	-0.103	-0.040	0.003	0.000	9.218	-1290.482	-70.220	59.705	0.292	0.823
2.680			1.224	0.060	**2.680**	-1.224	-0.060	0.309		

Table XI
ICAPM with news in variances

This table reports the estimation and evaluation results for the ICAPM with news in variances presented in Section III,

$$E(r_{i,t+1}-r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + 0.5\theta^2(\omega^2\sigma_{i,Vm} + (1-\omega)^2\sigma_{i,Vb}) \qquad (1)$$

$$E(r_{i,t+1}-r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + 0.5\theta^2\omega^2\sigma_{i,Vm} \qquad (2)$$

Panels A and B present the results for model (1) from first and second stage GMM, respectively, whereas Panels C and D show the results for model (2), from first and second stage GMM, respectively. There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Panels A and C report the risk prices for single regression betas in the first row, and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third rows, respectively. In panels B and D, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. λ_{VM} and λ_{VB} denote the risk prices associated with news in the volatilities of stock and bond returns. λ_V represents the common component of both λ_{VM} and λ_{VB}, and it is estimated in the cross-section. γ denotes the relative risk aversion coefficient. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section III.

λ_{CF}	λ_K	λ_B	λ_{VM}	λ_{VB}	γ	λ_V	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
Panel A (first stage GMM)									
SBV25									
0.376	-0.103	-0.040	0.108	0.023	8.612	273.837	32.690	0.270	0.877
1.776			0.979	0.979	*1.776*	0.979	0.087		
1.516			0.795	0.795	1.516	0.795			
SBV25 + IND38									
0.658	-0.103	-0.040	-0.051	-0.011	15.076	-129.887	59.134	0.236	0.886
3.333			-0.744	-0.744	**3.333**	-0.744	0.362		
3.014			-0.682	-0.682	**3.014**	-0.682			
SBV25+E/P+CF/P+D/P									
0.680	-0.103	-0.040	-0.042	-0.009	15.586	-106.409	31.770	0.237	0.894
3.194			-0.446	-0.446	**3.194**	-0.446	0.991		
2.886			-0.416	-0.416	**2.886**	-0.416			

λ_{CF}	λ_K	λ_B	λ_{VM}	λ_{VB}	γ	λ_V	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
Panel B (second stage GMM)									
SBV25									
0.397	-0.103	-0.040	0.047	0.010	9.089	120.499	22.891	0.295	0.854
2.378			1.092	1.092	2.378	1.092	0.467		
0.413	-0.103	-0.040	0.040	0.008	9.454	101.178	27.396	0.295	0.854
2.061			0.534	0.534	2.061	0.534	0.239		
SBV25 + IND38									
0.531	-0.103	-0.040	-0.041	-0.009	12.162	-103.717	64.837	0.261	0.861
3.768			-1.445	-1.445	**3.768**	-1.445	0.196		
0.544	-0.103	-0.040	-0.051	-0.011	12.459	-128.747	59.781	0.265	0.856
3.632			*-1.753*	*-1.753*	**3.632**	*-1.753*	0.340		
SBV25+E/P+CF/P+D/P									
0.679	-0.103	-0.040	-0.036	-0.008	15.550	-92.265	38.003	0.237	0.893
4.898			-1.104	-1.104	**4.898**	-1.104	0.940		
0.697	-0.103	-0.040	-0.057	-0.012	15.972	-144.725	33.126	0.237	0.893
4.475			*-1.728*	*-1.728*	**4.475**	*-1.728*	0.985		

Panel C (first stage GMM)

λ_{CF}	λ_K	λ_B	λ_{VM}	γ	λ_V	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
0.386	-0.103	-0.040	0.106	8.830	269.291	31.025	0.270	0.878
1.895			2.291	*1.895*	2.291	0.122		
1.155			0.943	1.155	0.943			
SBV25 + IND38								
0.669	-0.103	-0.040	-0.056	15.332	-141.175	59.078	0.236	0.887
3.183			-1.093	**3.183**	-1.093	0.364		
2.856			-0.985	**2.856**	-0.985			
SBV25+E/P+CF/P+D/P								
0.694	-0.103	-0.040	-0.048	15.896	-122.179	31.812	0.237	0.894
3.408			-1.258	**3.408**	-1.258	0.991		
2.946			-1.063	**2.946**	-1.063			

Panel D (second stage GMM)

λ_{CF}	λ_K	λ_B	λ_{VM}	γ	λ_V	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
0.404	-0.103	-0.040	0.045	9.247	114.916	23.280	0.295	0.854
2.486			1.275	2.486	1.275	0.444		
0.423	-0.103	-0.040	0.034	9.686	87.487	35.080	0.297	0.852
2.112			0.491	2.112	0.491	0.051		
SBV25 + IND38								
0.540	-0.103	-0.040	-0.045	12.378	-113.038	64.538	0.260	0.862
3.894			-1.997	**3.894**	-1.997	0.203		
0.562	-0.103	-0.040	-0.059	12.880	-149.446	59.704	0.266	0.856
3.774			-2.161	**3.774**	-2.161	0.343		
SBV25+E/P+CF/P+D/P								
0.681	-0.103	-0.040	-0.036	15.601	-90.926	37.987	0.237	0.893
5.014			-1.336	**5.014**	-1.336	0.940		
0.709	-0.103	-0.040	-0.063	16.237	-159.446	33.236	0.237	0.893
4.537			-2.111	**4.537**	-2.111	0.985		

Table XII

An unrestricted ICAPM with bond risk premia

This table reports the estimation and evaluation results for the unrestricted ICAPM presented in Section III,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_K\sigma_{i,K} + b_B\sigma_{i,B}$$

Panels A and B present the results from first and second stage GMM, respectively. There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Panel A reports the risk prices for single regression betas in the first row, and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third rows, respectively. In panel B, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. γ denotes the relative risk aversion coefficient. ϕ_1 and ϕ_2 represent the implied preference parameters, which are derived in Section III. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section III.

