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The Spirit of Capitalism and Expectation Driven Business Cycles

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Abstract

While news shocks are believed to be instrumental in explaining business cycles, many existing models fail to predict an economic boom in consumption, investment, employment, output and the stock market in response to good news about future productivity. This paper proposes and evaluates a model with the intrinsic desire for wealth accumulation, or 'the spirit of capitalism' hypothesis, which generates the aforementioned responses. Restrictions for the existence of expectation driven business cycles are derived analytically. The restrictions are confirmed by an estimated version of the model. The proposed preference specification is supported with additional empirical evidence.

Key words: Spirit of Capitalism; News Shocks; Business Cycles
***JEL codes**: E32*

Résumé

Bien que l'on estime que les chocs d'anticipations constituent un déterminant majeur des cycles économiques, plusieurs modèles existants n'arrivent pas à prédire des augmentations simultanées de la consommation, de l'investissement, de l'emploi, de production et une expansion du marché boursier en réponse à une bonne nouvelle sur la productivité dans le futur. Cet article propose et évalue un modèle incorporant l'hypothèse d'un désir intrinsèque d'accumulation de la richesse, ou l'hypothèse de 'l'esprit du capitalisme', capable de générer les réponses décrites ci-dessus. Les restrictions nécessaires à l'existence de cycles économiques entrainés par les anticipations sont dérivées analytiquement. Une version estimée du modèle montre que ces restrictions sont satisfaites. La spécification des préférences proposée est corroborée par d'autres observations empiriques.

Mots clés: *esprit du capitalisme; chocs d'anticipations; cycles économiques*
***Codes JEL**: E32*

1. Introduction

News shocks about future technological opportunities are believed to be at the heart of the explanation for some historical episodes. For example, the Internet boom-bust cycle in the U.S. is often attributed to overoptimistic beliefs about future productivity growth and their consequent downward revisions. Empirically, news shocks about future productivity growth explain a significant fraction of variability of macroeconomic variables in the U.S. and Japan, and induce an expansion in aggregate consumption, investment, employment, output and stock prices (Beaudry and Portier (2005), Beaudry and Portier (2006)). A serious limitation of many existing business cycle models is their inability to capture these empirical observations.[1] This paper demonstrates how the spirit-of-capitalism hypothesis is one mechanism through which news shocks can lead to booms and busts.

The phrase 'the spirit of capitalism' originates from the work of Max Weber (1958), who argued that the intrinsic desire for wealth accumulation is the essence of the capitalist society. The idea that wealth can be valued for its own sake, and not only for consumption, was also expressed in writings of Adam Smith, Schumpeter, Sombart, Keynes and others (Zou (1994)). Recently, the spirit-of-capitalism hypothesis has proven to be useful in understanding and resolving a number of puzzles, including those of asset pricing (Bakshi and Chen (1996), Boileau and Braeu (2007)), saving behavior (Zou (1995), Carroll (2000)) and cross-country growth differences (Zou (1994), Smith (1999)).

The spirit-of-capitalism hypothesis is generally formalized by assuming that wealth enters directly into the utility function. Microfoundations for these preferences are provided by theoretical work on social status. Wealth often determines the relative position in society, which, in turn, influences many nonmarket decisions, such as marriage (Cole et al. (1992)). Concerns about the relative social position also arise endogenously in a model with intergen-

[1] See Cochrane (1994), Beaudry and Portier (2004), Beaudry and Portier (2007), Jaimovich and Rebelo (2006), Christiano et al. (2007) for a detailed analysis.

erational transmission of cultural traits (Bisin and Verdier (1998)) and in an evolutionary model with incomplete environmental information (Samuelson (2004)). The financial literature justifies direct preferences for wealth on different grounds. Behavioral experiments demonstrate that the degree of risk aversion varies with financial wealth. Financial models with direct utility flows from the level or changes in the level of financial wealth can better explain various stylized facts about financial markets (Barberis et al. (2001), Levy and Levy (2004), McQueen and Vorkink (2004)).

The current paper contributes to the literature on the spirit of capitalism in two ways. First, it provides empirical estimates that support the existence of the intrinsic desire for wealth. Other studies in this area tend to be theoretically oriented. Second, it explores the implications of the spirit-of-capitalism hypothesis for labor supply decisions. The paper presents a variety of evidence that may be difficult to reconcile with the standard theory, but that can be accounted for, at the aggregate level, by direct utility flows from wealth. The evidence is drawn from recent empirical studies of the determinants of happiness and workers' job satisfaction, relative income effects and impacts of stock price changes on consumers' choices.

The current paper also enhances the theoretical understanding of how news shocks affect the economy. In this respect, it is complementary to the work of Beaudry and Portier (2004), Jaimovich and Rebelo (2006) and Christiano et al. (2007). These authors develop different economic environments capable of generating positive responses of consumption, investment, hours and output to news shocks. In contrast to other studies, this paper emphasizes a link between labor supply decisions and financial markets.

The role of the spirit-of-capitalism hypothesis in explaining expectation driven business cycles ($EDBC$) is evaluated in the context of a neoclassical growth model with capital adjustment costs. Restrictions for $EDBC$ are derived analytically. Intuitively, the model magnifies the incentives to save. The strong direct preferences for wealth make it costly to take leisure when the return on capital accumulation is high. At the same time, they raise the value of current consumption and stimulate consumer spending. Thus, households may choose to work, consume and invest more in response to an exogenous change in expectations.

Using specific functional forms, the model is estimated to match U.S. data. Evaluated at the parameter estimates, the model predicts a boom in response to good news about future productivity. If the news is not realized, investment, employment, output and stock price fall, while consumption decreases gradually. The model responses are fairly large even when a technological improvement is expected to occur far in the future. The simulated model explains well not only conventional statistics for aggregate quantities, but also business cycle facts about financial returns.

The rest of the paper is organized as follows. Section 2 describes the model, discusses its solution and parameterization. Section 3 derives analytical restrictions for the existence of expectation driven business cycles and illustrates their empirical feasibility. Section 4 analyzes the dynamic responses of the calibrated model. Section 5 evaluates the quantitative predictions using numerical simulations. Section 6 presents additional arguments for taking the preference specification seriously. Section 7 offers concluding remarks.

2. The spirit-of-capitalism model

2.1. Model Description

Three elements are central to the model: (i) direct preferences for financial wealth, (ii) costly capital accumulation, and (iii) news shocks about future technology. Direct preferences for wealth capture the spirit-of-capitalism idea and correspond to 'the absolute wealth is status' framework of Bakshi and Chen (1996). Costly capital accumulation introduces non-trivial equity prices. To highlight the implications for consumption, employment and asset pricing, this section describes a decentralized version.

2.1.1. Households

The economy consists of many identical households with preferences over consumption C_t, index of social status X_t and hours worked L_t :

$$E_\tau \sum_{t=\tau}^{\infty} \beta^{\tau-t} U\left(C_t, X_t, L_t\right), \ 0 < \beta < 1, \ \tau = 0, 1, ... \tag{1}$$

β is the discount factor, and E_τ is the expectation operator conditional upon the information available in period τ. The instantaneous utility function $U\left(\cdot,\cdot,\cdot\right)$ is twice continuously differentiable and quasi-concave. The per period time endowment is normalized to one, so $1-L_t$ represents leisure. Consumption and leisure are assumed to be normal goods: $U_C > 0$, $U_L < 0$, $U_{LL}/U_L > -U_{CL}/U_C$, -$U_{CC}/U_C > U_{CL}/U_C$. The representative household derives positive but nonincreasing marginal utility from social status: $U_X > 0$, $U_{XX} \leq 0$. At this point, the impacts of status on marginal utility of consumption and hours worked are left unrestricted. The signs and magnitude of these impacts will be critical in determining how the economy responds to news shocks, as shown in section 3.

The absolute-wealth-is-status framework captures the first order effect of wealth on status determination. Following this framework, the status is assumed to coincide with the value of financial assets held at the end of each period. A financial portfolio consists of risky equity S_t and risk-free one period bonds B_t. Hence, status is defined as $X_t = S_t + B_t$.

The representative household makes consumption, employment and saving-investment decisions to maximize the lifetime utility (1), subject to the definition of status and the sequence of budget constraints:

$$C_t + S_t + B_t = W_t L_t + R_t^e S_{t-1} + R_{t-1}^f B_{t-1}, \ t = 0, 1, ... \tag{2}$$

taken as given the initial value of equity S_{-1}, the hourly wage rate W_t and the gross returns on risk-free and risky assets R_t^f and R_t^e. The risk-free return R_t^f is determined in period t, but is paid off in the next period. The initial bond holdings are normalized to zero, without loss of generality. The consumption good is the numeraire.

The optimal household's choice is characterized by the intratemporal trade-off between consumption and leisure, and the intertemporal choice of consumption and investment:

$$-U_L(C_t, X_t, L_t) = W_t U_C(C_t, X_t, L_t) \tag{3}$$

$$U_C(C_t, X_t, L_t) = U_X(C_t, X_t, L_t) + \beta E_t\left[U_C(C_{t+1}, X_{t+1}, L_{t+1}) R^e_{t+1}\right] \tag{4}$$

$$U_C(C_t, X_t, L_t) = U_X(C_t, X_t, L_t) + \beta R^f_t E_t\left[U_C(C_{t+1}, X_{t+1}, L_{t+1})\right] \tag{5}$$

the budget constraints (2) and the transversality conditions $\lim_{t\to\infty} \beta^t U_C(C_t, X_t, L_t) S_t = 0$ and $\lim_{t\to\infty} \beta^t U_C(C_t, X_t, L_t) B_t = 0$. At an optimum, the marginal rate of substitution of leisure for consumption must be equal to the real wage, and the marginal cost and the marginal benefit of investment must be equalized. The marginal benefit of an additional unit of investment is equal to the additional direct utility flows from higher wealth, through its effect on status, and the expected return, evaluated in the units of future consumption and discounted back to the present. The marginal cost of this investment, from the household's point of view, is the forgone marginal utility of current consumption.

2.1.2. Firms

The production side is similar to Christiano and Fisher (1998) and Nakajima (2003). There are two representative perfectly competitive firms. The first firm produces new capital goods, and the second -final goods. Capital good production is externalized to clarify the model's implications for asset prices. Alternatively, the model can be formulated with a single representative firm which owns the capital stock and is subject to capital adjustment costs, as done by Boileau and Braeu (2007).

Capital Good Production New capital stock K_{t+1} is produced at the end of period t using a constant returns to scale, twice continuously differentiable and quasi-concave production function:

$$K_{t+1} = Q\left(\left(1-\delta\right)K_t, I_t\right) \tag{6}$$

with $Q_1 > 0$, $Q_2 > 0$. Q_j denotes the partial derivatives of Q with respect to the j^{th} argument. In the absence of capital adjustment costs $K_{t+1} = \left(1-\delta\right)K_t + I_t$.

