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DO OPTIMISTS GROW FASTER AND INVEST MORE?

Abstract

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DO OPTIMISTS GROW FASTER AND INVEST MORE? [1]

Marcin Kacperczyk and Zbigniew Kominek

The paper discusses a two-period model of an economy with two industries, positive production externalities and random shocks to production functions. Multiple equilibria that arise in such a framework can be ranked according to agent's optimism. The equilibria with higher levels of optimism are characterized by higher economic growth, higher production growth and higher proportion of investments in externality yielding industries. Using the U.S. data, it is shown that changes in sentiment predict economic growth. Sentiment has significant positive impact on industry growth, aggregate economic growth and relative levels of investment in industries. Externality yielding industries also appear to be more affected by shifts in sentiment than non-externality industries.

THERE IS A STRONG anecdotal evidence of the relationship between sentiment and economic growth. It is often thought that expectations of future increases in real economic variables drive current levels of people's optimism. For example, Gallup's Report on Investor Sentiment states on March 29, 2000 that "investor optimism fell (…), largely because of concerns about (…) lower economic growth". At the same time, it is frequently believed that sentiment affects future economic indicators. For instance, the Wall Street Journal of September 26, 2001 reports results from a survey of 26 economists who predict economic slowdown due to decrease in the current level of consumer sentiment. This apparent interdependence between sentiment and macroeconomic variables, although commonly accepted by practitioners, seems to obtain rather limited attention among academics.

The majority of research appears to concentrate on the linkages between consumer sentiment and consumption. In particular, Acemoglu and Scott (1994) and Carroll, Fuher and Wilcox (1994) show that increases in *consumer* sentiment result in expansion of household expenditures. These results are confirmed by Howrey (2001), who finds that the Index of Consumer Sentiment has a strong predictive power in explaining future consumption. Matsusaka and Sbordone (1995) go beyond consumption analysis and present empirical evidence of positive impact of *consumer* sentiment on economic growth. They explain this result by the existence of strategic complementarities. Lee, Shleifer and Thaler (1991) claim that *investor* sentiment, measured by the closed-end fund premium, predicts future expected returns on the stock markets, whereas Elton, Gruber, and Busse (1998) provide evidence that small *investor* sentiment is not a priced risk factor.

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This paper extends the existing literature in several dimensions. It formalizes the relationship between sentiment, economic growth and investment in a simple two period multiple equilibrium model. It enriches the existing studies by analyzing separately the externality yielding and the non-externality yielding industries and by allowing random shocks to production functions. The central result of this paper shows that future economic and production growth depends on current optimism, both on the aggregate and on the industry levels. It is also shown that the production growth and investment in the externality yielding industries are more sensitive to changes in optimism than the production growth and investment in the non-externality yielding industries.

The externality based view of investment activity, applied in this paper, is well known in the literature on economic growth. Romer (1990) and Jones (1995) provide examples of the models, in which growth is driven by the technological change that results from efforts of profit-maximizing agents in the sector of research and development (R&D). In these models, agents face production functions with constant *private*, but increasing *social* returns to scale. They are not able to internalize the social impact of their activities and thus under-invest in the externality yielding industries. In such a case, the allocation of resources based on the standard informationally efficient markets is not Pareto optimal (Yanagawa and Grossman, 1993) and an increase in R&D expenses results in enhancement of the economic growth. The endogenous growth literature points to the government subsidies as one of the possible solutions to this problem (Romer, 1990). This paper suggests that, at least in some cases, the market itself may bring the investments closer to the optimal level. In particular, 'optimistic' agents may increase capital allocation in the externality yielding industry without any government intervention. On the other hand, such an intervention might be needed when 'pessimistic' agents withdraw their investment from R&D oriented sectors.

It is a well established fact that external returns to scale provide foundation to build a competitive general equilibrium theory of endogenous economic growth (see Arrow, 1962 and Romer, 1986). In such a framework, increasing returns are external to the firm and often lead to the existence of multiple competitive equilibria. Weil (1989) argues that these competitive equilibria can be interpreted as "animal spirits" equilibria, which can be indexed by consumers' optimism or pessimism. He analyzes a simple two-period economy with identical agents and one storable good. In his model, the storage is a riskless activity with constant returns to scale from the private point of view and increasing returns to scale from the aggregate perspective. We extend Weil's (1989) model by allowing many storable goods (industries), with at least one of them yielding externalities. We also introduce uncertainty about future returns. In such a framework, increase in optimism results in higher investments and economic growth. Moreover, during the period of high optimism, investors allocate proportionally more money into externality yielding industries and the production growth in externality yielding industries increases.

Our model produces several interesting empirical implications, which are tested in the second part of the paper. Using the U.S. data, we show that contemporaneous level of optimism affects future economic growth. We show that the impact of *investor* sentiment on future growth is long-lasting (up to four years), whereas the impact of *consumer* sentiment tends to last for shorter periods (one to two quarters). Both results are robust to the inclusion of control variables. Our analysis suggests causality from sentiment to economic growth. It is also shown that sentiment has significant positive impact on industry growth, aggregate economic growth and relative levels of investment in externality yielding industries. The production growth and investments in the externality yielding industries, which are identified by high share of research and development investments, appear to be more affected by shifts in sentiment than in the non-externality yielding industries.

The rest of the paper is organized as follows. In Section I we provide an outline of the model. Section II explores its consequences for the relationship between sentiment and economic growth. Section III provides empirical tests of the major theoretical hypotheses. Section IV concludes.

I. MODEL

Consider a two-period economy inhabited by a continuum of identical individuals. Suppose that each individual receives an endowment $e_1>0$ (salary), when young, and $e_2 \geq 0$ (pension), when old. She may choose to consume endowment e_1, when young, or invest part of it into two available industries: industry F_1 and industry F_2. If her consumption when young is c_1, and c_2 when old, then her utility U is:

$$U=U(c_1, c_2). \tag{1}$$

We assume that U satisfies standard concavity, continuity and differentiability conditions. Moreover, the following holds $U_1\,(0,x) = \infty$, and $U_2\,(0,x)<\infty$.