Panel A (first stage GMM)

λ_{CF}	λ_K	λ_B	b_{CF}	b_K	b_B	γ	Φ_1	Φ_2	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25											
2.356	1.596	1.970	37.775	10.864	48.796	53.964	-0.031	-0.241	19.742	0.233	0.905
4.135	**2.638**	**2.862**	**4.135**	**2.638**	**2.862**	**4.135**	**-4.897**	**-3.121**	0.599		
2.673	*1.701*	*1.907*	**2.673**	*1.701*	*1.907*	**2.673**	**-2.889**	-2.014			
SBV25 + IND38											
0.467	-0.103	-0.321	7.485	-0.700	-7.947	10.693	0.000	0.239	59.168	0.233	0.887
1.309	-0.205	-1.059	1.309	-0.205	-1.059	1.309	0.000	0.701	0.326		
1.248	-0.190	-1.018	1.248	-0.190	-1.018	1.248	0.000	0.679			
SBV25+E/P+CF/P+D/P											
2.390	1.801	1.623	38.315	12.257	40.208	54.735	-0.034	-0.175	23.668	0.192	0.929
4.747	**3.079**	**3.368**	**4.747**	**3.079**	**3.368**	**4.747**	**-6.079**	**-2.989**	1.000		
3.165	2.013	2.342	**3.165**	2.013	2.342	**3.165**	**-3.654**	-1.975			

Panel B (second stage GMM)											
λ_{CF}	λ_K	λ_B	b_{CF}	b_K	b_B	γ	Φ_1	Φ_2	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25											
1.396	0.703	1.088	22.385	4.786	26.955	31.979	-0.025	-0.242	26.874	0.261	0.880
3.821	1.563	**2.976**	**3.821**	1.563	**2.976**	**3.821**	**-2.737**	**-2.763**	0.216		
1.311	0.747	0.693	21.022	5.081	17.154	30.032	-0.028	-0.142	20.493	0.268	0.874
2.315	1.115	1.328	2.315	1.115	1.328	2.315	-1.989	-1.111	0.552		
SBV25 + IND38											
0.263	-0.367	-0.245	4.223	-2.497	-6.069	6.032	0.051	0.217	66.754	0.239	0.881
1.246	-1.223	-1.379	1.246	-1.223	-1.379	1.246	0.508	0.603	0.133		
0.325	-0.263	-0.234	5.214	-1.790	-5.802	7.448	0.024	0.192	61.836	0.241	0.879
1.500	-0.844	-1.270	1.500	-0.844	-1.270	1.500	0.389	0.694	0.245		
SBV25+E/P+CF/P+D/P											
1.727	0.982	1.243	27.685	6.685	30.792	39.550	-0.027	-0.211	46.648	0.203	0.920
7.098	**3.029**	**6.038**	**7.098**	**3.029**	**6.038**	**7.098**	**-5.031**	**-4.947**	0.684		
1.332	0.350	0.852	21.359	2.383	21.105	30.512	-0.015	-0.215	26.189	0.281	0.847
3.395	0.750	**2.789**	**3.395**	0.750	**2.789**	**3.395**	-1.234	**-2.886**	0.999		

Table XIII
ICAPM with revisions in the VAR state variables

This table reports the estimation and evaluation results for the ICAPM with revisions in the VAR state variables, presented in Section III,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma\omega\sigma_{i,CF} - \omega\sigma_{i,K} - \sigma_{i,B} + \gamma_Y\sigma_{i,y}$$

The state variables used are FFPREM (Panel A), TERM (Panel B), VS (Panel C), EY (Panel D) and the real interest rate (Panel E). There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). In each panel, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. λ_{CF}, λ_K, λ_B and λ_Y denote the beta risk prices estimates for the cash-flow news, equity premia news, bond premia news and state variable news, respectively. γ denotes the relative risk aversion coefficient. ϕ represents the implied preference parameter, which is derived in Section III. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section III.

Panel A (FFPREM)

λ_{CF}	λ_K	λ_B	λ_Y	γ	γ_Y	Φ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25									
0.653	-0.103	-0.040	0.448	14.964	3.393	-0.0243	25.931	0.290	0.859
3.049			0.759	**3.049**	0.759	-0.9096	0.304		
0.644	-0.103	-0.040	0.364	14.753	2.757	-0.0200	33.655	0.283	0.865
$\underline{2.573}$			0.551	$\underline{2.573}$	0.551	-0.6398	0.070		
SBV25 + IND38									
0.402	-0.103	-0.040	-0.163	9.211	-1.232	0.0150	64.794	0.255	0.867
2.614			-0.442	**2.614**	-0.442	0.3989	0.197		
0.412	-0.103	-0.040	-0.015	9.438	-0.117	0.0014	61.537	0.272	0.850
$\underline{2.483}$			-0.041	$\underline{2.483}$	-0.041	0.0404	0.285		
SBV25+E/P+CF/P+D/P									
0.873	-0.103	-0.040	0.901	19.992	6.823	-0.0359	38.643	0.231	0.899
5.231			$\underline{2.190}$	**5.231**	$\underline{2.190}$	**-2.7183**	0.930		
0.929	-0.103	-0.040	0.945	21.273	7.158	-0.0353	35.256	0.236	0.894
4.683			$\underline{1.973}$	**4.683**	$\underline{1.973}$	$\underline{-2.4614}$	0.971		

Panel B (TERM)

