Optimism and Financial Fragility: Banks Credit Policy and Business Cycle Fluctuations

Krausz Miriam[a]
Snir Avichai[a, b]
Zilberfarb Ben-Zion[a,c]

a- Department of Economics, Bar-Ilan University, Ramat-Gan 52900, Israel.
b- Corresponding author. E-Mail: snirav@mail.biu.ac.il
c- and Edmond de Rothschild Professor of Global Asset Management, Netanya Academic College

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Abstract

This paper shows how a backward looking learning process used by banks in assessing credit risk creates a pro-cyclical effect. Building on the Bernanke and Gertler (1990) model it is shown that when banks use past experience to make current decisions their credit policy magnifies the effect of financial fragility in periods that were preceded by an economic boom. Using two unique data sets of Israeli construction firms, the empirical results support the theoretic analysis.

Key Words: Credit risk, Financial Fragility, Loans, Business Cycles.

JEL Classification: E32, G11, G21

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1. Introduction

Credit market imperfections are believed to play a role in driving output fluctuations (see Hubbard 1998 for a review of the Credit Channel). At the same time the literature suggests a relationship between credit policies and economic output based on optimism of lenders. The claim is that during periods of optimism in the market, lenders are more lenient towards borrowers (Shleifer and Vishny 1992, Peek and Rosengren 1995a, 1995b, Berger and Udell 2002). In this paper we show that when prevailing economic conditions affect credit decisions, credit policies are pro-cyclical on the one hand, but they also increase financial fragility on the other hand, increasing the risk of macro-economic downturns. Thus, we demonstrate that the level of optimism in the market can be viewed as a sub-channel of the credit channel.

Our theoretical model extends the Bernanke and Gertler (1990) model, henceforth BG. In their model, market performance depends on the balance-sheet position of a firm. When firms have a strong balance sheet position, they can obtain more credit and invest in more projects. During recessions, when firms have a weak balance sheet position, asymmetry in information between lenders and borrowers can lead to a situation where firms are credit constrained even when they try to implement projects of high quality.[1] Consequently, the economy's performance depends on firms' balance sheets, because the market may fall into a recession with a low level of investment and production if firms lack internal resources.

We consider a case where a single bank employs a backward-looking learning technique to update its expectations. Our results imply that learning from the past creates an optimistic (pessimistic) outlook following peaks (troughs) in the business cycle which magnifies the balance sheet effect. We find that optimism increases investment but the quality of projects being financed decreases while the size of debt grows, increasing financial fragility. It follows that in addition to the bank-lending and the balance-sheet channels (King 1986, Bernanke and Blinder 1992, Kashyap and Stein 2000), the bank's credit practices also play a role in accentuating swings in the business cycle.

Our results are closely related to the literature on optimism in credit markets, such as De Bondt and Thaler (1990), Peek and Rosengren (1995), Cecchetti et al.

[1] For more empirical and theoretical models that examine the relevance of firms' balance sheet position on economic performance, see for example: Himmelberg and Petersen 1994; Bernanke and Gertler 1995; Bernanke et al., 1996; Schiffman 2003).

(2000) and Berger and Udell (2002), among others, which suggest that when there is optimism in the markets, borrowers find it easier to obtain loans. However we add to this line of work by describing a mechanism through which this effect of optimism on credit decisions affects business cycles fluctuations.

The model's predictions are tested empirically using data from bank loans to firms in Israel's construction sector in the period 1995-2004. This period is unique in that it includes only one year of optimism (the year 2000), which was expected to continue but ended abruptly and unexpectedly at the end of 2000. This period is therefore a unique test case for the effects of optimism that is not associated with real changes in the economic environment.

Section 2 describes the theoretical model followed by section 3 which contains the results of the theoretical model. Section 4 describes the empirical tests of the model's results followed by conclusions in Section 5.

2. The model

2.1 The bank

Following BG, the model is a two period model, with decisions on investment and savings made during the first period. [2] There is a single bank in the economy that can earn the safe rate of return in the economy, denoted r. Alternatively, the bank can lend to entrepreneurs. The proportion of entrepreneurs in the population is μ. Entrepreneurs differ from the rest of the population in their ability to screen projects. If the bank lends money to an entrepreneur, the contract signed with this entrepreneur specifies the return, denoted Γ, to be paid by the entrepreneur in the case of success.[3] The payment to the bank, Γ, depends on the size of the loan and on the quality of the project as perceived by the bank. Both the bank and the entrepreneurs are risk-neutral.

Entrepreneurs differ in the quality of their projects, which is measured by the probability of success, denoted by p. Success of a project occurs when the project produces positive returns. The bank, which is unable to distinguish between

[2] We use the notation from Freixas and Rochet (1999).

[3] Since the bank works as a monopoly and since the rate of returns to depositors is set exogenously, it makes no difference for the results if the bank earns a fixed premium above the safe interest rate it gives depositors. It is, however, more convenient to solve the model under the assumption that the bank works as a frictionless distributor of wealth from lenders to borrowers.

entrepreneurs, knows the distribution function of quality of projects, $h(p)$ and the cumulative distribution function $H(p)$, on the basis of investments financed by the bank during the previous period, prior to the current investment period. It is further assumed that $h(p)$ was calculated according to a fully rational model of the economy and that the bank used this distribution function to make lending decisions. At the start of the current investment period, the bank observes the actual rate of success of projects that were financed in the previous period. Thus, in the current period the bank is able to use an updated version of the quality distribution based on $h(p)$ and the known success rate.[4]

Let α denote the percentage of entrepreneurs who successfully completed their project in the previous period. The bank computes the ex-ante expected success rate for the previous period, α^e as follows:

$$\alpha^e = \int_{p^*}^{1} \frac{p \times h(p) \times dp}{1 - H(p^*)} \tag{1}$$

Where p^* is the cut-off probability; projects with probability below p^* have negative expected NPV and are not carried out.

The bank compares α^e with the actual success rate, α. If the actual α differs from the expected value, the bank updates its distribution function. Following Peek and Rosengren (1995) and Berger and Udell (2002), if the success rate is higher than expected then the bank infers that successful projects belonged to a "superior" distribution function, which assigns greater probability to high quality projects. Under this assumption, the expected success rate is higher than originally predicted. If the actual success rate is lower than expected, the bank infers that the failed projects belonged to an inferior distribution function, one which assigns lower probabilities of success to unsuccessful projects. More formally, the updating process is as follows:

[4] Since the bank cannot observe the quality of individual projects a- priori, it cannot determine whether a high (low) success rate of entrepreneurs is the result of an exogenous shock, or whether those entrepreneurs had a- priori a higher than average success probability. As is implied by the BG model, the cost of differentiating between the two possibilities might be prohibitive for the bank.

$$h_b(p,\alpha)=\begin{cases}\alpha\times h(p)+(1-\alpha)\times g_l(p,\alpha) & \alpha<\alpha^e\\ h(p) & \alpha=\alpha^e\\ (1-\alpha)\times h(p)+\alpha\times g_h(p,\alpha) & \alpha>\alpha^e\end{cases}\ ^{5}. \tag{2}$$

Where $g_i(p,\alpha)$, $i\in(l,h)$, is the distribution function that the bank associates with entrepreneurs depending on the rate of success or failure during the previous period and $h_b(p,\alpha)$ is the updated quality distribution. The distribution function that depends on the past performance, $g_i(p,\alpha)$, $i\in(l,h)$, captures the effect of pessimism and optimism on the bank's calculations. It has the following properties:

I. $g_l(p,\alpha)$ is First Order Stochastically Dominated (F.S.D.) by h.

II. $g_h(p,\alpha)$ has F.S.D. over h.

III. When α increases, the bank attributes better quality to the entrepreneurs who request a loan. This is expressed by the following property of $g_i(p,\alpha)$, $i\in(l,h)$:

For two values of α, α_1 and α_2, if $\alpha_1>\alpha_2$ then the success probability distribution of entrepreneurs associated with α_1 gives better average quality to entrepreneurs than the success probability distribution of entrepreneurs associated with α_2. In other words, $g_i(p,\alpha_1)$ has F.S.D. over $g_i(p,\alpha_2)$, $i\in(l,h)$.

IV. The cumulative distribution function of $g_i(p,\alpha)$ is denoted by: $G_i(p,\alpha)$, $i\in(h,l)$, and the cumulative distribution function of $h_b(p,\alpha)$ is denoted by $H_b(p,\alpha)$.

The updated success distribution function, $h_b(p,\alpha)$, gives the banks predictions as a weighted average of $h(p)$ and $g_i(p,\alpha)$ where the weights are determined by the past level of success. [6]

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[5] This formulation for $h_b(p,\alpha)$ assumes that the bank is impressed by the overall rate of success and not only by the success rate relative to the expected success rate.

[6] Similar types of learning functions were suggested by Bomfim and Diebold (1997) and Evans and Ramey (1992) for modeling past effects on the macro-economy.

This setting implies that when the expectations of the bank, α^e, are matched by the performance of entrepreneurs, the bank assumes that it made the correct prediction in the preceding period, and therefore its expectations for the current period remain unchanged. As a result, the quality distribution function it associates with projects is $h(p)$ and there is no change in the behavior of the bank as compared with the BG model. This is a benchmark case where all the results from the basic model hold, and the level of investments depends only on the wealth of entrepreneurs and the quality of projects.

If the observed performance of entrepreneurs is above the expectations of the bank, the bank assumes that entrepreneurs have higher chances of success than it had previously estimated. As a consequence, the estimated success probability function the bank uses is biased towards high success chances. The level of optimism is expressed in equation (2) by the weight α given to the optimistic quality distribution function $g_h(p,\alpha)$.