The representative capital good producer purchases the previously installed capital at the price $P_{k,t}$ and investment good at the unitary price, and sells the newly produced capital to the final good producer at the price P_t. The profit maximization requires:

$$\begin{aligned} P_t Q_1\left(\left(1-\delta\right)K_t, I_t\right) &= P_{k,t} \\ P_t Q_2\left(\left(1-\delta\right)K_t, I_t\right) &= 1 \end{aligned} \tag{7}$$

In equilibrium, the profits of the capital good producer are zero.

Final Good Production Final good is produced from capital and labor inputs using a constant returns to scale, twice continuously differentiable and concave production function:

$$Y_t = F\left(K_t, A_t L_t, z_t\right), \tag{8}$$

with increasing marginal products: $F_K > 0$, $F_L > 0$, $F_z > 0$. Labour augmenting technological change A_t follows a deterministic growth path:

$$A_t = \gamma A_{t-1},\ \gamma > 1,\ \text{given } A_{-1} > 0$$

Stochastic technology shock z_t is described in details below. The final good is used for consumption and investment:

$$Y_t = C_t + I_t \tag{9}$$

The representative final good producer hires labor on the competitive spot labor market, after observing the realizations of the shocks. The profit maximization requires equalization of the marginal product of labor to the real wage:

$$F_L\left(K_t, A_t L_t, z_t\right) = W_t \tag{10}$$

The final good producer issues equity S_t to buy the required stock of capital K_{t+1} one period in advance:

$$P_t K_{t+1} = S_t \tag{11}$$

The producer chooses values for S_t and K_{t+1} at the end of period t, to maximize its expected discounted cash flows $E_t \rho_{t+1}\left[Y_{t+1} + P_{k,t+1}\left(1-\delta\right) K_{t+1} - W_{t+1} L_{t+1} - R^e_{t+1} S_t\right]$ subject to the production and financing constraints (8) and (11). The stochastic discount factor ρ_{t+1} converts the cash flows into period t consumption good units. The first order necessary conditions for capital and equity are:

$$\begin{aligned} E_t \rho_{t+1}\left[F_K\left(K_{t+1}, A_{t+1} L_{t+1}, z_{t+1}\right) + \left(1-\delta\right) P_{k,t+1}\right] &= \lambda P_t \\ E_t \rho_{t+1} R^e_{t+1} &= \lambda \end{aligned}$$

where λ is the multiplier on the financing constraint. In equilibrium, $\lambda = 1$ and $\rho_{t+1} = \beta \frac{U_{C,t+1}}{U_{C,t} - U_{X,t}}$. In period 0, the final good producer is endowed with K_0 units of capital, financed by S_{-1} units of equity.

2.1.3. News and technology shocks

A stochastic technology shock z_t represents temporary but persistent changes in total factor productivity (TFP) :

$$\ln z_t = \rho \ln z_{t-1} + \nu_t,\ 0 < \rho < 1 \tag{12}$$

Variable v_t is the measured productivity impulse. This impulse is partly anticipated n periods in advance:

$$\nu_t = \xi_t + \varepsilon_{t-n}, \ n > 0 \tag{13}$$

Impulses ξ_t and ε_t are normally distributed with zero means and variances σ_ξ^2 and σ_ε^2, and uncorrelated over time and with each other.

This specification can be interpreted as an outcome of a stylized learning process. Imagine that agents receive noisy signals about future technological opportunities; update their beliefs, based on these signals; and learn whether or not their previous beliefs were correct by observing the actual realizations of technology shock z. Under the rational expectations hypothesis, the measured productivity impulse v is a sum of the expectation revisions at all possible periods. Specification (13) is consistent with the assumption that there is only one signal, n periods before the realization of a technology shock. Thus, beliefs about technology shock z_t are updated twice: in periods t and $t-n$. Impulses ξ_t and ε_{t-n} represent these updates.

Since impulse ε_t affects TFP only with a delay, it is called a 'TFP news shock' or simply a 'news shock' in the rest of the paper. Impulse ξ_t is called an 'unexpected TFP shock'. Different combinations of these shocks can capture various learning scenarios. For example, if the initial signal was correct: $v_t = \varepsilon_{t-n}$, $\xi_t = 0$. If the initial signal was totally wrong: $v_t = 0$, $\xi_t = -\varepsilon_{t-n}$. If the technology impulse was completely unanticipated: $v_t = \xi_t$, $\varepsilon_{t-n} = 0$.

2.1.4. Asset market

The asset market of the model warrants an additional discussion. P_t can be interpreted as the price of an equity share, as shown by Christiano and Fisher (1998). The only asset in net positive supply in equilibrium is capital. The total household's financial wealth, and hence its social status, is determined by the market value of the capital stock:

$$X_t = S_t \tag{14}$$

The ex-post return on capital accumulation between periods t and $t+1$ can be expressed in terms of dividends and capital gains:

$$R^e_{t+1} = \frac{D_{t+1} + P_{t+1}}{P_t} \tag{15}$$

$$D_t = F_K\left(\left(1-\delta\right)K_t, A_t L_t, z_t\right) - \left[1 - \left(1-\delta\right)Q_1\left(\left(1-\delta\right)K_t, I_t\right)\right]P_t \tag{16}$$

where the dividends consist of the direct earning from a unit of capital less depreciation and installation costs. In the absence of capital adjustment costs, there is no distinction between the prices of capital and consumption goods: $P_t = 1$.

2.1.5. General equilibrium

A rational expectations equilibrium is the sequences of prices $\left\{W_t, R^e_t, R^f_t, P_t\right\}_{t=0}^{\infty}$ and quantities $\{L_t, C_t, X_t, I_t, S_t, Y_t, K_{t+1}, D_t\}_{t=0}^{\infty}$ that satisfy equations $(3)-(11)$ and $(14)-(16)$, and the transversality condition for equity, given the initial values of S_{-1} and K_0, and the current and past realizations of the technology processes $\{A_t, z_t, \upsilon_t, \xi_t, \varepsilon_t\}$.

2.2. Solution

The model is solved numerically, by log-linearizing the equilibrium conditions of the stationary representation of the model around the deterministic steady state and applying Blanchard and Kahn (1980)'s solution method. The only exception is financial returns. The ex-post return on equity is computed from the equilibrium series for prices and dividends. The risk-free return is constructed following the approach of Jermann (1998) and Boileau and Braeu (2007).

Numerical simulations are conducted with the following specifications for preferences and production functions. The instantaneous utility function takes the form:

$$\begin{aligned} U(C_t, X_t, L_t) &= \frac{1}{1-\sigma} V(C_t, X_t)^{1-\sigma} - \eta_t \frac{L_t^{1+\psi}}{1+\psi}, \ \sigma > 0, \ \eta_t > 0, \ \psi \geq 0 \\ V(C_t, X_t) &= \left[(1-\omega) C_t^{\theta} + \omega X_t^{\theta}\right]^{\frac{1}{\theta}}, \ 0 < \omega < 1, \ \theta < 1, \ \theta \neq 0 \end{aligned} \tag{17}$$

It is implied that values $\sigma = 1$ and $\theta = 0$ correspond to logarithmic functions. The weight ω defines the relative importance of status in the utility function. A higher value of ω means a stronger status-seeking motive. The parameter θ governs the degree of interdependence between C_t and X_t, with $\frac{1}{1-\theta}$ being the value of the elasticity of substitution between consumption and status. The parameter σ influences the willingness to substitute over time. The intertemporal elasticity of substitution of consumption is time varying: $IES_t \equiv -\frac{U_{C_t}}{C_t U_{C_t C_t}} = \left[\sigma + (1-\sigma-\theta)\, \varepsilon_{V_x}\left(\frac{C_t}{X_t}; \omega, \theta\right)\right]^{-1}$, where $\varepsilon_{V_x}\left(\frac{C_t}{X_t}; \omega, \theta\right) = \left(1 + \frac{1-\omega}{\omega}\left(\frac{C_t}{X_t}\right)^{\theta}\right)^{-1}$ is the elasticity of the V aggregator with respect to status. The elasticity ε_{V_x} is zero in the absence of the capitalist spirit, in which case the intertemporal elasticity of substitution is constant and equal to $1/\sigma$. To be consistent with balanced growth, preferences include the trend from the disutility of work, $\eta_t = \eta\gamma^{1-\sigma}$, with $\eta > 0$. The parameter ψ is the inverse of the Frisch elasticity of labor supply.

Final good production uses a Cobb-Douglas function with the capital share α, $0 < \alpha < 1$:

$$F(K_t, A_t L_t, z_t) = z_t K_t^{\alpha} (A_t L_t)^{1-\alpha} \tag{18}$$

Capital good production uses a constant elasticity of substitution function, as in Christiano and Fisher (1998) and Nakajima (2003):

$$Q((1-\delta) K_t, I_t) = \left[b_1 ((1-\delta) K_t)^{\phi} + b_2 I_t^{\phi}\right]^{\frac{1}{\phi}}, \ \phi \leqslant 1, \ b_1 > 0, \ b_2 > 0 \tag{19}$$

The elasticity of substitution between capital and investment is $\frac{1}{1-\phi}$. The value $\phi = 1$ corresponds to the case of no capital adjustment costs.

2.3. Parameter choice

The parameter values are assigned in two steps. The first set of parameters is chosen to match long-run averages. The second set is estimated by the Simulated Method of Moments (SMM). This section describes the calibration strategy.

Data The model is calibrated to quarterly U.S. data, for the period 1955:1-2002:4. Series for real private aggregate consumption and its price deflator, private fixed investment and output for non-farm business sector are from the National Income and Product Accounts. Indices for hours and real compensation per hour are from the Bureau of Labor Statistics. Quantity variables are converted into per capita terms using civilian noninstitutional population over 16 years old. The S&P 500 stock market index, deflated by the consumption price deflator, measures the equity price. The nominal rate on 3-month T-bills and nominal return on NYSE/AMEX value weighted index from the Center for Research in Security Prices are the empirical equivalents of the risk-free rate and the risky return. The returns are converted into real series using the realized inflation based on the consumption deflator. All financial series are from M.Yogo's website.[2]

Calibration to long-run averages The first set of parameters is commonly used in the business cycle literature. In particular, $\alpha = 1/3$, $\delta = 0.025$ and $\psi = 0$. The parameter of the disutility of work η is chosen to get the steady state hours worked equal to one third. The growth factor γ coincides with the average growth of output in the data sample, $\gamma = 1.005$. The discount factor β is selected so that the steady state rate of return to capital is 6.4% per annum. This is the average value of the real return on equity in the sample. The values of capital and investment shares in the production of new capital goods, b_1 and b_2, are set to make the steady state independent of the degree of capital adjustment costs. The parameters above imply that the steady state consumption share in output is 0.76 and

[2] http://finance.wharton.upenn.edu/~yogo/

capital to consumption ratio is 10.8.

