

Corporate Governance and Aggregate Volatility ^α

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Abstract

This paper argues that firms adapt their mode of governance to market conditions, and that this may help us understand the business cycle. I focus on the extent of insiders' control over firm's decisions. The delegation of control to insiders fosters initiative but it also gives them the opportunity to expand their firm beyond the profit-maximizing size. This type of behavior has very different implications at the firm level and in the aggregate. At the firm level, it destroys value. In the aggregate, however, when goods markets are imperfectly competitive, firms are too small relative to the social optimum. In such circumstances, insiders' tendency to increase investment, employment and output are at once costly for shareholders and beneficial for the economy. Under plausible assumptions, I show that firms find it optimal to delegate control when demand is high. A positive shock therefore induces more firms to delegate control. Because delegation itself increases output and productivity, the initial shock is amplified and other firms choose to delegate control. I incorporate these insights into a standard real business cycle model and show that delegation choices provide a powerful amplification mechanism. Finally, the model predicts that an increase in firm volatility can decrease aggregate volatility and I present evidence consistent with this prediction. (JEL D2, E3, E4, G3)

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1 Introduction

The question of who controls the firm is a central one in corporate finance. While the chain of formal authority is fairly well defined (running from the investors to the board, from the board to the CEO, and so on), effective control depends on how much of this formal authority is retained and on how much of it is delegated. This paper argues that control is tightened when business conditions deteriorate and that this has quantitatively important implications for the business cycle.

The paper analyzes the following trade-off. Authority (i.e., the right to make discretionary decisions) can be delegated to people inside firms. Delegation allows insiders to use their specific skills and expertise, which enhances productivity. The cost of delegating control is that it creates room for opportunistic behavior. If one does not delegate and instead asks people to go by the book, specific skills and expertise are partly lost, but so is egregious misbehavior.

To go further, one needs to be more specific about the costs and benefits of delegation. I follow Aghion and Tirole (1997) and Burkart, Gromb and Panunzi (1997) by assuming that delegation fosters initiative and non-contractible investments. These investments translate into higher productivity at the firm level. I model the costs of delegation as in Jensen (1986) and Hart and Moore (1995), and argue that managers who enjoy discretionary control tend to expand their firms beyond the profit-maximizing size.

The first insight of the paper is to notice that “empire building” behavior can have very different implications at the firm level and in the aggregate. When goods markets are imperfectly competitive, firms are too small relative to the social optimum. In this case, managerial tendencies to increase investment, employment and output are at the same time costly for shareholders and beneficial for the economy. On the other hand, other forms of managerial misbehavior, such as stealing and spending on non-productive activities, are socially wasteful.

Building on the idea that there is an important distinction between productive and non-productive deviations from profit maximization, the paper proposes a simple model to study the implications of firms’ governance choices for the business cycle. I assume that, at every period, each firm must decide whether or not to delegate control to insiders. When control is delegated, productivity is high but two distortions appear. First, output is too high. Second, there is excess overhead labor. When control is not delegated, productivity is lower

but profit maximization can be strictly enforced. Because delegation increases productivity, the benefits of delegation are higher the higher the demand for the firm's product. On the other hand, the costs of delegation do not increase one for one with the firm's demand. It is therefore optimal for the firms to delegate more when demand is high.

The main result of the paper is that these governance choices amplify aggregate fluctuations. When a negative shock hits the economy, some firms switch to a more conservative mode of governance because insiders' initiatives become relatively less valuable than cost cutting. This has three consequences, two of which amplify the initial shock: first, some specific expertise is lost when control is tightened and this leads to a drop in productivity; second, output goes back to the monopolistic level. The third consequence (less overhead labor) dampens the negative shock by freeing resources that were previously misallocated. The simulations below show that, at least for small initial deviations from profit maximization, the first two effects dominate the third one. The net consequence is, therefore, an amplification of the initial shock, which, in turn, leads other firms (suppliers or customers of the downsizing firms, for instance) to tighten their governance strategy.

I consider two classes of aggregate shocks: technology shocks and labor supply shocks¹. Governance choices amplify technology shocks by a factor of 1.5, and labor supply shocks by a factor of 1.9. In the case of labor supply shocks, the model without the endogenous governance mechanism predicts counter-cyclical real wages. The aggregate labor demand schedule is fixed and therefore the wage has to fall in booms for firms to be willing to hire more labor. This prediction is counter-factual. However, the governance model that I calibrate predicts weakly procyclical real wages even when the business cycle is driven by labor supply shocks. This is because a positive shock induces firms to delegate more control, which makes them at the same time more productive and more willing to hire for a given level of productivity. The aggregate demand for labor therefore shifts out and this increases the equilibrium wage.

