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The Spirit of Capitalism, Asset Returns, and the Business Cycle

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Abstract

We evaluate whether the spirit of capitalism improves the ability of real business cycle (RBC) models to explain the main features of both asset returns and business cycles. In our model, the spirit of capitalism is embodied in the assumption that individuals have direct preferences for financial wealth. Our simulation results suggest that this assumption improves the RBC model's ability to explain the features of asset returns. This assumption, however, markedly deteriorates the model's ability to account for the features of the business cycle.

JEL Classification Codes: Equity premium; Direct preferences for wealth.
Keywords: G12, E32

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1. Introduction

A number of recent papers jointly study the asset return and business cycle implications of production economies. Notable examples include Boldrin, Christiano, and Fisher (2001), Jermann (1998), Lettau (2003), Rouwenhorst (1995), and Tallarini (2000). These papers conclude that the standard model of production economies, the real business cycle (RBC) model, adequately replicates the main features of the business cycle, but seriously fails to replicate the main features of asset returns. In particular, the RBC model does not explain the presence of a much larger average return on the stock market than on Treasury bills, the equity premium puzzle, nor does it explain the low average return on Treasury bills, the risk-free rate puzzle.

The standard solution to these puzzles is to add habit formation to the RBC model (see Boldrin, Christiano, and Fisher 2001 and Jermann 1998). In this paper, we evaluate a different mechanism to solve the puzzles. This mechanism is based on the idea that the acquisition of wealth is driven not only by a consumption motive, but also by an intrinsic wealth accumulation motive. In particular, we assume that individuals have direct preferences for wealth. This assumption is motivated by the fact that individuals care about their societal status, and that higher levels of wealth signal higher status. Individuals then accumulate wealth for future consumption (the consumption motive) and to raise their status (the wealth accumulation motive). Obviously, the wealth accumulation motive has important implications for the behavior of savings. The resulting behavior also has implications for the demand and pricing of assets and for economic growth.

There is a rapidly growing literature on the intrinsic wealth accumulation motive. Bakshi and Chen (1996) and Zou (1995) argue that this motive embodies the spirit of capitalism. In the literature, several studies argue that this motive helps understanding the behavior of savings and asset pricing.[1] Among these studies, Zou (1995) argues that it solves the savings puzzle. That is, the accumulation motive explains why wealth increases with age, why individuals do not reduce their wealth after retirement, and why households with and without children have not shown significant differences in their savings behavior. Luo, Smith, and Zou (2002) argue that the motive solves the excess sensitivity and excess smoothness puzzles. That is, it explains why consumption reacts too much to expected changes in income, but not enough to unexpected changes. More directly related to our study are the papers by Bakshi and Chen (1996) and Gong and Zou (2002) who argue that the wealth accumulation motive explains volatile stock prices and may solve the equity premium puzzle. Kuznits (2001) argues that it also solves the risk-free rate puzzle.

Our paper proceeds as follows. Section 2 reviews the one-sector production economies studied in Boldrin, Christiano, and Fisher (2001) and Jermann (1998). These studies offer a good benchmark to compare our results. For this review, we construct simulated statistics for asset returns and the business cycle using two models, and compare these statistics to those obtained in historical data. The first model is a standard RBC model. It depicts a competitive economy with a representative consumer and a firm. In this artificial economy, goods are produced using capital and labor. As in previous studies, we find that the standard RBC model fails to replicate the main features of asset returns, but replicates the main features of the business cycle. In particular it fails to explain the risk-free rate puzzle and the equity premium puzzle.

The second model adds habit formation, labor market restrictions, and adjustment costs to capital to the standard RBC model. As discussed in Boldrin, Christiano, and Fisher (2001), the addition of habit formation is necessary to force consumers to care about

[1] The literature includes papers on savings and consumption (Luo, Smith, and Zou 2002, Luo and Young 2003, Zou 1995, and Yang and Zou 2003), on economic growth (Clemens 2003, Corneo and Jeanne 1997 and 2001, Futagami and Shibata 1998, Smith 1999, Zou 1994, and Yang and Zou 2003), on asset pricing (Bakshi and Chen 1996, Gong and Zou 2002, Evans, Joseph, Kenc 2003, Kuznits 2001, Smith 2001, and Yang and Zou 2003), and even on the current account (Fisher 2004 and Fisher and Hof 2004).

risk. Also, the labor market restrictions and adjustment costs to capital are necessary to allow variations in capital gains. We find that the Habit model fails to replicate the main features of the business cycle, but replicates the features of asset returns. In particular, the model counterfactually predicts that output is negatively autocorrelated.

Section 3 reports our results with the Spirit of Capitalism framework. Our model retains the labor market restrictions and adjustment costs of the habit formation model, but replaces habit formation by the absolute wealth is status preferences of Bakshi and Chen (1998). We adopt this version because it is the only one subjected to an empirical investigation in Bakshi and Chen (1998). We find that the spirit of capitalism model produces low risk-free rate, and may thus resolve the risk-free rate puzzle. The model produces reasonable volatilities for both risk-free and risky rates, but fails to produce a sizeable risk premium. Admittedly, the risk-premium is much larger than that produced by the RBC model. Thus, in contrast to conjectures in Bakshi and Chen (1998) and in Gong and Zou (2002), the spirit of capitalism model does not resolve the equity premium puzzle. When we were nearing the completion of our paper, we found a paper by Kuznits (2001) that studies a variant of these preferences for an endowment economy. His conclusion parallels ours: the spirit of capitalism may resolve the risk-free rate puzzle, but not the equity premium puzzle. We also find that the Spirit of Capitalism model counterfactually predicts a large volatility of consumption, a low volatility of investment, and negative autocorrelations for output.