The optimal allocation of consumption can be found by maximizing expected utility subject to budget constraints:

$$c_1 + k_1 + k_2 = e_1 \;; \qquad c_2 = e_2 + R_1 k_1 + R_2 k_2; \qquad c_1, c_2, k_1, k_2 \geq 0, \tag{2}$$

where k_1 denotes the amount invested in industry F_1, k_2 the amount invested in industry F_2, and R_1 and R_2 are gross returns to investments in the respective industries. From the perspective of an individual, the return to industry F_2 can be decomposed as:

$$R_2 = R_{2\mathrm{D}} + \varepsilon, \tag{3}$$

where $R_{2\mathrm{D}}$ and $\varepsilon\sim N(0,\sigma_\varepsilon^2)$ denote the deterministic and random components of R_2, respectively. If there was no risk people would invest all their money in the industry with higher expected return, causing discontinuous changes in investment allocation in response to variations in expected returns. We also assume that the random component ε is effectively diversified across all agents in the economy and does not appear in the formula for aggregate returns in the industry F_2. This assumption is subsequently referred to as the *diversification* assumption. It is worth noting that the diversification assumption is not crucial for the model and it is mainly intended to simplify the reasoning. As R_{2D} is equal to the expected value of R_2, omitting the diversification assumption would make all our propositions valid for expected growth rather than for growth only.

Further, we posit, that from a private viewpoint, investments in both industries have constant returns to scale:

$$R_1(k_1)>0,\ R_1'(k_1) = 0; \qquad R_{2\mathrm{D}}(k_2)>0,\ R_{2\mathrm{D}}'(k_2) = 0. \tag{4}$$

However, on the aggregate level, the returns exhibit constant returns to scale for industry F_1 and increasing returns to scale for industry F_2:

$$R_1(K_1)>0,\ R_1'(K_1)=0; \qquad R_{2\mathrm{D}}(K_2)>0,\ R_{2\mathrm{D}}'(K_2) >0, \tag{5}$$

where K_1 and K_2 are aggregate levels of capital invested in the respective industries. We motivate the existence of externalities on the aggregate level by observing the following. Many times, even though the individual decision regarding investment may not influence significantly the total capital outlay, the sum of individual decisions has a considerable impact on the overall level of expenditures. Hence, we believe this assumption is very close to the existing evidence.

Let $F_2(K_2, k_2) = R_{2D}(K_2)k_2$ denote per-capita output from investment in industry F_2. Note, that for any $\lambda>1$ we have:

$$F_2(\lambda K_2, \lambda k_2) > F_2(K_2, \lambda k_2) = R_{2D}(K_2)\, \lambda k_2 = \lambda\, F_2(K_2, k_2), \tag{6}$$

which means that the constant returns to scale are external to the agents in the economy. In other words, individual investors, since they are atomistic, neglect the externality of their own investment decision on the economic productivity in industry F_2.

If we express the optimisation problem in terms of capital outlays, an investor chooses k_1 and k_2 to maximize her expected utility function:

$$\max_{k_1,k_2}\left[E\left(U(c_1,c_2)\right]=\max_{k_1,k_2}\left[E\left(U(e_1-k_1-k_2,e_2+R_1k_1+R_2k_2)\right)\right]. \tag{7}$$

Let $k = k_1 + k_2$ be the total amount of capital invested in the economy and let $p_2 = k_2 / k$ be the proportion of capital invested in industry F_2. Then, (7) is equivalent to the following maximization problem:

$$\max_{k,p_2}\left[E\left(U(c_1,c_2)\right]=\max_{k,p_2}\left[E\left(U[e_1-k,e_2+k(R_1(1-p_2)+R_2p_2)]\right)\right]. \tag{8}$$

By definition, the return on investor's portfolio P is equal to $R_P(p_2)=R_1(1-p_2)+R_2p_2$. Consequently, applying (3), $R_P(p_2)$ is normally distributed with mean $R_1(1-p_2)+R_{2D}p_2$ and variance $p_2^2\sigma_\varepsilon^2$:

$$R_P(p_2) \sim \mathrm{N}\left(R_1(1-p_2) + R_{2D}\,p_2,\ p_2^2\sigma_\varepsilon^2\right). \tag{9}$$

For fixed k, c_1 and c_2, the maximization problem (8) reduces to:

$$\max_{p_2}\left[E\left(U(c_1,c_2)\right]=\max_{p_2}\left[E\left(U2[(R_P(p_2))]\right)\right] \tag{10}$$

where $U2$ is a univariate function such that:

$$E\left(U2[(R_P(p_2))]\right)=E\left(U[e_1-k,e_2+kR_P(p_2)]\middle|e_1,e_2,k\right) \tag{11}$$

and $0\leq p_2\leq 1$. In other words, the objective function in (8) can be simplified to a maximization problem with one decision variable p_2. For fixed k, c_1 and c_2, an individual chooses p_2 to maximize her second period utility, whereas her utility in the first period is determined by her first period endowment and total amount of invested capital.

Given our assumptions, $U2$ satisfies standard concavity, continuity and differentiability conditions. It is well known (e.g. Ingersoll, 1987, Chapter IV) that with normally distributed returns, an investor, maximizing (10), always chooses a mean-variance efficient portfolio. Moreover, investor's indifference curves in the mean-standard deviation space are convex.

Besides, note that:

$$\partial(R_1(1-p_2) + R_{2D}\, p_2)/\partial p_2 = R_{2D} - R_1 \quad \text{and} \quad \partial^2(R_1(1-p_2) + R_{2D}\, p_2)/\partial p^2_2 = 0, \tag{12}$$

$$\partial(p_2\sigma_\varepsilon)/\partial p_2 = \sigma_\varepsilon > 0 \quad \text{and} \quad \partial^2 (p_2\sigma_\varepsilon)/\partial p^2_2 = 0, \tag{13}$$

Note that if for some k_2 the return on the risky industry R_{2D} is lower than the return on the risk free industry R_1, i.e. R_{2D}-R_1<0, then, by the risk aversion assumption, all capital is invested in the risk free industry. This in turn, results in no investment and no production in the risky industry and thereby the problem becomes uninteresting from the perspective of analysing the interactions between investments and growth in different industries. Therefore, for the rest of this study, we restrict our analysis to the case when R_{2D}-R_1>0 for all k_1 and k_2, which means that returns on the risky industry are higher than returns on the risk free industry for all levels and proportions of invested capital. In such a case, the first part of the condition (12) can be restated as:

$$\partial(R_1(1-p_2) + R_{2D}\, p_2)/\partial p_2 = R_{2D} - R_1 > 0 \tag{12'}$$

which implies that the set of available portfolios of investments in externality yielding industry F_2 and non-externality yielding industry F_1 forms a positively sloping line in the mean-standard deviation space. Since convex and linear functions have only one point of tangency, from an individual investor perspective, there exists a unique equilibrium for the maximization problem (10). Moreover, the optimal proportion of capital invested in the externality yielding industry, p_2*, is fully determined by R_1, R_{2D}, σ_ε, and the properties of function $U2$.