λ_{CF}	λ_K	λ_B	λ_Y	γ	γ_Y	Φ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25									
0.528	-0.103	-0.040	-2.385	12.102	-6.208	0.0559	26.082	0.281	0.867
3.458			-2.488	**3.458**	-2.488	*1.9509*	0.297		
0.549	-0.103	-0.040	-2.775	12.574	-7.225	0.0624	35.446	0.273	0.875
2.673			-2.132	**2.673**	-2.132	*1.6508*	0.047		
SBV25 + IND38									
0.440	-0.103	-0.040	-0.795	10.070	-2.070	0.0228	65.661	0.261	0.862
3.315			-1.373	**3.315**	-1.373	1.2191	0.177		
0.443	-0.103	-0.040	-0.857	10.146	-2.232	0.0244	62.099	0.259	0.863
3.017			-1.367	**3.017**	-1.367	1.2242	0.268		
SBV25+E/P+CF/P+D/P									
0.462	-0.360	0.136	-2.633	14.101	-7.407	0.0565	36.094	0.221	0.907
4.694			**-4.552**	**4.694**	**-4.552**	**3.1378**	0.963		
0.645	-0.103	-0.040	-3.223	14.768	-8.390	0.0609	33.554	0.224	0.904
4.165			**-4.283**	**4.165**	**-4.283**	**3.0764**	0.983		

Panel C (VS)

λ_{CF}	λ_K	λ_B	λ_Y	γ	γ_Y	Φ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25									
0.888	-0.103	-0.040	-23.129	20.346	-0.177	0.0009	24.653	0.300	0.849
4.350			-2.423	**4.350**	-2.423	**3.2092**	0.368		
0.955	-0.103	-0.040	-29.107	21.864	-0.223	0.0011	29.594	0.336	0.811
3.811			-2.465	**3.811**	-2.465	**3.3263**	0.161		
SBV25 + IND38									
0.574	-0.103	-0.040	-7.143	13.151	-0.055	0.0004	65.812	0.256	0.866
3.694			-0.974	**3.694**	-0.974	1.0992	0.174		
0.621	-0.103	-0.040	-12.373	14.218	-0.095	0.0007	60.798	0.282	0.839
3.590			-1.462	**3.590**	-1.462	*1.7082*	0.307		
SBV25+E/P+CF/P+D/P									
1.038	-0.103	-0.040	-26.463	23.783	-0.202	0.0009	40.004	0.202	0.923
6.364			**-3.421**	**6.364**	**-3.421**	**4.2469**	0.906		
1.115	-0.103	-0.040	-30.395	25.528	-0.232	0.0009	29.330	0.201	0.924
5.607			**-3.025**	**5.607**	**-3.025**	**3.9548**	0.997		

Panel D (EY)									
λ_{CF}	λ_K	λ_B	λ_Y	γ	γ_Y	Φ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25									
0.880	-0.103	-0.040	63.037	20.163	0.046	-0.0002	25.407	0.289	0.860
3.516			1.622	**3.516**	1.622	-2.3720	0.330		
0.913	-0.103	-0.040	70.196	20.905	0.052	-0.0003	30.500	0.295	0.854
2.948			1.470	**2.948**	1.470	-2.2041	0.136		
SBV25 + IND38									
0.494	-0.103	-0.040	5.449	11.316	0.004	0.0000	65.168	0.252	0.871
2.805			0.194	**2.805**	0.194	-0.2034	0.188		
0.548	-0.103	-0.040	21.438	12.544	0.016	-0.0001	62.272	0.271	0.850
2.869			0.696	**2.869**	0.696	-0.8141	0.263		
SBV25+E/P+CF/P+D/P									
1.126	-0.103	-0.040	90.422	25.792	0.067	-0.0003	39.122	0.211	0.916
5.902			**3.029**	**5.902**	**3.029**	**-4.2411**	0.922		
1.188	-0.103	-0.040	94.736	27.213	0.070	-0.0003	31.339	0.212	0.915
4.883			2.420	**4.883**	2.420	**-3.4855**	0.992		

Panel E (r_r)									
λ_{CF}	λ_K	λ_B	λ_Y	γ	γ_Y	Φ	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25									
0.416	-0.103	-0.040	-6.398	9.534	-10.662	0.1249	13.798	0.196	0.935
2.743			**-4.695**	**2.743**	**-4.695**	2.2176	0.933		
0.298	-0.103	-0.040	-6.043	6.816	-10.069	0.1731	22.392	0.284	0.864
1.095			**-2.836**	1.095	**-2.836**	0.9204	0.497		
SBV25 + IND38									
0.406	-0.103	-0.040	-3.680	9.308	-6.131	0.0738	61.338	0.218	0.903
3.058			**-5.444**	**3.058**	**-5.444**	**2.6048**	0.291		
0.374	-0.103	-0.040	-3.218	8.571	-5.362	0.0708	56.035	0.238	0.885
2.419			**-3.726**	2.419	**-3.726**	2.2826	0.474		
SBV25+E/P+CF/P+D/P									
0.516	-0.103	-0.040	-7.040	11.822	-11.731	0.1084	37.676	0.165	0.948
3.849			**-7.602**	**3.849**	**-7.602**	**3.3065**	0.945		
0.451	-0.103	-0.040	-5.474	10.323	-9.122	0.0978	28.781	0.177	0.941
2.112			**-3.932**	2.112	**-3.932**	*1.8244*	0.997		

Table XIV
ICAPM with time-varying risk aversion: dividend yield

This table reports the estimation and evaluation results for the ICAPM with risk aversion scaled by the dividend yield, presented in Section IV,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma_0 \omega \sigma_{i,CF} + \gamma_1 \omega \sigma_{i,CFDY} - \omega \sigma_{i,K} - \sigma_{i,B}$$

There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Panel A reports the risk prices for single regression betas in the first row, and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third rows, respectively. In Panel B, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. λ_{CFDY} denote the risk prices associated with the scaled factor related with time-varying risk aversion. γ_0 and γ_1 represent the coefficients in the equation that governs time-varying risk aversion, γ_t. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section IV.

