THE ROLE OF HUMAN CAPITAL IN EXPLAINING THE CROSS-SECTIONAL VARIATION OF FTSE 100 STOCK RETURNS

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ABSTRACT

In this paper the Standard CAPM, the Labour CAPM, the Conditional CAPM and the Conditional Labour CAPM were tested on FTSE 100 return data over the period 1984–2004. When human capital is incorporated into the market portfolio the CAPM is able to explain additional cross-sectional variation in FTSE 100 stock returns. More importantly, when the cross-sectional regression method is refined to incorporate information relating to the sign of the market realisation in the test period the relationship between beta and return is statistically significant.

INTRODUCTION

The Capital Asset Pricing Model (CAPM) developed by Sharpe (1964), Lintner (1965) and Mossin (1966) has been the dominating capital market equilibrium model since its inception. It continues to be widely used in practical portfolio management and in academic research. Its central implication is that the contribution of an asset to the variance of the market portfolio – the asset's systematic or beta risk – is the correct measure of the asset's risk and the only systematic determinant of the asset's return.

Empirically examining whether this model is a reasonable description of reality requires measuring the market return, that is, the return on the aggregate market portfolio of all assets in the economy. Since the market return is unobserved, empirical studies of the CAPM have made the convenient assumption that the relevant stock index return is a good proxy for the market return. Many of these empirical studies find little empirical support for the CAPM. For example, Fama and French (1992) find a flat relationship between expected return and beta in US stock returns, and conclude that stock characteristics are important predictors of cross-sectional returns beyond that of market beta. The two most prominent characteristics are the size and the book-to-market ratio of the company. Strong and Xu (1997) note similar findings for the UK.

The general reaction to the lack of empirical support for the Standard CAPM has been to focus on alternative asset pricing models, e.g. the Fama and French (1993) three-factor model. However, recent empirical research indicates that this may not be necessary and suggests that the lack of empirical support for the CAPM may just be due to the inappropriateness of the auxiliary assumptions made to facilitate empirical analysis of the model. For example, empirical studies of the CAPM show a more favourable picture when researchers use a broader definition of the market portfolio (e.g. Jagannathan and Wang, 1993; Jagannathan, Kubota and Takehara, 1998; Fletcher, 2002; Durack, Durand and Maller, 2004) or a conditional version of the model that controls for different realised risk premia in up and down markets (Pettengill, Sundaram and Mathur, 1995).

The purpose of this paper is to investigate the empirical performance of different versions of the CAPM for UK stock returns between January 1984 and December 2004. This examination includes the Standard CAPM with the FTSE 100 as the proxy for the market portfolio, a Labour CAPM that adds a proxy for human capital to the definition of the market portfolio (Jagannathan and Wang, 1993), and a Conditional CAPM which allows for a negative cross-sectional risk–return relationship in periods in which the market portfolio yields a negative return relative to the risk-free rate (Pettengill et al., 1995). Finally, an examination of a Conditional Labour CAPM is undertaken, which incorporates both the human capital proxy and the conditional relationship between beta and returns.

The remainder of the paper is organised as follows. The next section focuses on recent CAPM empirical developments that attempt to explain the anomalies highlighted by Fama and French (1992). Data and a sample description are provided in the third section. Sections four and five describe the research methods employed to empirically investigate the performance of different versions of the CAPM. The results of the empirical analysis are presented and analysed in the sixth section. The final section summarises and discusses the limitations of our research.

RECENT EMPIRICAL DEVELOPMENTS

The returns to human capital are a crucial part of an individual's capital holding and comprise much of the total aggregate wealth in the US and other economically advanced nations. The OECD (1996, p. 22) defines human capital as the 'knowledge that individuals acquire during their life and use to produce goods, services or ideas in market or non-market circumstances'. Becker (1993) observes that the investment in human capital that takes place, along with the resultant increase in scientific knowledge and technical skills, probably explains the twentieth century's sustained growth in per capita income in the US, Japan and many Western countries.