Finally, I use the model to propose a new explanation for the recent decline in aggregate volatility. The amplification mechanism emphasized in this paper is based on the idea that firms adapt their mode of governance to market conditions. But market conditions are affected by both idiosyncratic and aggregate shocks. I document the fact that firm level risk

¹Labor supply shocks provide a convenient way to introduce aggregate shocks that do not directly affect the technological frontier of the economy. They can be interpreted, for instance, as nominal spending shocks that interact with nominal wage rigidities. See Chari, Kehoe and McGrattan (2002).

has increased over the past 40 years. There are two ways to capture this increase in firm level risk within the framework of this paper. The first is to spread out the distribution of firm level shocks. The second is to increase the degree of competition in the goods market. In this case, the fundamental firm level shocks are unchanged, but their consequences for output and employment are larger because customers are more willing to shift their spending across firms proposing similar products. The interesting insight is that the same increase in competition can also explain the decrease in aggregate volatility. When I calibrate the model using the actual increase in firm level risk (modelled either by spreading out the distribution of idiosyncratic shocks, or by increasing the degree of competition in the goods market), I find that the model can account for 40% to 50% of the actual decrease in aggregate volatility.

The paper is organized as follows. Section 2 discusses the related literature. Section 3 describes the economy. Section 4 discusses firms' governance decisions. Section 5 presents the intuition for the amplification mechanism. Section 6 discusses the empirical evidence and describes the calibration method. Section 7 presents the impulse responses of the model to technology and labor supply shocks. Section 8 compares the simulated economies with actual data. Section 9 presents evidence on the increase in firm volatility over the past 40 years and computes the implied decrease in aggregate volatility for the calibrated model. Section 10 concludes. Derivations and technical details are in the appendix.

2 Related Literature

This research is related to the microeconomic literature on governance conflicts between managers and shareholders. Jensen (1986) emphasizes the idea that managers tend to expand their firms beyond the profit-maximizing size. This "empire building" behavior also plays a key role in Hart and Moore (1995). The idea that delegation fosters initiative and non-contractible investments is presented in Aghion and Tirole (1997) and Burkart, Gromb and Panunzi (1997). Scharfstein and Stein (2000) provide a model where preferences for large firms arise endogenously from the interaction between two layers of agency. I will discuss the empirical literature about governance conflicts in detail when I turn to the calibration of the model.

The importance of imperfect competition for the business cycle has been emphasized by Blanchard and Kiyotaki (1987), and Rotemberg and Woodford (1992) among others. The

empirical ...nding that markups of prices over marginal costs are counter-cyclical² is relevant for my paper because a ...rm operating on its demand curve can expand its output only by lowering its markup. One expects to see lower markups when insiders control because they put more weight on sales and employment relative to profits than outsiders do. Counter-cyclical markups could then be driven by procyclical delegation of control to insiders.

Finally, this research is related to the literature that studies the macroeconomic implications of ...nancial frictions: Bernanke, Gertler and Gilchrist (1999), Kiyotaki and Moore (1997). The frictions that I emphasize are different in the sense that, in my model, ...rms do not suffer from liquidity constraints.

3 Model

Consider an infinite horizon stochastic general equilibrium model. The consumers maximize

$$\max_{K_{t+1}; L_t; C_t; u_t} E_0 \sum_t \beta^{-t} \log(C_t) + \frac{1}{Z_t} \frac{A}{A+1} L_t^{\frac{A+1}{A}} \quad (1)$$

subject to the budget constraint

$$(1 + g) K_{t+1} = (1 - \delta(u_t)) K_t + W_t L_t + u_t R_t K_t + \lambda_t + C_t + \frac{\phi}{2} \frac{(K_{t+1} - K_t)^2}{K_t} \quad (2)$$

R_t is the rental price of capital services, u_t is the rate of utilization of the existing stock of capital K_t , λ_t are aggregate profits, g is the trend growth rate of labor productivity and ϕ captures adjustment costs for investment as in Hall (2002). Z_t is an aggregate labor supply shock³. The cost of higher utilization is captured by an increase in the depreciation rate $\delta(u_t)$ as in King and Rebelo (1999).

The economy produces a final good using differentiated inputs. The final good is produced competitively and it can be used for consumption and investment. The differentiated goods are produced by a continuum of mass N of ...rms indexed from 0 to 1. N will be determined in equilibrium by a free entry condition. The production function for the final good is

$$Y_t = N \int_0^1 h_{it}^{\frac{1}{3}} y_{it}^{\frac{2}{3}} \quad (3)$$

²See Rotemberg and Woodford (1999) for a survey, and Bils and Kahn (2000) for recent evidence.

³Chari, Kehoe and McGrattan show how a model with nominal wage rigidities and monetary shocks can produce such shocks. More generally, I am interested in non-technological disturbances, and the simplest way to introduce them is through shocks that affect households' marginal rate of substitution between consumption and leisure.

and the final good producers solve

$$\max_{y_{it}} P_t Y_t - \sum_i \lambda_i (P_t y_{it} - h_{it})$$

where y_{it} is the production of intermediate good i at time t and h_{it} is an exogenous firm specific shock. The distribution of these shocks is time invariant and the mean is normalized to one: $\int_0^1 h_{it} = 1$. These shocks can be interpreted as relative productivity shocks from the point of view of final good producers, or as relative demand shocks from the point of view of intermediate goods producers.