λ_{CF}	λ_{CFDY}	λ_K	λ_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
Panel A (first stage GMM)								
SBV25								
0.497	0.041	-0.103	-0.040	11.393	6356.789	19.612	0.161	0.956
2.404	**4.537**			2.404	**4.537**	0.665		
0.947	2.181			0.947	2.181			
SBV25 + IND38								
0.510	0.011	-0.103	-0.040	11.675	1741.624	57.979	0.216	0.905
2.599	2.398			**2.599**	2.398	0.402		
2.095	2.444			2.095	2.444			
SBV25+E/P+CF/P+D/P								
0.485	0.035	-0.103	-0.040	11.107	5385.066	29.548	0.172	0.944
2.537	**3.948**			2.537	**3.948**	0.996		
1.092	2.195			1.092	2.195			
Panel B (second stage GMM)								
SBV25								
0.447	0.020	-0.103	-0.040	10.229	3155.084	12.947	0.226	0.914
2.940	**4.180**			**2.940**	**4.180**	0.953		
0.497	0.018	-0.103	-0.040	11.376	2758.160	20.329	0.215	0.923
1.331	*1.897*			1.331	*1.897*	0.622		
SBV25 + IND38								
0.431	0.009	-0.103	-0.040	9.864	1364.577	62.704	0.235	0.887
3.214	**4.052**			**3.214**	**4.052**	0.251		
0.362	0.009	-0.103	-0.040	8.290	1414.609	54.946	0.271	0.850
2.248	**3.949**			2.248	**3.949**	0.515		
SBV25+E/P+CF/P+D/P								
0.540	0.021	-0.103	-0.040	12.367	3204.052	39.211	0.185	0.935
4.101	**6.382**			**4.101**	**6.382**	0.921		
0.568	0.019	-0.103	-0.040	13.003	2952.445	27.018	0.191	0.931
2.106	**3.388**			2.106	**3.388**	0.999		

Table XV

ICAPM with time-varying risk aversion: bond premia

This table reports the estimation and evaluation results for the ICAPM with risk aversion scaled by bond premia news, presented in Section IV,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = \gamma_0 \omega \sigma_{i,CF} + \gamma_1 \omega \sigma_{i,CFB} - \omega \sigma_{i,K} - \sigma_{i,B}$$

There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Panel A reports the risk prices for single regression betas in the first row, and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third rows, respectively. In Panel B, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. λ_{CF}, λ_K and λ_B denote the beta risk prices estimates for the cash-flow news, equity premia news and bond premia news, respectively. λ_{CFB} denote the risk prices associated with the scaled factor related with time-varying risk aversion. γ_0 and γ_1 represent the coefficients in the equation that governs time-varying risk aversion, γ_t. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. The beta risk prices (λ) are reported in %. For further details, refer to Section IV.

λ_{CF}	λ_{CFB}	λ_K	λ_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
Panel A (first stage GMM)								
SBV25								
-0.042	-0.103	-0.103	-0.040	-0.970	-3914.383	17.230	0.228	0.912
-0.133	**-3.193**			-0.133	**-3.193**	0.798		
-0.047	-1.786			-0.047	-1.786			
SBV25 + IND38								
0.481	-0.009	-0.103	-0.040	11.020	-343.453	61.770	0.237	0.886
1.970	-0.558			1.970	-0.558	0.278		
1.747	-0.533			*1.747*	-0.533			
SBV25+E/P+CF/P+D/P								
0.240	-0.056	-0.103	-0.040	5.493	-2101.218	26.543	0.226	0.903
0.972	**-2.831**			0.972	**-2.831**	0.999		
0.536	-2.022			0.536	-2.022			
Panel B (second stage GMM)								
λ_{CF}	**λ_{CFB}**	**λ_K**	**λ_B**	**γ_0**	**γ_1**	**$\alpha'\Sigma^{-1}\alpha$**	**RMSE**	**R^2**
SBV25								
0.209	-0.046	-0.103	-0.040	4.792	-1739.749	39.237	0.270	0.878
1.266	**-3.559**			1.266	**-3.559**	0.019		
0.351	-0.027	-0.103	-0.040	8.043	-1008.154	19.212	0.271	0.877
0.963	-1.147			0.963	-1.147	0.689		
SBV25 + IND38								
0.373	-0.010	-0.103	-0.040	8.552	-378.405	65.768	0.260	0.862
2.693	-1.644			**2.693**	-1.644	0.175		
0.358	-0.007	-0.103	-0.040	8.204	-275.545	62.063	0.277	0.844
2.373	-1.100			2.373	-1.100	0.269		
SBV25+E/P+CF/P+D/P								
0.388	-0.035	-0.103	-0.040	8.880	-1326.214	39.531	0.228	0.901
2.785	**-4.685**			**2.785**	**-4.685**	0.915		
0.347	-0.038	-0.103	-0.040	7.958	-1437.906	27.555	0.227	0.902
1.683	**-3.576**			*1.683*	**-3.576**	0.999		

Table XVI
An unrestricted ICAPM with time-varying risk aversion

This table reports the estimation and evaluation results for the unrestricted ICAPM with time-varying risk aversion presented in Section IV,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFDY}\sigma_{i,CFDY} + b_K\sigma_{i,K} + b_B\sigma_{i,B}$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFB}\sigma_{i,CFB} + b_K\sigma_{i,K} + b_B\sigma_{i,B}$$

Panels A and B present the results from first stage GMM, for dividend yield and bond premia, respectively, whereas Panels C and D report the second stage GMM estimation results. There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). Panels A and B report the covariance risk prices and the associated Newey-West t-statistics (with 5 lags) arising from GMM I and II standard errors in the second and third rows, respectively. In Panels C and D, the first two rows show the efficient parameter estimates and the associated Newey-West t-statistics (with 5 lags) arising from system GMM I, whereas the following two rows report the results for the GMM II system. γ_0 and γ_1 represent the coefficients in the equation that governs time-varying risk aversion, γ_t. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. RMSE is the square root of the average pricing error (in %). R^2 refers to the cross sectional adjusted R^2. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. For further details, refer to Section IV.