Becker (1993) also estimates the value of human capital to be at least four times as large as the value of stocks, bonds, housing and all other assets combined. Total national income in the UK in 2002 was £1,121,240 million (Bank and Smith, 2002). Of that amount, £672,744 million (60 per cent) was wages and salaries. Given that human capital forms the largest component of the national wealth portfolio, recent empirical research examines the empirical performance of the CAPM when the proxy for the market portfolio includes a proxy for labour income in addition to the stock market index. Following Mayers (1972), Jagannathan and Wang (1993) find that when human capital is included in measuring wealth the CAPM is able to explain 28 per cent of the cross-sectional variation in average returns on the portfolio used in the Fama and French (1992) study. Using Japanese data, Jagannathan et al. (1998) demonstrate that the Standard CAPM performs poorly. The relationship between average return and market betas is flat with an adjusted $\overline{R}^2$ of 2 per cent. However, when labour beta is included in addition to the stock index beta the performance of the CAPM improves remarkably. The $\overline{R}^2$ rises to 75 per cent. Fletcher (2002) examines the empirical performance of the CAPM in UK stock returns, using a stochastic discount framework. Fletcher (2002) finds that when the proxy for the market portfolio includes a proxy for labour income growth in addition to the stock market index, the performance of the CAPM improves. However, in contrast to previous studies, Durack et al. (2004), using Australian data, found that the inclusion of a proxy for human capital does not save the CAPM and beta remains insignificant.

Pettengill et al. (1995) argue that the cross-sectional second stage regression of the Fama and MacBeth (1973) test procedure may be the reason for the apparent independence of beta risk and realised returns documented by Fama and French (1992) and others. The key distinction between the Pettengill et al. (1995) tests and traditional tests is the recognition that the positive relationship between returns and beta predicted by the Standard CAPM is based on expected rather than realised returns. Pettengill et al. (1995) demonstrate that in periods where realised market returns fall below the risk-free rate, a negative relationship is predicted between realised returns and beta. When the expectations concerning negative market excess return are incorporated, Pettengill et al. (1995) find a consistent and significant relationship between beta and returns. The results for the US capital markets are supported by further international evidence. Fletcher (1997), Hodoshima, Garza-Gomez and Kunimura (2000) and Isakov (1999) obtain similar results for the British, the Japanese, the Hong Kong and the Swiss stock markets respectively. These results suggest that beta does have predictive power for the cross-section of returns.

In summary, while early empirical tests concluded in favour of the CAPM (e.g. Fama and MacBeth, 1973), subsequent studies provide evidence that is less than conclusive. Fama and French (1992) find a flat relationship between expected return and beta in US stock returns. Jagannathan and Wang (1993) believe that the rejection of the CAPM may be a direct result of failing to capture the true wealth portfolio, whereas Pettengill et al. (1995) argue that once the conditional relationship between beta and returns is incorporated the CAPM has significant explanatory power. The next section investigates the empirical performance of the Standard CAPM, the Labour CAPM, the Conditional CAPM and the Conditional Labour CAPM in UK stock returns between January 1984 and December 2004.

DATA AND SAMPLE DESCRIPTION

As there is a requirement for financial market information and labour market information, data are collected from two sources. All financial data are obtained from DataStream International. Labour market data are obtained from the UK National Statistics Office website. The stock market data used in the empirical analysis consist of monthly stock prices on shares listed on the FTSE 100. The index used to proxy the market is the FTSE 100 all share index. The risk-free rate is proxied by the UK one-month fixed inter-bank rate. As this is given as an annualised figure the monthly risk-free rate is calculated assuming that it was compounded on a monthly basis. Market value of common stock is calculated as the average market capitalisation of common equity stock series listed on the FTSE 100 for the period December 1984–January 2004 for every company.

Following Jagannathan and Wang (1993) in measuring the returns to human capital, it is assumed that the return on human capital is a linear function of the growth rate in per capita labour income. Monthly labour income from salaries and wages is taken from the monthly personal income numbers obtained from the UK National Statistics Office.

Data are collected from January 1984 to December 2004 inclusive, yielding 228 monthly observations. All companies listed on the FTSE 100 in 2004 were initially included in the sample. In order to combat survivorship biases firms delisted from the FTSE 100 in each year between 1984 and 2004 were identified and consequently added to the initial sample. This resulted in the addition of 207 companies. Obtaining yearly constituent lists for the FTSE 100 and investigating changes achieved this. Consequently, sample bias towards successful and financially strong companies has been mitigated to a reasonable extent.

The experimental design employed in this study also requires an additional constraint, in order to be included in the final sample. To be included in the sample, a company must have had uninterrupted stock price data for 30 months before the portfolio formation date. This condition is in line with the Fama and MacBeth (1973) methodology, which requires at least 30 to 48 consecutive monthly returns for estimating the stock index beta on individual companies. Also, to be included in the sample, a firm's market capitalisation information must be available for all years corresponding to the firm's portfolio formation period. This resulted in 81 firms being deleted. The sample therefore consists of a total number of 225 firms listed on the FTSE 100 for the study period 1984–2004.