In particular, if we assume that the utility function $U2$ can be decomposed into a difference between an increasing function $U2_1$ of expected second period income and a risk penalty term $U2_2$, we can write:

$$U2 = U2_1\,(e_2 + k(R_1(1-p_2) + R_{2D}p_2)) - U2_2(p_2, \sigma_\varepsilon\,) \tag{14}$$

where $\partial U2_2/\partial p_2$ >0 and $\partial U2_2/\partial\sigma_\varepsilon$ >0. The above relationships imply that the penalty term increases, when the proportion of funds invested in the industry F_2 or the variance of returns on the industry F_2 grows.

The investor chooses equilibrium level of p_2* to maximize $U2$. The value of p_2* depends on the functional form of $U2$ and on the parameters involved. Hence, treating e_1, e_2, k and σ_ε as constants, and R_1 and R_{2D} as varying parameters, we can write:

$$p_2^* = P(R_1, R_{2D}), \tag{15}$$

where P is a function of R_1, R_{2D}, σ_ε and γ only. We additionally assume that an increase in the expected return on the externality yielding industry, increases the proportion of capital invested in equilibrium in this industry:

$$\partial p_2^* / \partial R_{2D} > 0. \tag{16}$$

This assumption restricts the shape of the utility function, yet it encompasses the majority of the standard utility curves.

Let R denote the optimal risk-adjusted return on the portfolio of investments in externality yielding and non-externality yielding industries, determined by (10). That means:

$$E[U2(R_P(p_2^*))] = E[U2(R)] = U2(R). \tag{17}$$

After solving the portfolio allocation problem (10), the investor faces the following maximization problem:

$$\max_k [E(U(c_1, c_2))] = \max_k [E(U(e_1 - k, e_2 + Rk))]. \tag{18}$$

Following (4) and (9), from an individual perspective, R_P has constant returns to scale. However, by (5), on the aggregate level, the gross return R_P exhibits increasing returns to scale:

$$R_P = R_P(K), \qquad R_P(K) > 0, \qquad R_P'(K) > 0. \tag{19}$$

Note, that there are two components, which determine this fact. First, by (9), R_P is a weighted average of R_1 and R_{2D}, reduced by the risk adjustment factor. From (15), the risk adjustment factor is independent of K. Hence, on the aggregate level, increasing returns to scale on the externality yielding industry translate into condition $R_P'(K) > 0$. Second, on the aggregate level, $R_{2D} = R_{2D}(K_2)$. An increase in K causes an increase in K_2, which subsequently leads to higher returns on the externality yielding industry. This by condition (16) implies that a higher proportion of investment is directed to externality yielding industry and, thereby, higher returns can be realized on the investment portfolio.

II. IMPLICATIONS FOR SENTIMENT AND ECONOMIC GROWTH

To analyse the optimisation problem outlined in equations (17), (18) and (19), we follow Weil (1989). In particular, Weil's propositions 2 and 3 can be readily adapted to our analysis.

PROPOSITION 1

If a) *for all* $x>0$, $U_1(0,x) = \infty$ *and* $U_2(0,x)<\infty$,

b) $R(0)< U_1(e_1, e_2)/U_2(e_1, e_2)$,

then there exists an even number of equilibria.

PROOF: Normalizing the size of population to one, it must be the case that in equilibrium $k = K$. From equations (2) and (24), one can easily see that equilibrium investment solves the inequality:

$$z(k) \leq 0 \qquad (20)$$
$$= 0 \text{ if } k > 0,$$

where: $$z(k) = - U_1[e_1 - k, e_2 + R(k)k] + R(k)U_2[e_1 - k, e_2 + R(k)k]. \qquad (21)$$

Assumption a) implies that $z(e_1) = -\infty$, while assumption b) and condition (19) result in $z(0)<0$. Since function $z(k)$ is continuous over interval $(0, e_1)$ there must be an even number of solutions to (20) and thus an even number of interior equilibria.

The equilibria can be ranked according to the expected levels of invested capital and hence the expected returns on the externality yielding industry. Assume that each equilibrium is assigned such variable that equilibrium with higher expected return on the externality yielding industry always corresponds to higher value of this variable than any equilibrium with lower expected return on the externality yielding industry. In the remainder of this paper, such variable is referred to as optimism.

PROPOSITION 2

If $K^j > K^i > 0$ *are two equilibrium levels of investment, then the utility is higher in the equilibrium* K^j *with higher level of optimism.*

PROOF: Following condition (19), $K^j > K^i$ implies that $R(K^j) > R(K^i)$. Therefore, an affordable consumption set for the total level of investment K^j must include the optimal consumption bundle for K^i. Thus, given quasi-concavity of the utility function, the optimal consumption choice for K^j must be strictly preferred to the equilibrium consumption basket for K^i, and K^j equilibrium outcome Pareto dominates K^i outcome.

In the above reasoning, the equilibrium level of investment depends exclusively on the expected value of $R(K)$. The higher the expected $R(K)$ is, the larger is the total investment and hence the actual rate of return $R(K)$, and the better is the optimal consumption bundle. More optimistic expectation, i.e. the expectation with higher investment level K, leads to an increase in utility from consumption. The equilibrium with higher level of optimism always Pareto dominates the equilibrium with lower level of optimism. In light of the above, it is relatively straightforward to restate Proposition 2 in terms of the economic growth. Note that since our model does not have outputs in period 1, growth rate is simply an output of period 2.

PROPOSITION 3

If $K^j > K^i > 0$ are two levels of investment, then

a) *the proportion of capital invested in the externality-yielding industry is higher in equilibrium K^j with higher level of optimism*
b) *the level of capital invested in the externality-yielding industry is higher in equilibrium K^j with higher level of optimism;*

PROOF: Conditions (3) and (5) and the *diversification* argument imply that a higher level of investment increases the aggregate rate of return on the externality yielding industry F_2:$\partial R_{2D}/\partial K_2>0$. Given positive interest elasticity of investment, as stated in equation (16), we can additionally observe, that the equilibrium proportion of capital increases with the increasing rate of return to F_2, i.e. $\partial p_2^*/\partial R_{2D}>0$. Consequently, the equilibrium proportion of capital p_2^* invested in the externality-yielding industry F_2 must increase with the overall level of investment and optimism, which concludes the proof of point a). Additionally, an increase in p_2^*, along with the increase in the level of equilibrium investment $K^j > K^i$, guarantee higher level of investment in externality yielding industry F_2 in equilibrium j than in equilibrium i. This proves part b) of the proposition.