Panel A (DY, first stage GMM)								
b_{CF}	b_{CFDY}	b_K	b_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
18.360	4135.739	2.791	24.889	26.228	5908.198	20.682	0.152	0.957
<u>2.553</u>	**4.827**	0.747	*1.742*	<u>2.553</u>	**4.827**	0.478		
1.372	**2.610**	0.411	0.952	1.372	**2.610**			
SBV25 + IND38								
7.220	1193.359	-0.661	-7.025	10.314	1704.799	57.190	0.212	0.905
1.272	<u>2.329</u>	-0.193	-0.925	1.272	<u>2.329</u>	0.358		
1.133	<u>2.378</u>	-0.175	-0.839	1.133	<u>2.378</u>			
SBV25+E/P+CF/P+D/P								
26.536	3284.674	6.585	34.303	37.908	4692.391	29.983	0.149	0.956
4.142	**4.073**	*1.842*	**3.143**	**4.142**	**4.073**	0.992		
<u>2.535</u>	<u>2.455</u>	1.193	*1.745*	<u>2.535</u>	<u>2.455</u>			
Panel B (bond premia, first stage GMM)								
b_{CF}	b_{CFB}	b_K	b_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
17.939	-2227.003	5.301	37.663	25.627	-3181.432	17.118	0.214	0.916
<u>2.192</u>	**-3.877**	1.361	<u>2.329</u>	<u>2.192</u>	**-3.877**	0.704		
0.930	-1.154	0.495	1.193	0.930	-1.154			
SBV25 + IND38								
3.789	-404.998	-1.708	-10.308	5.413	-578.569	62.982	0.231	0.887
0.716	-1.096	-0.533	-1.408	0.716	-1.096	0.188		
0.681	-0.986	-0.481	-1.377	0.681	-0.986			
SBV25+E/P+CF/P+D/P								
34.444	-535.075	11.381	38.095	49.205	-764.392	23.352	0.190	0.929
4.280	*-1.688*	**2.939**	**3.135**	**4.280**	*-1.688*	1.000		
2.954	-0.797	*1.826*	<u>2.261</u>	**2.954**	-0.797			

Panel C (DY, second stage GMM)								
b_{CF}	b_{CFDY}	b_K	b_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
14.010	2187.604	1.220	17.816	20.014	3125.148	15.624	0.204	0.923
2.448	**3.996**	0.407	*1.871*	2.448	**3.996**	0.790		
20.947	2594.248	5.820	23.370	29.924	3706.068	22.190	0.259	0.877
2.202	**2.811**	1.114	*1.820*	2.202	**2.811**	0.389		
SBV25 + IND38								
4.479	903.825	-2.273	-4.948	6.398	1291.179	64.731	0.219	0.898
1.249	**3.632**	-1.076	-1.076	1.249	**3.632**	0.150		
4.084	978.958	-1.973	-4.830	5.834	1398.512	53.246	0.235	0.883
0.973	**3.782**	-0.852	-0.988	0.973	**3.782**	0.503		
SBV25+E/P+CF/P+D/P								
20.501	1913.187	3.229	27.071	29.287	2733.124	39.076	0.172	0.942
5.486	**5.675**	1.518	**5.305**	**5.486**	**5.675**	0.889		
19.598	2302.496	1.518	24.479	27.997	3289.280	33.690	0.244	0.882
3.152	**4.355**	0.519	**3.243**	**3.152**	**4.355**	0.971		

Panel D (bond premia, second stage GMM)								
b_{CF}	b_{CFB}	b_K	b_B	γ_0	γ_1	$\alpha'\Sigma^{-1}\alpha$	RMSE	R^2
SBV25								
14.180	-905.446	2.423	23.030	20.258	-1293.495	25.811	0.253	0.883
2.334	**-2.634**	0.797	2.469	2.334	**-2.634**	0.214		
16.351	-714.665	0.526	13.016	23.359	-1020.951	18.537	0.407	0.695
1.476	-1.053	0.089	0.962	1.476	-1.053	0.615		
SBV25 + IND38								
0.947	-389.052	-3.367	-8.146	1.353	-555.788	66.320	0.237	0.882
0.268	-2.382	-1.641	*-1.825*	0.268	-2.382	0.121		
2.110	-343.723	-2.151	-8.378	3.015	-491.033	63.120	0.253	0.865
0.563	*-1.840*	-0.944	*-1.812*	0.563	*-1.840*	0.185		
SBV25+E/P+CF/P+D/P								
25.781	-231.336	6.162	30.162	36.830	-330.480	46.680	0.203	0.919
6.575	-1.187	**2.815**	**5.744**	**6.575**	-1.187	0.646		
19.290	-495.299	1.467	19.575	27.557	-707.569	25.318	0.353	0.754
3.120	*-1.852*	0.458	**2.722**	**3.120**	*-1.852*	0.999		

Table XVII
Average pricing errors for book-to-market quintiles

This table reports In Panel A the square root of the average pricing error in % (RMSE), and the cross sectional adjusted (R^2), for several models. The models are the BBGB model in equation (18); the CAPM and 2 beta CAPM with unrestricted risk prices of equations (66) and (67); the ICAPM I, II, III and IV corresponding to equations (22), (44) and (49); the ICAPM V, VI, VII, VIII and IX corresponding to equations (54), (58), (60), (61) and (62), respectively; and the Fama-French 3 factor model (FF3). In Panel B are reported the average pricing errors across the book-to-market quintiles. All the pricing errors are presented in percentage points. BV1 denote the lowest book-to-market quintile. The sample is 1954:08-2003:12. For further details, refer to section V of the paper.