Within the framework of the model, the series for technology shocks z_t can be measured by Solow residuals, from the definition of production function (18). The law of motion (12) can then be used to recover the persistence coefficient ρ and the variance of the measured productivity impulse σ_v^2. These values are set to the empirical estimates of these parameters, reported in King and Rebelo (1999): $\rho = 0.979$, $\sigma_v = 0.0072$. Given a value for σ_ε^2, the variance of ξ is equal to $\sigma_\xi^2 = \sigma_v^2 - \sigma_\varepsilon^2$. Previous studies, however, do not provide precise guidance about empirical values of the remaining six parameters. These parameters are estimated by SMM.

Estimation of the key model parameters The idea of SMM is to select parameters to minimize the distance between empirical statistics and their equivalents produced by a calibrated model. Relative to alternative methods of estimation, such as the maximum likelihood, method of moments techniques have the advantage of being more efficient and more robust to model misspecification (Ruge-Murcia (2007)).

Five statistics were selected as targeted moments: the correlation coefficients between consumption and risk-free return $\rho\left(C_t, R_t^f\right)$, hours worked and risk-free return $\rho\left(L_t, R_t^f\right)$, and consumption and investment $\rho\left(C_t, I_t\right)$, the standard deviation of investment relative to output $\sigma_{I_t}/\sigma_{Y_t}$ and the volatility of output σ_{Y_t}. The correlations involving the risk-free return are expected to shed light on the strength of the capitalistic spirit, since the model modifies how consumption, saving and labor supply respond to changes in interest rates. The consumption-investment correlation is of particular interest because standard specifications generate a negative contemporaneous correlation between these two variables in response to news shocks. The relative volatility of investment is expected to be informative of the degree of capital adjustment costs. The output volatility is selected to provide information about the relative importance of news and unexpected TFP shocks. All moments are computed for the Hodrick-Prescott (HP) cyclical components of the logarithmic series with the smoothing parameter 1600.

The estimation procedure was implemented for $N = 500$ replications. For each replication i, the SMM estimator of the parameter vector $\boldsymbol{\mu}$=$\{\sigma,\ \theta,\ \omega,\ \phi,\ \sigma_{\varepsilon}^{2}\}$, for a particular value of n, was a vector $\hat{\boldsymbol{\mu}}_i(n)$ that minimized the distance between empirical moments M^0 and theoretical moments. The latter were approximated numerically. Specifically, for given parameter values, the model was simulated $N^s = 20$ times for 292 periods. $T = 192$ corresponded to the length of the empirical data sample. Additional 100 periods were included to limit the dependence on the initial conditions. These periods were discarded for estimation. The series for ξ_t and ε_t were constructed on the basis of $N \times N^s \times (T + 100) \times 2$ draws from the standard normal distribution. These draws were fixed at the start of the estimation. Since σ_{ε}^{2} was one of the parameters to be estimated, the variances of simulated series of news and unexpected TFP shocks were adjusted using the current estimate of σ_{ε}^{2} for each simulation j. The moments $M_j^s(\boldsymbol{\mu})$ were computed in the same way as the data moments. The estimate $\hat{\boldsymbol{\mu}}_i(n)$ for replication i:

$$\hat{\boldsymbol{\mu}}_i(n) \equiv \arg\min_{\boldsymbol{\mu}} J_i(n) = \frac{N^s T}{1+N^s T}\left(M^0 - \frac{1}{N^s}\sum_{j=1}^{N^s} M_j^s(\boldsymbol{\mu}; n)\right)\left(M^0 - \frac{1}{N^s}\sum_{j=1}^{N^s} M_j^s(\boldsymbol{\mu}; n)\right)'$$

For a specific length of anticipation periods n, the estimate of $\boldsymbol{\mu}(n)$ and its standard error were computed by averaging across the replications. The estimation was restricted to the region of determinacy. Similar to Nakajima (2003), the model had sunspot equilibria for certain combinations of σ and θ. Such combinations were excluded from consideration. The inequality restrictions $\sigma \geq 0.0001$, $\theta \leq 0.999$, $0 \leq \omega \leq 0.999999$, $0 \leq \sigma_{\varepsilon}^{2} \leq 0.0072^2$ were imposed in the estimation. The estimation procedure was repeated for each value of n between 1 and 6. Exactly the same random draws were used across values of n, thus the estimation results were directly comparable. The resulting value of n was chosen to give the lowest average value of the J statistic.

Estimation results Table 1 reports the estimated parameter values and their standard errors for the minimum average $J-$statistic. This case corresponds to $n = 4$. Overall, the results support both the spirit-of-capitalism assumption and the presence of news shocks. The weight of status in the utility function ω is strongly positive. While θ is estimated imprecisely, its value indicates that consumption and status exhibit some complementarity. Evaluated at the steady state, the elasticity of substitution between consumption and status is 0.66, and the intertemporal elasticity of substitution is 1.12. The model does not require a large departure from the frictionless capital accumulation. The implied degree of capital adjustment costs is relatively small, but very precisely estimated.

TFP news shocks in the model are summarized by two parameters: the number of anticipation periods n and the variance of the shock σ_ε^2. Value $n = 4$ suggests that technology shocks could be anticipated a year in advance. Values of the J statistics declined substantially for $n > 1$. The difference between the J statistics for other values of n was of the order $1e - 5$. The estimation procedure attributed almost two thirds of the variation in technology shocks to news shocks. These results are consistent with the findings of Beaudry and Portier (2004), who, in the context of a very different model, confirm that agents could receive signals about future productivity one year ahead, and that these signals could be rather informative.

Quantitative implications of spirit-of-capitalism model are analyzed using the mean values of the parameter estimates, unless specified otherwise. The role of the model assumptions is better understood in comparison with a more familiar benchmark. For this purpose, the results are also reported for a real business cycle model (RBC) that abstracts from capital adjustment costs and social status. For this alternative specification, the preferences are $U(C_t, L_t) = \frac{C_t^{1-\sigma}}{1-\sigma} - \eta_t \frac{L_t^{1+\psi}}{1+\psi}$. The key parameters for the RBC model are listed in Table 1.

3. Possibility of expectation driven business cycles

Beaudry and Portier (2007, p. 464) define expectation driven business cycles as "a positive co-movement between consumption, investment and employment induced by a change in expectations holding current technology and preferences constant." They also prove that most commonly used macroeconomic models, including the real business cycle model with capital adjustment costs (19), fail to generate these types of cycles. This section derives analytical restrictions under which $EDBC$ can arise in the spirit-of-capitalism model. The empirical feasibility of these restrictions is illustrated numerically.

To determine whether a model can generate a positive co-movement between consumption, investment and employment immediately after exogenous changes in expectations, it is sufficient to analyze the *intra*temporal equilibrium conditions of the model, or its temporary equilibrium. This approach, proposed by Beaudry and Portier (2007), has an advantage of not taking a stand on a source of changes in expectations or the rationality of these changes. The temporary equilibrium of the spirit-of-capitalism model can be reduced to two equations in terms of consumption, hours worked and capital: the goods-leisure trade-off and the aggregate resource constraint :

$$-U_L\left(C_t, \mathcal{S}\left(K_{t+1,}K_t\right), L_t\right) = U_C\left(C_t, \mathcal{S}\left(K_{t+1,}K_t\right), L_t\right) F_L\left(K_t, A_t L_t, z_t\right) \tag{20}$$

$$C_t = G\left(K_t, L_t, K_{t+1}; A_t, z_t\right) \equiv F\left(K_t, A_t L_t, z_t\right) - \mathcal{I}\left(K_{t+1}, K_t\right) \tag{21}$$

These specifications use the fact that equilibrium investment and financial wealth can be expressed as functions of capital stocks K_{t+1} and K_t. The investment function $I_t = \mathcal{I}\left(K_{t+1}, K_t\right)$ is obtained by inverting (6). The model assumptions imply that $\mathcal{I}_{K_{t+1}} > 0$ and $\mathcal{I}_{K_t} < 0$. The financial wealth function $S_t = \mathcal{S}\left(K_{t+1,}K_t\right) = \frac{K_{t+1}}{Q_2((1-\delta)K_t, \mathcal{I}(K_{t+1}, K_t))}$ is based on (11), investment function and the stock market price (7).

If changes in expectations induce an immediate simultaneous increase (or a simultaneous decline) in consumption, investment and employment without any change in technology or preferences, it must be the case that the surface defining the temporary equilibrium has the property that $\frac{\partial C_t}{\partial K_{t+1}} > 0$ and$\frac{\partial L_t}{\partial K_{t+1}} > 0$. The propositions below show that these two inequalities are satisfied in the spirit-of-capitalism model if status raises the cost of leisure, measured in utility units, at the time of a consumption boom. The proofs of the propositions are given in the Appendix. To simplify the notation, the arguments of all functions are omitted in the rest of the section.

Proposition 1 *Expectation driven business cycles* can *arise in the spirit-of-capitalism model only if* $\frac{X_t U_{C_t X_t}}{U_{C_t}} > \frac{X_t U_{L_t X_t}}{U_{L_t}}$ *or, alternatively, only if the marginal rate of substitution of hours worked for consumption* $MRS_{L_t C_t} = U_{L_t}/U_{Ct}$ *is increasing in status.*

Corollary 1 *Expectation driven business cycles* can *arise in the spirit-of-capitalism model with preferences* (17) *and production technologies* (18) *and* (19) *only if* $1 - \sigma - \theta > 0$.

Proposition 1 provides a necessary condition for the existence of expectation driven business cycles. It states that $EDBC$ can arise only if higher status increases the value of consumption by more than it decreases the value of work (or increases the value of leisure). When status is separable from hours worked ($U_{L_t X_t} = 0$), the necessary condition simply requires that the value of consumption increases with status.

The intuition for the necessary condition is best understood by analyzing the temporary labor market equilibrium. Let us, for concreteness, consider the log-linearized equations of the model with the specific functional forms used in the simulations:

$$\begin{aligned} \alpha \hat{L}_t^d \left(\hat{w}_t; \hat{k}_t, \hat{z}_t\right) &= -\hat{w}_t + \alpha \hat{k}_t + \hat{z}_t \\ \psi \hat{L}_t^s \left(\hat{w}_t; \hat{c}_t, \hat{x}_t\right) &= \hat{w}_t - \sigma \hat{c}_t + (1 - \sigma - \theta)\, \varepsilon_{Vx}^* (\omega, \theta) \left(\hat{x}_t - \hat{c}_t\right) \end{aligned}$$

Variables with carets represent proportionate deviations of detrended variables from their steady states, denoted by variables with stars. For example, $\hat{c}_t = \log\left(c_t / c^*\right)$. The steady state value of the elasticity of the V aggregator with respect to status $\varepsilon_{Vx}^* (\omega, \theta)$ is between zero and one; it is equal to zero, when households do not care about status. The labor demand curve, conditional on capital and observed technology shock, is identical to that of the RBC model. The marginal utility constant labor supply curve, however, has an extra term. This term corresponds to the change in status-consumption ratio.