The opposite occurs if entrepreneurs under-perform, i.e., when the success rate of entrepreneurs is below α^e. The bank then becomes pessimistic about the success probabilities of entrepreneurs, and associates lower quality with their projects than before. This pessimism is expressed in equation (2) by the weight of $1-\alpha$ given to the probability distribution function: $g_l(p,\alpha)$.

2.2 Entrepreneurs

Each entrepreneur i has initial wealth $\omega_i \in [0,1]$[7] and is endowed with a project of quality p_i, where $p_i \in [0,1]$ denotes the success probability of the project. In what follows, it is further assumed that:

I. The past success rate of entrepreneurs, α, is common knowledge.

II. Entrepreneurs use the same distribution function as the bank, $h_b(p,\alpha)$, to form their expectations on the quality of projects[8].

[7] It is assumed throughout this model that α and ω are uncorrelated. This is done in order to simplify the model. One interpretation of this assumption is that agents consume any excess revenues and remain with their initial endowment.

[8] This assumption is equivalent to assuming that the economic mood influences all agents in a similar way. Optimism (pessimism) is therefore shared by all agents.

The cost of implementing a project is equal to 1 for all projects. If a project is successful, it yields a gross return $R > 1$. Otherwise it yields 0. If an entrepreneur i has sufficient initial wealth, i.e., $\omega_i = 1$, he does not need to borrow, and therefore he can implement the project on his own. This is equivalent to the first best benchmark case of BG. Consequently all projects that yield positive expected returns, and only such projects, are taken. In such a case the economy is fully efficient. Otherwise, an entrepreneur who has initial wealth less than 1 and who decides to implement a project must borrow a sum of $1-\omega_i$ from the bank. The entrepreneur must first screen the project in order to find its success probability before deciding whether to invest. Investing in a project without first finding its success probability is assumed to be unprofitable,[9] implying that $\mathrm{E}(p_i)\times R < r\times\omega_i$.

As a consequence, any entrepreneur who invests has first screened his project and found its quality, p_i. The cost of screening is the cost of effort put into the screening process. The monetary equivalent of this effort is denoted by e.[10]

Entrepreneurs who screen their project invest if the expected net return from their project (after paying Γ to the bank) exceeds the opportunity cost of safely depositing their endowment. An entrepreneur i who screened a project to find that the success probability of his project is p_i, implements the project if:

$$p_i \times (R-\Gamma) - r\times\omega_i \geq 0. \tag{3}$$

From this equation it is possible to find the condition a project must satisfy if it is to be implemented. Letting $\Gamma_{b(\alpha,\omega)}$ denote the return to the bank under the distribution function $h_b(p,\alpha)$, an entrepreneur implements a project if the project's quality is at least as good as $p^*_{b(\alpha,\omega)}$ where $p^*_{b(\alpha,\omega)}$ satisfies:

$$p^*_{b(\alpha,\omega)} \times (R-\Gamma_{b(\alpha,\omega)}) - r\times\omega_i = 0. \tag{4}$$

When considering whether to screen a project or not, the entrepreneur first calculates whether the expected addition to his profits from implementing a project (before knowing the project's quality) is greater than the effort put into

[9] This ensures that in equilibrium only entrepreneurs implement projects.
[10] Assuming that the cost is in terms of wealth rather than in terms of effort does not change the results (see: BG).

screening the project, e. If an entrepreneur chooses not to screen the project, he can earn $r \times \omega_i$ by safely depositing his wealth. Screening gives an entrepreneur the option to implement the project; the value from screening is therefore:

$$MaxE_p\{[p_i \times (R - \Gamma_{b_{(\omega,\alpha)}}), r \times \omega_i] \mid h_b(p,\alpha)\} \tag{5}$$

Denoting by $V^b_{(\omega,\alpha)}$ the expected addition to the entrepreneur's profits from screening, the added expected value equals:

$$V^b_{(\omega,\alpha)} = MaxE_p\{[p_i \times (R - \Gamma_{b(\alpha,\omega)}) - r \times \omega_i, 0] \mid h_b(p,\alpha)\}. \tag{6}$$

The first term in the brackets stands for the expected addition to an entrepreneur's wealth if the project probability is high and he chooses to invest. The second term in the brackets is zero because if the project quality is not good, the entrepreneur deposits his money and earns nothing from the screening process.

To calculate $V^b_{(\omega,\alpha)}$, the entrepreneur first finds the probability that he will screen a project of quality $p^*_{b(\alpha,\omega)}$ or better. Since each entrepreneur assumes that projects' quality is distributed according to $h_b(p,\alpha)$ he believes that the probability of the project he screens being above $p^*_{b(\alpha,\omega)}$ equals: $1 - H_b(p^*_{b(\omega,\alpha)},\alpha)$. The entrepreneur then calculates the expected profit from taking a project with a quality higher than $p^*_{b(\alpha,\omega)}$. This expected profit is the expected average success rate of projects with quality higher than $p^*_{b(\alpha,\omega)}$, times the returns from a successful project. The net revenue to an entrepreneur from a successful project is: $R - \Gamma_{b(\omega,\alpha)}$, where R is the profit from the projects and $\Gamma_{b(\omega,\alpha)}$ is the payment to the bank. Denoting by $\Phi_b(p^*_{b(\omega,\alpha)},\alpha)$ the expected average success probability of projects conditional on their quality being higher than $p^*_{b(\alpha,\omega)}$, that is: $\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) = \dfrac{\int_{p^*_{b(\omega,\alpha)}}^{1} p \times h_b(p,\alpha)dp}{1 - H_b(p^*_{b_{(\omega,\alpha)}},\alpha)}$, gives the expected profit from screening a project as:

$$\Phi_b(p^*_{b(\omega,\alpha)},\alpha) \times (R - \Gamma_{b(\omega,\alpha)}). \tag{7}$$

2.3 Equilibrium

The bank sets $\Gamma_{b(\omega,\alpha)}$ such that its expected profits are not less than the safe rate of interest in the economy, r. This implies:

$$\Phi_b(p^*_{b(\omega,\alpha)},\alpha) \times \Gamma_{b(\omega,\alpha)} = r \times (1 - \omega). \tag{8}$$

Substituting equation (8) into equation (7) reveals that the expected addition to entrepreneurs' profits from projects that have a quality higher than $p^*_{b(\omega,\alpha)}$ is:

$$\Phi_b(p^*_{b(\omega,\alpha)},\alpha) \times R - r. \tag{9}$$

Using the information on the probability that he would implement a project if he screens it, and the expected addition to his profits in such a case, each entrepreneur can then find the value of screening:

$$V^b_{(\omega,\alpha)} = [1 - H_b(p^*_{(\omega,\alpha)},\alpha)] \times (\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) \times R - r) \tag{10}$$

This can also be written as:

$$V^b_{(\omega,\alpha)} = \int_{p^*_{b(\omega,\alpha)}}^{1} (p \times R - r) \times h_b(p,\alpha) \times dp \tag{11}$$

The entrepreneur chooses to screen if the addition to expected profits exceeds the cost of effort of screening:

$$V^b_{(\omega,\alpha)} \geq e. \tag{12}$$

The level of wealth which satisfies: $V^b_{(\omega,\alpha)} = e$ is denoted by $\omega^e_{b(\alpha)}$. It is the minimum level of wealth that an entrepreneur must posses in order to make the screening worthwhile.

3. Results

Several propositions are derived from the model described in the previous section. Let the subscript $_{cc}$ denote the cut-off probability in the BG case where only the wealth of entrepreneurs influences credit decisions, and therefore the level of investment depends solely on the distribution of the initial wealth and the quality of projects.

Proposition 1: The minimum cut-off probability, denoted as $p^*_{b(\omega,\alpha)}$ is a decreasing function of α, and has the following properties:

$$\textbf{(A)}\quad \frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \le 0 . \tag{13}$$

$$\textbf{(B)}\quad \begin{array}{lll} p^*_{b(\omega,\alpha)} < p^*_{cc(\omega)} & if & \alpha > \alpha^e \\ p^*_{b(\omega,\alpha)} = p^*_{cc(\omega)} & if & \alpha = \alpha^e \\ p^*_{b(\omega,\alpha)} > p^*_{cc(\omega)} & if & \alpha < \alpha^e \end{array} \tag{14}$$

Proof: (See Appendix A)

Proposition 1 implies that an increase in the bank's optimism with respect to the general quality of entrepreneurs due to a high success rate in the past period, leads to a decrease in the quality of projects entrepreneurs choose to implement. In the new optimistic environment, entrepreneurs find it in their interest to invest in projects that they considered before as too risky to be profitable.