Panel A

	BBGB	I	II	III	IV	V	VI	VII	VIII	IX	CAPM	CAPM2	FF3
RMSE	0.273	0.272	0.223	0.223	0.233	0.146	0.161	0.228	0.152	0.214	0.290	0.287	0.137
x12	3.281	3.260	2.671	2.676	2.796	1.757	1.936	2.741	1.826	2.565	3.478	3.449	1.647
R^2	0.880	0.881	0.913	0.913	0.905	0.964	0.956	0.912	0.957	0.916	0.865	0.867	0.967

Panel B

	BBGB	I	II	III	IV	V	VI	VII	VIII	IX	CAPM	CAPM2	FF3
BV1	-0.396	-0.391	-0.172	-0.156	-0.229	-0.068	-0.102	-0.181	-0.083	-0.148	-0.427	-0.423	-0.026
BV2	-0.075	-0.074	-0.072	-0.095	-0.038	0.025	0.003	-0.142	0.007	-0.112	-0.073	-0.073	-0.010
BV3	0.105	0.103	0.031	0.047	0.138	0.040	0.043	0.060	0.076	0.109	0.121	0.116	0.039
BV4	0.233	0.231	0.108	0.153	0.180	0.072	0.059	0.205	0.069	0.199	0.263	0.258	0.057
BV5	0.240	0.236	0.149	0.099	0.025	-0.038	0.036	0.125	-0.028	0.019	0.284	0.282	-0.032

Table XVIII

ICAPM with bond risk premia: Incorporating the UMD factor

This table reports the estimation and evaluation results for the ICAPM models presented in Section V,

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \quad (1)$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFDY}\sigma_{i,CFDY} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \quad (2)$$

$$E(r_{i,t+1} - r_{f,t+1}) + \frac{\sigma_i^2}{2} = b_{CF}\sigma_{i,CF} + b_{CFB}\sigma_{i,CFB} + b_K\sigma_{i,K} + b_B\sigma_{i,B} + b_{UMD}\sigma_{i,UMD} \quad (3)$$

Panels A, B and C present the results for models (1), (2) and (3), respectively. There are 3 sets of test assets - the 25 size/book-to-market portfolios (SBV25); the combination of these with 38 industry portfolios (SBV25+IND38), and the combination of SBV25 with 30 characteristic portfolios (SBV25+E/P+CF/P+D/P). In each panel are reported the covariance risk prices and the associated Newey-West t-statistics (with 5 lags) arising from first stage GMM (first 2 rows) and second stage GMM (following 2 rows), where the standard errors are from system GMM I. b_{UMD} represent the covariance risk prices associated with the UMD factor. Test values (first row) and respective p-values (second row) for the asymptotic χ^2 test are presented for each GMM estimation. The sample is 1954:08-2003:12. Italic, underlined and bold numbers denote statistical significance at the 10%, 5% and 1% levels respectively. For further details, refer to Section V.

Panel A (unrestricted ICAPM)

b_{CF}	b_K	b_B	b_{UMD}	$\alpha'\Sigma^{-1}\alpha$
SBV25				
6.345	-2.253	9.520	-21.829	33.991
0.696	-0.439	0.776	**-2.863**	<u>0.036</u>
15.959	3.717	11.467	-0.570	25.649
<u>2.348</u>	0.972	1.311	-0.118	0.220
SBV25 + IND38				
5.091	-1.707	-9.159	-3.318	60.633
0.823	-0.463	-1.159	-0.882	0.249
4.889	-1.882	-4.216	1.049	65.040
1.347	-0.866	-0.901	0.537	0.144
SBV25+E/P+CF/P+D/P				
25.215	6.101	28.674	-10.453	34.473
3.686	1.443	**3.334**	<u>-2.240</u>	0.963
20.863	3.639	23.838	-4.460	42.987
5.469	*1.652*	**4.801**	<u>-2.296</u>	0.780

Panel B (DY)					
b_{CF}	b_{CFDY}	b_K	b_B	b_{UMD}	$\alpha'\Sigma^{-1}\alpha$
SBV25					
36.823	5417.602	10.507	48.072	17.003	21.699
3.880	**6.647**	2.018	**3.668**	**2.767**	0.357
35.380	3221.370	12.325	36.755	20.165	16.118
4.668	**5.263**	**2.989**	**3.593**	**4.365**	0.709
SBV25 + IND38					
5.600	1159.549	-1.346	-7.875	-2.255	61.138
0.899	2.349	-0.363	-0.983	-0.626	0.207
5.419	808.514	-1.560	-3.153	1.711	63.648
1.433	**3.205**	-0.702	-0.655	0.880	0.150
SBV25+E/P+CF/P+D/P					
21.430	2922.453	4.200	29.315	-5.111	37.834
3.195	**4.717**	0.992	**3.384**	-1.292	0.897
18.484	1657.116	2.454	23.986	-1.275	38.271
4.831	**5.059**	1.115	**4.746**	-0.697	0.887