PORTFOLIO ANALYSIS

It is common practice within the cross-sectional asset return literature to form portfolios and thus test a model's predictive ability on a group of stocks instead of individually. Two attributes, firm size and beta, are used in grouping stocks into portfolios. The approach of Fama and MacBeth (1973) is followed when forming portfolios. Monthly stock returns are calculated for each company for each month in the 20-year period, and stored in a company returns array. Similarly, monthly risk-free rates and market returns are calculated and stored in appropriate arrays. For the first time period t_1 (month 1 – month 60) all stock returns are examined. If a company had less than 30 continuous observations for this period it is automatically discarded and the beta and average return for this company for the time period are set to zero. For companies with 30 or more observations, Matlab code is written that estimates the beta, β_{it}^{vw} of that company for the period using equation 1, where R_{it}, R_{mt} and β_{it}^{vw} are as defined in Figure 1.

$$\beta_{it}^{vw} = \frac{Cov(R_{it}, R_{mt})}{Var(R_{mt})} \tag{1}$$

To calculate a labour beta, i.e. beta calculated from the growth in per capita income, the Matlab code was modified so that for each company *i* for each time period *t* a second beta, β_{it}^{l}, is calculated using equation 2.

$$\beta_{it}^{l} = \frac{Cov(R_{it}, R_{lt})}{Var(R_{lt})} \tag{2}$$

In order to form beta-sorted portfolios all companies that have both a zero beta and zero average return are removed. The remaining companies are organised in order of descending stock index betas. Portfolios containing either 10 or 11 companies are formed as follows: if there were q many companies with enough information for the period, form integer $(q/10)$ many portfolios. Once all the companies are sorted into portfolios, calculate the average beta and average return for each of the portfolios. This is done on an equal weighting basis.

To form size-sorted portfolios, an average market capitalisation for each company for the whole period and an overall market capitalisation for all companies combined is calculated. Companies are ranked as small, medium or large by comparing the average individual market value capitalisation for each company with the overall average market capitalisation for all companies combined. If the individual market capitalisation was less than 0.4 of the average it was termed 'small'. If the individual market capitalisation was above the average by more than 0.4 it was termed 'large'. If the individual market capitalisation was in between these two figures it was termed 'medium'. Due to the reduced size of the split data set (e.g. 103 small, 69 medium and 53 large companies), smaller portfolios are formed in order to ensure that a good cross-section is obtained.

METHODOLGY

The cross-sectional regressional analysis (CSR) follows the methodological framework of Fama and MacBeth (1973). The CSR is run to test the Standard CAPM, where the dependent variable is the portfolio returns and the independent variable is the portfolio stock index beta. Figure 1 presents the regression model to be tested.

An inherent problem in the empirical specification of the Standard CAPM is the assumption that R_{vwt} is a good proxy for market return. It was demonstrated earlier that the return to human capital forms the largest component of the UK's national wealth portfolio. To investigate this issue the assumption that R_{vwt} is a good proxy for the true return on the market portfolio is relaxed and the theory that the inclusion of a labour beta (a proxy for human capital) will improve the performance of the CAPM is examined. If R_{lt} were the growth in average earnings, which proxies for the return on human capital, then the true market return would be a linear function of R_{vwt} and R_{lt}. With labour income built into the CAPM the asset pricing model is outlined in Figure 2.

In order to test the assumption that beta and portfolio returns have a negative relationship on months of negative market excess returns, the market data are split in two distinct data sets: up-months and down-months, i.e. months where the market return is greater than and less than the risk-free rate respectively. This distinction between positive and negative market excess returns is crucial in defining the new model outlined in Figure 3.