It is interesting to compare these results with the results derived in the first best case. The first best case corresponds to the case where entrepreneurs have enough private wealth to finance their project ($\omega_i \ge 1$). In this case the bias introduced in the bank's decision process makes no difference. Letting the subscript $_{fb}$ denote the first best case, it follows that: $p^*_{b(\alpha,\omega)} = p^*_{cc(\omega)} = p^*_{fb}$, regardless of α. This result is derived by setting 1 in place of ω_i in the bank's incentive decision (equation (8)). This leads to $\Gamma_{b(\omega,\alpha)} = 0$. I.e., when an entrepreneur does not borrow, he also does not pay interest to the bank. Substituting this result in the entrepreneur's incentive function (equation (4)) yields:

$$p^*_{b(\alpha,\omega)} = p^*_{cc(\omega)} = \frac{r}{R} = p^*_{fb} . \qquad (15)$$

BG show that when the level of investment depends only on the wealth of entrepreneurs and the quality of projects then the cutoff probability is below the first best cutoff because the bank is unable to verify the true quality of projects. As a consequence, high quality projects subsidize low quality projects, because the limited liability prevents the bank from forcing payment from entrepreneurs whose projects have failed. Entrepreneurs with low wealth facing relatively risky projects may therefore find it in their interest to risk the bank's money by borrowing and implementing their low quality projects. This principal-agent moral hazard problem is aggravated when the past performance of entrepreneurs is good. The tendency of entrepreneurs to over-invest is encouraged by the optimistic, easy credit policy of the bank. When the bank becomes optimistic, the effect on entrepreneurs is twofold: First, since entrepreneurs are also affected by the general optimistic mood, they assess their success probability as too high and are therefore more likely to invest. Second, since they know the bank is willing to extend credit under easier terms, they invest in projects that are more risky and that would not have gained credit when the bank's credit policy was tougher. The next proposition discusses credit terms.

Following BG, define the nominal interest rate, $\Psi_{b(\alpha,\omega)}$, which is defined as the sum to be paid to the bank divided by the size of the loan. In mathematical notations:

$$\Psi_{b(\omega,\alpha)} = \frac{\Gamma_{b(w,\alpha)}}{1-\omega} . \qquad (16)$$

Proposition 2: The following properties hold for the nominal interest rate:

(A) $$\frac{\partial \Psi_{b(\omega,\alpha)}}{\partial \alpha} \le 0 . \qquad (17)$$

(B) $$\begin{array}{lll} \Psi_b > \Psi_{cc} & if & \alpha < \alpha^e \\ \Psi_b = \Psi_{cc} & if & \alpha = \alpha^e \\ \Psi_b < \Psi_{cc} & if & \alpha > \alpha^e \end{array} . \qquad (18)$$

Proof: (See Appendix A)

Proposition 2 implies that when there is optimism, the interest rate charged by banks from borrowers decreases.

Proposition 1 and Proposition 2 show that following an economic peak entrepreneurs find it optimal to take larger loans and invest in riskier projects ($p^*_{b(\omega,\alpha)}$ is lower) because the nominal rate of interest is lower. This leads to the next proposition:

Proposition 3: The per capita investment, denoted by $I_{b(\alpha)}$, is dependent on α and maintains the following relationship with the per capita investment in the BG benchmark model, denoted as I_{cc}:

$$\begin{aligned} I_{b(\alpha)} &< I_{cc} \quad \textit{if} \;\; \alpha < \alpha^e \\ I_{b(\alpha)} &= I_{cc} \quad \textit{if} \;\; \alpha = \alpha^e \;. \\ I_{b(\alpha)} &> I_{cc} \quad \textit{if} \;\; \alpha > \alpha^e \end{aligned} \tag{19}$$

Proof: (See Appendix A)

<u>**Corollary:**</u> The minimum level of wealth $\omega^e_{b(\alpha)}$ that an entrepreneur must posses in order to make investment in screening profitable depends on α as follows:

$$\frac{\partial \omega^e_{\mathrm{b}(\alpha)}}{\partial \alpha} \leq 0 \tag{20}$$

Proposition 3 implies that high levels of past success create an optimistic mood bringing about an increase in the per capita investment. Furthermore, this result directly implies that the minimum level of wealth required for an entrepreneur to screen a project when the economy depends on past success of entrepreneurs, decreases with α.

As in the BG model, where investment depends only on entrepreneurs' initial endowment, the question remains whether there is over- or under-investment (compared with the first best allocation of income). In the BG model the per capita investment is given by:

$$I_{cc} = \mu \times \int_{\omega^e_{cc}}^{1} [1 - \mathrm{H_b}(p*_{cc(\omega)}, \alpha)] \times f(\omega) \times \mathrm{d}\omega, \tag{21}$$

where $f(\omega)$ is the entrepreneurs' wealth distribution function and μ is the proportion of investors in the population.

When there are no credit constraints, the first best per capita investment is given as follows:

$$I_{fb} = \mu \times \int_{p_{fb}^*}^{1} h(p) \times dp = \mu \times [1 - H_b(p_{fb}^*, \alpha)] \qquad (22)$$

Without knowing the initial distribution of income, it is impossible to determine whether the per capita investment is greater in the first best case or in the case where entrepreneurs require credit in order to implement projects. This is because when credit plays a role, entrepreneurs who screen their project tend to over-invest, as implied by the fact that $p^*_{cc(\omega)} \le p^*_{fb}$. On the other hand, not all entrepreneurs are able to screen, because entrepreneurs require initial endowment of at least ω^e_{cc} in order to screen. These two factors work in opposite directions. Without knowing which effect dominates the results, it is therefore impossible to determine whether I_{cc} is greater, equal or smaller than I_{fb}.[11]

Proposition (3) highlights the fact that a good past record of entrepreneurs has a positive effect on investments. After successful periods, the likelihood of over-investment therefore rises for any given wealth distribution. At the same time, if entrepreneurs have been less successful than anticipated, then the pessimism in the credit market increases the likelihood of credit rationing and under-investment.

These results are important in the context of explaining turning-points in the economic business cycle. Assume that the previous period enjoyed a positive economic shock, and the percentage of entrepreneurs who succeeded was greater than expected. In the next period, the bank becomes optimistic; more credit flows into the economy and risky projects are taken by entrepreneurs who cannot obtain financing during other times.[12] Consequently, the market becomes financially fragile; i.e. a

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[11] BG show that when the level of endowment in the economy is low, then the lack of wealth effect dominates, and the economy may suffer a financial collapse where there are no (or very few) entrepreneurs who are able to screen and invest.

[12] In the model's terms, it is possible that some firms invest even though their level of wealth is below the level of wealth that would have allowed them to invest in the basic BG model, where the minimum

small negative shock can drive many entrepreneurs to the point where they do not have enough personal wealth to maintain their investments. As firms start to fail, the level of optimism in the markets also falls, making the bank lending policy more restrained. This means that the minimum level of wealth required for securing a loan from the bank also increases, and more firms find themselves credit constrained. The results of this financial accelerator foreseen by BG are thus aggravated by the effects of pessimism. It follows that as the recession worsens, only the largest of borrowers can finance their investments (Bernanke, Gertler and Gilchrist 1996, Schiffman 2003). [13]. Once the economy is in recession, the combined effect of the low balance-sheet position of firms and the pessimism in the credit markets makes it harder for the economy to recover. Without some exogenous shock that improves the balance sheet of investors, or that makes the bank more willing to grant credit, the economy may remain in a recession for a prolonged period.

4. Empirical tests

4.1 Empirical Background

The model developed in the previous chapter shows that as a result of optimism banks' credit officers offer borrowers more lenient terms during periods of economic expansions. This pro-cyclical credit policy leads to over-investment during economic booms and under-investments in recessions. In other words, the model predicts that during expansionary periods banks offer more credit and to a riskier pool of borrowers than during other times[14]. These predictions lead to the following testable hypotheses:

Hypothesis 1: The quality of projects financed in optimistic years, in terms of expected profits, is overestimated more than the quality of projects financed at other times.

Hypothesis 2: The probability that borrowers are high-risk (low-risk) is larger (smaller) for borrowers who took large loans in periods of optimism.

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level of wealth required to undertake investment is ω_{cc}^{e} . Such entrepreneurs are allowed to invest solely due to the optimism of the bank. This optimism will disappear with the first negative shock..

[13] It is interesting to note that the level of depression should be correlated to the level of over optimism in investment and credit extension: I.e., to what extent $g_h(p)_{(\alpha)}$ F.S.D. $h(p)$.

[14] There is not much empirical work in the literature on the subject of risk associated with loans during different economic times. Work that has been done so far gives mixed results and includes Ratti (1980), Rajan (1994), Demsetz and Strahan (1997) and Agrawal et al. (2004).

The hypotheses follow from Proposition 1 and Proposition 3 which state that when the economic mood improves and there is more optimism in credit markets, the bank under-estimates risks and allows entrepreneurs with less initial wealth to implement projects. Under-estimation of risk implies over-estimation of expected profits. It follows that the bank allows entrepreneurs to perform projects although their self-investment is smaller than during other times. Hence, entrepreneurs find it profitable to perform riskier projects.

Hypothesis 2 is derived from Proposition 1. Proposition 1 states that when credit terms become easier, entrepreneurs invest in riskier projects because they are required to risk less of their own wealth.

In order to test these hypotheses, data on the construction market in Israel was collected. The construction sector is suitable for testing the impact of financial factors, since in this market both buyers and sellers depend on credit terms. Changes in credit terms thus lead to quick and strong reactions (see Stein 1995, Hubbard 1998 and Elul 1999). This is especially true for the Israeli construction sector in the 1990s. The large size of the construction market (between 6.4 and 6.9 percent of Israel's GDP) and its high volatility (see Figure 1) make it an ideal test case for measuring the effects of changes in credit terms on investment.

*** Figure 1 about here ***

4.2 Empirical test of hypothesis 1

4.2.1 The data set

Two sets of data are used in the empirical analysis. The first database, which is used to test hypothesis 1, consists of real estate estimators' reports of 153 projects performed in Israel in the period 1995–2003.[15] Each report gives the following information regarding the construction project: name of the construction firm, name of the bank that provided credit, the size of investment, the location of the project, the date when the project began and the planned and actual finishing dates. The data also includes information on the expected revenues and costs before the beginning of the project, and the actual revenues and costs that were realized. It should be emphasized that the real estate estimator report, including the estimated profits, is handed to the

[15] The second database is discussed in section 4.3.1 below.

bank as a part of the request for a loan.[16] Therefore, the figures regarding expected profits represent the bank's estimate of the ex-ante quality of the project. The dataset also includes the amount of capital that the entrepreneur was asked by the bank to invest in the project (equity).[17] Table 1 below describes the main summary statistics for this dataset.