The failure of the RBC model, and its many variants, to generate $EDBC$ comes from its prediction of a negative co-movement between consumption and hours in response to changes in expectations that do not affect the marginal product of labor. Barro and King (1984) were probably first to argue this point. Consider, for example, a change in expectations that leads to an increase in current consumption, but does not affect the marginal product of labor. Higher consumption reduces the cost of leisure, measured in utility units. If status is not valued and if consumption and leisure are normal goods, labor supply, and hence equilibrium hours worked, must decline.

The spirit-of-capitalism model introduces an additional channel through which movements in interest rates and income can influence labor decisions. If status has a positive effect on the marginal utility constant labor supply, equilibrium hours worked can increase jointly with consumption. Otherwise, $EDBC$ are ruled out. Proposition 2 defines the existence condition for $EDBC$.

Proposition 2. *Expectation driven business cycles will arise in the spirit-of-capitalism model if the following condition is satisfied:*

$$\frac{X_t}{-MRS_{L_tC_t}}\frac{\partial MRS_{L_tC_t}}{\partial X_t}\frac{I_t}{S_t}\frac{\partial \mathcal{S}_t}{\partial I_t} > \frac{I_t}{Y_t}\frac{F_t}{L_tF_{L_t}}\left(\frac{-L_tF_{L_tL_t}}{F_{L_t}} + \frac{L_t}{MRS_{L_tC_t}}\frac{\partial MRS_{L_tC_t}}{\partial L_t}\right)$$

Corollary 2. *Expectation driven business cycles will arise in the log-linearized version of the model with preferences* (17) *and production technologies* (18) *and* (19) *if*

$$(1-\sigma-\theta)\,\varepsilon^*_{v_x}(\omega,\theta)\left(1-\phi\frac{1-\delta}{\gamma}\right) > \left(\frac{i}{y}\right)^*\frac{\alpha+\psi}{1-\alpha} \tag{22}$$

where $\left(\frac{i}{y}\right)^*$ *is the steady state share of investment in output.*

Several factors determine the existence of $EDBC$: the status-seeking motive, the degree of capital adjustment costs, the curvatures of production functions and preferences, and the share of investment in output. These factors influence, directly or indirectly, the value of leisure. They must balance out to increase the cost of taking leisure at the time of the expectation driven consumption boom. If equilibrium hours and consumption both rise, an expansion of output and investment become possible.

Proposition 2 indicates that $EDBC$ are theoretically possible even without capital adjustment costs. In this case, $\frac{I_t}{S_t}\frac{\partial S_t}{\partial I_t} = \frac{I_t}{K_{t+1}}$. However, a calibrated version requires capital adjustment costs to predict a boom in response to a TFP news shock. Capital adjustment costs introduce non-trivial movements in the price of capital. Higher asset prices raise the current wealth and increase investment demand. This helps to raise status, which in equilibrium coincide with the value of capital, and to increase labor supply.

The role of each factor is easier to interpret for the model with specific functional forms. Status-seeking, measured by ω, is essential to overcome the negative co-movement between hours and consumption, as shown in Proposition 1. Higher capital costs (lower ϕ), higher willingness to substitute over time (lower σ), lower share of labor in production (lower α), higher Frisch elasticity of labor supply (lower ψ), and lower share of investment in production make the existence of $EDBC$ more likely. The model predicts that the real wage must fall at the beginning of an expectation driven boom. The slopes of the labor demand and labor supply in the temporary equilibrium, α and ψ, determine the wage elasticity of equilibrium hours. Investment share in output, depreciation rate and technological growth influence the amount of labor that is required to produce an extra unit of new capital versus an extra unit of consumption. These factors define a necessary shift in employment.

The existence condition (22) is satisfied at the mean values of parameter estimates. In fact, it can be satisfied for a large range of parameter configurations. Figure 1 provides a numerical illustration. Two values of the financial wealth weights are used: $\omega = 0.8$ (the left panel) and $\omega = 0.65$ (the right panel). On each panel, the straight line corresponds to the condition $\sigma + \theta = 1$. The other curves are constructed as follows. For a given value of ϕ, the curve plots a value of σ, as a function of θ, for which the condition (22) is satisfied with equality. The value $\phi = 0.8$ is the SMM estimate, $\phi = 0.23$ is from Christiano and Fisher (1998) and Boileau and Braeu (2007), and $\phi = -1.5$ is used by Nakajima (2003). The admissible values for θ and σ that lead to $EDBC$ are below the $\phi-$curve and above $\sigma = 0$ line. Throughout the derivations β is adjusted to keep the steady state real interest rate unchanged. This calibration keeps the right hand side of inequality (22) constant.

Figure 1 visualizes the impact of the four parameters on the empirical feasibility of $EDBC$. The feasibility range for σ and θ expands when status is more valued in preferences (ω is higher) or capital accumulation is more costly (ϕ is lower). The relationship between θ and σ is non-monotonic. On the one hand, the lower value of θ increases $1 - \sigma - \theta$. On the other hand, it decreases the steady state elasticity ε^*_{Vx}.

This section has focused on the impact responses of consumption, investment and hours worked to changes in expectations. The analytical restrictions for the existence of $EDBC$ do not guarantee that these variables will *increase* on impact. Further, the analysis is silent about what happens to these variables along the transition path. The rest of the paper addresses these issues by focusing on changes in expectations about future TFP.

4. Dynamic adjustment to shocks

Impulse response functions trace the adjustment of the model economy to news and unexpected TFP shocks. Three experiments are considered: good news about future TFP that is realized, (ii) good news about future TFP that is not realized, and (iii) an unexpected positive TFP shock. In all experiments, the economy starts at its steady state level.

Boom driven by realized good news shock Figure 2 shows that good news about a future technological improvement creates an economic expansion. Variable responses correspond to an announcement, received in period 1, that the level of TFP will be one percent higher in period 5. The announcement is followed by the actual increase in TFP.

When the news arrives, it is understood that future TFP improvement will raise the marginal product of capital. Anticipating higher capital needs, the firms start building up their productive capacity immediately. The firms meet greater financial needs by issuing new equity. They take advantage of lower labor costs to expand employment and production. In equilibrium, the described actions of the firms are consistent with the decisions of the households.

When the news arrives, three effects take place. First, the boom on the stock market increases the value of the financial portfolio. Higher wealth increases the demand for consumption, status and leisure. Second, the households realize that their future wage income will be higher. The income effect induces an increase in the demand for all goods. Third, the households expect higher returns on saving. The intertemporal substitution effect of higher returns provides incentives to work more and save more, to generate more wealth. In the spirit-of-capitalism model, wealth is accumulated not only for the provision of material goods, but also for its own sake. In comparing the value of current and future consumption, households take into account both the market returns and the utility flows from wealth. Overall, the households are willing to work more, save and invest in the stock market, and use the capital gains to finance consumption.

The model's predictions are qualitatively consistent with the estimated responses in Beaudry and Portier (2006). The model economy experiences a boom in consumption, investment, hours, output, and the stock market before the actual change in TFP. The boom continues after the news is validated and technology improves in period 5. These are the dynamics that many macroeconomic models cannot produce. For comparison, Figure 3 presents the responses of the RBC model. The good news in that model leads to a boom in consumption, but a decline in hours, investment and output.

Boom-bust driven by unrealized good news shock Figure 4 demonstrates that the model economy can go through a boom-bust cycle without any change in technology. Variable responses correspond to an announcement, received in period 1, that the level of TFP will be one percent higher in period 5. Unlike the previous experiment, the initial optimistic beliefs are not confirmed. Until period 5, when the agents observe the actual TFP, the dynamic paths of this and the previous experiment coincide. In period 5, the agents learn that there is an oversupply of capital. Equity price and investment demand fall sharply, lowering the current return on equity. The firms decrease employment and production. Consumption decreases gradually, being sufficiently complementary to capital through the link of capital to financial wealth and status. As capital depreciates, the economy converges back to its steady state.

The difference in the responses of consumption and investment is intriguing. This pattern of adjustment is qualitatively consistent with the behavior of the U.S. economy during the 2001 recession. Despite the collapse of investment and the stock market, consumption growth remained positive during that period. It is also worth pointing out that the model can predict a sharper fall in consumption. For example, consumption, investment, hours and output all decline in the model with higher capital adjustment costs $\phi = 0.23$, as illustrated in Figure 5. However, this estimation procedure did not select the parameters that lead to a sharper fall in consumption. Figure 5 also highlights a potentially important role of the stock market during expectation driven booms. Without capital adjustment costs $(\phi = 1)$, the model predicts a boom in investment, employment and output, but not in consumption.

The sensitivity of the responses to the length of anticipation periods n is illustrated on the right-hand side panels of Figure 5. The model can generate a boom-bust cycle even when the news is about TFP in a more distant point in the future. The adjustment paths represent the responses to two types of announcements. The solid lines ($n = 12$) correspond to an announcement, received in period 1, about a technological improvement three years ahead. The dashed lines ($n = 4$) correspond to an announcement, received in period 9, about a technological improvement a year ahead. In both cases, the agents expect a positive technology shock in period 12. This shock is not realized. The impact responses to the news about a more distant event remain sizable. Values at the peak, in period 11, are even stronger for consumption, hours and output.

Boom driven by positive unexpected TFP shock Figure 6 presents the model adjustment to an unexpected one percent increase in TFP, observed in period 1. The impact responses of the SOC and RBC models are qualitatively similar. The only exception is the equity price, which is constant in the RBC case. The subsequent adjustment differs in endogenous propagation. It is well known that the dynamics of hours and output in the RBC model mimic the dynamics of the technology shock (Cogley and Nason (1995)). In contrast, the responses of these variables follow a hump-shaped pattern in the SOC specification. Additional benefits from saving, in the form of higher social status, make it optimal for the household to increase work effort as long as the return on capital remains high.

5. Does the model produce "realistic" business cycles?

This section turns to quantitative implications of the spirit-of-capitalism model. The objective is to examine how well the model can reproduce business cycle statistics. In addition to measures of volatility, co-movement and persistence of aggregate quantities, predictions for financial and labor market statistics are analyzed. The results are compared with the implications of the benchmark RBC model.

Statistics for simulated data as well as historical statistics for the United States are reported in Tables 2, 3 and 4. Theoretical moments are given for four specifications. The spirit-of-capitalism model (SOC) relies on both news and unexpected TFP shocks. To isolate the effects of the two shocks, the same model is simulated with news shocks only (SOC (ε only) specification), and with unexpected TFP shocks only (SOC (ξ only) specification). The RBC model does not differentiate between news and unexpected TFP shocks. This model is simulated with the implied observed productivity impulses.

Theoretical moments are constructed as the averages of 1000 replications of sample size 192. Additional 100 periods were added in each replication to limit the dependence of the initial conditions. These periods were discarded in computing the moments. All moments, unless specified otherwise, were computed for the HP cyclical components of the logarithmic series using the smoothing parameter 1600. Tables 2-4 report the predictions for volatility, co-movement and persistence, as measured by standard deviation, correlation and autocorrelation coefficients. Only moments in Table 2 for the SOC model were targeted by the estimation procedure.