Section 4 concludes. Overall, our analysis suggests that the spirit of capitalism improves the ability of the standard RBC model to explain volatile asset prices and the asset return puzzles. Unfortunately, it also suggests that the spirit of capitalism does not explain the observed risk premium or the main features of the business cycle.

2. Production Economies with Habit Formation

The real business cycle (RBC) and habit formation (Habit) economies are similar to those in Boldrin, Christiano, and Fisher (2001). Although we are interested in asset prices, the allocation for these economies can be found as the solution to a planner's problem. This allocation is then used to uncover the required asset prices.

2.1 The Economic Environment

The planner chooses consumption, employment, and investment to maximize consumers' expected lifetime utility

$$E_0\left[\sum_{t=0}^{\infty}\beta^t\big[u(c_t-\psi c_{t-1})-\theta n_t\big],\right] \tag{2.1}$$

subject to

$$y_t = c_t + x_t, \tag{2.2}$$

$$y_t = z_t k_t^{\alpha} n_t^{1-\alpha}, \tag{2.3}$$

$$k_{t+1} = \phi\left(\frac{x_t}{k_t}\right)k_t + (1-\delta)k_t, \tag{2.4}$$

$$\ln(z_t) = (1-\rho)\ln(\bar{z}) + \rho\ln(z_{t-1}) + \epsilon_t, \tag{2.5}$$

where E_t is the conditional expectation operator, c_t is consumption, n_t is employment, x_t is investment, y_t is output, k_t is the stock of capital, and z_t is the stochastic level of total factor productivity. The parameter $0 < \beta < 1$ is the consumer's subjective discount factor, $\psi \geq 0$ is the measure of habit formation, $\theta > 0$ is the measure of disutility from working, $0 < \alpha < 1$ is the share of capital, $0 < \delta < 1$ is the rate of depreciation, and $0 < \rho < 1$ is the persistence of total factor productivity. Finally, ϵ_t is an independently and identically distributed normal random variable with mean 0 and variance σ^2.

The planner's objective is displayed in equation (2.1). The constraints are shown in equations (2.2) to (2.5). They show the economy's aggregate resource constraint, production technology, capital accumulation, and stochastic process for total factor productivity.

The period utility is linear in employment as in the indivisible labor model of Hansen (1985). In the RBC model, employment is chosen after realization of the productivity shock. In the Habit model, however, employment is chosen before the realization of the productivity shock. That is, as in Boldrin, Christiano, and Fisher (2001), the choice of n_t is conditioned on the information set that includes only past variables. Finally, the functional form for $u(c_t - \psi c_{t-1})$ is

$$u(c_t - \psi c_{t-1}) = (c_t - \psi c_{t-1})^{1-\gamma}/(1-\gamma),$$

where the parameter $\gamma \geq 1$ is the coefficient of relative risk aversion. Note that, for the RBC model, we set $\psi = 0$ to eliminate any habit formation. For the habit model, we set $\psi > 0$.

Capital accumulation is costly. The adjustment cost function $\phi(x_t/k_t)$ is

$$\phi\left(\frac{x_t}{k_t}\right) = \frac{\omega_1}{1-1/\xi}\left(\frac{x_t}{k_t}\right)^{1-1/\xi} + \omega_2.$$

The parameter $\xi > 0$ is the elasticity of investment with respect to Tobin's q. The RBC model uses the standard no-adjustment cost version, which is obtained when $\xi \to \infty$.

The first-order conditions of the planner's problem for the RBC model are

$$\lambda_t = u'(c_t - \psi c_{t-1}) - \psi\beta E_t\Big[u'(c_{t+1} - \psi c_t)\Big], \tag{2.6}$$

$$\theta = \lambda_t(1-\alpha)y_t/n_t, \tag{2.7}$$

$$\mu_t = \beta E_t\left[\frac{\lambda_{t+1}}{\lambda_t}\left(\alpha\frac{y_{t+1}}{k_{t+1}} + \mu_{t+1}\left[\phi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \phi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} + (1-\delta)\right]\right)\right], \tag{2.8}$$

where λ_t is the multiplier associated with the aggregate resource constraint (2.2), $u'(c_t - \psi c_{t-1})$ is the derivative of the subutility function with respect to its argument, $\mu_t = 1/\phi'(x_t/k_t)$, and $\phi'(x_t/k_t)$ is the derivative of the adjustment cost function with respect to its argument. The Habit model yields similar first-order conditions, except that the labor market condition (2.7) becomes

$$\theta = E_t\Big[\lambda_{t+1}(1-\alpha)y_{t+1}/n_{t+1}\Big]. \tag{2.7$'$}$$

The constraints (2.2)–(2.5) and the conditions (2.6)–(2.8) can be used to uncover the economy's allocation. This allocation can then be used to uncover asset prices. For asset prices, we follow Boldrin, Christiano, and Fisher (2001), and assume that investment is fully equity financed and define the risky return as the return on capital:

$$R_{t+1}^{k} = \Big(\alpha y_{t+1}/k_{t+1} + p_{0,t+1}^{k}\Big)/p_{1,t}^{k}, \tag{2.9}$$

where

$$p_{0,t+1}^{k} = \mu_{t+1}\left[\phi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \phi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} + (1-\delta)\right], \tag{2.10}$$

$$p_{1,t}^{k} = \mu_t. \tag{2.11}$$

The price $p_{1,t}^{k}$ is the value of a unit of capital to be used in production at period $t+1$ and the price $p_{0,t+1}^{k}$ is the value of that same unit after production. Also, we define the risk-free return as the return on a one-period bond:

$$R_t^f = \beta^{-1}\lambda_t/E_t\Big[\lambda_{t+1}\Big]. \tag{2.12}$$

Finally, in each case, we report results for annualized percentage returns. That is, we define $r_t^k = 100[(R_t^k)^4 - 1]$ and $r_t^f = 100[(R_t^f)^4 - 1]$.