*** Table 1 about here ***

4.2.2 Macroeconomic conditions during the sample period

Among the nine years of the sample period, only 2000 can be regarded as an expansionary period that was expected to last. The Israeli economy grew very rapidly during the first half of the 1990s (annual growth of 6.2% on average during 1990 – 1995) However, starting in 1996 the economy had slowed down. Between 1997 and 1999 GDP grew, on average, only 3.2% per annum, about half the corresponding rate for the preceding period. The slowdown is even more evident in the figures for the business sector. Output of the business sector grew on average, at an impressive 7.4% per annum during 1990 – 1996 and by less than half of that in the 1997 – 1999 period (3.5%).[18] The slow growth period ended in the year 2000, which registered a record growth rate: 8% for GDP and 10.2% for output of the business sector (see Figure 2 and Table 2). However, this boom year did not last. In the years 2001 – 2003 the Israeli economy experienced its longest and deepest recession ever. GDP declined in each of the years 2001 and 2002 and grew by a mere 1.3% in 2003.[19]

It should be emphasized that the switch from boom (in 2000) to bust was unexpected and was a result of exogenous events that were unforeseen including the outbreak of the Palestinian intifada at the end of 2000 and the worldwide crisis in the

[16] The estimators are independent, and provide what is considered unbiased assessments. The banks, however only accept estimations if they are made by offices they are familiar with. As a consequence, there are about 10 large offices that estimate most of the projects (for large projects the list is smaller and includes only the 3-4 largest offices).

[17] In general when banks in Israel decide to finance construction projects they open a credit line to the firm to be used for that project only. The construction company can draw money from the credit line only through a special "escort" account set up for this purpose. All the revenues from the project must also be deposited into this account. Most commonly, before extending any money to a project, banks demand that the construction firm place a certain sum of money in this account. If the project fails and the company cannot pay its loan to the bank, the bank takes over this sum (together with any other sum accumulated in this "escort account").

[18] For an analysis of the reasons for the high rates of growth of the Israeli economy in the first half of the 1990s, see Zilberfarb (1996).

[19] See Zilberfarb (2006) for an analysis of the factors that led to the slowdown of the Israeli economy in the second half of the 1990 and the recession of 2001 -2003.

high-tech industry. Thus the year 2000 may be viewed as a boom year that was expected to last.

*** Figure 3 about here ***

4.2.3 Empirical Results

Hypothesis 1 implies that projects initiated in optimistic years would be riskier than predicted by the bank. Consequently, a greater difference between their expected and actual profits should be expected. On the other hand, profits for projects, initiated in times of pessimism, would be under-estimated and therefore they will be more profitable than expected by the bank.

To check this hypothesis, the first database is used to run the following regression:

$$dif\_profit = \alpha + \beta_1 \times Duration + \beta_2 \times Total\_\cos t + \beta_3 \times Ratio\_self + \beta_4 \times Commerce +$$
$$+ \beta_5 \times L\arg e\_bank + \sum_{T=1995}^{2004} \gamma_T \times YearT + \delta \times Lcoation + \varepsilon_i$$

Where:

dif_profit is defined as actual profits minus expected profits divided by the total cost of the project (to normalize the profits as a function of the cost).

Duration is the planned duration (in months) of each project. This variable controls for the risk associated with projects that are performed over longer periods.

Ratio_self is the ratio of the equity (provided by the construction company) over the total cost of the project. This variable should capture the risk to the entrepreneur relative to the risk to the bank.

Commerce is a dummy variable receiving the value of 1 if the project is intended for commercial uses and 0 if it is a residential building.

Large_bank is a dummy variable receiving the value of 1 if the project was financed by one of the two largest banks in Israel and 0 otherwise. Since these banks extend about 60% of all the loans to construction companies in Israel, this variable controls for any systematical differences between their performance and that of the smaller banks.

Location are a set of fixed effects for the location of the project. We divided Israel into three main areas (north, south and center) and we also included dummies for the three major cities (Tel-Aviv, Haifa and Jerusalem).[20]

YearT are dummy variables for each of the years 1995, 1996… 2004. Each of these variables receives a value of 1 if a project was audited and initiated during that year and 0 otherwise. We take the date of the initial real estate estimator report as a proxy for the date when the bank agreed to finance the project.

The regression equation was estimated by OLS using the White robust standard error estimator to correct for heteroscedasticity. The empirical results are reported in Table 3.

***Table 3 about here ***

The most important result is the negative significant coefficient for the year 2000 dummy variable and the positive significant coefficient for the year 2003 dummy variable. The negative coefficient for the year 2000 implies that projects initiated then (a year of optimism) yielded results that are below the ex-ante predictions, even when controlling for other variables.[21] This is exactly the outcome that was expected from our model. The dummy variables for all other years except 2003 are insignificant even at the 10% level. The fact that the dummy for 2003 is positive and significant lends further support to our model. The year 2003 was the third year of a long recession. While the data shows, in retrospect, that recovery started at the end of 2003, the business community recognized it only in late 2004. The model predicts that during such times banks would be overly conservative when they audit projects, which leads to the finding that projects financed during 2003 have higher profits than predicted.

[20] To test our specification, we tried to sub-divide the country into finer sub-categories, but the results for the other variables remained almost unchanged.

[21] For brevity, the coefficients of the location dummy variables are not reported here. Only the Tel-Aviv dummy variable came out as marginally significant (10%) and negative. It indicates that projects initiated in Tel-Aviv, which is the main commercial center of Israel, were somewhat over-valued by the banks.

Two variables are insignificant: the expected duration of the project, implying that banks control for the extra risk in projects that are longer and the *Commerce* dummy variable (implying that there is no difference in the banks' ability to predict the outcome of commercial and residential projects).

The negative constant term of the equation (which is significant at the 10% level), implies that banks have a tendency to overestimate expected profits. However, the positive value of the large bank dummy variable (which is highly significant) implies that the large banks in Israel have a better ability to correctly predict actual profits than small banks[22]. This may be the result of larger evaluation resources, or the fact that riskier projects which are rejected by big banks, are financed by smaller banks.

As predicted by our model, equity is a good predictor for a project's success: The more the entrepreneur invests, the more likely it is that it is a good and safe project that will yield high returns close to or above the projected ones[23].

4.3 Empirical test of hypothesis 2

4.3.1 The data set

We now turn to check another implication of the optimism bias, by testing Hypothesis 2 which refers to the probability that a project is high risk. The second hypothesis is tested by utilizing another data set. The second data set includes semi annual observations on loans extended to 232 firms of all sizes in the construction business by one of the largest banks in Israel. The data specifies each firm's debt to the bank at semi annual intervals from December 1997 to April 2004. It also gives each firm's credit rating on a scale equivalent to one going from "AAA" (best ranking) to "D" (lowest ranking). The rating is based on an internal model, calculated by the bank's research department. The credit rating is calculated for each firm by taking into account the firm's business performance and the value of the collateral the firm has provided. Table 4 summarizes the main characteristics of this data set.

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[22] While the constant term for large banks is still negative (adding the constant term and the coefficient of the dummy variable yields a value of -0.029) one cannot reject the null hypothesis that the combined coefficient is not statistically different from 0.

[23] We also estimated a regression that includes dummy variables for individual banks, and one that includes dummy variables for the largest construction companies (using the D&B estimates to identify the five largest construction companies in Israel). This, however, did not change any of our main results.

*** Table 4 about here ***

Figure 3 depicts the percentage change in credit extended to the sample firms during the period December 1997 – April 2004. The credit figures are in real terms, using the Price Index of Inputs in Residential Building as a deflator. The pattern revealed is in line with the predictions of the model. The optimistic year of 2000, is also the only year in which there was a significant increase in the amount of credit extended by the bank.

*** Figure 3 about here ***

Let $debt_{i,t}$ stand for the percentage change in the debt of firm i between the end of year t and year t-1. $\overline{debt_t}$ is the mean percentage change in the debt of all firms during that year. A normalized proxy for the rate of change in the debt of each firm, $loan_{i,t}$ is calculated as: $loan_{t,i} = \frac{debt_{i,t}}{\overline{debt_t}}$ (23)

This normalized value measures the deviations in each firm's debt from the normal changes in the debt in that year. Accordingly a $loan_{t,i}$ variable is defined for each of the following years: 1998, 1999, 2000, 2001, 2002 and 2003, as follows: $loan98_i, loan99_i, loan00_i, loan01_i, loan02_i, loan03_i$.

In addition to the $loan_{t,i}$ variables, $open_i$ is the opening debt of the firm in December 1997. This variable was added to the regression in order to capture the effect of the actual size of a firm's loan on its credit rating.

The empirical test is based on observations for 219 firms[24]. The rating used in this paper is the year 2004 rating given to each firm.

[24] As mentioned in the data section, some firms that have defaulted have a ranking that is calculated on a different basis than that of the other firms. Dropping these firms from the sample leaves 219 firms in the sample group.