Much of the success of the RBC model is attributed to its ability to reproduce stylized facts about volatility, co-movement and persistence of output, consumption, investment and hours worked. As far as these statistics are concerned, the SOC model performs equally well. It even matches better the relative volatility of consumption and hours, and persistence of output and investment, as shown in Table 3.

The performance of the RBC model is much less favorable with respect to prices. It is well known that the implications of the RBC model for financial and labor markets are often at odds with the data.[3] For example, the model generates strongly procyclical interest rates and wages, low variability of interest rates, and minimal equity premium. However, prices play a critical role in equilibrium business cycle models. It is precisely through them marginal rates of substitution are equalized to marginal rates of transformation within and

[3] See, for example, Christiano and Eichenbaum (1992), Beaudry and Guay (1996), Jermann (1998), King and Rebelo (1999), Boldrin et al. (2001).

between the periods. Tables 2 and 4 demonstrate that the SOC model improves significantly the predicted behavior of prices.

First, the SOC model produces countercyclical interest rates. The estimation procedure targeted the correlation of risk-free return with consumption and hours (Table 2), but not with output. It is remarkable the latter statistic in Panel A, Table 4, is very close to its empirical value. Further, the SOC model is successful in reproducing the fact that correlation between output and equity returns is stronger (in absolute values) than the correlation between output and risk-free return. Conditional correlations highlight the importance of news shocks in generating the correlation signs. The SOC model that relies solely on unexpected TFP shocks generates a procyclical risk-free return and a positive correlation of the return with consumption and hours.

Second, the SOC model is more successful in reproducing the volatility of returns. Panel B of Table 4 presents the statistics for risk-free and risky rates. The rates are reported in levels at the quarterly frequency, in percent per quarter. Equity rates, predicted by the SOC model, are almost twice as volatile as risk-free rates. The standard deviation of risk-free rate is amplified by the factor of four, relative to the RBC model. However, the volatility of equity returns remains too low. The model cannot replicate fully the volatility of the asset prices. Empirically, the high variability of equity returns is largely driven by variation in capital gains.

Third, output and the asset prices are positively correlated in the model. The price of capital and investment are linked through a $q-$theory type of the relation. Although the empirical correlation is not as high in the data, it is supportive of the outlined theoretical mechanism. The model relies only on two types of shocks, and only on one friction, the costly capital accumulation. In reality, other characteristics may be important for explaining completely the behavior of asset prices.

Fourth, the SOC model generates marginally higher equity premium, defined as the difference between the unconditional means of risky and risk-free rates. The implied equity premium is 0.07% and 0.02% in the SOC and the RBC models, at the annual rate. Historically, the return on equity has been higher than the return on short-term bonds. This phenomenon is known as the equity premium puzzle. Bakshi and Chen (1996) show that the spirit-of-capitalism hypothesis can resolve the equity premium puzzle in exchange economy. In contrast, Boileau and Braeu (2007) find that in production economy with costly capital accumulation the spirit-of-capital assumption alone cannot provide a solution. Their results are confirmed here for the SOC model with TFP news shocks.

Finally, the SOC model is successful in reducing the predicted correlations of output and hours worked with real wage (Panel C, Table 4). News shocks play a key role in this respect. As Figures 2 and 3 illustrate, the real wage falls in response to a positive news shock until the realization of the TFP shock is observed.

6. Additional empirical evidence

How plausible is the spirit-of-capitalism model and its restrictions for existence of expectation driven business cycles? Preference-based theories are ultimately judged by their ability to explain empirical phenomena. Zou (1995) and Carroll (2000) argue that direct preferences for wealth may be especially useful for understanding why the old do not generally decumulate wealth during retirement, why households with and without children do not show any significant differences in their savings behavior, and why the rich save so much. This section offers additional reasons, with a particular focus on the model's implications for labor supply.

6.1. Wealth and value of work and leisure

The existence of $EDBC$ in the model requires that an increase in financial wealth reduces the value of leisure, and hence provides more incentives for work. If the only purpose of wealth accumulation is a provision for future material needs, more wealth should increase consumption of leisure. Yet, many wealthy individuals, such as Donald Trump, refuse to retire, "continue to work very hard and take large risks to increase their net worth" (Cole et al. (1992), p.1116). These patterns of work, puzzling from the point of view of the standard theory, may be explained by several factors: wealth accumulation as the leading indicator of the job performance, greed, lust for power, towering, philanthropic motivations. However, all these explanations are behaviorally indistinguishable from the assumption that wealth can be pursued for its own sake. Carroll (2000) makes this point and gives evidence in its support.

The idea that an individual with a capitalistic spirit may choose to work harder, in order to increase his net worth or expand his business, is expressed by Weber and Sombart. Zou (1995, p. 137-138) cites two examples: "When Jacob Fugger, in speaking to a business associate who had retired and who wanted to persuade him to do the same, since he had made enough money and should let others have a chance, rejected that as pusillanimity and answered that 'he (Fugger) thought otherwise, he wanted to make money as long as he could'" (Weber (1958), p.51) and "It frequently happens that he really does not want to expand further, but he must. Many a captain of industry has confessed as much... Most capitalist undertakers think nothing else but this desire for extension and expansion, which to the outside observer appears so meaningless" (Sombart (1915), p. 174-175).

Anecdotal evidence points that possibly similar motives were driving the behavior of entrepreneurs in Silicon Valley during the Internet boom. In describing the behavior of these entrepreneurs at the later phase of the boom, Levy (1999) wrote: "[F]ew of the new multimillionaires and billionaires have cashed in their lucrative shares ... all keep hours as long now as when their companies were mere blips on the technology scene."

The Internet boom provides another interesting evidence, based on statistics from Cheng and French (2000). Individuals aged 55 and older, as a group, were the largest holders of corporate stock, inclusive of indirect holdings through mutual funds, pension and trust accounts. This group benefited the most from the run-up of stock prices between 1994 and 1999: twenty one percent of this group received wealth gains in excess of $50,000. This amount could have replaced, on average, at least one year of earning. Remarkably, the labor force participation of both men and women in this group increased during this period.

A link between the stock market and workers' effort appears to be strengthen by new human resource management practices. These practices include variable pay (performance bonuses, profit sharing, stock options) as well as greater involvement of workers in the decision making process. Lebow et al. (1999) give an idea of the relative importance of variable pay. Sixty three percent of the U.S. firms surveyed by the American Compensation Association in 1998-99, and almost ninety percent of the firms interviewed by Federal Reserve banks in 1998, used some form of variable pay. In the 1998 Survey of Consumer Finances, 11.2 percent of families reported having received stock options. Information on the relative size of the stock options is available for the 125 nonfinancial corporations in the S&P 500 with the largest market capitalization. The value of stock option grants and gains from their exercise, per employee, were estimated at $565 and $450 in 1994, and $1,648 and $3,699 in 1998. One reason for adopting the new practices is the belief that they will "boost productivity by raising workers' incentives to work harder and smarter" (Lebow et al. (1999), p. 10). The actual productivity gains are estimated at between 2 and 10 percent.

The financial and market performance of firms can affect workers' effort beyond a purely pecuniary channel. Based on a unique panel data set of U.S. firms, Schneider et al. (2003)

find a causal impact of return on assets and earnings per share on employee satisfaction with job security and with overall job satisfaction, as well as the reciprocal relations between satisfaction with pay and firms' performance. Thus, employees may work harder at the time of rising stock prices because they feel more satisfied with their job or have a more direct stake in the firm's fortunes, not only because they are paid more. Given that about 40 percent of the U.S. employees work in publicly traded firms, the macroeconomic impact of workers' choices may be quantitatively important.

6.2. Relative standards and the spirit of capitalism

The spirit-of-capitalism model was formulated under the assumption that status is derived from absolute wealth. The model can be re-interpreted as representing concerns about the relative standing in society or in a reference group. For example, social status may depend on the difference between the individual wealth and some "self-assessed reservation or subsistence wealth level," (Bakshi and Chen (1996). p. 137), say, $X_t \equiv S_t^{ind} - \kappa S_t^{ref}$, with $\kappa > 0$. While the reference wealth is likely to vary from one person to another, it is natural to equate this level with the aggregate wealth in a representative agent model. Equilibrium status is then given by $X_t = (1 - \kappa) S_t$, since individual and aggregate wealth coincide. This specification becomes observationally equivalent to the main formulation.

The alternative interpretation of preferences points out their similarity with models of habit formation (Constantinides (1990)) and "catching up with the Joneses"(Abel (1990)). Those models express the relative standards in terms of consumption (either of one's own past consumption or the consumption of others), rather than wealth. Defining status in terms of relative wealth is also useful for linking the spirit-of-capitalism model with empirical evaluation of relative standards. The available evidence, albeit limited, supports the existence of these standards.

First, employment decisions of women are significantly affected by relative income considerations. Neumark and Postlewaite (1998) find that employment and incomes of the sisters and sisters-in-law, as well as the income of the husbands relative to the income of the sister's husbands are important in explaining women's labor force participation. Their model with relative income concerns in the utility function helps to understand why women's employment in the U.S. during certain episodes grew faster than predicted by the neoclassical model. Park (2005) shows that a married woman is more likely to be in the labor force when her husband's relative income is low.

Second, hours of work chosen by an individual are influenced by the average hours of work in his social reference group. According to the estimation of Aronsson et al. (1999), the effects of a tax reform on hours of work would be underestimated by more than fifty percent if the preference interdependences are neglected. Finally, relative income affects subjective well-being. Luttmer (2005) finds a sizable relative income impact on reported individual happiness. For a panel of 9,000 individuals, he is able to use the average earning in the neighborhood in which individuals live. In his data set, an increase in the average income in the neighborhood reduces individual happiness by about as much as a decline in individual's income does.

6.3. Stock market, consumer sentiment and business cycles

Movements of the stock market may affect consumer spending by means that go beyond the conventional wealth effect. Changes in stock prices are covered in the daily news. They provide signals about the current and future health of the economy. Rising stock markets may stimulate consumer optimism and lead to higher consumer spending. Romer (1990) proposes the "consumer confidence channel" in her study on the onset of the Great Depression. More recent work confirms an independent transmission of changes in stock prices to consumption through their impact on consumer sentiments.

Consumer sentiments tend to be positively correlated with stock prices and stock returns.

In the very short term, from two weeks to one month, increases in stock prices boost consumer sentiment, but the reverse does not hold. The causal relation from changes in stock prices to changes in consumer sentiment is largely driven by expectations about aggregate economic conditions, rather than about personal finances. Otoo (1999) documents these patterns for the U.S. and Jansen and Nahuis (1998) - for Europe. Evidence from Carroll et al. (1994) and Bram and Ludvigson (1998) that improvements in consumer sentiment stimulate consumption growth completes the transmission chain.