2.2 Simulation Method

The asset pricing and business cycle implications of the above economic environment are analyzed using simulations. The simulation method is similar to that in Jermann (1998). The method combines the log-linear approximation of King, Plosser, and Rebelo (2002) to solve for quantities with a log-normal approximation to solve for the risk-free return.

The method works as follows. First, as in Jermann (1998), we employ the log-linear approximation to 1000 time-series of 200 periods each for consumption, investment, capital, employment, and output. These series are then used to construct the risky return using

(2.11). The series are also used to construct the risk-free return. To do so, we rewrite the risk-free return as

$$R_t^f = \beta^{-1}\exp(\widehat{\lambda}_t)/E_t\left[\exp(\widehat{\lambda}_{t+1})\right], \tag{2.13}$$

where $\widehat{\lambda}_t = \ln(\lambda_t/\lambda)$ and λ is the deterministic steady state value of λ_t. Then, we use a log-normal approximation to the expectational term in (2.13):

$$E_t\left[\exp(\widehat{\lambda}_{t+1})\right] = \exp\left(E_t\left[\widehat{\lambda}_{t+1}\right] + (1/2)E_t\left[\left(\widehat{\lambda}_{t+1} - E_t[\widehat{\lambda}_{t+1}]\right)^2\right]\right). \tag{2.14}$$

The above method requires numerical values for all parameters. To ease comparison, we base our values on Boldrin, Christiano, and Fisher (2001) and Jermann (1998). Boldrin, Christiano, and Fisher (2001) set $\beta = 0.99999$, $\gamma = 1$, $\theta = 1$, $\alpha = 0.36$, $\delta = 0.021$, $\xi = 0.23$, $\psi = 0.90$, $\rho = 1$, and $\sigma = 0.018$. Jermann (1998) sets $\beta = 0.99$, $\gamma = 5$, $\theta = 0$, $\alpha = 0.36$, $\delta = 0.025$, $\xi = 0.23$, $\psi = 0.82$, and $\rho = 0.99$. He also selects σ to ensure that the volatility of output growth is 1 percent.

For the RBC model, we set $\beta = 0.99$, $\gamma = 2$, $\alpha = 0.36$, and $\delta = 0.021$. We remove any investment adjustment costs (i.e. we let $\xi \to \infty$, $\omega_1 = 1$, and $\omega_2 = 0$) and habit persistence ($\psi = 0$). We let employment be chosen after realization of the shocks and set θ to ensure that employment $n = 1$ in the steady state. Finally, we set $\rho = 0.979$ and $\sigma = 0.0072$ as in King and Rebelo (2000).

For the Habit model, we retain $\gamma = 2$, $\alpha = 0.36$, $\delta = 0.021$, $\rho = 0.979$, and $\sigma = 0.0072$, but set $\beta = 0.99999$ to lower the risk free rate. In addition, we set $\xi = 0.23$ and $\psi = 0.90$ to allow adjustment costs and habit formation. We impose the restricted labor market assumption and set θ to ensure that employment $n = 1$ in the steady state. Finally, we set ω_1 and ω_2 to ensure that $\phi(\delta) = \delta$ and $\phi'(\delta) = 1$.

2.3 Simulation Results

Tables 1 and 2 report financial and business cycle statistics. The tables report historical statistics for United States data as well as statistics for simulated data.

The data statistics come from two sources. The financial statistics are those shown in Boldrin, Christiano, and Fisher (2001) and are estimates taken from Cecchetti, Lam, and Mark (1993). In particular, the mean annual risk-free rate is $E(r^f) = 1.19$ percent, the equity premium is $E(r^k - r^f) = 6.63$ percent, the standard deviations of the risk-free and risky rates are $\sigma_{r^f} = 5.27$ percent and $\sigma_{r^k} = 19.40$ percent, and the Sharpe Ratio is $E(r^k - r^f)/\sigma_{r^k} = 0.34$. For comparison, Jermann (1998) uses estimates from Mehra and Prescott (1985). These estimates are: mean annual risk-free rate $E(r^f) = 0.80$ percent, equity premium $E(r^k - r^f) = 6.18$ percent, standard deviations of risk-free and risky rates $\sigma_{r^f} = 5.67$ percent and $\sigma_{r^k} = 16.54$ percent, and Sharpe Ratio $E(r^k - r^f)/\sigma_{r^k} = 0.37$.

The business cycle statistics are constructed from seasonally adjusted quarterly data for the 1964:1 to 2001:4 period. In all cases, the statistics are based on the logarithm if quarterly per capita real variables, where the logarithm of each variable is detrended using the Hodrick-Prescott filter with a smoothing parameter of 1600. The statistics refer to the volatility, correlation, and persistence of different variables. The volatility are the ratio of the standard deviations of consumption, investment, and employment to the standard deviation of output: $\sigma_c/\sigma_y = 0.80$ percent, $\sigma_x/\sigma_y = 2.61$ percent, and $\sigma_n/\sigma_y = 0.99$ percent. The correlations are the contemporaneous correlations of consumption, investment, and employment with output: $\rho(c, y) = 0.96$, $\rho(x, y) = 0.94$, and $\rho(n, y) = 0.80$. Finally, the persistence are the first autocorrelation of consumption and output: $\rho(c', c) = 0.86$ and $\rho(y', y) = 0.89$.

First, the RBC model does not replicate the financial statistics. That is, Table 1 reports that the benchmark RBC model generates a much too high risk-free rate, no sizeable equity premium, and much too low volatility for both the risk-free and risky rates. Similar results are found in Jermann (1998), Lettau (2003), Tallarini (2000), and Boldrin, Christiano, and Fisher (2001). To verify the robustness of these results, we raise the coefficient of relative risk aversion to $\gamma = 10$. The results for this experiment appear as High γ in Tables 1 and 2. Raising the coefficient of relative risk aversion has only marginal effects on the financial statistics, and mainly results in further consumption smoothing (see Table 2).