Panel C (bond premia)					
b_{CF}	b_{CFB}	b_K	b_B	b_{UMD}	$\alpha'\Sigma^{-1}\alpha$
SBV25					
-4.319	-1810.367	-4.497	7.294	-18.036	36.763
-0.414	**-3.781**	-0.844	0.584	-2.540	0.012
13.246	-579.045	3.276	12.544	1.383	26.876
1.754	*-1.719*	0.831	1.347	0.293	0.139
SBV25 + IND38					
1.735	-380.512	-2.605	-11.318	-3.157	60.688
0.286	-1.046	-0.734	-1.459	-0.846	0.218
2.144	-316.897	-2.633	-6.023	1.024	64.569
0.554	*-1.898*	-1.192	-1.255	0.518	0.132
SBV25+E/P+CF/P+D/P					
18.138	-828.604	4.236	24.448	-11.316	35.472
2.600	-2.442	1.012	**2.821**	-2.367	0.940
17.192	-391.312	2.568	22.064	-4.906	42.964
4.406	*-1.957*	1.173	**4.293**	-2.491	0.749

Figure 1

Average pricing errors: 25 size/book-to-market portfolios

This figure presents the average pricing errors (stated in percentage points) across the book-to-market quintiles associated with the 25 size/book-to-market portfolios. Figure 1.A. presents the BBGB model in equation (18), the CAPM and 2 beta CAPM with unrestricted risk prices of equations (66) and (67), and the ICAPM I, II, III and IV corresponding to equations (22), (44) and (49). In figure 1.B. the ICAPM models are V, VI, VII, VIII and IX, corresponding to equations (54), (58), (60), (61) and (62), respectively. Figures 1.C. and 1.D. are the same as Figures 1.A. and 1.B. respectively, with the difference that the CAPM and 2 beta CAPM models, are those derived in equations (64) and (65) with restricted risk prices. ij denotes the portfolio with ith size and jth book-to-market quintiles. The sample is 1954:08-2003:12. For further details, refer to Section V.