According to the consumer confidence channel, a bull stock market makes consumers feel better about the future of the aggregate economy, and hence feel happier in general. Studies based on the surveys of happiness also find that the subjective perception of well-being tend to vary with business cycles. Di Tella et al. (2003) examine the data for Europeans and Americans from the 1970s to the 1990s. They find that changes in reported happiness of individuals are significantly correlated with the level and growth rates of GDP, inflation and unemployment rates. Their results indicate that costs and rewards from business cycles may be largely nonpecuniary. An average citizen, not only a person who lost his job, feels worse when the unemployment rate in the economy is higher. To compensate for pure 'psychic' losses from a typical U.S.-size recession, each citizen would have to be given an annual compensation of approximately three percent of per capita GDP. This cost is estimated to be almost 15 percent higher for an individual who loses his job during the recession.

The spirit-of-capitalism model captures the effects of the consumer confidence channel and the dependence of individual happiness on aggregate variables, to some degree. When the necessary condition for $EDBC$ is satisfied, rising stock prices increase the marginal value of consumption, at the given allocations. Households in the model economy feel 'happier', and augment their spending. The externality-type effect of status pushes consumption beyond the level predicted by the conventional wealth channel.

6.4. On the potential scope of the spirit-of-capitalism effect

How large is a fraction of the population that could potentially be affected by the capitalistic spirit considerations? Judging by the direct exposure to stock holding only, this fraction is likely to be limited. Stock ownership constitutes a modest fraction of household net worth. It tends to be rather concentrated and unevenly distributed across age groups. For example, the top one percent of equity holders in the U.S. in 1998 owned about half of the total private holdings of corporate equity, while the bottom eighty percent held only 4.1 percent (Poterba (2000), p. 101).

However, there are three reasons to believe that movements in the stock market may influence the decisions of non-shareholders: workers' involvement in the company management, relative income considerations and the consumer confidence channel. The evidence presented above indicates that all three reasons may have consequences that are quantitatively important at the macroeconomic level. A more precise judgement is not possible at this point, since the empirical literature in this area is at the early stage of development.

7. Concluding Remarks

This paper has argued that direct preferences for wealth, representing the concerns about absolute and relative social status, or the spirit-of-capitalism hypothesis, may help to understand the role of news shocks in the economy. A business cycle model that incorporates this feature can generate a boom in consumption, investment, employment, output and the stock market in response to news about a future technological improvement. A simulated version of the model replicates well several business cycle and financial statistics. A more general conclusion emerges from the analysis: a link between labor supply and the stock market may be important for explaining $EDBC$.

The spirit-of-capitalism is not the only mechanism which can lead to an expectation driven boom. Beaudry and Portier (2004), Jaimovich and Rebelo (2006) and Christiano et al. (2007) provide interesting alternatives. As more research develops, it becomes imperative to find ways to differentiate various explanations. Focusing on business cycle properties of aggregate quantities may not be sufficient for this purpose. The three models cited above, as well as the current model perform rather well on this dimension. It appears that examining the predictions for prices, and, in particular, for real wages may provide a partial test: if expectation driven expansions are explained predominately by shifts of labor demand, as in the multi-sectoral specification of Beaudry and Portier (2004), the real wage must increase in response to news shocks. If such expansions are explained predominately by shifts of labor supply, as in the spirit-of-capitalism model, the wage rate should fall. Empirical evidence on wage responses to news shocks is currently non-existent, but highly warranted.

Finally, differentiating the models has practical relevance. The model of Christiano et al. (2007) highlights the leading role of monetary policy in expectation driven business cycles. In fact, they argue that $EDBC$ may, to a large extent, result from a suboptimal monetary policy. In this paper, as well as in Beaudry and Portier (2004) and Jaimovich and Rebelo (2006), these cycles represent a real-side phenomenon. Given the empirical plausibility of news shocks, a better understanding of the channels through which these shocks affect the economy is required to design correct policy responses. However, a detailed comparative analysis of the alternative explanations is left for future research.

A Proofs of propositions and corollary 1

Proof of Proposition 1

Total differentiation of equations (20) and (21), keeping the stock of current capital and technology unchanged ($dK_t = 0$, $dA_t = 0$, $dz_t = 0$), leads to

$$dL_t = \kappa_1 \left(\kappa_2 dC_t + \kappa_3 dK_{t+1}\right) \tag{23}$$

$$dC_t = \frac{G_{K_{t+1}} + G_{L_t}\kappa_1\kappa_3}{1 - G_{L_t}\kappa_1\kappa_2} dK_{t+1} \tag{24}$$

with $\kappa_1 \equiv -\left(F_{L_t}U_{C_tL_t} + U_{C_t}F_{L_tL_t} + U_{L_tL_t}\right)^{-1} > 0$, $\kappa_2 \equiv F_{L_t}U_{C_tC_t} + U_{L_tC_t} < 0$, $\kappa_3 \equiv G_{L_tK_{t+1}}U_{C_t} + \left[U_{C_tX_t}G_{L_t} + U_{L_tX_t}\right]\mathcal{S}_{K_{t+1}} \lesseqgtr 0$. In this model, $G_{L_tK_{t+1}} = 0$, $G_{L_t} = F_{L_t} > 0$ and $G_{K_{t+1}} = -\frac{1}{Q_2((1-\delta)K_t, \mathcal{I}(K_{t+1}, K_t))} < 0$. Thus, if $\kappa_3 \leqslant 0$, then $\frac{\partial L_t}{\partial K_{t+1}} < 0$ and $\frac{\partial C_t}{\partial K_{t+1}} < 0$. Since $\mathcal{S}_{K_{t+1}} = \frac{1}{Q_{2,t}}\left[1 - \frac{K_{t+1}Q_{22,t}}{Q_{2,t}^2}\right] > 0$ and $G_{L_t} = -U_{L_t}/U_{C_t}$ from (20), the condition $\kappa_3 > 0$ is equivalent to $\frac{U_{C_tX_t}}{U_{C_t}} > \frac{U_{L_tX_t}}{U_{L_t}}$. The second part of the proposition is evident from $\frac{\partial MRS_{L_tC_t}}{\partial X_t} = \frac{\partial}{\partial X_t}\left(\frac{U_{L_t}}{U_{Ct}}\right) = \frac{U_{L_tX_t}U_{C_t} - U_{L_t}U_{C_tX_t}}{U_C^2} > 0$. $\diamond$

Discussion In the model without direct preferences for wealth, $\kappa_3 = U_{C_t}G_{L_tK_{t+1}}$, and a necessary condition for $EDBC$ is $G_{L_tK_{t+1}} > 0$: the marginal product of labor must increase with the level of investment. Since $G_{L_tK_t} = 0$, $EDBC$ cannot arise even in the model with capital adjustment costs. This conclusion changes when wealth has sufficiently strong intrinsic value.

Proof of Corollary 1 With preferences (17), $U_{L_tX_t} = 0$. The coefficient $\kappa_3 > 0$ if and only if $U_{C_tX_t} = (1 - \sigma - \theta)\,\omega\,(1-\omega)\,C_t^{\theta-1}S_t^{\theta-1}V\left(C_t, X_t\right)^{1-\sigma-2\theta} > 0$. $\diamond$

Proof of Proposition 2

$EDBC$ arise if $\frac{\partial C_t}{\partial K_{t+1}} > 0$ and $\frac{\partial L_t}{\partial K_{t+1}} > 0$. From (23) and (24), these inequalities are equivalent to $G_{K_{t+1}} + G_{L_t}\kappa_1\kappa_3 > 0$. The inequality in the proposition is derived by using the expressions for the coefficients κ_1 and κ_3, and equilibrium equations (20) and (21). $\diamond$

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Table 1: Key Model Parameters

	n	σ	θ	ω	ϕ	σ_ϵ^2	J-statistic
SOC	4	0.19	-0.52	0.79	0.80	0.32	2.4e-6
		[0.02]	[0.45]	[0.10]	[0.00]	[0.04]	[1.5e-5]
RBC	0	1	–	0	1	0	

Notes: Parameters for the spirit-of-capitalism model SOC are estimated by the simulated method of moments, based on the statistics in Table 2. The reported values and their standard errors (in brackets) are the averages across 500 replications. Parameters for the RBC model are set a priori. Value of θ is indeterminate in the RBC model. Variance of news shocks σ_ϵ^2 is reported in percent terms.

Table 2: Statistics Targeted in the Estimation

	$\rho(C, R^f)$	$\rho(L, R^f)$	$\rho(C, I)$	σ_I/σ_Y	σ_Y
Data	-0.30	-0.03	0.83	2.31	2.13
SOC	-0.30	-0.03	0.83	2.31	2.14
	[0.05]	[0.06]	[0.02]	[0.04]	[0.24]
SOC (ϵ only)	-0.40	-0.09	0.77	2.21	1.57
SOC (ξ only)	0.85	0.95	0.93	2.43	1.45
RBC	0.78	1.00	0.87	2.94	1.60

Notes: The data sample is 1955:1-2002:4. All variables are logged and detrended with the HP filter using the smoothing parameter 1600. Theoretical moments are the averages across 1000 replications of sample size 192. Standard deviation of output is reported in percent terms. The spirit of capitalism model is simulated with news and unexpected TFP shocks jointly (version SOC) and separately (versions SOC(ϵ only) and SOC(ξ only)). The RBC model is simulated with measured TFP impulses. $\rho(h, g)$ denotes the correlation coefficient between variables h and g, σ_h denotes the standard deviation of variable h.

Table 3: Standard Business Cycle Statistics

	$\rho(Y,C)$	$\rho(Y,I)$	$\rho(Y,L)$	σ_C/σ_Y	σ_L/σ_Y	$\rho(Y,Y')$	$\rho(C,C')$	$\rho(I,I')$
Data	0.88	0.91	0.86	0.58	0.84	0.85	0.86	0.90
SOC	0.95	0.96	0.98	0.64	0.86	0.76	0.78	0.75
SOC (ϵ only)	0.98	0.99	1.00	0.56	0.90	0.72	0.76	0.71
SOC (ξ only)	0.94	0.94	0.96	0.69	0.82	0.79	0.78	0.80
RBC	0.93	0.99	0.97	0.41	0.63	0.71	0.78	0.69

Notes: The data sample is 1955:1-2002:4. All variables are logged and detrended with the HP filter using the smoothing parameter 1600. Theoretical moments are the averages across 1000 replications of sample size 192. Numbers in brackets are standard errors. The spirit of capitalism model is simulated with news and unexpected TFP shocks jointly (version SOC) and separately (versions SOC(ϵ only) and SOC(ξ only)). The RBC model is simulated with measured TFP impulses. $\rho(h,g)$ denotes the correlation coefficient between variables h and g, σ_h denotes the standard deviation of variable h, $\rho(h,h')$ denotes the autocorrelation coefficient.