Based on the credit rating, firms were divided into 4 broad categories: The first group includes the safest firms; those with a credit rating between AAA and A, and it received a value of 3. A second group, including firms with a credit rating between BBB and B, received a value of 2. Firms in this group are good firms, but the bank's research department recommends some additional auditing before granting them more credit. A third group is composed of high risk firms with a rating between CCC and C. Each firm in this group received a value of 1. The final group is composed of firms that are in serious difficulties and their credit rating is between DDD and D. Firms in this group were given a value of 0.

4.3.2 Empirical Results

Using $loan_{i,t}$ and the credit rating of firms, a multi-logistic and ordered-logistic regressions were estimated. We report the results for the multi-logistic regression because its coefficients are easier to interpret, and their effect on the probability that a firm belongs to any of the four groups are easily obtained. Similar results are obtained from the Ordered-Logistic model.

The multi logistic function results are given as the ratio of the probability that a firm belongs to any of the groups, in comparison with the probability that the firm belongs to a base group chosen from one of the possible values. Mathematically, the multi logistic function calculates for each group: $\frac{p_i}{p_b} = e^z$, where p_i $, i \in \{0...3\}, i \neq b$, stands for the probability that the firm belongs to each of the groups except a base group, p_b is the probability that the firm belongs to the base group, and z is a function of the independent variables.

The following specification for z was defined:

$$z = \alpha + \beta_1 \times loan98_i + \beta_2 \times loan99_i + \beta_3 \times loan00_i + \beta_4 \times loan01_i + \beta_5 \times loan02_i + \\ + \beta_6 \times loan03_i + \beta_7 \times open_i + \varepsilon_i . \quad (24)$$

The results of the multi logistic regression are given in Table 5 in the form of three regressions. Each regression indicates the effect each variable has on the probability that a firm belongs to the specified group. All the probabilities are measured in comparison with the base group that was selected as the BBB – B group.

*** Table 3 about here ***

The interesting results are those that measure the impact of loans taken in the year 2000. It is possible to see that the increase in debt during 2000 significantly (at the 5% level) increases the probability that a firm will belong to the group of firms with a credit ranking between DDD and D. It suggests that firms that took large loans in 2000 are more likely to face financial problems. This result is, however, in line with the prediction of our model namely, projects taken during expansionary years are riskier than projects taken at other times[25].

It is interesting to note that loans taken during the year 2000 have a lower probability of belonging to the CCC – C group (at the 10% level). This may be a by-product of the significant increase in the probability that firms that have taken large loans during the year 2000 belong to the DDD- D group.

Another result is that firms that took large loans during 1998 are less likely to be in financial trouble: The coefficient of $loan98$ for firms in the DDD – D group is significantly negative (at the 2% level). The year 1998 was a pessimistic year in the construction sector, since by that time it became evident that the large immigration wave that fuelled the demand for housing in the first part of the 1990s was slowing down. This explanation is in accordance with the model's predictions. As a result of the flight to quality, only larger firms with safer projects receive large loans during pessimistic years. Thus, firms that managed to borrow more than the average firm during 1998 are safer borrowers.

Finally, $loan01$ has a significant negative sign for the regression on firms with AAA - A ranking. This can be attributed to projects taken in 2000. Firms that began implementing large projects during 2000 probably also required borrowed funds during 2001 in order to try and maintain their operations when the economic cycle turned down[26]. Such firms suffer not only from having a large debt, but also from having a large stock of real estate that is hard to sell because of the economic contraction.

[25] In the Ordered-Logistic regression only the coefficients of $loan00$ and $loan01$ were significant (at the 10% and 5% level, respectively).

[26] Research on business cycles often finds that during the first stages of recession firms actually take more loans than usual, because they require more money during such times to handle unanticipated inventory accumulation. See for example: Bernanke et al. (1996) and Romer (1996).

The fact that a large opening debt in December 1997 is negatively correlated (at the 5% significance level) with the probability that a firm is in the best group can also be explained by the model's predictions. Israel experienced a period of extremely rapid growth in its population in the first half of the 1990s. This was due to high rates of immigration from the former Soviet Union. The waves of immigrants increased demand for new housing and encouraged entrepreneurs to invest in real-estate. The rate of immigration, however, was significantly reduced in the second half of the 1990s. As a consequence the construction business entered a period of recession (see Figure 1). A large opening debt in 1997 signifies that a firm entered the recessionary period of 1997- 1999 with a heavy debt accumulated during the more optimistic period –that preceded it. It is not surprising that such firms are less likely to belong to the group of firms that are most financially sound.

5. Conclusions

This paper extends the Bernanke and Gertler (1990) model, and demonstrates that a backward looking learning process can introduce an optimism bias into banks' credit policy. Consequently, banks encourage over-investment during periods of rapid economic growth by extending credit under easier terms than during other times. By the same token, entrepreneurs find it harder to obtain credit during times of recession, because the pessimism of banks implies that they lend money only to high quality borrowers; i.e. to the relatively few entrepreneurs who have enough personal wealth to finance most of their investments. This pro-cyclical credit-policy therefore serves as another sub-channel of the credit-channel in accentuating business cycles fluctuations.

Two unique data sets on the Israeli banking system were used to empirically test the model. The results support the theoretical model. Firms that received credit during economic expansion end up being riskier than firms that received loans during other periods. Furthermore, projects implemented during expansionary periods yield smaller than planned profits. The results show that banks' policy during economic booms indeed creates a more fragile portfolio of loans. This suggests that the banks may have increased the overall financial fragility of the Israeli market and thus served to aggravate the economic recession that plagued Israel in the years 2001 – 2003.

References

Agarwal S., Chomsisengphet S. and Driscoll J. C., 2004, *Loan Commitments and Private Firms*, Finance and Economics Discussion Series, Division of Research and Statistics and Monetary Affairs, Federal Reserve Board, Washington, DC.

Berger A. N. and Udell G. F., 2002, "The Institutional Memory Hypothesis and the Procyclicality of Bank Lending Behavior", Working Paper.

Bernanke B. S. and Blinder A., 1992, *The Federal Funds Rate and the Channels of Monetary Transmission*, The American Economic Review (82, 4): 901 – 921.

Bernanke B. S. and Gertler M., 1990, *Financial Fragility and Economic Performance*, The Quarterly Journal of Economics (105, 1): 87 – 114.

Bernanke B. S. and Gertler M., 1995, *Inside the Black Box: The Credit Channel of Monetary Policy Transmission*, The Journal of Economic Perspectives (9, 4): 27 – 48.

Bernanke B. S., Gertler M. and Gilchrist S., 1996, *The Financial Accelerator and the Flight to Quality*, The Review of Economics and Statistics, (78, 1): 1 - 15.

Bomfim A. N. and Diebold F. X., 1997, *Bounded Rationality and Strategic Complementarity in a Macroeconomic Model: Policy Effects, Persistence and Multipliers*, The Economic Journal (107): 1358 – 1374.

Cecchetti S. G., Pok- Sang L. and Mark N. C., 2000, *Asset Pricing with Distorted Beliefs: Are Equity Returns Too Good to be True?*, The American Economic Review (90, 4): 787 – 805.

De Bondt W. F. M. and Thaler R. H., 1990, *Do Security Analysts Overreact?*, The American Economic Review (80, 2): 52 – 57.

Demsetz R. S. and Strahan P. E., 1997, *Diversification, Size and Risk at Bank Holding Companies*, Journal of Money, Credit and Banking (29, 3): 300 – 313.

Elul R., 1999, *Collateral, Credit History and the Financial Decelerator*, Working paper, Brown University, Providence.

Evans G. W. and Ramey G., 1992, *Expectation Calculation and Macroeconomic Dynamics*, The American Economic Review (82, 1): 207 – 224.

Freixas X. and Rochet J. C., 1999, *Microeconomics of Banking*, Massachusetts Institute of Technology Press.

Himmelberg C. P. and Petersen C. P., 1994, *R & D and Internal Finance: A Panel Study of Small Firms in High- Tech Industries*, The Review of Economics and Statistics, (76, 1): 38 – 51.

Hubbard R. G., 1998, *Capital Market Imperfections and Investment*, Journal of Economic Literature (36, 1): 193 – 225.

Kashyap A. K. and Stein J. C., 2000, *What do a Million Observation on Banks Say about the Transmission of Monetary Policy*, The American Economic Review (90, 3): 407 – 428.

King S. R., 1986, *Monetary Transmission: Through Bank Loans or Bank Liabilities?*, Journal of Money, Credit and Banking (18, 3): 290 – 303.

Peek J. and Rosengren E. S. (1995a), "Bank Regulation and the Credit Crunch" *Journal of Banking and Finance* (19), 679 – 692.

Peek J. and Rosengren E. S. (1995b), "The Capital Crunch: Neither a Borrower nor a Lender Be," *Journal of Money, Credit and Banking* (27, 3): 625 – 638.

Rajan R. G., 1994, *Why Bank Credit Fluctuate: A Theory and Some Evidence*, *Quarterly Journal of Economics* (109, 2): 399 – 441.

Ratti R. A., 1980, *Bank Attitude Toward Risk, Implicit Rates of Interest, and the Behavior of an Index of Risk Aversion for Commercial Banks*, The Quarterly Journal of Economics (95, 2): 309 – 331.

Romer D., 1996, *Advanced Macroeconomics*, McGraw- Hill Companies, inc.

Sah K. R. and Stiglitz J. E., 1986, *The architecture of Economic Systems: Hierarchies and Polyarchies*, The American Economic Review (76, 4): 716 – 727.

Schiffman D., 2003, *Shattered Rails. Ruined Credit: Financial Fragility and Railroad Operations in the Great Depression,* Journal of Economic History.