Another important implication of the model concerns the economic growth.

PROPOSITION 4

In a two-period economy, if $K^j > K^i > 0$ *are two equilibrium levels of investment, then the economic growth in period two is higher in equilibrium* K^j *with higher level of optimism.*

PROOF: Equilibria with higher level of optimism correspond to higher aggregate investment. Since the rates of return to externality yielding and non-externality yielding industries are non-decreasing functions of the aggregate investments in these industries, therefore, higher aggregate investment transforms, in a deterministic way, into higher aggregate returns both to the externality yielding and the non-externality yielding industries. This is due to a deterministic character of returns to non-externality yielding industry F_1, diversification assumption for the externality yielding industry F_2 and the facts that $R_{2D}(k_2)>R_1$ for all k_2 and assumption $\partial p_2^* / \partial R_{2D}>0$. Furthermore, increased capital outlays along with higher returns, translate into higher output in the second period. Since the increase in investment does not have any impact on the production in the first period, it must increase the growth of the economy from the first to the second period.

Note that since our simplified model does not include output in the first period, growth rate is simply equal to the output in the second period. In this context, the next proposition describes the relation between sentiment and growth of non-externality yielding and externality yielding industries.

PROPOSITION 5

a) *The level of investment in the externality-yielding industry is more sensitive to changes in optimism than the level of investment in the non-externality yielding industry.*

b) *The growth rate of the externality yielding industry is more sensitive to changes in optimism than the growth rate of the non-externality yielding industry.*

PROOF: In Proposition 3 we claim that for $K^j > K^i$ the proportion of capital invested in the externality yielding industry is higher in equilibrium K^j than in equilibrium K^i. Therefore, an increase in optimism causes larger changes of investment in the externality yielding industry than of investment in the non-externality yielding industry. Since the same argument applies to decreases in sentiment, investment in externality yielding industry is clearly more sensitive to changes in sentiment than investment in the non-externality yielding industry. This proves condition a). Due to externalities and the assumption of *diversification*, in equilibrium K^j the aggregate rate of return to industry F_2 is always higher than in equilibrium K^i, whereas for industry F_1, it is the same in both cases. Even if the aggregate rates of return to both industries were the same in both equilibria, an increase in proportion of capital invested in F_2, along with an increase in the level of overall investment, would guarantee higher growth of output in industry F_2 than that in industry F_1. Similar reasoning applies to decreases in investor optimism. Consequently, the fact that the proportion of capital invested in F_2 positively co-varies with the total level of investment, assures higher sensitivity of growth in F_2 as compared to growth in F_1, which concludes the proof of part b) of the proposition.

It is important to understand, that the choice of only two industries in the model is purely illustrative. The separation of decisions about portfolio choice and the total level of investment guarantees that the reasoning presented above holds for any finite number of externality yielding and non-externality yielding industries. Similarly, the results are invariant to the presence or absence of additional industries with stochastic component in the production functions.

Finally, there is no reason to believe why returns to externality-yielding industry should be defined in a very simple way, given by equations (4) and (5). In fact, Jones (1995) suggests that the externalities to R&D sector are of much complicated form. Nevertheless, as long as $R_2'(K_2) > 0$, the equilibrium with higher level of optimism will always Pareto-dominate the one with lower level of optimism, implying analogical differences in the growth rate of the economy. The situation reverses, if there exists some interval in which $R_2'(K_2) < 0$. Such a situation would correspond to negative externalities of, for example, many research teams working on the same project and reporting identical results. In such a world, with non-monotonic social returns to externality yielding industry, the existence of equilibria would depend upon particular forms of utility and production functions.

III. EMPIRICAL EVIDENCE

III.1 SENTIMENT AND ECONOMIC GROWTH

Proposition 4 states that future economic growth should increase with current growth in sentiment. We test this hypothesis using proxies for consumer sentiment and investor sentiment.

For both of them, we analyse short-term implications, with the impact on growth of up to four quarters, and long-term implications with the impact on growth within one to four years.

To illustrate the short-term relation, we regress current quarterly economic growth on four lags of consumer sentiment (ICS).[2] We proxy for economic growth using GDP growth (GDP)[3] and the Composite Index of 4 Coincident Indicators (COINC).[4]

Table 1

Index of Consumer Sentiment and Short-Term Economic Growth (1960-1998)

Panel A: Regressions without control variables

Dependent Variable	ICS_{t-1}	ICS_{t-2}	ICS_{t-3}	ICS_{t-4}	Adj. R^2
Δ $\log GDP_t$	.00046	.00006	-.00024	-.00001	.2159
t-OLS	(3.981)	(0.398)	(-1.583)	(-0.134)	
t-NW (4 lags)	[3.763]	[0.372]	[-1.789]	[-0.135]	
Δ $\log COINC_t$	.00057	-.0001	.0001	-.0003	.3121
t-OLS	(5.296)	(-0.705)	(0.755)	(-2.809)	
t-NW (4 lags)	[4.452]	[-0.653]	[0.761]	[-2.561]	

Panel B: Regressions with control variables

Dependent Variable	ICS_{t-1}	ICS_{t-2}	ICS_{t-3}	ICS_{t-4}	$Prod_{t-1}$	$Prod_{t-2}$	$Prod_{t-3}$	$Prod_{t-4}$	Adj. R^2
Δ $\log GDP_t$	.00024	.00006	-.00017	-.00003	-.00052	.00014	.00016	-.00005	0.3530
t-OLS	(2.100)	(0.418)	(-1.058)	(-0.242)	(-2.079)	(0.798)	(0.916)	(-0.328)	
t-NW (4)	[1.816]	[0.416]	[-1.113]	[-0.261]	[-1.908]	[0.910]	[1.094]	[-0.357]	
$\Delta\log COINC_t$	.00018	-.00010	.00023	-.00026	-.00009	.00029	.00016	-.00016	0.4770
t-OLS	(1.576)	(-0.761)	(1.634)	(-2.498)	(-0.575)	(2.014)	(1.061)	(-1.119)	
t-NW (4)	[1.442]	[-0.722]	[1.808]	[-2.525]	[-0.660]	[1.698]	[1.128]	[-1.173]	