Table 4: Other Business Cycle Statistics

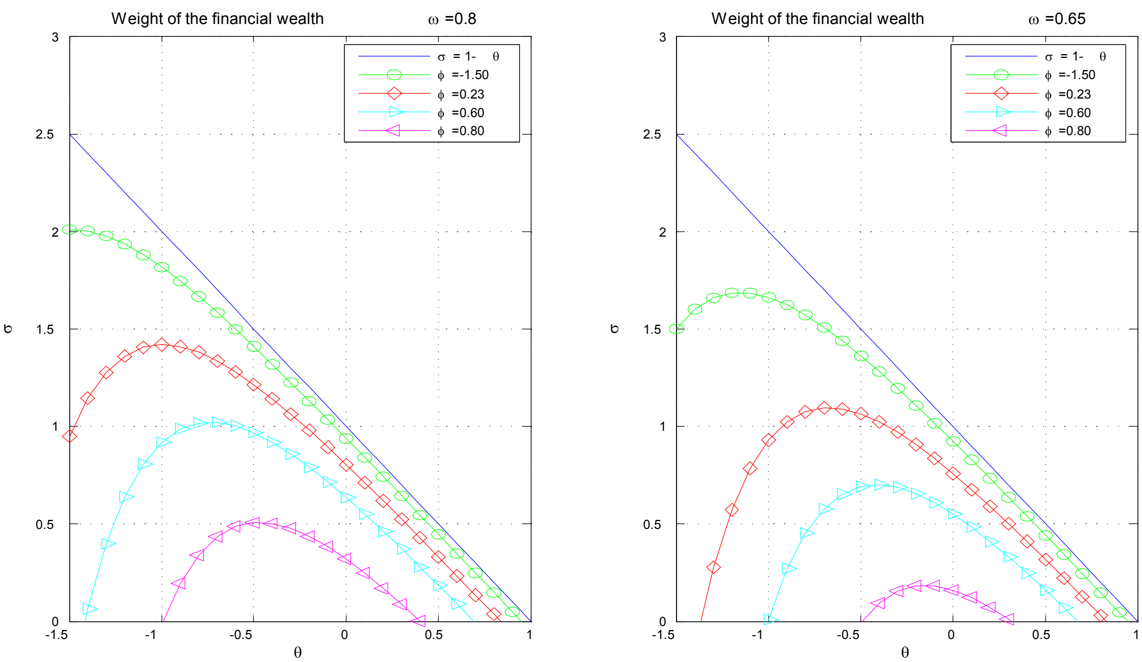
Panel A: Asset Returns				
	Er^f	Er^e	σ_{r^f}	σ_{r^e}
Data	0.56	1.60	0.64	8.14
SOC	1.60	1.62	0.43	0.76
SOC (ϵ only)	1.60	1.61	0.42	0.49
SOC (ξ only)	1.60	1.61	0.05	0.58
RBC	1.60	1.60	0.11	0.12

Panel B: Output and Financial Market				
	$\rho(Y, R^f)$	$\rho(Y, R^e)$	$\rho(Y, P)$	σ_P/σ_Y
Data	-0.17	-0.22	0.43	4.35
SOC	-0.15	-0.37	0.93	0.45
SOC (ϵ only)	-0.25	-0.37	0.90	0.43
SOC (ξ only)	0.94	-0.37	0.96	0.47
RBC	0.95	0.58	–	0.00

Panel C: Output and Labor Market			
	$\rho(Y, W)$	$\rho(L, W)$	σ_W/σ_Y
Data	0.28	0.10	0.42
SOC	0.67	0.50	0.24
SOC (ϵ only)	0.68	0.45	0.31
SOC (ξ only)	0.96	0.95	0.10
RBC	0.93	0.82	0.41

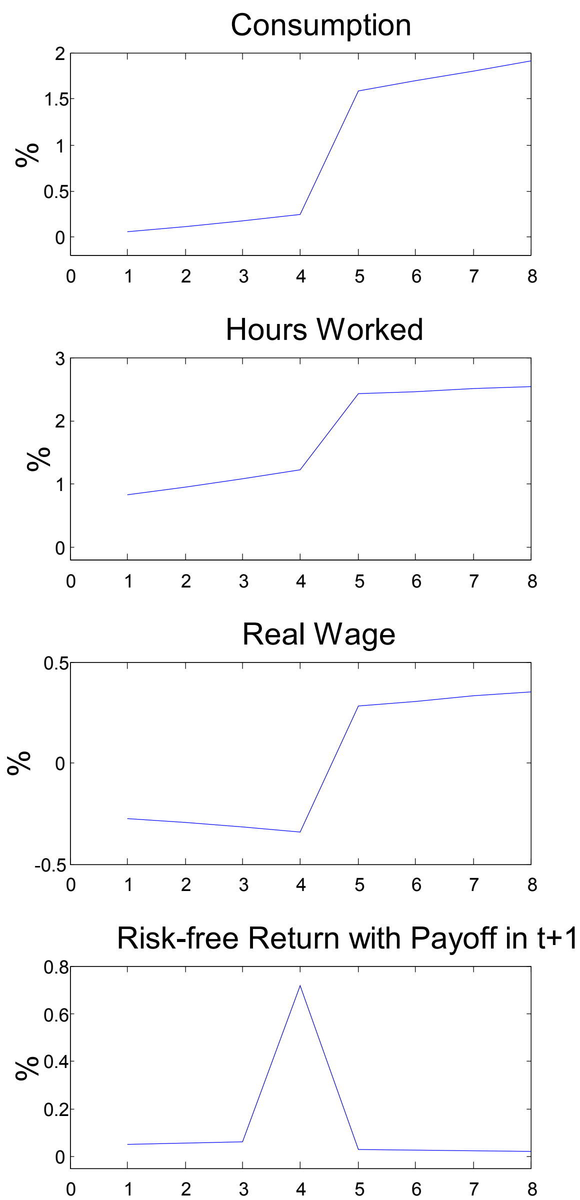
Notes: The data sample is 1955:1-2002:4. All variables, except the risk-free and risky rates, are logged and detrended with the HP filter using the smoothing parameter 1600. The rates are expressed in levels. Standard deviations are reported in percent terms. The real rates and returns are reported at the quarterly frequency, in percent per quarter. Equity price is constant in the RBC model. Theoretical moments are the averages across 1000 replications of sample size 192. The spirit of capitalism model is simulated with news and unexpected TFP shocks jointly (version SOC) and separately (versions SOC(ϵ only) and SOC(ξ only)). The RBC model is simulated with measured TFP impulses. $\rho(h, g)$ denotes the correlation coefficient between variables h and g, σ_h denotes the standard deviation of variable h.

Figure 1. Parameter Restrictions for Existence of Expectation Driven Business Cycles
SOC Model: Illustration



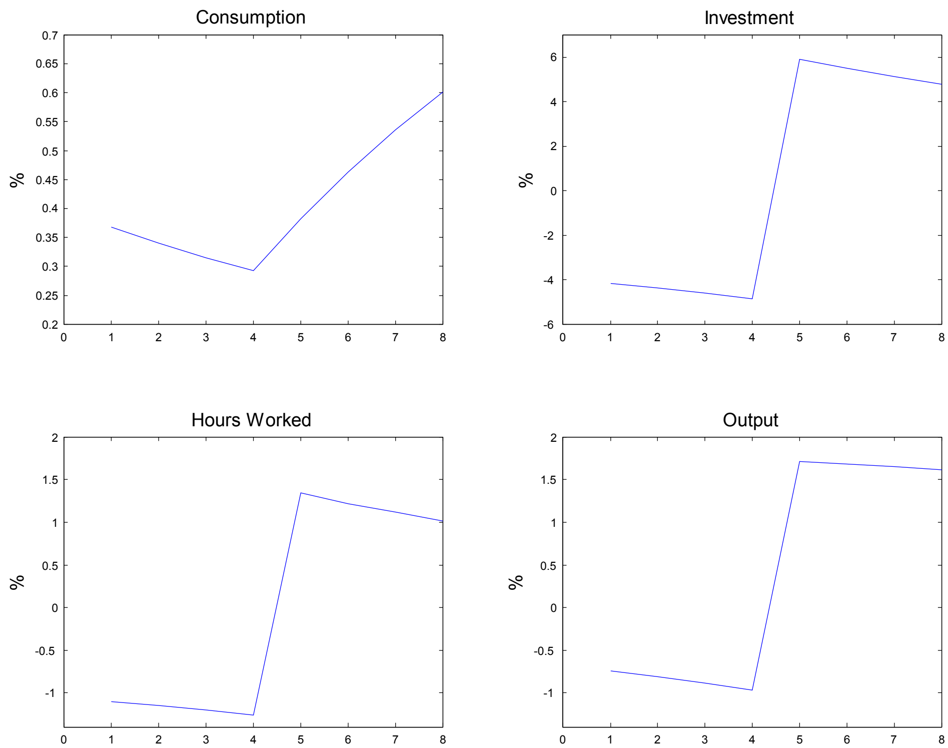
Notes: The spirit-of-capitalism model predicts a positive contemporaneous co-movement between consumption, investment, hours worked and output in response to exogenous changes in expectations for values of θ and σ that fall in the area below the $\phi-$curves, corresponding to the degree of capital adjustment costs.