As Boldrin, Christiano, and Fisher (2001) argue, the RBC model does not generate a risk premium because the linearity of capital accumulation and the unrestricted labor adjustments allow consumers to smooth consumption too much. As shown in Lettau (2003), the implied reduction in the variance of the marginal utility of consumption (and hence, the pricing kernel) raises the risk-free rate. In addition, both factors work to reduce the volatility of the risky rate. In particular, the linearity of capital accumulation eliminates potential capital gains and effectively makes the supply of capital perfectly elastic. Even if this was not the case, the ability of firms to adjust employment reduces the needs to respond to productivity shocks by adjusting capital. Thus, both factors limit fluctuations in the price of capital, and thus limit the volatility of the risky rates and the appearance of a risk premium.

In contrast, the Habit model replicates some of the financial statistics. In particular, the Habit model explains a lower risk-free rate and a sizeable equity premium. Our version, however, generates too much volatility for both the risk-free and risky rates, and this implies a low Sharpe Ratio. The Habit model's success comes from a correction of the main failure of the RBC model: the Habit model adds habit formation and restrictions to capital and labor adjustments. Habit formation forces consumers to care about the volatility of consumption (and the volatility of the marginal utility). That is, habit formation generates a large volatility of the marginal utility from a small volatility of consumption, at low values of risk aversion. In addition, the restrictions to capital and labor adjustments ensure sizeable variations in the price of capital. Similar results are found in Boldrin, Christiano, and Fisher (2001) and Jermann (1998). Note that the formulation of habit formation and of the restrictions to capital adjustments displayed in our economic environment are similar to those in Boldrin, Christiano, and Fisher (2001) and Jermann (1998).

Second, the RBC model replicates most of the business cycle statistics. Admittedly, it slightly underpredicts the volatility of consumption and employment. Furthermore, as argued in Cogley and Nason (1995), the large predicted persistence of consumption and output are generated by the exogenous persistence of total factor productivity. Figure 1 shows the dynamic responses of output, consumption, employment, and investment to a positive one standard deviation shock to productivity. As is standard, the rise in productivity raises output, consumption, investment, and employment.

In contrast, the Habit model does not replicate the main business cycle facts. In particular, it further underpredicts the volatility of consumption and now overpredicts the volatility of employment. In addition, it counterfactually predicts that employment is acyclical and that output is negatively autocorrelated. Figure 2 shows the dynamic responses of output, consumption, employment, and investment to a positive one standard deviation shock to productivity. The rise in productivity stimulates output, consumption, and investment. Surprisingly, employment falls with a one-quarter lag. Similar results are found in Boldrin, Christiano, and Fisher (2001). First, the lag occurs because employment is predetermined. Second, the fall occurs because the adjustment cost on capital acts as a tax on the return to labor. Because of this tax, the increase in productivity ensures that the resulting income effect dominates the substitution effect. Unfortunately, the fall in employment reduces output. The resulting pattern of ups and downs implies a negative autocorrelation for output.

To resolve the anomalous behavior of employment, we implement a case with inelastic labor supply, as in Jermann (1998). To do so, we set $\theta = 0$ and impose that $n_t = 1$. The results for this experiment appear as Inelastic Labor in Tables 1 and 2. This change eliminates any movement of hours worked: it imposes a zero volatility of employment and a zero correlation with output. As shown in the tables, the change corrects the anomalous negative autocorrelation of output, raises the volatility of consumption, and reduces that of investment (while still producing a sizeable risk premium).

Overall, the standard RBC model fails to replicate the financial statistics, but mostly replicates the business cycle statistics. Interestingly, the failures to replicate the financial statistics appears independent of the value of the coefficient of relative risk aversion. In contrast, the Habit formation model replicates the financial statistics, but fails to replicate the business cycle statistics.

3. Production Economies with Spirit-of-Capitalism

The Spirit of Capitalism model retains the production structure of the Habit formation model, but replaces the habit formation preferences by direct preferences for financial wealth. In doing so, our benchmark model is the absolute wealth is status framework of Bakshi and Chen (1996). For this model, we create a decentralized version that retains some features of the Habit model.

3.1 The Economic Environment

The decentralized equilibrium is solved as follows. Consumers choose consumption, employment, and asset holdings to maximize

$$E_0\left[\sum_{t=0}^{\infty}\beta^t\left[u(c_t,s_t)-\theta n_t\right]\right] \tag{3.1}$$

subject to

$$c_t+p_t a_{t+1}+q_t b_{t+1}=w_t n_t+(p_t+d_t)a_t+b_t, \tag{3.2}$$

where s_t is the index of status, w_t is the wage rate, a_t and p_t are the quantity and price of the risky asset, d_t is dividends paid by the risky asset, and b_t and q_t are the quantity and price of the risk-free asset. The objective function (3.1) shows expected lifetime utility and the constraint (3.2) is the consumer's period budget.