Equation (3) implies that each producer i faces an isoelastic demand curve:

$$y_{it} = h_{it} \left(\frac{Y_t}{N} \right)^{\frac{1}{\mu}} \left(\frac{p_{it}}{P_t} \right)^{\frac{\mu}{\mu-1}} \quad (4)$$

The price level, P_t , is such that $\int_0^1 h_{it} \left(\frac{p_{it}}{P_t} \right)^{\frac{\mu}{\mu-1}} = 1$. This is also the zero profit condition for the final good producers. There is monopolistic competition in the differentiated goods sector. The production function for intermediate good i is characterized by constant returns to variable factors and some fixed costs. The variable factors are the flow of capital services k_{it} and labor l_{it} . The production function for good i at time t is:

$$y_{it} = \mu_t q_{it} k_{it}^{\alpha} l_{it}^{1-\alpha}$$

μ_t is an aggregate technology shock and q_{it} is the firm's idiosyncratic productivity. The fixed costs for firm i are α units of final good and an amount I_{it}^a of overhead labor. The (real) profits of firm i are therefore:

$$\pi_{it} = \frac{p_{it}}{P_t} y_{it} - W_t (l_{it} + I_{it}^a) - R_t k_{it} - \alpha$$

The simplest way to model the governance choice is to see it as a choice among two technologies. At every period, each firm i must choose to delegate control to its insiders or not. I describe this choice with the dummy variable $D_{it} \in \{0, 1\}$. This choice is made after all the shocks $(Z_t; \mu_t; h_{it})$ have been observed.

The first mode of governance, which I will call the conservative mode, has no delegation of control to insiders ($D_{it} = 0$). Productivity is low $q_{it} = \underline{q} < 1$ but there is no overhead labor ($I_{it}^a = 0$) and profit maximization is strictly enforced. Formally, when $D_{it} = 0$, the program of the firm is

$$\max_{k,l} \pi_{it}$$

subject to (4) and $y_{it} = \mu_t q k^{1-\alpha} l^\alpha$. The resulting profits are $\pi_{it}(0)$.

The second mode of governance, which I will call innovative, delegates control to the insiders ($D_{it} = 1$). The innovative mode has a high productivity, $q_{it} = 1 > q$, but it has two distortions. First, there is excess overhead labor, $l_{it}^\alpha = l^\alpha > 0$, and, second, the objective function of the firm is to maximize a weighted average of sales and profits. The weight the insiders put on sales is $\beta > 0$. When $D_{it} = 1$, the program of the firm is

$$\max_{k,l} \beta p_{it} y_{it} + (1 - \beta) \pi_{it}$$

subject to (4) and $y_{it} = \mu_t k^{1-\alpha} l^\alpha$. The resulting profits are $\pi_{it}(1)$.

Finally, I assume that delegation is chosen to maximize the profits of firm i at time t .

$$D_{it} = \arg \max_{D \in \{0,1\}} \pi_{it}(D)$$

A rational expectations equilibrium for this economy is a set of stochastic processes for the exogenous technology and labor supply shocks $\{\mu_t, Z_t\}$ and for the endogenous prices and quantities. $\{D_{it}, l_{it}, k_{it}, p_{it}, g_i\}$ solve the intermediate firms' program described above, $\{Y_t, y_{it}\}$ are determined by (3), and consumers maximize (1) over $\{K_{t+1}, C_t, L_t, u_t\}$. All the agents take $\{P_t, W_t, R_t\}$ as given, and the following market clearing conditions hold:

$$\begin{aligned} Y_t &= C_t + \int_0^1 z_t \pi_{it} di \\ u_t K_t &= N \int_0^1 k_{it} di \\ L_t &= N \int_0^1 (l_{it} + D_{it} l^\alpha) di \end{aligned}$$

This definition of equilibrium is conditional on the number of firms, N , which is constant. To pin down N , I impose that a free entry condition holds in the non-stochastic steady state of the economy (see Rotemberg and Woodford, 1999 and the appendix).

4 Governance Choice

There are many ways to motivate the reduced form used above and a formal model is presented in the appendix. Before discussing the interpretation of the reduced form, I describe how firms choose among the two modes of governance.

Assumption 1: $\beta > q^{3/4}$ where $\beta < \frac{1 - \beta}{(1 - \beta)^{3/4}}$

Assumption 1 ensures that delegation is sometimes desirable. The function \cdot is concave and reaches a maximum of one for $\hat{\cdot} = 0$. It reflects the profit losses coming from the fact that firms in the innovative mode deviate from the objective of profit maximization. For given factor prices (W and R), and demand conditions (h and Y), the cash flows generated by firm i (before overhead costs are paid) are proportional to $\cdot(\hat{\cdot}) \in q^{3/4} i^{-1}$. In the innovative mode, this becomes $\cdot(\hat{\cdot}) \in 1$ and in the conservative mode, $1 \in q^{3/4} i^{-1}$. Assumption 1 ensures that the gains from innovative efforts outweigh the losses from excessive production. Proposition 1 describes the optimal governance choice for firm i at time t .