Stein J. C., 1995, *Prices and Trading Volume in the Housing Market: A model with Down Payment Effects*, The Quarterly Journal of Economics (110, 2): 379 – 406.

Zilberfarb B., 1996, "The Israeli economy in the 1990s - immigration, the peace process and the medium term prospects for growth," *Israel Affairs*, Vol. 3, N0. 1, Autumn 1996, 1-13.

Zilberfarb B., 2006 . "From boom to bust: the Israeli economy 1990 – 2003", *Israel Affairs*, Vol. 12, N0. 2, April 2006, 221 – 233

Appendix A

Proof of Proposition 1 (A): The minimum cutoff probability is set by the contract between the bank and the entrepreneurs. The bank looks to satisfy the condition that its expected income from lending should equal the safe returns in the economy. This condition is given by equation (8):

$$\Phi_b(p^*_{b(\omega,\alpha)},\alpha)\times\Gamma_{b(\omega,\alpha)} = r\times(1-\omega).$$

Entrepreneurs, for their part, look to satisfy the condition that their expected revenue is not less than the opportunity cost of depositing their wealth in the bank. This gives equation (4):

$$p^*_{b(\omega,\alpha)}\times(R-\Gamma_{b(\omega,\alpha)}) - r\times\omega_i = 0.$$

The value of $p^*_{b(\omega,\alpha)}$ is set when both equations (4) and (8) are satisfied. Note that the quality distribution as seen by the bank, $h_b(p,\alpha)$, is a linear combination of $h(p)$ and $g_i(p,\alpha)$, $i\in(h,l)$. This implies that the average success probability of projects of quality above $p^*_{b(\omega,\alpha)}$ is:

$$\Phi_b(p^*_{b(\omega,\alpha)},\alpha) = \begin{cases} \alpha\times\Phi_h(p^*_{b(\omega,\alpha)},\alpha)+(1-\alpha)\times\Phi_{g_l}(p^*_{b(\omega,\alpha)},\alpha) & if\ \alpha<\alpha^e \\ \Phi_h(p^*_{b(\omega,\alpha)},\alpha) & if\ \alpha=\alpha^e \\ (1-\alpha)\times\Phi_h(p^*_{b(\omega,\alpha)},\alpha)+\alpha\times\Phi_{gh}(p^*_{b(\omega,\alpha)},\alpha) & if\ \alpha>\alpha^e \end{cases} \quad \text{(A1)}$$

Where $\Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)$ denotes the average success probability of $h(p)$ conditional on projects having better quality than $p^*_{b(\omega,\alpha)}$ and $\Phi_{gi}(p^*_{b(\omega,\alpha)},\alpha)$ denotes the average success probability of $g_i(p,\alpha)$ $i\in(h,l)$, conditional on projects having quality above the cutoff probability $p^*_{b(\omega,\alpha)}$.

Assume that the success rate of entrepreneurs in the previous period was above the expected success rate of the previous period ($\alpha>\alpha^e$). From equation (A1), this implies:

$$\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) = (1-\alpha)\times\Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha) + \alpha\times\Phi_{gh}(p^*_{b_{(\omega,\alpha)}},\alpha).$$

Using this result to differentiate equation (8) gives:

$$\Gamma_{b_{(\omega,\alpha)}} \times \left\{ \Phi_{gh}(p^*_{b_{(\omega,\alpha)}},\alpha) - \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha) + (1-\alpha)\times\frac{\partial\Phi_h\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}}\times\frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial\alpha} + \right.$$

$$\left. +\alpha\times\left[\frac{\partial\Phi_{gh}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial\alpha} + \frac{\partial\Phi_{gh}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}}\times\frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial\alpha}\right]\right\} +$$

$$+\frac{\partial\Gamma_{b_{(\omega,\alpha)}}}{\partial\alpha}\times\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) = 0. \qquad \text{(A2)}$$

Differentiating equation (4) with respect to α yields:

$$\frac{\partial p^*_{b(\omega,\alpha)}}{\partial\alpha}\times\left[R-\Gamma_{b(\omega,\alpha)}\right] - \frac{\partial\Gamma_{b(\omega,\alpha)}}{\partial\alpha}\times p^*_{b(\omega,\alpha)} = 0. \qquad \text{(A3)}$$

Using (A3) to isolate $\frac{\partial\Gamma_{b(\omega,\alpha)}}{\partial\alpha}$ gives:

$$\frac{\partial\Gamma_{b(\omega,\alpha)}}{\partial\alpha} = \frac{\frac{\partial p^*_{b(\omega,\alpha)}}{\partial\alpha}\times(R-\Gamma_{b(\omega,\alpha)})}{p^*_{b(\omega,\alpha)}}.$$

Using this result to substitute for $\frac{\partial\Gamma_{b(\omega,\alpha)}}{\partial\alpha}$ in equation (A2) gives (after some rearrangements):

$$\frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial\alpha}\times\left[\Gamma_{b_{(\omega,\alpha)}}\times(1-\alpha)\times\frac{\partial\Phi_h\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}} + \alpha\times\frac{\partial\Phi g_h\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}}\times\Gamma_{b_{(\omega,\alpha)}} + \right.$$

$$\left. +\frac{(R-\Gamma_{b_{(\omega,\alpha)}})^2}{p^*_{b_{(\omega,\alpha)}}}\right] = -\Gamma_{b_{(\omega,\alpha)}}\times[\Phi_{g_h}(p^*_{b_{(\omega,\alpha)}},\alpha) - \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)] -$$

$$-\alpha\times\frac{\partial\Phi_{g_h}(p^*_{b(\omega,\alpha)},\alpha)}{\partial\alpha} \qquad \text{(A4)}$$

To find the sign of this expression, first concentrate on the R.H.S. By the construction of $\Phi_{g_h}(p^*_{b(\omega,\alpha)},\alpha)$ it follows that for every value of α, $\frac{\partial \Phi_{g_h}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} \geq 0$. Also from the definition of $g_h(p,\alpha)$ it follows that $\Phi_{gh}(p^*_{b_{(\omega,\alpha)}},\alpha) > \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)$[27]. These two facts put together imply that the R.H.S must be equal or smaller than zero.

On the L.H.S. of (A4) the signs of the partial derivatives in the brackets are non negative:

$\frac{\partial \Phi_b\left(p^*_{b(\omega,\alpha)},\alpha\right)}{\partial p^*_{b(\omega,\alpha)}} \geq 0$ and $\frac{\partial \Phi_{gh}\left(p^*_{b(\omega,\alpha)},\alpha\right)}{\partial p^*_{b(\omega,\alpha)}} \geq 0$,

because when $p^*_{b(\omega,\alpha)}$ increases so must the conditional success probability (the average must increase when the smallest terms are removed).

As a result, the expression in the brackets on the L.H.S. is positive. Therefore to maintain the equality between the sides it must be that: $\frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \leq 0$.

The same result is obtained if $\alpha < \alpha^e$. The proof is symmetric and is based on the fact that $\Phi_{gl}(p^*_{b_{(\omega,\alpha)}},\alpha) < \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)$.

Q.E.D.

Proof of Proposition 1 (B): When the performance of entrepreneurs in the past period is as expected, equation (A1) implies that: $\Phi_{b(\alpha,\omega)} = \Phi_{cc(\omega)}$. This is the benchmark case where there is no bias as the result of optimism in the behavior of the bank. This implies that the same results are reached in this case as in the basic model and therefore $p^*_{b(\alpha,\omega)} = p^*_{cc(\omega)}$.

[27] $g_h(p,\alpha)$ stochastically dominates $h(p)$ by construction. This implies that for any p^*, the conditional probability of success for $g_h(p^*,\alpha)$ must be greater than the conditional probability of success of $h(p^*)$.

When the performance of entrepreneurs in the past period was above expectations ($\alpha > \alpha^e$) then for any given initial wealth, ω, it follows that $p^*_{b(\alpha,\omega)} < p^*_{cc(\omega)}$. This result is derived by first considering the benchmark case. In this case, $\alpha = \alpha^e$ and for every initial endowment, ω, the cutoff probability is identical to that of the BG model: $\alpha = \alpha^e \Rightarrow p^*_{b(\alpha,\omega)} = p^*_{cc(\omega)}$. Since $\dfrac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \leq 0$, then holding ω constant, an increase in α relative to expectations must be followed by a decrease in the cutoff probability relative to the benchmark case. It is therefore possible to conclude that:

$\alpha > \alpha^e \Rightarrow p^*_{b(\alpha,\omega)} < p^*_{b(\alpha^e,\omega)} = p^*_{cc(\omega)}$.

The opposite result is derived when $\alpha < \alpha^e$. Since $p^*_{b(\alpha,\omega)}$ is a decreasing function of α, as α decreases, $p^*_{b(\alpha,\omega)}$ must increase. It was shown above that in the benchmark case, where $\alpha = \alpha^e$, $p^*_{b(\alpha,\omega)} = p^*_{cc(\omega)}$. A decrease in α relative to this benchmark case, must therefore imply an that: $\alpha < \alpha^e \Rightarrow p^*_{b(\alpha,\omega)} > p^*_{cc(\omega)}$.

Q.E.D.

Proof of Proposition 2 (A): The nominal interest rate is calculated by dividing the return to the bank by the size of the loan: $\Psi_{b(\alpha,\omega)} = \dfrac{\Gamma_{b(w,\alpha)}}{1-\omega}$.