As before, the period utility is linear in employment, and we only consider the case where employment is chosen before realization of the technology shock. The functional form for the subutility function $u(c,s)$ follows Bakshi and Chen (1998):

$$u(c_t,s_t)=c_t^{1-\gamma}s_t^{-\eta}/(1-\gamma),$$

where $\gamma \geq 1$ and $\eta \geq 0$. The parameter η measures the extent to which individuals care about status. Using the terminology of Smith (2001), $1/\gamma$ is the effective elasticity of intertemporal substitution and $\gamma+\eta$ is the effective degree of risk aversion. This formulation of preferences (or a slight variant) is used in Futagami and Shibata (1998), Gong and Zou (2002), Luo, Smith, and Zou (2002), and Smith (2001). In addition, we restrict our attention to their absolute wealth is status framework, where status is defined exclusively as financial wealth:

$$s_t = p_{t-1}a_t + q_{t-1}b_t, \tag{3.3}$$

There are two possible interpretations to the above problem. It may be interpreted as an economy where identical consumers have preferences over a bundle of consumption and status, and where each consumer has linear preferences over hours worked. In addition, these consumers have identical initial holdings of equity and bonds. This interpretation is consistent with Bakshi and Chen (1998), Futagami and Shibata (1998), Gong and Zou (2002), Luo, Smith, and Zou (2002), and Smith (2001). Alternatively, it may be interpreted as a pseudo planner problem where work is indivisible. In this case, consistent with Hansen (1985) and Rogerson (1985), consumers must enter work lotteries and purchase unemployment insurance. We assume that these assets exist in addition to the risky and risk-free assets, and that they are excluded from the definition of status.

The problem yields the following first-order conditions:

$$\lambda_t^c = u_c(c_t, s_t), \tag{3.4}$$

$$\theta = E_t\left[\lambda_{t+1}^c w_{t+1}\right], \tag{3.5}$$

$$\lambda_t^c = \beta E_t\left[\lambda_{t+1}^c R_{t+1}^e + \lambda_{t+1}^s\right], \tag{3.6}$$

$$\lambda_t^c = \beta E_t\left[\lambda_{t+1}^c R_t^f + \lambda_{t+1}^s\right], \tag{3.7}$$

where λ_t^c is the multiplier associated with the budget constraint (3.2), $\lambda_t^s = u_s(c_t, s_t)$, and $u_c(c_t, s_t)$ and $u_s(c_t, s_t)$ are the derivatives of the subutility function with respect to its arguments. Also, the risky return is

$$R^e_{t+1} = (p_{t+1} + d_{t+1})/p_t. \tag{3.8}$$

The risk-free return is

$$R^f_t = 1/q_t. \tag{3.9}$$

The firm wishes to maximize it's value. The firm's value is $v_t = (p_t + d_t)A_t$, where $A_t = 1$ is the total amount of shares issued. Using the equity return (3.8), the firm's value can be expressed as the discounted sum of future dividends. Thus, the firm chooses employment and investment to maximize the discounted sum of dividends

$$E_0\left[\sum_{t=0}^{\infty} \chi_t d_t\right] \tag{3.10}$$

subject to

$$d_t = y_t - w_t n_t - x_t, \tag{3.11}$$

$$y_t = z_t k_t^{\alpha} n_t^{1-\alpha}, \tag{3.12}$$

$$k_{t+1} = \phi\left(\frac{x_t}{k_t}\right) k_t + (1-\delta)k_t, \tag{3.13}$$

$$\ln(z_t) = (1-\rho)\ln(\bar{z}) + \rho\ln(z_{t-1}) + \epsilon_t, \tag{3.14}$$

where $\chi_{t+1} = \chi_t / R^e_{t+1}$ and $\chi_0 = 1$.

The firm's problem yields the following first-order conditions.

$$w_t = (1-\alpha)y_t/n_t, \tag{3.15}$$

$$\mu_t = 1/\phi'\left(\frac{x_t}{k_t}\right), \tag{3.16}$$

$$\mu_t = E_t\left[\frac{1}{R^e_{t+1}}\left(\alpha\frac{y_{t+1}}{k_{t+1}} + \mu_{t+1}\left[\phi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \phi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} + (1-\delta)\right]\right)\right], \tag{3.17}$$

where μ_t is the multiplier associated with the capital accumulation equation (3.13).

The economy is closed by the following market clearing conditions. The asset market clearing conditions are

$$a_t = 1. \tag{3.18}$$

$$b_t = 0. \tag{3.19}$$

The goods market clearing condition is

$$y_t = c_t + x_t. \tag{3.20}$$

The budget constraints (3.2) and conditions (3.4)–(3.6), the firm's constraints (3.12)–(3.14) and conditions (3.15)–(3.17), the definition of status (3.3), and market clearing conditions (3.18)–(3.20) are used to compute the economy's allocation. This allocation is then used to compute asset prices. As before, we define the risky return as the return on capital:

$$R^k_{t+1} = \left(\alpha y_{t+1}/k_{t+1} + p^k_{0,t+1}\right)/p^k_{1,t}, \tag{3.21}$$

where

$$p^k_{0,t+1} = \mu_{t+1}\left[\phi\left(\frac{x_{t+1}}{k_{t+1}}\right) - \phi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\frac{x_{t+1}}{k_{t+1}} + (1-\delta)\right], \tag{3.22}$$

$$p^k_{1,t} = \mu_t. \tag{3.23}$$

Note that the simulation results are identical when we use the return on equity shown in condition (3.8). In fact, as shown in Appendix A, the assumption that investment is fully equity financed implies that $p_t = k_{t+1}/\phi'(x_t/k_t)$ and that $R^e_{t+1} = R^k_{t+1}$. Finally, we compute the risk-free rate using condition (3.7).