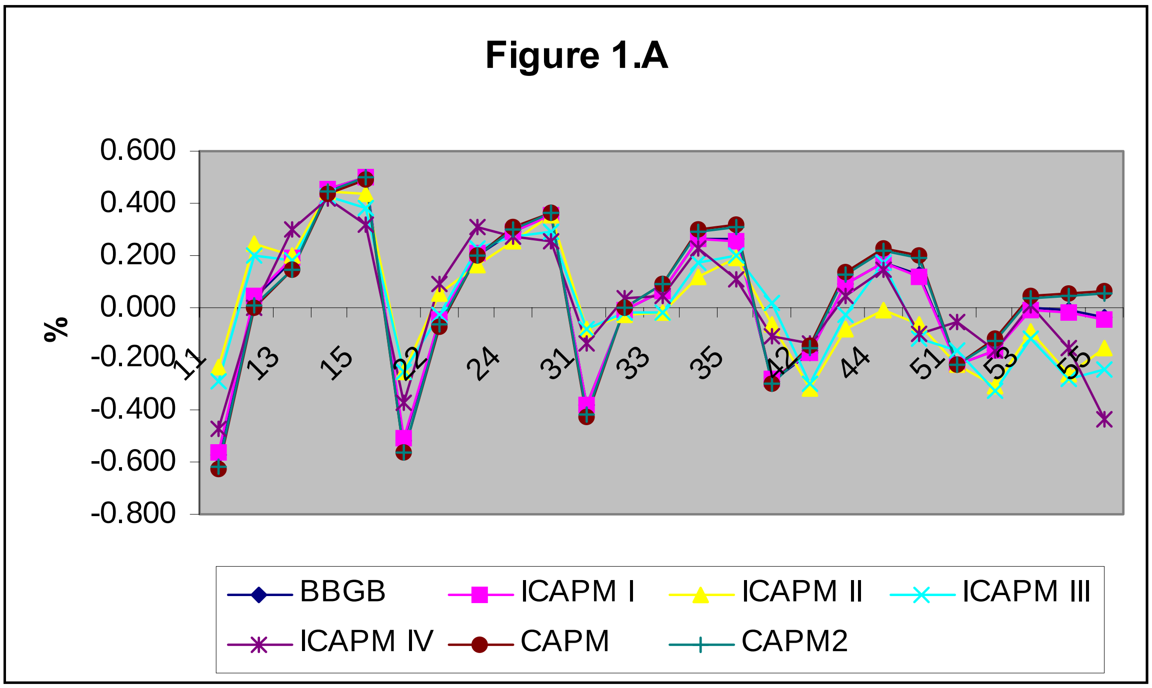


Figure 1.B

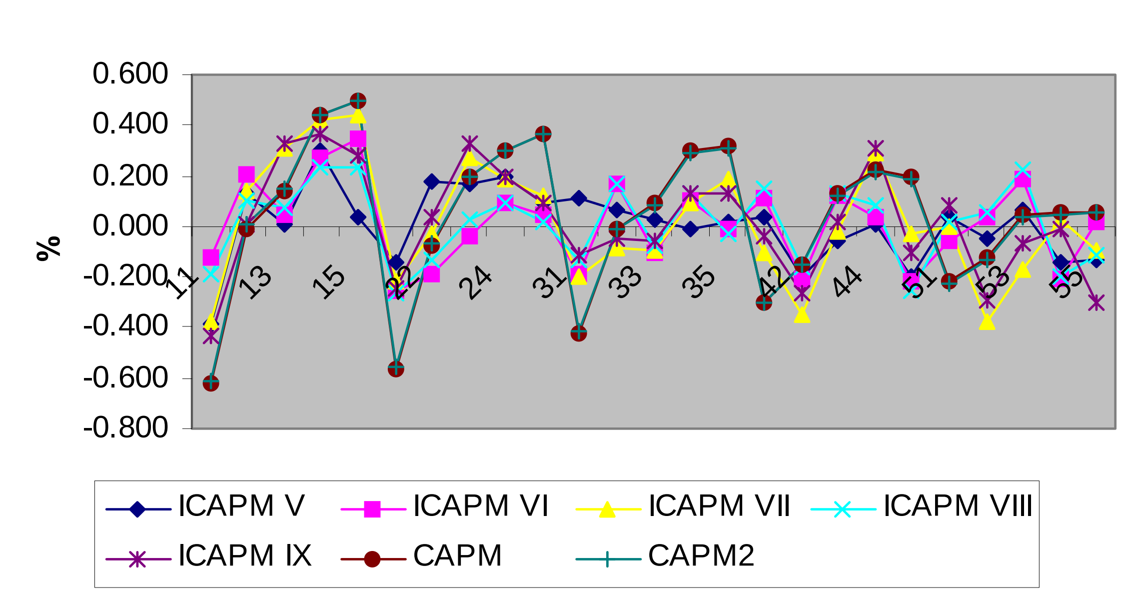
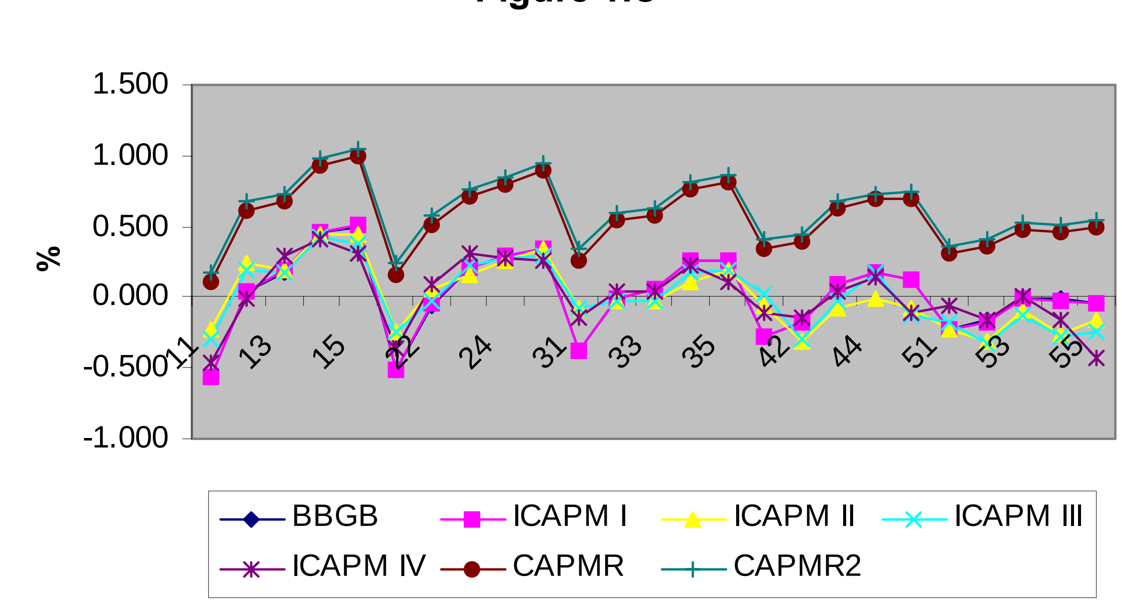


Figure 1.C



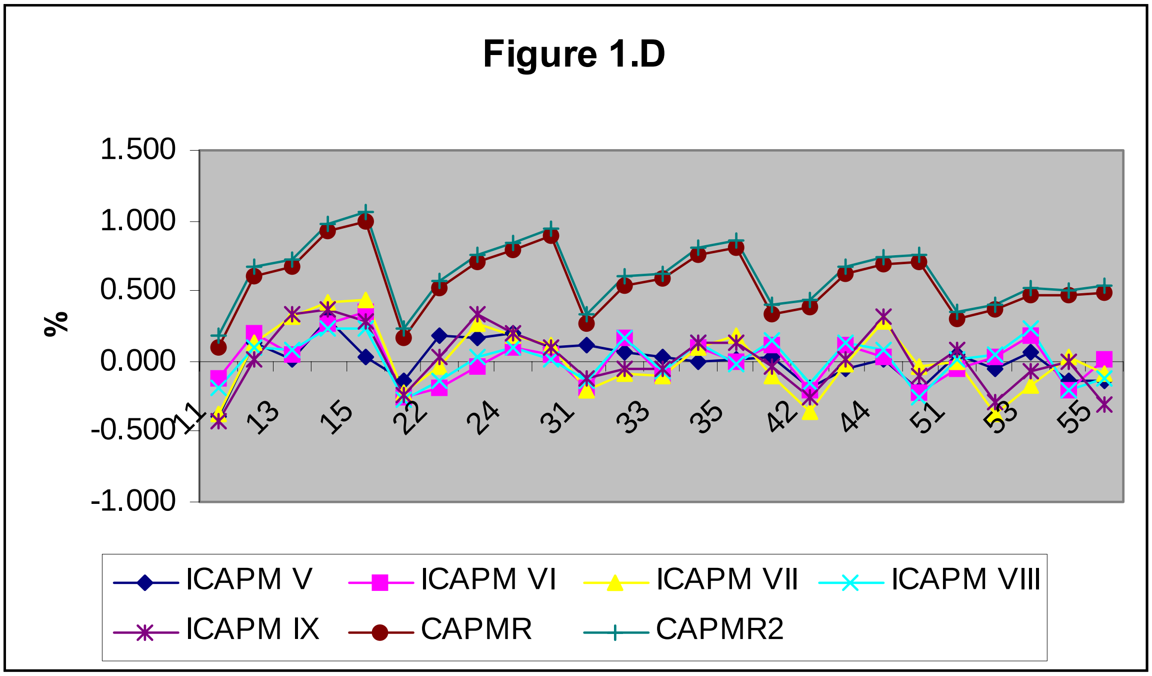


Figure 1.D
1.500
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ICAPM V
ICAPM VI
ICAPM VII
ICAPM VIII
ICAPM IX
CAPMR
CAPMR2