Differentiating $\Psi_{b(\alpha,\omega)}$ with respect to α gives:

$$\frac{\partial \Psi_{b(\omega,\alpha)}}{\partial \alpha} = \frac{\dfrac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}}{1-\omega}$$

This implies that the sign of $\dfrac{\partial \Psi_{b(\omega,\alpha)}}{\partial \alpha}$ is the same as the sign of

$$\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}.$$

The sign of $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}$ can be inferred from Equation (A3), where:

$$\frac{\partial p^*_{b(\alpha,\omega)}}{\partial \alpha} \times [R - \Gamma_b] - \frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha} \times p^*_{b(\alpha,\omega)} = 0.$$

Isolating $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}$ gives:

$$\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha} = \frac{\frac{\partial p^*_{b(\alpha,\omega)}}{\partial \alpha} \times \left(R - \Gamma_{b(\alpha,\omega)}\right)}{p^*_{b(\alpha,\omega)}}.$$

It was shown above that: $\frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \leq 0$ and therefore: $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha} \leq 0$.

Since: $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha} \leq 0$, it must follow that :

$$\frac{\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}}{1-\omega} \leq 0 \Rightarrow \frac{\partial \Psi_{b(\omega,\alpha)}}{\partial \alpha} \leq 0.$$

Q.E.D.

Proof of Proposition 2 (B): When $\alpha = \alpha^e$ it follows from Equation (2) that the bank's quality distribution, $h_b(p,\alpha)$ equals $h(p)$. As a consequence, when $\alpha = \alpha^e$, $\frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} = 0$ and therefore: $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha} = 0$. Since in this case the return to the bank is unaffected by the success rate of entrepreneurs, the results are the same as in the basic model. This in turn implies: $\Psi_{b(\alpha,\omega)} = \Psi_{cc(\omega)}$. If the success rate of entrepreneurs, however, differs then the expected rate of success, then $\frac{\partial \Psi_{b(\omega,\alpha)}}{\partial \alpha} \leq 0$ implies as a result that for a given level of wealth: $\Psi_{b(\alpha,\omega)} > \Psi_{cc(\omega)}$, if $\alpha < \alpha^e$. When $\alpha > \alpha^e$ it must follow that: $\Psi_{b(\alpha,\omega)} < \Psi_{cc(\omega)}$.

Q.E.D.

Proof of Proposition 3: The minimum level of wealth required to make an entrepreneur screen a project when the economy depends on past success of entrepreneurs, $\omega^e_{b(\alpha)}$, is implicitly defined by equation (12): $V^b_{(\omega,\alpha)} = e$.

Differentiating equation (10)

$$V^b_{(\omega,\alpha)} = [1 - H(p^*_{b(\omega,\alpha)},\alpha)] \times (\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) \times R - r),$$

with respect to α gives:

$$\frac{\partial V^b_{(\omega,\alpha)}}{\partial \alpha} = -h_b(p^*_{b_{(\omega,\alpha)}},\alpha) \times \frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial \alpha} \times \left(\Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha) \times R - r\right) +$$
$$+ \frac{\partial \Phi_b(p^*_{b_{(\omega,\alpha)}},\alpha)}{\partial \alpha} \times R \times \left[1 - H_b(p^*_{b_{(\omega,\alpha)}},\alpha)\right]. \quad \text{(A5)}$$

When $\alpha > \alpha^e$, the expression $\frac{\partial \Phi_b(p^*_{b(\omega,\alpha)},\alpha)}{\partial \alpha}$ in (A5) stands for:

$$\frac{\partial \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} = (1-\alpha) \times \frac{\partial \Phi_h\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b(\alpha,\omega)}} \times \frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial \alpha} + \alpha \times$$
$$\times \left[\frac{\partial \Phi_{gh}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} + \frac{\partial \Phi_{gh}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}} \times \frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial \alpha}\right] + \Phi_{gh}(p^*_{b_{(\omega,\alpha)}},\alpha) - \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)$$

.

When $\alpha < \alpha^e$:

$$\frac{\partial \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} = \alpha \times \frac{\partial \Phi_h\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}} \times \frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial \alpha} + (1-\alpha) \times$$
$$\times \left[\frac{\partial \Phi_{g_l}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} + \frac{\partial \Phi_{g_l}\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial p^*_{b_{(\omega,\alpha)}}} \times \frac{\partial p^*_{b_{(\omega,\alpha)}}}{\partial \alpha}\right] - \Phi_{g_l}(p^*_{b_{(\omega,\alpha)}},\alpha) + \Phi_h(p^*_{b_{(\omega,\alpha)}},\alpha)$$

.

To derive the sign of $\frac{\partial \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha}$ it is possible to use Equation (A2), that can be written as:

$$\Gamma_{b_{(\alpha,\omega)}} \times \frac{\partial \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha} + \frac{\partial \Gamma_{b_{(\alpha,\omega)}}}{\partial \alpha} \times \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right) = 0 .$$

Since $\frac{\partial \Gamma_{b(\alpha,\omega)}}{\partial \alpha}$ is known to be non-positive, $\frac{\partial \Phi_b\left(p^*_{b_{(\omega,\alpha)}},\alpha\right)}{\partial \alpha}$ must be non-negative. This, together with the fact that $\frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \le 0$, gives that: $\frac{\partial V^b_{(\omega,\alpha)}}{\partial \alpha} \ge 0$.

Using this result it is possible to derive Proposition 3 by comparing the results when optimism plays a role in credit market with the results of the basic model. Since $\omega^e_{b(\alpha)}$ is the level of wealth that satisfies Equation (12) $V^b_{(\omega,\alpha)} = e$, and since e is a constant, it must follow that since $V^b_{(\omega,\alpha)}$ is an increasing function of both α and ω, if α increases, the value of ω required to satisfy [12] must decrease. Thus:

$$\frac{\partial V^b_{(\omega,\alpha)}}{\partial \alpha} \ge 0 \Rightarrow \frac{\partial \omega^e_{b(\alpha)}}{\partial \alpha} \le 0$$

As a consequence, the level of per capita investment, given by:

$$I_{b_{(\alpha)}} = \mu \times \int_{\omega^e_{b(\alpha)}}^{1} \left[1 - H_b(p^*_{b(\omega,\alpha)},\alpha)\right] \times f(\omega) \times d\omega , \tag{A6}$$

where $f(\omega)$ is the distribution of wealth among entrepreneurs, must be an increasing function of α as can be seen from differentiating (A6) by applying the Leibnitz rule:

$$\frac{\partial I_{b_{(\alpha)}}}{\partial \alpha} = \mu \times \int_{\omega^e_{b(\alpha)}}^{1} \frac{-\partial H_b\left(p^*_{b(\omega,\alpha)},\alpha\right)}{\partial \alpha} f(\omega) \times d\omega - \left[1 - H_b\left(p^*_{b(\omega,\alpha)},\alpha\right)\right] \times \frac{\partial \omega^e_{b_{(\alpha)}}}{\partial \alpha}$$

(A7)

It was proven above that $\frac{\partial \omega^{e}_{b(\alpha)}}{\partial \alpha} \le 0$ and therefore the second expression in the R.H.S. of (A7) is non-negative. Using the definition of $H_b\left(p^*_{b(\omega,\alpha)},\alpha\right)$ as the accumulative function of $h_b\left(p^*_{b(\omega,\alpha)},\alpha\right)$ gives that for the case where $\alpha > \alpha^{\mathrm{e}}$:

$$\frac{-\partial H_b\left(p^*_{b(\omega,\alpha)},\alpha\right)}{\partial \alpha} = -\left\{ \int_0^{p^*_{b(\omega,\alpha)}} \left(-h(p) + g_h(p,\alpha)\right) \times dp + \int_0^{p^*_{b(\omega,\alpha)}} \left(\alpha \times \frac{\partial g_h(p,\alpha)}{\partial \alpha}\right) \times dp \right.$$

$$\left. + \left[(1-\alpha)\times h(p) + \alpha \times g_h(p,\alpha)\right] \times \frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha} \right\} \qquad \text{(A8)}$$

The Third term in the brackets is non-positive since $\frac{\partial p^*_{b(\omega,\alpha)}}{\partial \alpha}$ is non positive. The sign of the second term is the same as the sign of $\frac{\partial g_h(p,\alpha)}{\partial \alpha}$ that is by construction non-positive. The sign of the first term can be deducted from the fact that $g_h(p,\alpha)$ stochastically dominates $h(p)$ and therefore, by definition: $\int_0^{p^*_{b(\omega,\alpha)}} h(p) \times dp \ge \int_0^{p^*_{b(\omega,\alpha)}} g_h(p,\alpha)$. This implies that the first term is negative as well. Therefore the minus of the entire expression must be non negative and $\frac{\partial I_{b(\alpha)}}{\partial \alpha} \ge 0$.

The proof for the case where $\alpha < \alpha^e$ is symmetric and follows from the fact that $h(p)$ has FSD over $g_h(p,\alpha)$.

Q.E.D.

Table 1: Project Summary Statistics

Varaible	Mean	S.D.
Planned duration of projects (in months)	33.58	18.9
Share of projects performed by large banks	0.52	
Self Investment of construction companies in the project[28]	7,445,520	9,806,221
Planned Profit	6,555,261	51,722,130
Total Cost	62,600,000	86,500,000

Remarks: Prices are in NIS, values deflated by the Price Index of Input in Residential Building[29], using 1992 prices as the base prices.

[28]

[29] The Price Index of Input in Residential Building is calculated by the Israeli Central Bureau of Statistics on a monthly basis. It measures the changes in the cost of inputs most relevant to the construction business.