3.2 Simulation Method

The asset pricing and business cycle implications of the above economic environment are analyzed using the simulation method described in Section 2. The pricing equation for the risk-free rate is somewhat different. We rewrite it as

$$R^f_t = \beta^{-1}\left(\exp(\widehat{\lambda}^c_t) - \beta(\lambda^s/\lambda^c)E_t\left[\exp(\widehat{\lambda}^s_{t+1})\right]\right)/E_t\left[\exp(\widehat{\lambda}^c_{t+1})\right], \tag{3.24}$$

where $\widehat{\lambda}_t = \ln(\lambda_t/\lambda)$. We approximate the expectational in terms (3.24) as

$$E_t\left[\exp(\widehat{\lambda}_{t+1})\right] = \exp\left(E_t\left[\widehat{\lambda}_{t+1}\right] + (1/2)E_t\left[\left(\widehat{\lambda}_{t+1} - E_t[\widehat{\lambda}_{t+1}]\right)^2\right]\right). \tag{3.25}$$

As in the previous models, we set $\alpha = 0.36$, $\delta = 0.021$, $\xi = 0.23$, $\rho = 0.979$, and $\sigma = 0.0072$. We set θ to ensure that employment $n = 1$ in the steady state, and set ω_1 and ω_2 to ensure that $\phi(\delta) = \delta$ and $\phi'(\delta) = 1$. Bakshi and Chen (1996) provide estimates of γ and η for $\beta = 1$. The unrestricted estimates of γ vary between 2.27 and 3.08, while those of η vary between 0.75 and 1.27. As a benchmark, we retain $\beta = 0.99999$ and $\gamma = 2$, and set $\eta = 1.27$.

3.3 Simulation Results

The simulation results are presented in Tables 1 and 2. The simulated statistics for the Spirit of Capitalism model are computed as before.

First, the benchmark Spirit of Capitalism model fails to replicate the financial statistics. The model predicts a negative risk-free rate. Note that, far from a failure, the underprediction of the risk-free rate can be interpreted as the ability to resolve the risk-free rate puzzle. A comparison between equations (2.13) and (3.22) suggests that the model produces a low risk-free rate because of the marginal utility of status $\lambda^s = u_s(c, s) > 0$. That is, the expected future return to financial assets includes not only higher future consumption, but also higher future status. This latter effect reduces the equilibrium risk-free rate. The model produces a reasonable amount of volatility for the risk-free rate, but not enough for the risky rate. In addition, the model produces only a minimal risk premium. Admittedly, the risk premium is considerably larger than that produced by the RBC model, but it is an order of magnitude too small.

Second, the Spirit of Capitalism model also fails to replicate the business cycle statistics. The model seriously overpredicts the volatility of consumption and employment, while it underpredicts the volatility of investment. It underpredicts the procyclicality of employment. Finally, it also incorrectly predicts that output and consumption are negatively autocorrelated. Figure 3 shows the dynamic responses of output, consumption, employment, and investment to a positive one standard deviation shock to productivity. As expected, the rise in productivity stimulates output, consumption, and investment. As in the Habit model, employment falls with a one-quarter lag. The fall in employment drags output down. Unfortunately, investment remains high enough that consumption must also fall in response to the fall in output. This up and down pattern promotes negative autocorrelations for both output and consumption.

To further understand these results, we run five experiments on the Spirit of Capitalism model. The first experiment studies the underprediction of the mean risk-free rate. In this experiment, we set $\beta = 0.9431$ to match the mean risk-free rate of $E(r^f) = 1.19$ percent. The implications of this change for the financial and business cycle statistics appear under "Low β" in Tables 1 and 2. Lowering the subjective discount factor reduces the equity premium and the volatility of both risk-free and risky rates. It also reduces the volatility of consumption and investment, but otherwise has little effect on the business cycle statistics.

The second experiment analyzes the impact of risk aversion. To do so, we set $\gamma = 10$. The results appear as "High γ" in the tables. Raising risk aversion raises the volatility of both the risk-free and risky rates, and also raises the equity premium. The equity premium is now 1.59 percent, but is still much smaller than the observed 6.63 percent. In addition, raising risk aversion reduces the volatility of consumption and raises that of investment. Otherwise, it has little effects on the business cycle statistics.

The third and fourth experiments study the extreme volatility of consumption and investment. Note that the Spirit of Capitalism model further restricts the volatility of investment because consumers are risk averse in their status. In equilibrium, status and financial wealth are intimately related to the capital stock. The result is that consumers are willing to suffer more consumption volatility to reduce the volatility of investment and the capital stock.

To see this, the third experiment removes the investment adjustment costs (i.e. we let $\xi \to \infty$, $\omega_1 = 1$, and $\omega_2 = 0$). The results of this experiment appear as "High ξ" in the tables. Eliminating the adjustment cost makes the predictions of the Spirit of Capitalism model closer to those of the standard RBC model. It corrects the anomalous volatility of both consumption, raises the volatility of investment, and corrects other anomalous business cycle statistics. Unfortunately, it also eliminates the equity premium and seriously reduces the volatility of both risk-free and risky rates.

The fourth experiment simply lowers the extent to which consumers care about status. Note that this also lowers the effective degree of risk aversion. For this experiment, we set $\eta = 0.75$—the lower estimate in Bakshi and Chen (1998). The results appear as "Low η" in the tables. As expected, lowering the extent to which consumers care about status reduces the volatility of both the risk-free and risky rates, and also lowers the equity premium. In addition, it reduces the volatility of consumption, but not sufficiently. Otherwise, it has little effects on the business cycle statistics.

The final experiment studies the anomalous behavior of employment and its effect on the autocorrelation of output. As in the Habit model, we implement a case where consumers supply labor inelastically. To do so, we set $\theta = 0$ and impose that $n_t = 1$. This experiment appears under "Inelastic Labor" in the tables. Making labor inelastic has only a small effect on the financial statistics. Obviously, it imposes a zero volatility of employment and a zero correlation with output. It corrects the anomalous negative autocorrelations of consumption and output, but still produces a large volatility of consumption and a small volatility of investment.

Overall, these results indicate that the absolute wealth is status framework of the Spirit of Capitalism model may solve the risk-free rate puzzle and considerably raises the equity premium. The equity premium, however, is still an order of magnitude too small. In addition, the Spirit of Capitalism model seriously mispredicts the main business cycle statistics.

4. Conclusion

In this paper, we evaluate whether the spirit of capitalism improves the ability of standard RBC models to explain the main features of both asset returns and business cycles. In our model, the spirit of capitalism is embodied in the assumption that individuals care about their status, and that higher levels of wealth signal higher status.