Panel A of Table 1 reports results from regressions on the set of lagged ICSs ($\Delta\log(DEP_t)=\alpha_0+\Sigma^4_{I=1}\beta_i ICS_{t-i}+\varepsilon_t$), whereas Panel B reports results from regressions with control variables including four-period lags of growth of GDP, T-bill one-month rate, and productivity growth (Prod). The t-statistics from OLS regressions are given in parentheses and Newey-West heteroscedasticity- and serial-correlation-robust t-statistics are shown in brackets. The ICS appears to explain about 20% of the variability in the growth of GDP and about 30% of the

[2] Consumer sentiment is measured by the Index of Consumer Sentiment (ICS), released by the Survey Research Center of the University of Michigan, which is an aggregate measure capturing consumer confidence about the present and future economic situation. It is obtained from survey responses and has considerable predictive power for real economic variables (see: Carroll et al. (1993); Matsusaka and Sbordone (1995), and Howrey (2001)). Although ICS is accessible on the monthly basis, we use quarterly data, because other macroeconomic variables which are used in this paper are documented using quarterly frequency at best.

[3] Data is obtained from Datastream.

[4] Data is obtained from Conference Board at the U.S. Department of Commerce.

variability in the growth of COINC in the next four quarters. In both cases, the impact of sentiment on growth of economic product in the *next* quarter is significantly positive. The second and the third quarters show insignificant positive influence, while growth in the fourth quarter is significantly negatively correlated with sentiment. This reversal in relationship might be due to short-term horizon of consumers' analysis.

Panel A of Table 1 shows that *consumer* sentiment explains a significant part of future economic growth. To check robustness of this result, we include in regressions a standard set of control variables, similar to this used in Carroll et al. (1993). We use the values of growth both in GDP and COINC, 30-day T-bill discount yield, and productivity growth.[5]

The results from these extended regressions are summarized in Panel B of Table 1. As in Panel A, the impact of ICS on next quarter's growth is positive and significant. Moreover, these findings seem to contradict the hypothesis that an increase in future growth is mainly driven by an increase in productivity.

To illustrate the long-term relation, we regress economic growth within one to four years ahead on contemporaneous investor sentiment (CFP).[6] We run multivariate regressions with four measures of long-term economic growth as dependent variables and sentiment as an independent variable. This allows us to account for the correlation of the overlapping growth variables.

Table 2 shows the relationship between contemporaneous level of *investor* sentiment measured by the closed end fund premium (CFP) and economic growth within the next one, two, three and four years. Panel A reports results from regressions of the dependent variables on CFP, while regressions in Panel B include the set of the same control variables as in Table 1. The relation between closed-end fund premium and future GDP growth is evidently positive. The significance of coefficients for CFP increases with the length of the horizon and is highest for growth within the next four years. Similar results hold for Index of Coincident Indicators (COINC). In both cases, investor sentiment explains about 20-23% of the variability in economic growth within the next four years.

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[5] The data for T-bill rates have been obtained from Datastream, whereas growth in productivity has been compiled by Bureau of Labor Statistics. All control variables have up to four lags.

[6] Investor sentiment is measured by the closed-end fund premium (CFP). Lee et al. (1991) claim that the values of discounts and premiums at which the closed-end funds are traded relative to their net asset values are highly correlated with the behavior of stock returns, especially those of the firms with small capitalization and the aggregate premium (discount) can be used as a measure of general investors' optimism. This interpretation is also based on the facts that it is uncorrelated with risk factors (see e.g. Chen, Roll and Ross, 1986). In this study, we apply the data originally used by Lee et al. (1991). Our sample includes 82 quarters, spanning the period from 1965:3 to 1985:4.

Table 2

Closed-end Fund Premium and Long-Term Economic Growth (1965-1985)

Panel A: Regressions without control variables

Dependent Variable	CFP(1year)	CFP(2years)	CFP(3years)	CFP(4years)
Δ $\log GDP_t$	.00029	.00085	.00175	.00210
t-OLS	(0.939)	(1.911)	(3.771)	(4.890)
t-NW (4 lags)	[0.555]	[0.992]	[1.768]	[2.571]
Adj. R^2	.0109	.0437	.1509	.2301
Δ $\log COINC_t$	.00015	0.00065	.00171	.00224
t-OLS	(0.401)	(1.171)	(2.982)	(4.368)
t-NW (4 lags)	[0.264]	[0.677]	[1.528]	[2.421]
Adj. R^2	.0020	.0169	.1000	.1926

Panel B: Regressions with control variables

Dependent Variable	CFP	Prod	CFP	Prod	CFP	Prod	CFP	Prod
	(1 year)		(2 years)		(3 years)		(4 years)	
Δ $\log GDP_t$	-.00005	.00138	.00046	.00246	.00150	.00394	.00203	.00347
t-OLS	(-0.191)	(1.784)	(1.116)	(1.971)	(3.308)	(2.892)	(4.863)	(2.762)
t-NW (4 lags)	[-0.116]	[1.348]	[0.601]	[1.818]	[1.698]	[2.953]	[2.669]	[2.070]
Adj. R^2	0.3537		.2298		.2564		.3312	
Δ $\log COINC_t$	-.00027	.00148	.00007	.00346	.00129	.00476	.00199	.00443
t-OLS	(-0.895)	(1.646)	(0.144)	(2.333)	(2.349)	(2.879)	(3.975)	(2.936)
t-NW (4 lags)	[-0.673]	[1.306]	[0.089]	[2.187]	[1.298]	[3.297]	[2.337]	[2.210]
Adj. R^2	0.4311		.2959		.2411		.2859	

To check robustness of our results, we add the set of control variables to the above regressions. We apply the same control variables as in the short term, with the lag structure consistent with CFP. The results of our analysis are reported in Panel B of Table 2. They confirm significance of investor sentiment in predicting future economic growth. The coefficients corresponding to the long-term growth are significant, whereas short-term relations are of no statistical importance.

Overall, the regressions (both with and without control variables) support the hypothesis about a positive relationship between sentiment and economic growth. Moreover, we can observe that shocks to economic growth coming from variations in *consumer* sentiment culminate and decline faster than shocks resulting from changes in *investor* sentiment.[7] One of the possible explanations of this fact may be that consumption decisions are transformed into economic growth within a shorter time, while shocks to investments usually affect economy over a longer horizon. This, however, requires further investigation.