An average return and an average stock index beta and labour beta based on the up-months only is calculated. Similarly an average return and an average

FIGURE 1: THE STANDARD CAPM

$$R_{it} = \gamma_O + \gamma_1 \beta_{it} + \varepsilon_{it}$$

where

R_{it} = the return on portfolio *i* in time period *t*

$\beta_{it} = Cov(R_{it}, R_{mt}) / Var(R_{mt})$

R_{mt} = the return on the proxy for the market index portfolio in time period *t*

ε_{it} = error term

Under the assumption that R_{vwt} (the value-weighted portfolio of all stocks traded on FTSE 100) is a good market proxy, the empirical specifications of CAPM becomes:

$$R_{it} = \gamma_o + \gamma_1 \beta_{it}^{vw} + \varepsilon_{it}$$

where

$\beta_{it}^{vw} = Cov(R_{it}, R_{vwt}) / Var(R_{vwt})$

FIGURE 2: THE LABOUR CAPM

$$R_{it} = \gamma_0 + \gamma_1 \beta_{it}^{vw} + \gamma_2 \beta_{it}^{l} + \varepsilon_{it}$$

where

R_{it} = return on portfolio *i* in time period *t*

$\beta_{it}^{vw} = Cov(R_{it}.R_{vwt}) / Var(R_{vwt})$

R_{vwt} = return on the value-weighted market proxy in time period *t*

$\beta_{it}^{l} = Cov(R_{it}, R_{lt}) / Var(R_{lt})$

R_{lt} = return in per capital labour income in time period *t*

FIGURE 3: THE CONDITIONAL CAPM

$$R_{it} = \gamma_0 + \delta\gamma_1\beta_{it}^{vw} + (1-\delta)\gamma_2\beta_{it}^{vw} + \varepsilon_{it}$$

where:

$$\delta = 0 \ \text{if} \ (R_{mt} - R_{ft}) < 0$$

$$\delta = 1 \ \text{if} \ (R_{mt} - R_{ft}) > 0$$

FIGURE 4: THE CONDITIONAL LABOUR CAPM

$$R_{it} = \gamma_0 + \delta\gamma_1\beta_{it}^{vw} + \delta\gamma_2\beta_{it}^{l} + (1-\delta)\gamma_3\beta_{it}^{vw} + (1-\delta)\gamma_4\beta_{it}^{l} + \varepsilon_{it}$$

where:

$$\delta = 0 \ \text{if} \ (R_{mt} - R_{ft}) < 0$$

$$\delta = 1 \ \text{if} \ (R_{mt} - R_{ft}) > 0$$

stock index beta and labour beta based on the down-months is also calculated. Thus, twice as many matrices for the testing process are formed.

The final version of CAPM to be tested is the Conditional Labour CAPM. The lack of empirical support for the CAPM is associated with the auxiliary assumptions made in order to facilitate its empirical analysis. In order to implement the CAPM, for practical purposes it is commonly assumed that the return to the value-weighted stock exchange is a reasonable proxy for the return on the market portfolio of all assets. The Conditional Labour CAPM allows the market portfolio to be expanded to include human capital, which forms the largest component of the national wealth portfolio (Becker, 1993). Furthermore, by analysing monthly returns with positive and negative market premia, it allows the hypothesis of a relationship between beta and return to be tested independently of the hypothesis of a positive market risk premia in the sample period. In summary, the Conditional Labour CAPM allows risk and return to be empirically tested under more rational assumptions. Formally, the model can be defined by Figure 4.

RESULTS

In order to compare the relative performance of the different variants Table 1 is presented. The results for the Standard CAPM, the Labour CAPM, the Conditional CAPM and the Conditional Labour CAPM are reported in Panels A, B, C and D respectively. Results for four sets of regressions are reported:

- Beta-sorted portfolios (P_β)
- Small portfolios (P_s)
- Medium portfolios (P_m)
- Large portfolios (P_l)