Our simulation results suggest that the spirit of capitalism partially explains the main features of asset returns. That is, the RBC model with direct preferences for wealth produces a low risk-free rate, volatile asset returns, and a much larger equity premium than the standard RBC model. The equity premium, however, is still an order of magnitude too small. In that sense, the spirit of capitalism may solve the risk-free rate puzzle but not the equity premium puzzle. In addition, our results suggest that the spirit of capitalism does not explain the main features of the business cycle. That is, the RBC model with direct preferences for wealth produces too much volatility for consumption and not enough volatility for investment.

One drawback of our analysis is that the RBC model is based (as in most of the literature) on a representative consumer. It might be important to account for the heterogeneity amongst consumers to get the full benefit of the spirit of capitalism. Luo and Young (2003) construct such an economy to study the effects of the spirit of capitalism on the distribution of wealth. In particular, they wish to evaluate whether the spirit of capitalism can raise the counterfactually low wealth inequality produced by standard general equilibrium model. Unfortunately, they find that the spirit of capitalism reduces rather than increase wealth inequality.

Appendix A

In this appendix, we show that $R^e_{t+1} = R^k_{t+1}$ in all models considered.

First, we define the firm's dividends as $d_t = y_t - w_t n_t - x_t = \alpha y_t - x_t$, since $w_t n_t = (1-\alpha) y_t$. Second, we apply a forward substitution on the equity price $p_t = E_t\Big[(p_{t+1} + d_{t+1})/R^e_{t+1}\Big]$ to obtain

$$p_t = E_t\left[\frac{1}{R^e_{t+1}} d_{t+1} + \frac{1}{R^e_{t+1}}\frac{1}{R^e_{t+2}} d_{t+2} + \frac{1}{R^e_{t+1}}\frac{1}{R^e_{t+2}}\frac{1}{R^e_{t+3}} d_{t+3} + \ldots\right]. \qquad (A.1)$$

Third, we rewrite the firm's first-order condition for investment

$$\mu_t = E_t\left[\frac{1}{R^e_{t+1}}\left(\alpha\frac{y_{t+1}}{k_{t+1}} + \mu_{t+1}\Big[\phi_{t+1} - \phi'_{t+1}\frac{x_{t+1}}{k_{t+1}} + (1-\delta)\Big]\right)\right] \qquad (A.2)$$

as

$$E_t\Big[d_{t+1}/R^e_{t+1}\Big] = \mu_t k_{t+1} - E_t\Big[\mu_{t+1} k_{t+2}/R^e_{t+1}\Big], \qquad (A.3)$$

where $\mu_t = 1/\phi'_t$, $d_{t+1} = \alpha y_{t+1} - x_{t+1}$, and $k_{t+2} = (\phi_{t+1} + (1-\delta))\, k_{t+1}$. Fourth, equation (A.3) is used to simplify (A.1) to $p_t = \mu_t k_{t+1}$. Finally, the relatiion between equity price and capital stock implies that $R^e_{t+1} = R^k_{t+1}$:

$$\begin{aligned} R^e_{t+1} &= \frac{p_{t+1} + d_{t+1}}{p_t} \\ &= \frac{\mu_{t+1} k_{t+2} + \alpha y_{t+1} - x_{t+1}}{\mu_t k_{t+1}} \\ &= \frac{\alpha y_{t+1}/k_{t+1} + \mu_{t+1}\left[\phi_{t+1} - \phi'_{t+1} x_{t+1}/k_{t+1} + 1 - \delta\right]}{\mu_t} \\ &= R^k_{t+1}. \qquad (A.4) \end{aligned}$$

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Table 1. Financial Statistics

	Averages		Volatility		Ratio
	$E(r^f)$	$E(r^k - r^f)$	σ_{r^f}	σ_{r^k}	$E(r^k - r^f)/\sigma_{r^k}$
Data	1.19	6.63	5.27	19.40	0.34
RBC Model					
Benchmark	4.10	0.01	0.32	0.34	0.04
High γ	4.09	0.02	0.26	0.27	0.07
Habit Model					
Benchmark	2.75	7.10	30.05	49.82	0.14
Inelastic Labor	-0.87	5.63	7.96	32.74	0.17
Spirit of Capitalism Model					
Benchmark	-3.97	0.38	5.09	10.15	0.04
Low β	1.19	0.11	2.67	5.69	0.02
High γ	-0.45	1.59	14.34	23.60	0.07
High ξ	-4.11	-0.01	0.12	0.13	-0.02
Low η	-3.45	0.33	4.54	9.44	0.04
Inelastic Labor	-3.99	0.29	5.26	9.21	0.03

Note: Entries under Averages, Volatility, and Ratio refer to the unconditional mean of a variable, the standard deviation of a variable, and the ratio of the unconditional mean of a variable to a standard deviation of a variable. The variables are the annualized percentage risk-free rate r^f, the annualized percentage risky rate r^k, as well as the difference between the two. The Data statistics are taken from Boldrin, Christiano, and Fisher (2001). The Model statistics are computed as the averages over 1000 repetitions of 200 periods.