[7] Our model does not specify the length of the period and hence, it accommodates both cases.

III.2 CAUSALITY

Although many people believe that certain relationship between sentiment and economic growth exists, there is some disagreement about the existence and direction of causality in this relation. On one hand, it is possible that the future economic situation determines the current level of optimism, as perspectives and expectations play an important role in determining people's sentiment. On the other hand, it is likely that sentiment has an impact on economic indicators in the future, simply because the level of optimism influences over a certain period, investing and spending and hence, overall economic growth. Both hypotheses sound credible and thus, it is difficult to establish the actual direction of this causality. Our model adopts the latter view, stating that current change in sentiment should affect future economic growth. We attempt to test this hypothesis below.

First, we apply Granger "causality" tests. Although, most of the existing research in economics agrees that this test does not establish solid proof of causality, yet it can be used to detect predictive patterns in the time-series of data. The null hypothesis assumes "no causality" between two variables. The appropriate statistic of this test for the VAR (p) specification is the Wald statistic, which under the null hypothesis has chi-squared distribution with p-degrees of freedom. We perform this test for both measures of economic growth and for both sentiment indices. For each relation, we test the specification with one, two, three, and four lags. The sample for the ICS covers the period 1960:1-1998:3, whereas the range for CFP is 1965:3-1985:4. The columns include three possible variations of dependent variables, while the rows have each of these variables in the model with up to four quarters of lags. We test a null hypothesis that the independent variable does not cause the dependent variable for a particular lag specification. The Wald statistic of non-causality has been provided for each meaningful entry together with the respective p-values in parentheses. The results are presented in Table 3.

Wald statistics and their respective p-values show that, at confidence level of 5%, we can reject the null hypothesis that Index of Consumer Sentiment (ICS) does not Granger cause GDP and COINC for each model with up to four lags. Conversely, we cannot reject the null hypothesis that GDP and COINC do not Granger cause *consumer* sentiment for all lags.

Table 3
Granger causality tests for economic growth and sentiment

Dependent Variable→ Independent Variable ↓		Granger causality test ICS	CFP	GDP	COINC
1 Lag	ICS	-	N/A	15.10 (p=0.000)	6.217 (p=0.013)
	CFP	N/A	-	0.468 (0.494)	0.212 (p=0.645)
	GDP	0.176 (p=0.674)	0.973 (p=0.324)	-	N/A
	COINC	0.050 (p=0.823)	0.048 (p=0.826)	N/A	-
2 Lags	ICS	-	N/A	13.09 (p=0.001)	9.461 (p=0.009)
	CFP	N/A	-	1.286 (p=0.526)	0.655 (p=0.721)
	GDP	0.145 (p=0.929)	0.602 (p=0.740)	-	N/A
	COINC	1.849 (p=0.397)	0.022 (p=0.989)	N/A	-
3 Lags	ICS	-	N/A	20.79 (p=0.000)	13.96 (p=0.003)
	CFP	N/A	-	1.247 (p=0.742)	0.813 (p=0.846)
	GDP	1.266 (p=0.737)	1.281 (p=0.733)	-	N/A
	COINC	2.745 (p=0.433)	0.288 (p=0.962)	N/A	-
4 Lags	ICS	-	N/A	19.61 (p=0.000)	16.60 (p=0.002)
	CFP	N/A	-	1.187 (p=0.880)	1.339 (p=0.855)
	GDP	1.718 (p=0.787)	1.479 (p=0.830)	-	N/A
	COINC	3.428 (p=0.489)	1.295 (p=0.862)	N/A	-

On the other hand, we have no reason to reject the null hypothesis about lack of causality between *investor* sentiment and our proxies for economic growth. This might be either because such causality does not exist or because it occurs over a longer period of time, as suggested in Table 2.

In specifying our regressions, we implicitly assumed that sentiment is an exogenous variable. However, it is very likely that there exist other variables, which explain sentiment and what is more important is that, the residuals obtained from such specification may be correlated with the residuals from the initial model. To address this endogeneity problem, we run instrumental variable (IV) regressions of GDP and COINC on ICS and CFP. We use inflation rate as an instrument for the ICS index and the number of new IPOs as an instrument for the closed-end fund premium. Our instruments are motivated by the fact that inflation is hardly correlated with GDP growth (-0.02) and has very important impact on the consumer sentiment. Similarly, the number of IPOs exhibits low correlation with the GDP growth (0.14), but has a significant influence on investor sentiment. The results are presented in Table 4. Panel A exhibits results of multivariate regressions of short-term, up to four quarters, economic growth on consumer sentiment measured by ICS, while Panel B lists the results of univariate regressions of long-term, of one to four years, economic growth on investor sentiment measured by CFP.

Table 4

IV regressions of sentiment and economic growth

Panel A: ICS (1960-1998)

Horizon (quarters)	GDP				COINC			
	ICS	t-OLS	t-NW (4)	Adj. R^2	ICS	t-OLS	t-NW (4)	Adj. R^2
1	.0004	3.230***	2.927***	0.2477	.00051	4.435***	4.200***	0.3413
2	.00007	0.462	0.407		-.00009	-0.641	-0.667	
3	-.00025	-1.646*	-1.787*		.00009	0.695	0.940	
4	-.00001	-0.084	-0.090		-.00029	-2.766**	-2.766**	

Panel B: CFP (1965-1986)

Horizon (years)	GDP				COINC			
	ICS	t-OLS	t-NW (4)	Adj. R^2	ICS	t-OLS	t-NW(4)	Adj. R^2
1	.00051	1.418	0.787	0.0270	.00063	1.410	0.911	0.0477
2	.00109	2.073	0.997	0.0585	.00127	1.939*	0.994	0.0524
3	.00188	3.495	1.550	0.1887	.00224	3.386***	1.530	0.1411
4	.00222	4.418	2.429**	0.2608	.00291	5.064***	2.657**	0.2646

*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level

The IV regressions show that *consumer* sentiment has strong predictive power for economic growth in the short period. In the longer horizon, its power diminishes with potential reverse patterns. Conversely, predictive power of investor sentiment is mostly long-term with the strongest impact on the cumulative growth within next three and four years. In summary, both Granger causality test and IV regressions indicate causality from current sentiment to future economic growth.