TABLE 1: EVALUATION OF VARIOUS CAPITAL ASSET PRICING MODELS SPECIFICATIONS

Coefficient			$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{R}^2$
Panel A: Standard CAPM	$H_0 : E[\gamma_0] = 0$	P_β	0.0060*** (3.12)	0.0029 (1.38)	—	0.2839
$R_{it} = \gamma_O + \gamma_1 \beta^{vw}{}_{it} + \varepsilon_{it}$	$H_0 : E[\gamma_1] = E[R_{mt}] - E[R_{Ft}] > 0$	P_s	0.0073* (1.83)	0.0007 (0.14)	—	0.1457
		P_m	0.0064* (1.78)	0.0016 (0.39)	—	0.3237
		P_l	0.0008 (0.37)	0.0081 (1.43)	—	0.3284
Panel B: Labour CAPM	$H_0 : E[\gamma_0] = 0$	P_β	0.057*** (2.77)	0.0010 (0.64)	–0.0005 (0.35)	0.3568
$R_{it} = \gamma_0 + \gamma_1 \beta_{it}^{vw} + \gamma_2 \beta_{it}^{l} + \varepsilon_{it}$	$H_0 : E[\gamma_1] = E[R_{mt}] - E[R_{Ft}] > 0$	P_s	0.0070* (1.73)	0.0017 (0.36)	–0.0007 (–0.29)	0.2878
	$H_0 : E[\gamma_2] \neq 0$	P_m	0.0068 (1.81)	0.0017 (0.43)	–0.2956 (–0.01)	0.5040
		P_l	0.0019 (0.59)	0.0058 (1.07)	–0.0005 (–0.48)	0.5070
Panel C: Conditional CAPM	**Up-months**	P_β	0.0213*** (7.41)	0.0167*** (6.44)	—	0.7939
$R_{it} = \gamma_0 + \delta\gamma_1 \beta_{it}^{vw} + (1-\delta)\gamma_2 \beta_{it}^{vw} + \varepsilon_{it}$	$H_0 : E[\gamma_0] = 0$	P_s	0.0344*** (4.19)	0.0047 (0.58)	—	0.1744
	$H_0 : E[\gamma_1] > 0$	P_m	0.0231*** (2.862)	0.1840*** (1.89)	—	0.4058
		P_l	0.0275*** (2.57)	0.0116 (1.23)	—	0.344

TABLE 1: CONTINUED

Coefficient			$\bar{\gamma}_0$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$\bar{R}^2$
	Down-months	P_β	–0.0077** (–2.19)	—	–0.0157*** (–4.76)	0.5770
	$H_0: E[\gamma_0] = 0$	P_s	–0.0197 (–1.13)	—	–0.0070 (–0.83)	0.2310
	$H_0: E[\gamma_2] > 0$	P_m	–0.0159 (–1.42)	—	–0.0124 (–1.14)	0.3488
		P_l	–0.0265*** (–2.63)	—	–0.0020 (–0.08)	0.3314
Coefficient			$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_2$	$\bar{R}^2$
Panel D: Conditional Labour CAPM	**Up-months**	P_β	0.0214*** (6.86)	0.0161*** (4.48)	0.0007	0.8147
$R_{it} = \gamma_0 + \delta\gamma_1\beta_{it}^{vw} + \delta\gamma_2\beta_{it}^{l} + (1-\delta)\gamma_3\beta_{it}^{vw} + (1-\delta)\gamma_4\beta_{it}^{l} + \varepsilon_{it}$	$H_0: E[\gamma_0] = 0$	P_s	0.0322*** (3.32)	0.0049 (0.456)	0.0002	0.3397
	$H_0: E[\gamma_1] > 0$	P_m	0.0202*** (2.91)	0.0167* (1.88)	–0.0008	0.6034
	$H_o: E[\gamma_2] \neq 0$	P_l	0.0283*** (2.39)	0.0100 (1.09)	0.0011	0.5501

TABLE 1: CONTINUED

Coefficient			$\bar{\gamma}_0$	$\bar{\gamma}_3$	$\bar{\gamma}_4$	$\bar{R}^2$
Panel D: Conditional Labour CAPM	**Down-months**	P_β	–0.0057**	–0.0114***	–0.0040	0.7337
			(–2.22)	(–4.26)	(–0.26)	
	$H_0 : E[\gamma_0] = 0$	P_s	–0.0037**	–0.0174***	–0.0010	0.8351
			(–1.65)	(–5.80)	(–0.61)	
	$H_0 : E[\gamma_3] > 0$	P_m	–0.0036***	–0.0195***	–0.0006	0.8586
			(–4.43)	(–9.27)	(–0.69)	
	$H_o : E[\gamma_4] \neq 0$	P_l	–0.0037***	–0.0203***	–0.0009	0.8748
			(–2.72)	(–7.35)	(1.07)	

The t-values (in parentheses) are equal to the mean value of the coefficient divided by its standard deviation. This tests whether the coefficient value is significantly different from zero

*Indicates statistical significance at the 10% level

**Indicates statistical significance at the 5% level

***Indicates statistical significance at the 1% level

The results for the Standard CAPM (with the FTSE 100 as the proxy for the market portfolio) indicate a lack of significance for the $\bar{\gamma}_1$ slope coefficient, which suggests that stock index beta is not a good predictor of portfolio return. Although the $\bar{\gamma}_1$ coefficients are of the correct sign the associated *t*-statistics are very low. Another feature of the results is the significance of the intercept terms, $\bar{\gamma}_0$, for three of the four regressions. This further suggests that the beta is not capable of explaining the cross-section of portfolio returns. The $\overline{R}^2$ statistics range from 0.1457 for small portfolios to 0.3281 for large portfolios.