Table 2. Business Cycle Statistics

	Volatility			Correlation			Persistence	
	σ_c/σ_y	σ_x/σ_y	σ_n/σ_y	$\rho(c,y)$	$\rho(x,y)$	$\rho(n,y)$	$\rho(c',c)$	$\rho(y',y)$
Data	0.80	2.61	0.99	0.96	0.94	0.80	0.86	0.89
RBC Model								
Benchmark	0.33	3.13	0.40	0.97	0.99	0.91	0.73	0.70
High γ	0.14	3.68	0.50	0.98	0.99	-0.78	0.72	0.70
Habit Model								
Benchmark	0.30	2.69	1.74	0.26	0.98	0.03	0.91	-0.04
Inelastic Labor	0.64	2.13	0.00	0.71	0.93	0.00	0.93	0.71
Spirit of Capitalism Model								
Benchmark	2.22	0.69	1.95	0.92	0.86	0.28	-0.44	-0.31
Low β	1.32	0.38	1.91	0.99	0.82	0.27	-0.37	-0.32
High γ	0.94	1.32	2.05	0.90	0.92	0.38	-0.49	-0.35
High ξ	0.27	1.29	0.52	0.97	0.99	0.87	0.81	0.82
Low η	1.70	0.68	1.76	0.97	0.93	0.11	-0.36	-0.17
Inelastic Labor	1.72	1.14	0.00	0.57	0.88	0.00	0.44	0.70

Note: Entries under relative volatility, autocorrelation, and correlation refer to the sample standard deviation of the variable relative to the sample standard deviation of y, the sample first-order autocorrelation of the variable, and the sample contemporaneous correlation between variables. The variables are the detrended logarithm of consumption c, investment x, employment n, and output y. The Data statistics are computed from post-war U.S. quarterly data. The Model statistics are computed as the averages over 1000 repetitions of 200 periods. All variables are detrended with the Hodrick-Prescott filter with a smoothing parameter of 1600.

Figure 1:
RBC Model

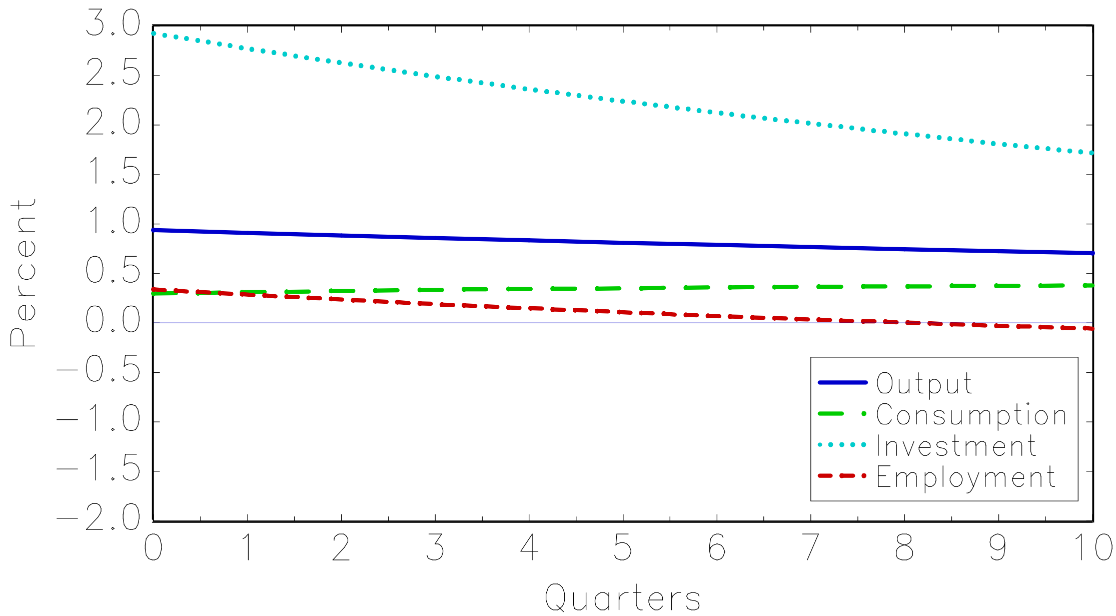

Figure 2:
Habit Model

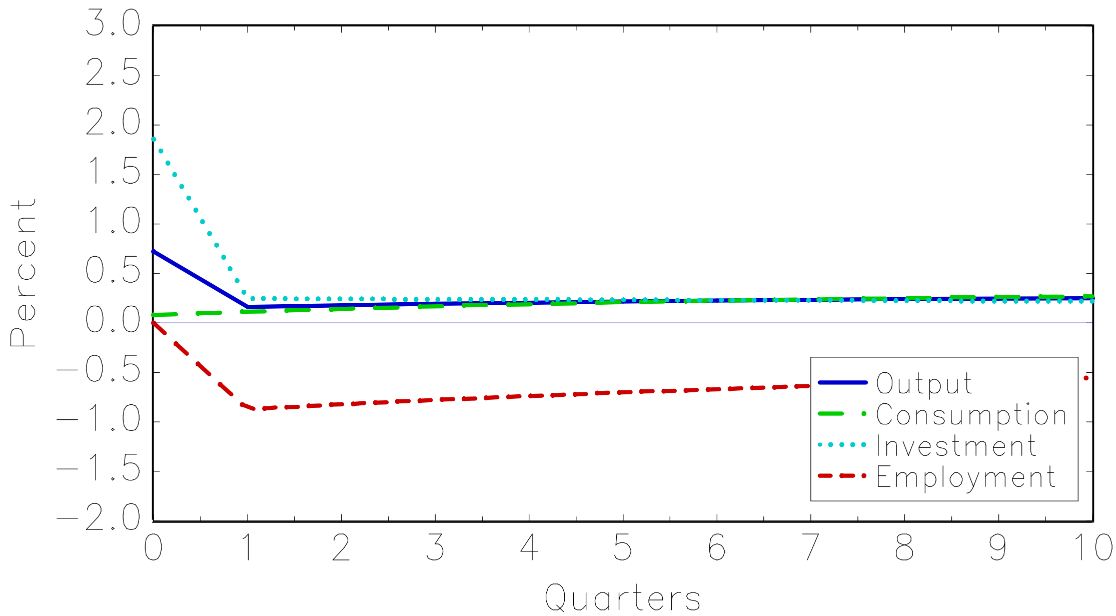

Figure 3:
Spirit of Capitalism Model