Proposition 1 Firm i will choose the innovative mode of governance at time t if and only if

$$h_{it} > h_t^a$$

where

$$h_t^a = \frac{W_t}{A_t} \frac{I^a}{\cdot(\hat{\cdot})_i q^{3/4} i^{-1}} \quad (5)$$

$$A_t = \frac{1}{\mu_t} \frac{R_t}{1 - i^a} \frac{W_t}{R_t} \frac{Y_t}{3/4 N}$$

Proof. In the innovative mode of governance, the choice of production is made to maximize $\hat{\cdot} p_{it} y_{it} + (1 - \hat{\cdot}) \frac{1}{4} i_{it}$. The resulting profits are $\frac{1}{4} i_{it}^a = A_t h_{it} \cdot^a i^{-1} W_t I^a$, where \cdot^a is defined in assumption 1 and I^a is excess overhead labor. In the conservative mode, profits are simply $\frac{1}{4} i_{it} = A_t h_{it} q^{3/4} i^{-1}$. Comparing the two levels of profits completes the proof. ■

The economic intuition is fairly straightforward. Because delegation increases initiative, delegation is more valuable when the demand for the firm's product is high. On the other hand, the costs of delegation do not increase one for one with the firm's demand. Thus, the choice of governance mode takes the form of a simple cutoff rule: firms that do well (high h) choose the innovative mode and firms that do poorly (low h) choose the conservative mode. The cutoff h_t^a depends on the overhead labor distortion and on the aggregate conditions in the economy. It is relatively more costly to delegate when the real wage is high, because of overhead labor costs. The effects of aggregate demand, Y_t , and of the marginal cost of production, $\frac{1}{\mu_t} \frac{R_t}{1 - i^a} \frac{W_t}{R_t}$, are standard. As Y_t increases, delegation becomes relatively more valuable, and the opposite happens for an increase in the rental price or in the real wage (independently of the overhead labor cost).

The assumption that some of the delegation costs become relatively smaller when the firm does well is crucial for the result that delegation is more valuable in a boom. I will argue below that this is an empirically plausible assumption.

I can now discuss two interpretations of the model. The first one follows closely Burkart, Gromb and Panunzi (1997) and Aghion and Tirole (1997). In their model, a principal chooses to delegate more or less control to an agent. There are many such relationships inside firms, but, for concreteness, one can think of the principal as the board of directors and the agent as the CEO. The board can decide how much it wants to interfere with the CEO's decisions. Freedom fosters productive initiatives ($q = 1$) but the CEO then has some discretion concerning the corporate objective. In particular, she has a preference for large firms ($\hat{\pi} > 0$) and for overhead labor ($l^o > 0$). The two key assumptions in this setup are that the CEO has some empire building tendencies, and that selective intervention is not an option. More precisely, delegation can improve CEO's incentives to make firm-specific investments precisely because delegation is a commitment not to intervene ex-post. In this case, the "innovative" governance mode can be seen as a solution to the hold-up problem.

The second interpretation is more mechanical. Suppose that the agent makes hiring and investment propositions to the principal, who can either rubber-stamp the propositions, or decide to investigate. Investigation is time consuming and there is always a probability that the investment opportunity will disappear before the investigation is finished. Without investigation, the principal cannot discover whether the agent is spending too much or not (l^o and $\hat{\pi}$). The key mechanism is once again that the opportunity cost of monitoring is higher in booms because booms are times when profit opportunities should not be missed, even if that means rubber-stamping projects that are marginally too large or too fancy. In recessions, on the other hand, the principal is more willing to stick to the old projects and focus on cutting costs.

The basic point is that governance should be designed in such a way as to leave more discretion to insiders when times are good. A separate issue is how to implement this in practice. One way would be to use the firm's financial structure. Equity holders are more likely than debt holders to rubber-stamp the decisions of the manager. Thus the model is consistent with the fact that equity holders control in good times and debt holders in bad times. However, I would like to point out a crucial difference with existing models of financial structure, like the one in Hart and Moore (1995). The difference is that I do not assume that

aggregate shocks are unobservable. This is important because models of liquidity constraints usually share the feature that observable shocks should be contracted upon, which would make them irrelevant. In the context of a debt contract for instance, these models predict that interest payments should be contingent on the state of the economy. Firms would have to pay back more in good times, less in bad times and the fraction of firms that suffer from liquidity shortages would not vary with the business cycle. To justify the use of non-contingent debt and make sure that liquidity matters in the aggregate, one typically needs to assume that firms cannot contract on the state of the economy, even implicitly. If giving more liquidity to firms in bad times could substantially increase their value, it is hard to imagine that the financial markets would have been unable to create the appropriate instruments. In the model I propose, everybody knows that firms are short of cash and forced to cut their spending in bad times, but this is privately optimal for the investors. Of course, this result follows from the assumption that there are increasing returns in the delegation technology.