The Labour CAPM (adding a proxy for human capital to the definition of the market portfolio) does not improve the performance of the model. The results indicate that labour beta is statistically insignificant and does not impact on the cross-sectional variation of stock returns. The stock index beta coefficients, $\bar{\gamma}_1$, are of the correct sign but are not statistically different from zero. The labour beta coefficients, $\bar{\gamma}_2$, are negative without exception but statistically insignificant, while the intercept terms, $\bar{\gamma}_0$, are significant for three of the four regressions. All of this suggests that the Labour CAPM fails to improve on the performance of the Standard CAPM. These results are consistent with the extant literature. Durack et al. (2004), using Australian data, also found that labour beta is an insignificant factor in explaining the average excess returns. As one would expect, the $\overline{R}^2$ statistics have risen.

Table 2 presents comparative adjusted $\overline{R}^2$ statistics. The $\overline{R}^2$ statistics improve for the Labour CAPM but this should be interpreted with caution given the lack of significance in the regression slope coefficients.

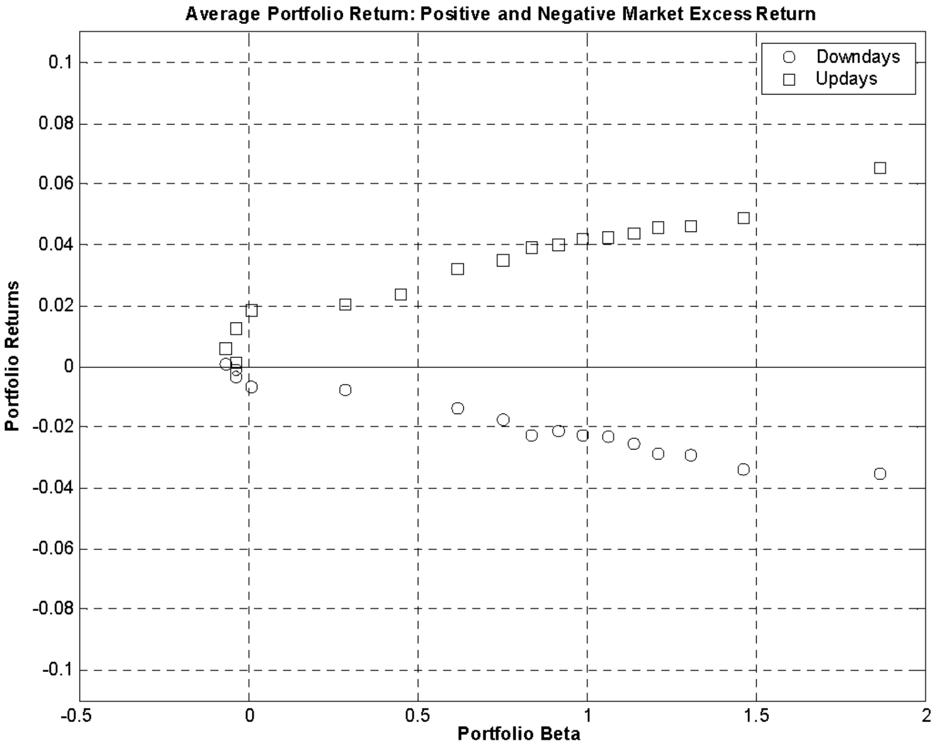
Clearly, the empirical performance of the two models examined is poor. Neither stock index beta nor labour beta is significant in explaining the cross-section of portfolio returns. Furthermore, the regressions feature significant intercept terms, further evidence to reject the model.