III.3 SENTIMENT AND EXTERNALITY YIELDING

Proposition 3 claims that the level and proportion of capital invested in the externality yielding industry are higher in equilibrium with higher level of optimism. We assume that capital invested in the externality yielding activities can be, on the aggregate level, approximated by expenses in research and development (R&D). Aggregate data on R&D investment have been obtained from the National Science Foundation and U.S. Department of Commerce.

To test the first part of Proposition 3, we regress de-trended (first differenced) logarithms of R&D expenditures on both measures of sentiment. To test the second part of the Proposition 3, we regress the ratio of R&D expenditures to total investments on both sentiment measures. The results are presented in Table 5. We use two measures of R&D expenditures: the levels of R&D de-trended using first differences of logarithms, and the ratio of R&D expenses to Real Fixed

Private Domestic Investment, reported by Bureau of Economic Analysis of the US Department of Commerce and denominated in 1996 US dollars.

Table 5

Sentiment and R&D Investment

Dependent Variable	Leads	ICS	t-OLS	t-NW	R^2	CFP	t-OLS	t-NW	R^2
Levels of R&D	0	.0002516	5.063***	3.318***	.1443	.000328	3.334***	1.980**	.1220
	1	.0002359	4.686***	3.121***	.1262	.000392	4.148***	2.571***	.1770
	2	.0002053	3.953***	2.758***	.0938	.0004437	4.794***	3.251***	.2231
	3	.0001632	3.038***	2.201**	.0580	.0004715	5.147***	3.927***	.2488
	4	.0001209	2.192**	1.651*	.0312	.0004835	5.271***	4.481***	.2578
R&D / Investment	0	.000799	4.371***	3.171***	.1052	.001485	5.214***	3.056***	.2537
	1	.0007447	4.012***	2.087**	.0958	.0013333	4.740***	3.444***	.2192
	2	.0007398	3.950***	2.157**	.0937	.0011952	4.217***	3.116***	.1818
	3	.0007618	4.056***	2.321**	.0988	.0010294	3.583***	2.624***	.1383
	4	.0008008	4.282***	2.552**	.1096	.0008645	2.995***	2.159**	.1008

*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level

Both measures of sentiment are positively correlated with current and future R&D expenditures and proportions of R&D expenditures to total investments. Stronger explanatory power is observed for the closed end fund premium. This is not surprising, as this index reflects sentiment of people who directly make decisions regarding capital allocation and thus the level of expenditures on R&D. Moreover, *consumer* sentiment has greater impact on R&D expenditures in a short horizon, whereas investor sentiment influences R&D expenses mainly in a long horizon. This pattern is not clear for the ratio of R&D to total investments.

Having discussed the externality yielding relationships for the aggregate economy, we now focus on industry level analysis. Unless otherwise noted, we apply the data for industries from manufacturing sector, grouped by their two-digit SIC codes. There are twenty such industries.

From Proposition 5 we know that the sensitivity of production growth and investments to changes in sentiment should increase with externality yielding abilities of an industry. Following earlier tests, we use ratio of R&D expenditures to total investment in a given industry to assess its externality yielding properties.[8] We assume that the higher is the level of R&D as a percentage of

[8] We use annual data of private domestic capital outlays and production growth for *twenty* manufacturing industries provided by NBER. Those are industries with SIC codes between 20 and 39. Since the data have been provided for 4-digit industries, we use aggregation procedures to elicit 2-digit components. We approximate aggregate investment in externality yielding industries using quarterly values of total capital expenditures on Research & Development obtained from the Federal Reserve Bank of St. Louis. The value of private investments (FINV) has been obtained from DRI Economics Database. All above measures are of quarterly frequency and span the period 1960:1-1998:3.

total investments in a given industry, the higher are the abilities of an industry to exhibit externalities. Next, we sort all industries into two groups: one with higher and one with lower externality yielding abilities. Now, for each industry we regress future production growth on current sentiment and future investment on current sentiment. In both cases, we use annual data. Following earlier observations, we correlate investment and production growth in one year with contemporaneous *consumer* sentiment. *Investor* sentiment is correlated with aggregate values of investments and production growth within the next four years.[9] Investment data are taken in logarithms and de-trended (first differenced). Coefficients and p-values from these regressions are reported in Table 6. For each of the four associations we report Spearman rank statistic together with its p-value.

For *consumer* sentiment, industries with higher externality yielding abilities show stronger relationship between sentiment and production growth (eight coefficients significant), and between sentiment and investments (six coefficients significant), than industries with lower externality yielding abilities. The Spearman rank correlation test, between externality-yielding abilities and the strength of the relationship between sentiment and investments and sentiment and production growth, returns statistics which are significant at 10% level and equal to 0.4045 and 0.618, respectively.

Similar analysis for *investor* sentiment shows that long-term positive relationships between the amount of capital invested and sentiments, as well as production growth and sentiment, are stronger for more externality yielding industries. In the first group, seven industries for growth in production and six industries for investments exhibit significant dependence on investors' optimism, while in the second group, the respective numbers are six and one. The Spearman rank correlation statistics are significantly positive in both cases at 10% significance level (0.4159 for investments and 0.6887 for production growth).

The above analysis provides support for the hypothesis that levels of investment and production growth in externality yielding industries are more sensitive to changes in sentiment than levels of investment and production growth in the less externality yielding industries.

Additionally, we construct the measure of externality yielding ability of specific industries by taking the ratio of R&D expenses in a particular industry and total investment level in this industry. R&D levels have been compiled using Compustat tapes. Our measure obtained on the annual basis covers the period 1960-1996.

[9] The level of investments is obtained by taking the sum of investment over four consecutive years. Production growth is measured as log difference between production in four years and current production.