5 Amplification

The main result of the paper is that firms' delegation choices amplify aggregate shocks. Before turning to the simulations of the model, it is useful to present the intuition for this result. From the definition of the aggregate price level and from the pricing decisions of the intermediate goods producers, one can obtain the following equation

$$P_t^{-1} c_t = \int J(h_t^i) \mu_i \frac{1}{1 - \mu_i} q_i^{\mu_i - 1} + (1 - \int J(h_t^i)) \mu_i q_i^{\mu_i - 1} \quad (6)$$

where

$$c_t = \frac{1}{\mu_t} \frac{\mu_t R_t}{1 - \mu_t} \mu_t \frac{W_t}{\mu_t}$$

is the marginal cost associated with the Cobb-Douglas production function. $J(h_t^i) = \int_{h_t^i} R_t^{-1} h f(h) dh$ and $f(\cdot)$ is the distribution function of the idiosyncratic shocks h . Equation (6) is shared by all general equilibrium models of imperfect competition where the pricing behavior of firms is described by $\frac{p_{it}}{P_t} = (1 - \mu_i) c_{it}$. Most models focus on the symmetric equilibrium where all firms have the same marginal cost $c_{it} = c_t$ and the same markup $(1 - \mu_i) = 1$. In a symmetric equilibrium, one would get the simple condition: $(1 - \mu_i) c_t = 1$. In my model however, firms differ in both their marginal costs and their markups. Firms that choose to delegate control have higher productivity $q_{it} = 1$ and lower markups $(1 - \mu_i) = (1 - \mu_i) c_t^{-1}$ than

other firms. Equation (6) can be seen either as defining the aggregate markup as a weighted average of the firms' markups or as defining the aggregate marginal cost as a weighted average of the firms' marginal costs. The weight on the innovative firms is $J(h_t^a)$. Because the markup choices are correlated with firms' idiosyncratic productivity, one cannot in general disentangle the aggregate markup from the aggregate marginal cost. But one can consider a few special cases.

2. $\lambda^a = 0$. In this case, we know from proposition 1 that $h_t^a = 0$. Since $J(0) = 1$, we get $(1 - \lambda^a)^{-1} \epsilon c = 1$. In this symmetric equilibrium, all firms charge the same price but they deviate from the profit maximizing markup μ by a factor $(1 - \lambda^a)$.
2. $\lambda^a = 1$. In this case, all firms charge the profit maximizing markup but productivity levels differ across firms. This case is isomorphic to a model with increasing returns at the firm level. To see why, interpret $W_t \lambda_t^a$ not as a cost of delegation due to managerial misbehavior, but as a fixed cost of operating a high productivity technology. Firms choose this technology only when they face a high demand. The aggregate marginal cost decreases when the weight of high productivity firms increases.

Using the definition of the cutoff (5) together with equation (6), I get

$$\frac{J(h_t^a) \epsilon \frac{1}{1 - \lambda^a} \lambda_t^a + (1 - J(h_t^a)) \epsilon q^{\frac{3}{4}i - 1}}{J(h_t^a) \epsilon \frac{1}{1 - \lambda^a} \lambda_t^a + (1 - J(h_t^a)) \epsilon q^{\frac{3}{4}i - 1}} = \frac{W_t \frac{3}{4} N \lambda^a}{Y_t \cdot (\lambda^a)^i q^{\frac{3}{4}i - 1}}$$

In this equation, the LHS is increasing in h_t^a . The RHS increases with W and decreases with Y . We can now understand the amplification mechanism. Consider the case of a positive technology shock. Following the shock, output will increase but so will the real wage. If factor supplies are elastic, output will increase more than the real wage and this will push the cutoff h_t^a to the left and lead some firms to switch to the innovative mode of governance. These firms will then hire more capital and labor and increase their output. Again, if factor supplies are elastic, this will increase output more than it will increase the wage and h_t^a will move further to the left⁴. We therefore expect the amplification mechanism to be stronger when factor supplies are elastic. This is why the presence of capacity utilization is important in this model. It is well understood that capacity utilization makes the standard RBC model more responsive to shocks (King and Rebelo 1999). Here, this will also apply to the amplification factor over and above what the RBC would predict.

⁴This suggests that the model could have multiple equilibria. This is indeed a possibility. For the parameter values that I estimate however, idiosyncratic risk is high enough to remove this possibility.

6 Calibration

I will now describe briefly the calibration procedure. All data are detrended using the HP filter. I consider the impact of labor market disturbances, captured by the parameter Z_t and aggregate technology shocks μ_t .

There are three non-standard parameters in the model described above: $\hat{\gamma}$; I^a and q . A key feature is that these parameters will have different effects on profits, sales and employment, respectively. $\hat{\gamma}$ captures over-expansion. It increases sales and employment and decreases profits. I^a captures non-productive expenses. It has no impact on sales and employment, and a negative impact on profits. Finally, productive initiatives q are going to increase sales, profits and employment. The following table summarizes the predictions.