Table 2: Summary statistics of the firms in the sample. The figures are in thousands of NIS (values deflated by the Price Index of Input in Residential Building[30], using 1992 prices as the base prices)

Average loan December 1997	35,942
Standard Deviation December 1997:	66,074
Average loan April 2004	41,921
Standard Deviation April 2004:	63,016
Number of firms:	232

[30] The Price Index of Input in Residential Building is calculated by the Israeli Central Bureau of Statistics on a monthly basis. It measures the changes in the cost of inputs most relevant to the construction business.

Table 3: Percentage difference between the actual profits and the planned profits for projects initialized in different years.

Variable	coefficient
Constant	-0.912 ** (0.41)
Time_diff	-0.0017 * (0.0008)
Total_cost	0.056 ** (0.025)
Ratio_self	0.124 *** (.02)
Commerce	-0.15 * (.093)
Large_bank	.044 (0.037)
Y2004	0.07 ** (0.033)
Y2000	-0.16 ** (0.066)
R^2	0.25 ***

Remarks:
* -Significant at the 10%
**- Significant at the 5%
***- Significant at the 1%

Number of observations: 153
White Robust Standard Errors are reported in parentheses
The regression also includes location dummies (north of Israel, south of Israel, Israel's Center, Tel-Aviv, Haifa and Jerusalem).

Table 4: Number of observations: 219. Log Likelihood: -216.788.

Probability > $\chi^2 = 0.0032$.

Rating	DDD – D		CCC – C		AAA – A	
Value:	0		1		3	
Variable	Coef.	Std. Dev.	Coef.	Std. Dev.	Coef.	Std. Dev.
$loan98$	-1.13**	0.463	0.145	0.212	-0.027	0.16
$loan99$	-0.947	1.8	-0.13	1.19	0.0188	0.0197
$loan00$	0.476*	0,235	-0.57*	0.34	0.0067	0.111
$loan01$	-0.373	0.232	0.034	0.158	-0.21*	0.11
$loan02$	0.0096	0.075	0.027	0.048	-0.0032	0.31
$loan03$	-0.31	0.06	-0.978	0.103	-0.0085	0.013
$open$	1.14×10^{-6}	3.63×10^{-6}	-3.18×10^{-6}	2.86×10^{-6}	-8.66×10^{-6}**	4.34×10^{-6}
Constant	-1.35	0.345	-2.008	0.398	-0.46	0.27

*Significant at the 10%. ** Significant at the 5%. *** Significant at the 1%.

Figure 1: The number of dwelling starts in Israel 1990 - 2002.

Source: Construction in Israel, 2002. Israel's Central Bureau of Statistics (CBS) publication 1215:

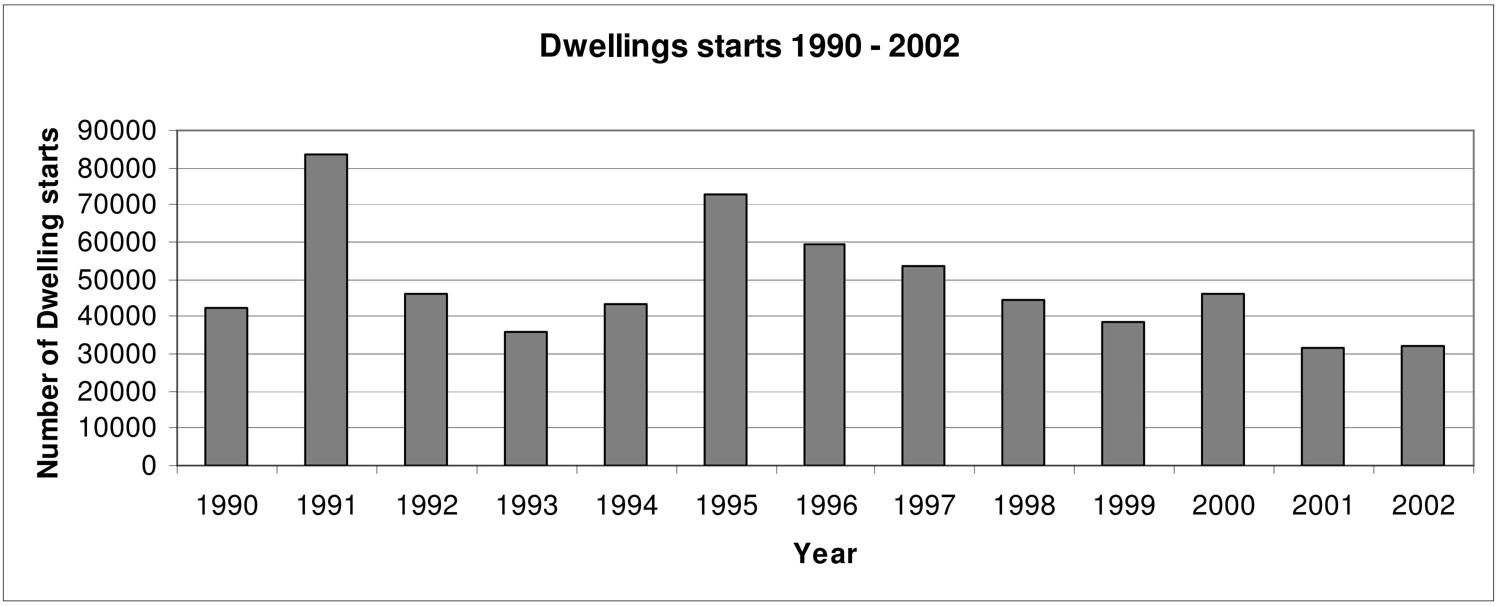

Figure 2: Percent changes in the the GDP and Manufaturing: 1995 – 2004.

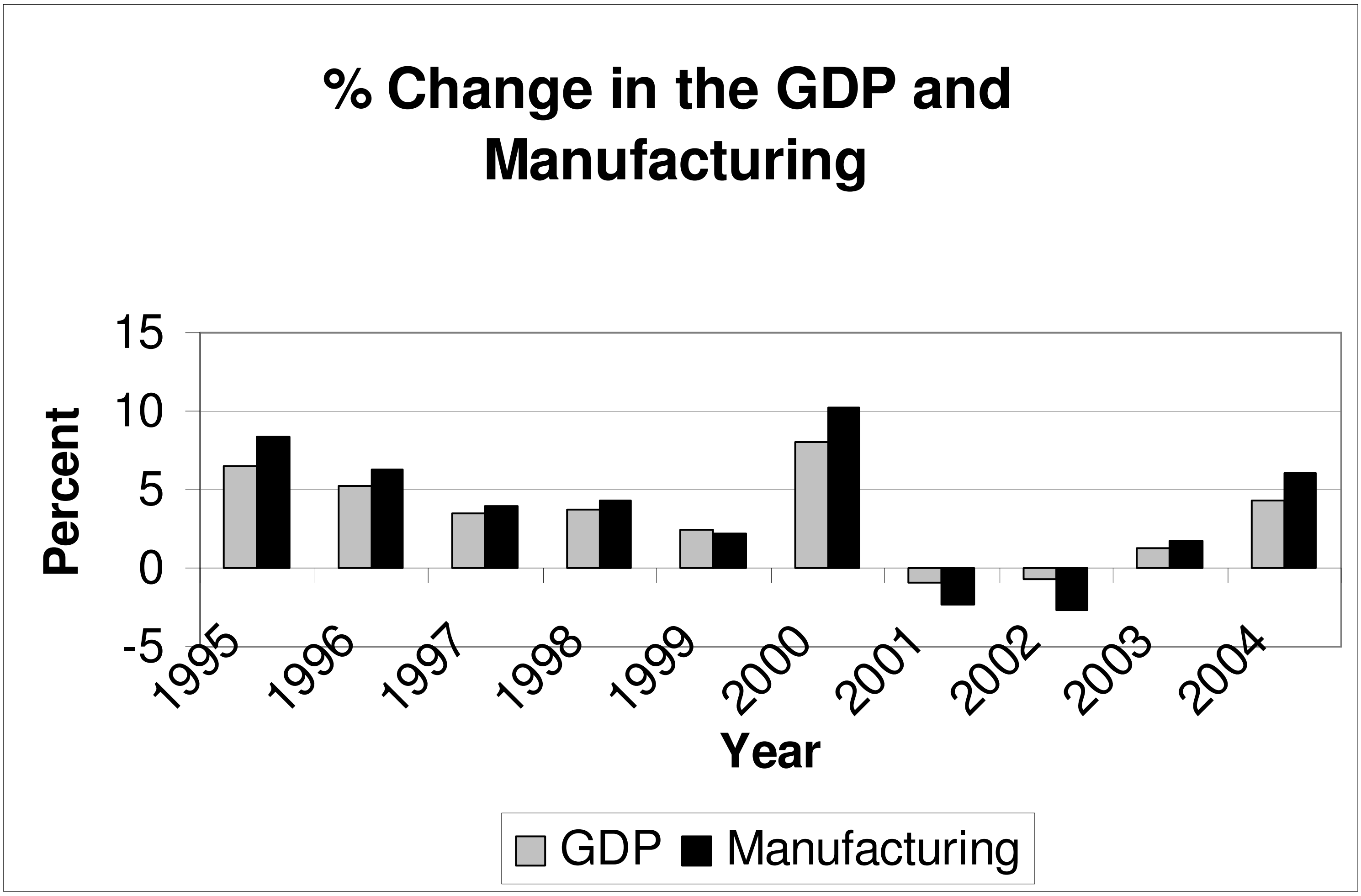

Figure 3: The development of credit 1997- 2004.