Figure 2. Responses to TFP News Shock Followed by Increase in TFP
SOC Model



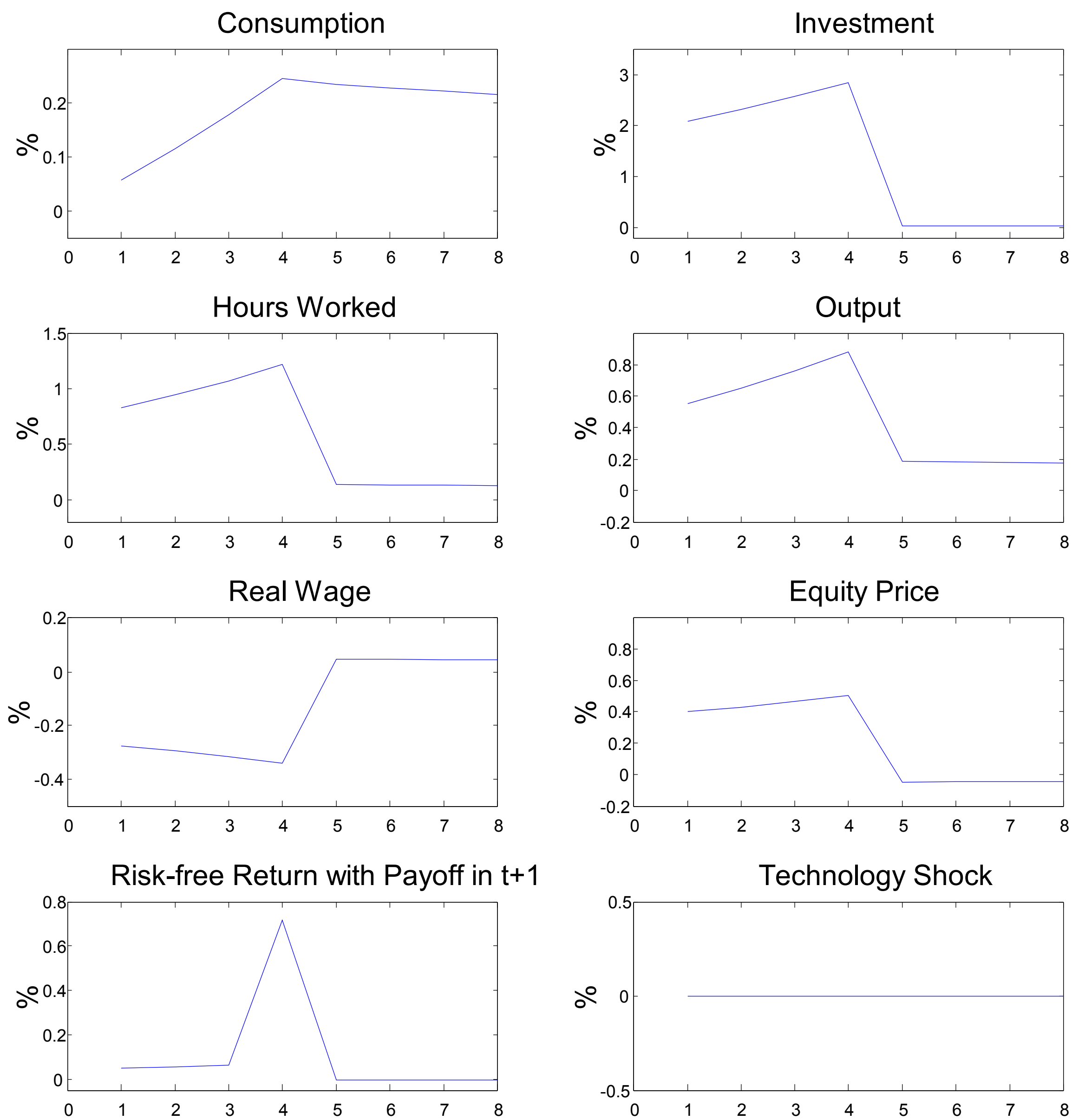
Notes: Future positive TFP shock is announced in period 1 and is realized in period 5. All variables are in percent deviations from the steady state. The risk-free return is expressed at the quarterly frequency.

Figure 3. Responses to TFP News Shock Followed by Increase in TFP
RBC Model



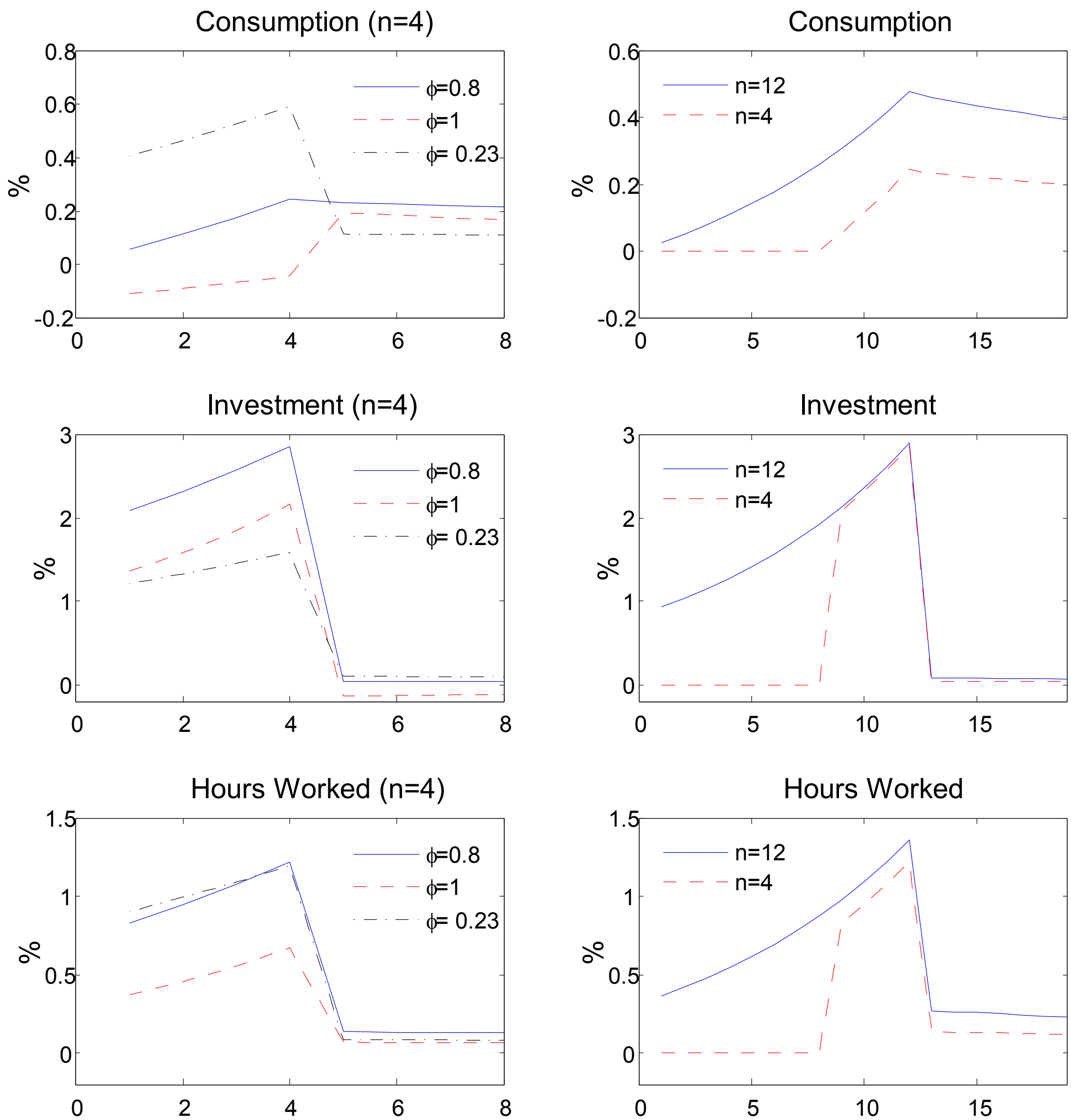
Notes: Future positive TFP shock is announced in period 1 and is realized in period 5. All variables are in percent deviations from the steady state.

Figure 4. Responses to TFP News Shock Followed by no Change in TFP
SOC Model



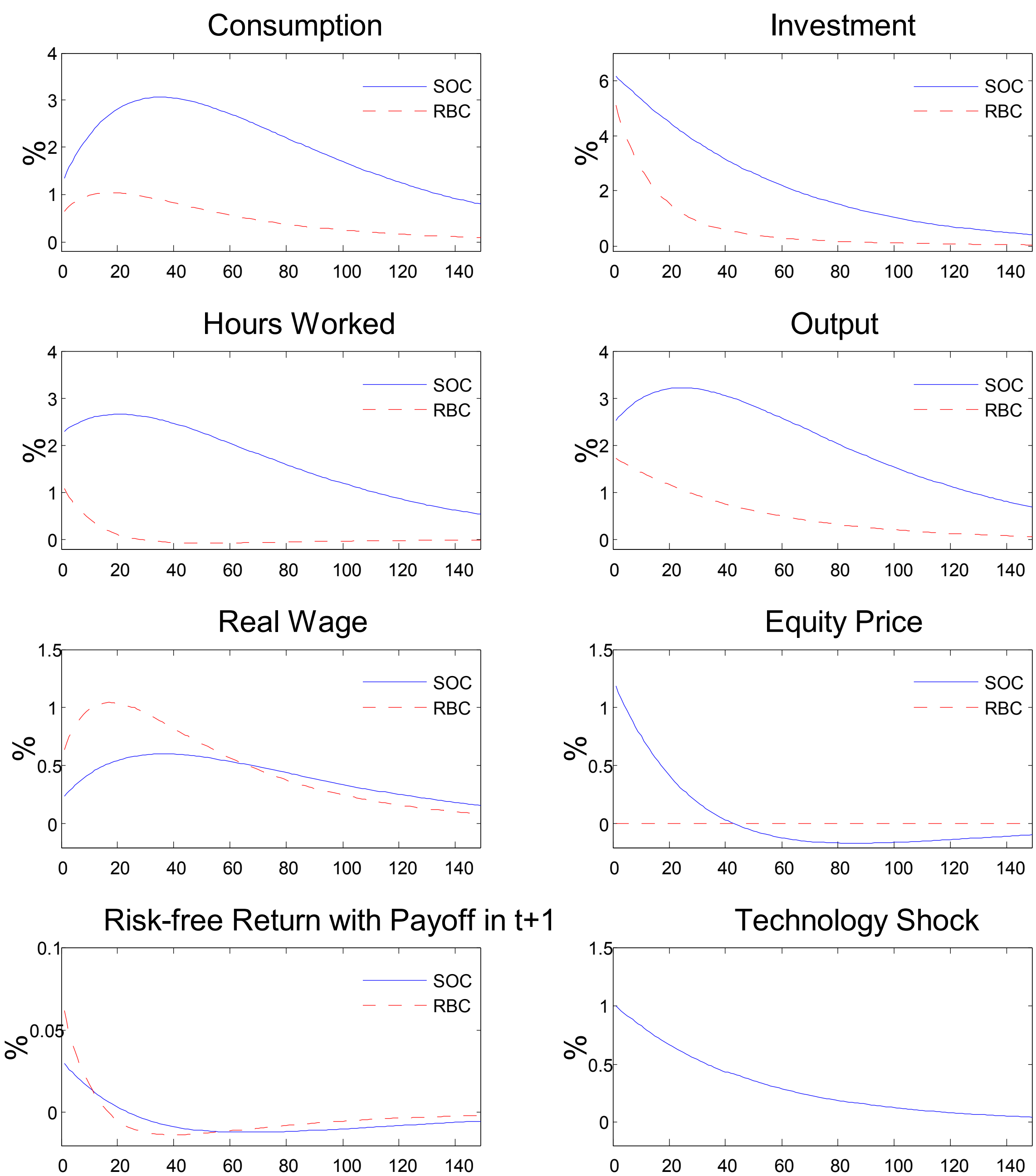
Notes: Future positive TFP shock is announced in period 1, but is not realized in period 5. All variables are in percent deviations from the steady state. The risk-free return is reported at the quarterly frequency.

Figure 5. Sensitivity of Responses to TFP News Shock Followed by no Change in TFP
SOC Model



Notes: Responses on the left-hand side panels illustrate the sensitivity to the degree of capital adjustment costs. Future positive TFP shock is announced in period 1, but is not realized in period 5. Responses on the right-hand side panels illustrate the sensitivity to the length of the anticipation periods. For the model with $n = 12$, future increase of TFP is announced in period 1. For the model with $n = 4$, future increase of TFP is announced in period 9. The TFP increase is expected to occur in period 12, but it is not realized. All variables are in percent deviations from the steady state.

Figure 6. Responses to Unexpected TFP Shock
SOC and RBC Models



Notes: All variables are in percent deviations from the steady state. The risk-free return is reported at the quarterly frequency.