Table 6
Industry externality yielding associations with sentiment

Industry SIC code	Consumer Sentiment (ICS)		Investor Sentiment (CFP)	
	Production growth*	Investment (levels)*	Production growth*	Investment (levels)*
3800	0.078***	0.012***	0.00006***	0.045***
3600	0.054***	0.057***	0.882	0.011***
3500	0.006***	0.180	0.001***	0.381
2800	0.005***	0.188	0.0006***	0.064***
3700	0.168	0.039***	0.251	0.037***
3900	0.032***	0.092***	0.001***	0.545
3000	0.034***	0.009***	0.017***	0.618
3400	0.006***	0.015***	0.222	0.299
2500	0.170	0.220	0.005***	0.042***
2600	0.057***	0.138	0.02***	0.08***
3300	0.011***	0.227	0.0002***	0.239
2000	-0.904	0.057***	0.063***	0.928
2100	0.786	-0.464	0.06***	0.069***
3200	0.006***	0.172	-0.171	0.123
2200	0.365	0.318	0.01***	0.411
2300	0.493	0.170	-0.681	0.368
2900	0.178	0.473	0.153	-0.972
2400	0.310	0.218	0.0004***	-0.307
3100	0.987	0.236	-0.842	-0.869
2700	0.509	0.216	-0.893	-0.299
Spearman rank**	0.618 (p=0.0037)	0.4045 (p=0.0769)	0.4159 (p=0.0681)	0.6887 (p=0.0008)

* - p-values from the regressions on sentiment
** - Spearman rank correlation test between externality yielding abilities and the strength of the relationship between sentiment and investments and sentiment and production growth (p-values in brackets)
*** - significant at 10% level

IV. CONCLUSIONS

In this paper, we analysed the relationship between sentiment and economic growth in the context of a two-period macroeconomic model with two industries, one of which has positive production externalities. We allowed random shocks to production functions. We showed that in such an economy there exist multiple equilibria, which can be ranked according to agents' optimism. Equilibria with higher level of optimism are characterized by higher economic growth, higher production growth in externality yielding industries and higher proportion of investments being directed towards externality yielding industries.

Our study extends the existing literature on the impact of sentiment on macroeconomic variables, by analysing the interactions on the industry level. The model classifies industries according to their externality yielding abilities. Externality yielding industries, empirically identified by high percentage of research and development expenses, appear to be more affected by shifts in sentiment than other industries. In this respect, our model indicates that investments and production growth in such industries, for example in information technology and biotechnology, are more sensitive to changes in sentiment than in the traditional sectors. The evidence supporting this claim is found using the U.S. data. Consequently, our results may offer a credible explanation why these research-intensive sectors suffer the biggest losses during the economic turmoil accompanied by consumer and investor pessimism. The paper also confirms the hypothesis about the causality from changes in sentiment to economic growth.

Finally, this paper offers interesting implications for policy makers. Given the fact that in the period with optimism people tend to invest in R&D, while in pessimism investment in R&D significantly decreases, one would expect the government to allocate more capital to research during the times of low optimism in the economy, at the same time giving a free choice to market mechanisms in the periods with high levels of optimism.

Since our results may be sensitive to the selection of proxies we apply various robustness checks, *investor* and *consumer* sentiment being the two most important ones. Nevertheless, even if approximations applied in the paper did not allow for arbitrary division between optimism, we could draw a conclusion that generally defined sentiment-related variables have significant impact on macroeconomic variables, both on the industry and aggregate level.

One of the consequences of this fact is that modern macroeconomic models should attempt to include sentiment variables both on aggregate and industry levels. This indication is strengthened by the fact that the results from regressions with control variables suggest that sentiment can account for significant part of volatility unexplained by traditional macroeconomic variables. Another useful extension of our model would be to endogenise sentiment variable. In our simplified two-period framework, the level of sentiment is defined outside the system. Explaining the formation of sentiment, from a different perspective than we observe it in the existing literature (see Barberis et al. (1998)), would clearly enrich our understanding of its role in the macroeconomic models and possibly in the price formation.

REFERENCES

Acemoglu, Daron and Scott, Andrew (1994), 'Consumer confidence and rational expectations: Are agents' beliefs consistent with the theory?', *Economic Journal*, vol. 104, no. 422 (January), pp. 1-19.

Arrow, Kenneth (1962), 'The economic implications of learning by doing', *Review of Economic Studies*, vol. 29, no.3 (June), pp. 155-173.

Barberis, Nicolas, Shleifer, Andrei and Vishny, Robert (1998), 'A model of investor sentiment.', *Journal of Financial Economics*, vol. 49, no. 3 (September), pp. 307-343.

Carroll, Christopher D., Fuhrer, Jeffrey S. and Wilcox, David W. (1994), 'Does consumer sentiment forecast household spending? If so, why?', *American Economic Review*, vol. 84, no. 5 (December), pp. 1397-1408.

Chen, Nai-Fu, Roll, Richard and Ross, Stephen (1986), 'Economic forces and the stock market.', *Journal of Business*, vol. 59, no. 3 (July), pp. 383-403.

Daniel, Kent, Hirshleifer, David, and Subrahmanyam, Avanidhar (2001), 'Overconfidence, arbitrage and equilibrium asset pricing.', *Journal of Finance*, vol. 56, no. 3 (June), pp. 921-965.

Elton, Edwin J., Gruber, Martin J. and Busse, Jeffrey A. (1998), 'Do investors care about sentiment?', *Journal of Business*, vol. 71, no. 4 (October), pp. 477-500.

Howrey, Philip (2001), 'The predictive power of the Index of Consumer Sentiment.', *Brookings Papers on Economic Activity*, vol. 2001, no. 1, pp. 175-216.

Ingersoll, Jonathan E. Jr. (1987), *Theory of financial decision making*, Rowman and Littlefield, Savage, Maryland.

Jones, Charles I. (1995), 'R&D-based models of economic growth.', *Journal of Political Economy*, vol. 103, no. 4 (August), pp. 759-784.

Lee, Charles M. C., Shleifer, Andrei and Thaler, Richard H. (1991), 'Investor sentiment and the closed-end fund puzzle.', *Journal of Finance*, vol. 46, no. 1 (March), pp. 75-109.

Matsusaka, John G., and Sbordone, Argia M. (1995), 'Consumer confidence and economic fluctuations.', *Economic Inquiry*, vol. 33, no. 2 (April), pp. 296-319.

Romer, Paul H. (1986), 'Increasing returns and long-run growth.', *Journal of Political Economy*, vol. 94, no. 5 (October), pp.1002-1037.

Romer, Paul H. (1990), 'Endogenous technological change.', *Journal of Political Economy*, vol. 98, no. 5 (October), pp. 71-102.

Weil, Philippe (1989), 'Increasing returns and animal spirits.', *American Economic Review*, vol. 79, no. 4 (September), pp. 879-894.

Yanagawa, Noriyuki and Grossman, Gene M. (1993), 'Asset bubbles and endogenous growth.', *Journal of Monetary Economics*, vol. 31, no. 1 (February), pp. 3-19.