Effect of parameters on:	Profits	Sales	Employment
$\hat{\gamma}$	-	+	+
I^a	-	0	0
q	+	+	+

Berger and Ofek (1999) show that the amount of unallocated expenses is a strong determinant of corporate refocusing programs. Lichtenberg and Siegel (1990) focus on ownership changes and show that employment growth is much lower in establishments changing owners than in those not changing owners, and that the effect is stronger for auxiliary establishments than for production establishments. This is consistent with my assumption that I^a is strictly positive. Berger and Ofek (1999) also show that disciplinary events (shareholder pressure, financial distress, management turnover) usually occur before refocusing takes place and are followed by average cumulative abnormal returns of 7%. Denis and Kruse (2000) show that the corporate restructuring following declines in performance involves major cost cutting efforts, plant closing, asset sales and layoffs. These restructuring efforts increase shareholder value (see also Gilson, 1998). Denis and Denis (1995) show that, following a normal retirement of the CEO at age 65, the median firm experiences an employment decline of 7%, suggesting that the firm was previously too fat. Similarly, Kaplan (1989) finds that MBOs are followed by declines in employment, sales and investment, and by increases in profits.

These results suggest that both $\hat{\gamma}$ and I^a are positive. Suppose that a firm has $\hat{\gamma} = 3\%$ and that the elasticity of substitution between goods is $\frac{1}{\sigma} = 4$. Then a disciplinary event that brings $\hat{\gamma}$ down to 0 will be associated with a drop in sales and employment of 9% because sales and employment are proportional to $(1 - \hat{\gamma})^{1/\sigma}$. But note that this will have very little impact on the firm's profits since $\frac{\partial \pi}{\partial \hat{\gamma}} \approx -3\%$ by the envelope theorem. This suggests

that $I^a > 0$ is needed to explain significant effects on profits without unrealistically large changes in sales. Indeed, a simultaneous decline in $\hat{\pi}^a$ and I^a can simply be interpreted as a firm that downsizes its activities by closing its less productive plants first. To see why, suppose that the firm has two plants with fixed capacity and fixed productivity. Profits would be maximized by closing the less productive plant but the manager is reluctant to do so. When a bad shock hits the firm, the manager is forced to close the plant. Profits go up and production goes down.

One can also obtain evidence from the literature that studies the effects of leverage on firms' behavior. As I have explained above, one can think of implementing the delegation mechanism with a debt contract. Empirically, one sees that more highly leveraged firms charge higher prices and respond more quickly and more strongly to shocks: Phillips (1995), Sharpe (1994), Chevalier and Scharfstein (1996). Kovenock and Phillips (1997) confirm the results in Kaplan (1989) that LBO firms decrease their investment and show that this effect is stronger in highly concentrated industries. Opler and Titman (1994) show that firms in financial distress experience large drops in sales and employment beyond what one would expect from the direct effects of the shock. The distressed firms lose market shares to their competitors. The idea that leverage can be used to put pressure on insiders is also directly supported by the fact that boards increase the leverage of their companies in response to an increase in unions' power (Gary Gorton and Frank Schmid (2000) for Germany, Stephen Bronars and Donald Deere (1991) for the US). Finally, it is important to emphasize that debt contracts are almost never contingent on aggregate shocks. Since corporate profits are strongly procyclical, this means that effective debt constraints are counter-cyclical and this provides support for the idea that insiders enjoy more freedom in booms than in recessions.

First, I choose h^a such that, in steady state, half of the firms are in the conservative governance mode and half of the firms are in the innovative mode. Based on the empirical evidence discussed above, I set $\hat{\pi}^a = 3\%$ and $1 - \underline{g} = 1\%$. I use $\frac{1}{\sigma} = 4$ as a benchmark for the elasticity of substitution between goods. This implies a value-added markup of 1:33 consistent with Rotemberg and Woodford (1999). These values for $\hat{\pi}^a$ and $\frac{1}{\sigma}$ imply that for half of the firms, sales are 9% higher than they would be under strict profit maximization (holding productivity constant). The profit losses from this deviation are very small ($1 - \hat{\pi}^a = 0:6\%$). The value of \underline{g} implies that the penalty for downsizing is a temporary productivity loss of one percent.

The adjustment cost parameter ϕ is set to 4 (at quarterly frequency), following Hall (2002). The elasticity of depreciation with respect to utilization is 0.2 consistent with King and Rebelo (1999). The labor supply elasticity \bar{A} is 4 as in the benchmark RBC model (see for instance King and Rebelo 1999).