The Conditional CAPM (which allows for a negative cross-sectional risk–return relationship) shows improved results. The results provide support for a systematic but conditional relationship between stock index beta and realised returns. For up-months two of the regressions – P_B and P_m – have significant $\bar{\gamma}_1$ terms that are of correct sign. However the intercept terms for all regressions are highly significant, suggesting other factors for the explanation of portfolio returns. The results for down-months show a significant slope coefficient for P_B regressions only. It is negative and of similar magnitude to the $\bar{\gamma}_1$ coefficient for up-month regressions. The intercept terms are significant for the P_B and P_s regressions. Both sets of regressions are characterised by relatively high $\overline{R}^2$ statistics (particularly

TABLE 2: COMPARSION OF STANDARD CAPM AND LABOUR CAPM

Portfolio	Standard CAPM	Labour CAPM	Gain in Precision
P_β	28.39%	35.68%	7.29%
P_s	14.57%	28.78%	14.21%
P_m	32.37%	50.40%	18.03%
P_l	32.84%	50.70%	17.86%

FIGURE 5: PORTFOLIO ANALYSIS – POSITIVE AND NEGACTIVE MARKET EXCESS RETURNS



the regressions). Figure 5 shows why the results for the conditional regression are 'better' than the standard regressions.

Results for the Conditional Labour CAPM (which incorporates both a proxy for human capital and the conditional relationship between beta and returns) are mixed. The results confirm a consistent and significant relationship between stock index beta and returns. However, labour beta remains statistically insignificant across all size portfolios and in both up and down markets.

Our findings are consistent with previous empirical research for the Standard CAPM. It is found that there is little empirical support for the Standard CAPM, which assumes that the relevant stock market index is the market return. The relationship between average returns and beta is flat – which is similar to the results reported in the literature by studies using US, Japanese, UK and Australian data.

In contrast to the extant literature (e.g. Jagannathan and Wang, 1993; Jagannathan et al., 1998), the Labour CAPM does not perform well. Including labour beta in the Standard CAPM specification does little to improve the performance of the CAPM. Consistent with the findings of Durack et al. (2004), we do not 'save' the stock index beta through the inclusion of a proxy for the return to human capital. With respect to the Conditional CAPM our results are broadly in line with those of Pettengill et al. (1995) for US markets. The beta coefficient is significantly positive for up-months and is significantly negative on down-months. Furthermore, the coefficients are of similar magnitude.

Finally, the Conditional Labour CAPM has not been considered in the literature. To the best of the authors' knowledge this is the first study to simultaneously investigate the performance of the CAPM when both the conditional relationship between beta and returns is recognised and when the market portfolio includes a proxy for human capital. The results show that the relationship between stock index beta and return remains statistically significant. However, conditioning on the market realisation does not improve the significance of the labour beta.

SUMMARY AND CONCLUSIONS

> In a way it (capital asset pricing model) reminds us of cartoon characters like Wile E. Coyote who have the ability to come back to original shape after being blown to pieces or hammered out of shape (Jagannathan and Wang, 1993, p. 4).

While the evidence against the CAPM presented by, amongst others, Fama and French (1992) is imposing, it is not sufficient to conclude that the CAPM does not provide a useful framework for explaining the cross-sectional variation of asset returns. This study explores whether the lack of empirical support for the CAPM may be due to the inappropriateness of the auxiliary assumptions made to facilitate the empirical analysis of the CAPM. In empirical studies of the CAPM it is generally assumed that the return on the aggregate wealth portfolio is a linear function of the return on some portfolio of actively traded stocks. Following Mayers (1972), it is argued that it is important to include human capital when empirically examining the CAPM.

It has also been noted that the Fama and MacBeth (1973) two-pass test procedure is a joint test of the hypothesis, that there is a linear relationship between beta and realised returns and that the market risk premium is positive. Following Pettengill et al. (1995), it is recognised that the positive relationship between beta and returns predicted by the Standard CAPM is based on expected rather than realised returns. In order to test the assumption that beta and returns should have a negative relationship on months of negative market excess returns, the market data were split in two distinct sets: up-months and down-months.

There are three main findings. Firstly, the Standard CAPM performs poorly in empirical tests. It is characterised by a significant intercept term and an insignificant beta term. Secondly, the addition of a human capital to improve the market proxy does not result in significant improvements in explaining the cross-section of FTSE 100 equity returns. Finally, the Pettengill et al. (1995) analysis results in significant beta coefficients in some cases and improved $\overline{R}^2$ statistics.

The research has a number of limitations that can be addressed in future work. The proxy for human capital – labour income growth – is not necessarily a good proxy and has been referred to as 'ad hoc' in the literature. The proxy is limited for several reasons. For example, it does not take account of the capital gains of the stock of human capital, it assumes that labour supply is exogenous and it ignores the skills premia and the role of worker experience. Clearly a better proxy for human capital would be preferable to include in future empirical tests of the Labour CAPM. Furthermore, the proxy used was seasonally adjusted, which would have lessened its variability and mitigated its contribution to the analysis.

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