β	\bar{A}	α	g	\bar{A}	ϕ	$\frac{\sigma}{\sigma-1}$
1.33	4	3%	.99	4	4	0.2

The steady state is computed to match the standard ratios $(\frac{C}{GDP}; \frac{WL}{GDP}; \frac{K}{GDP})$. Recall that free entry drives the profits to 0 on the balanced growth path. This pins down N and ω . The implied value for I^a is such that the average excess overhead labor is less than 1% of the employed population. The total ex-ante losses from all governance conflicts combined are 2.27%

$$\frac{E[I^a]}{L} = 0.82\%$$

$$\frac{E[\frac{1}{4}q = 1; I^a = 0; \alpha = 0] + R_N^K}{E[\frac{1}{4}] + R_N^K} = 2.27\%$$

Finally, the distribution of idiosyncratic shocks (h) is such that the 4-quarters standard deviation of the growth rate of sales across firms is 12%, which is the empirical value in the first half of the sample period⁵ (see below).

The model can then be log-linearized around its balanced growth path. I describe here the calibration with the labor supply shock. $\log(Z_t)$ is specified as an AR(1) process:

$$Z_t = \frac{1}{2}Z_{t-1} + \epsilon_t$$

The model has one state variable (capital stock) and one exogenous driving process (z). Note however that z is not observable in the data and that $\frac{1}{2}$ is not known. The calibration procedure follows the strategy used by King and Rebelo 1999. I make an initial guess for $\frac{1}{2}$. Given this guess, I solve the model using rational expectations. The solution takes the form

$$y_t = \gamma_{yk} E_t k_t + \gamma_{yz} E_t z_t$$

The coefficient γ_{yk} and γ_{yz} are complex functions of all the parameters of the model and of $\frac{1}{2}$. This equation for output can be inverted into $k_t = \frac{1}{\gamma_{yk}} E_t y_t - \frac{\gamma_{yz}}{\gamma_{yk}} E_t z_t$. Using actual values

⁵This is assuming that the h shocks are iid at the annual frequency. I have also experimented with an AR(1) process for h . The results were quantitatively similar.

for b_t and k_t , one can create a series for \hat{b}_t . One can then compute the AR(1) coefficient for this series. It is, in general, different from the original $\frac{1}{2}$. This value is then used as a new starting point. The procedure is repeated until convergence. The estimated value of $\frac{1}{2}$ is .89 (I estimated essentially the same values for z and for μ).

7 Impulse Responses

The intuition for the amplification mechanism is the following. Firms that have a low demand $h_{it} < h_t^*$ are in the conservative governance mode: they have no overhead labor, low productivity and high markup. Following a positive aggregate shock, output Y_t and factor prices R_t and W_t are going to increase. To the extent that the labor supply is elastic and that capacity utilization can accommodate the increase in the demand for capital services, the rise in factor prices will not undo the initial rise in output and h_t^* will decrease. Some firms will therefore switch to the innovative mode of governance. They will reduce their markups, increase their productivity but also hire excess overhead labor. The net effect of these actions for the economy is positive and this leads other firms to follow the same path.

7.1 Technology Shocks

Figure 1 shows the response of the model to a positive technology shock. The shock is the dotted line. GDP is the solid line. The third line represents the fraction of firms that choose the conservative mode compared to the steady state value of 50%. Over time, the economy accumulates capital and the initial shock fades away. This drives up the wage relative to output, making it more costly for firms to have excess overhead labor. As h_t^* increases, some firms tighten control and output is pushed below its steady state value.

Figure 2 shows the impulse responses of different models to a positive technology shock (μ). The exogenous shock (μ) is the same as in Figure 1. The dotted line is the textbook RBC. Above is the RBC with capacity utilization and adjustment costs for investment. This model provides much stronger amplification than the basic RBC. The dashed line is the governance model with only the productivity channel, $\underline{g} < 1$ and $\hat{\mu} = 0$. In this model, firms that switch from conservative to innovative governance are more productive but they have excess overhead labor. As explained in section 5, this case can be interpreted as an economy with some increasing returns at the firm level. This flattens the aggregate marginal cost curve and creates amplification. The solid line is the model with $\underline{g} < 1$ and $\hat{\mu} > 0$. In

this model, the innovative firms are not only more productive, but they also expand output beyond the profit-maximizing size. This second channel of amplification works like in other models of counter-cyclical markups (Rotemberg and Woodford, 1999).

7.2 Labor Supply Shocks

Figure 3 shows the impulse response of the model with respect to aggregate labor supply shocks, Z_t . The results are similar to the ones obtained with technology shocks but the amplification compared to the augmented RBC model (with capacity utilization and adjustment costs) is larger. This is because a positive labor supply shock will, all other things equal, tend to decrease the real wage. This decreases the costs of excess overhead labor and makes delegation more attractive.

Figure 4 compares the impulse responses of GDP to a positive labor supply shock for different models. The governance model delivers strong amplification by two channels, productivity and markup. The model with only the productivity effect delivers substantially less amplification. Finally, as in the case of technology shocks, we see that capital utilization plays an important role.

8 Simulations

I now turn to the comparison of the simulated models with actual US data.

8.1 Technology Shocks

Figure 5 shows the governance amplification in the model driven by technology shocks. Amplification can be seen in two ways. In the top panel, the governance model is calibrated to fit the GDP series (the solid line). Then the structural technology shocks (μ) from this model are put into the augmented RBC model and into the standard RBC model. The figure shows that output would have been less volatile without the governance mechanism. The amplification is 1.5 compared to the augmented RBC and 3 compared to the textbook RBC.

In the bottom panel, the same result is shown in a different way. This time, both the RBC and the governance model are independently calibrated. The figure shows the path of the technological driving process μ implied by the two models. The shock implied by the

augmented RBC is one and a half times more volatile than the one implied by the governance model.

8.2 Labor Shocks

Figure 6 shows the overall fit of the governance model driven by labor shocks. There is nothing impressive about the way the model fits the GDP series. This is a mechanical consequence of the calibration procedure. The model should only be judged based on how well it fits the other series.

Figure 7 shows the governance mechanism at work. In a boom, more firms are in the innovative mode and aggregate productivity is higher. The bottom panel shows that the model is able to replicate the behavior of the (uncorrected) Solow residual. In fact, this is entirely due to the presence of fixed costs and capacity utilization. The correct technological residual (defined over gross output and controlling for utilization) looks nearly constant compared to the Solow residual. In other words, a model without endogenous governance but with the same average markup would also fit the Solow residual. However, the model without governance conflicts would need much larger labor shocks and would make counterfactual predictions concerning the behavior of the real wage, as one can see on the next two figures.

Figure 8 shows the labor shocks implied by the different models. The governance mechanism provides an amplification of 1.9 compared to either the RBC model or the imperfect competition model with exogenous markups and productivity.

Figure 9 shows that the models without endogenous governance predict a counter-cyclical real wage. The governance model reverses this prediction. This is a well known result from the literature on counter-cyclical markups (see Rotemberg and Woodford, 1999).

9 The rise in idiosyncratic risk and the fall in aggregate volatility

The decline in aggregate volatility was first described by Kim and Nelson (1999) and McConnell and Perez-Quiros (2000). Both papers conclude that the decline happened in the first quarter of 1984. Blanchard and Simon (2000) interpret the same finding as evidence of a downward trend in the post-war period, interrupted by a period of high instability in the 1970s. Stock and Watson (2002) present a very detailed study of the phenomenon. They pro-

vide new evidence on the quantitative importance of various explanations for the increased stability of the economy and reach mixed conclusions: “Taken together, we estimate that the moderation in volatility is attributable to a combination of improved policy (20-30%), identifiable good luck in the form of productivity and commodity price shocks (20-30%), and other unknown forms of good luck that manifest themselves as smaller reduced form forecast errors (40-60%).”

I will now propose a tentative explanation for the “unknown forms of good luck.” First, I will document the fact that the decrease in aggregate volatility coincided with a large increase in firm level volatility. Second, I will show that the model presented above can rationalize the two facts, and that it suggests a unified explanation.

Campbell, Lettau, Malkiel and Xu (2001) show that individual stocks have become more volatile. The increase is very large: individual stocks volatility was multiplied by more than two between the 1960s and the 1990s. My first task is to document the same fact using “real” (as opposed to financial) data on employment and sales. Chaney, Gabaix and Philippon (2002) look at firm level data using COMPUSTAT. Define the growth rate of the sales of company i between time t and time $t + 1$:

$$S_{it} = \frac{\frac{P_{it+1}}{P_{t+1}} y_{it+1} \quad i \quad \frac{P_{it}}{P_t} y_{it}}{\frac{P_{it}}{P_t} y_{it}}$$

Let N_t be the number of companies in the sample at time t , and define firm level volatility at time t as:

$$\sigma_t^2 = \frac{1}{N_t} \sum_i S_{it}^2 \quad \mu = \frac{1}{N_t} \sum_i S_{it}$$

If one does this exercise on the full sample, one sees an enormous increase from 1960 to 2001 (figure 10). But, of course, there is entry in the panel and entrants are smaller and more volatile (there are many more “small” firms in COMPUSTAT in 2001 than there were in 1960). The results also hold controlling for firm size (in real terms), but this is only half convincing since, with technological progress, the same real sales in 2001 represent a smaller firm than in 1960. So I also computed the volatility using only firms with more than 1000 employees. The trend is still very large in this sub-sample (figure 11). A simple way to summarize the results is to compute the size weighted standard deviation, which is similar to what Campbell et. al. did for stock prices. Let ω_{it} be the weight of firm i at time t :

$$\omega_{it} = \frac{P_{it} y_{it}}{\sum_j P_{jt} y_{jt}}$$

Define the average sales growth as

$$\bar{s}_t = \frac{1}{N} \sum_i s_{it}$$

and define the size weighted volatility as

$$\sigma_t^2 = \frac{1}{N} \sum_i (s_{it} - \bar{s}_t)^2$$

The size weighted volatility is the answer to the following question: suppose you pick at random a “chunk” of sales in the sample; what would its volatility be? The results of this exercise are shown on Figure 12⁶. The aggregate GDP volatility is computed using a 15 quarters rolling window. The two series have been scaled to plot on the same figure. Size weighted firm level volatility is 12% on average before 1984, and it is 20% on average after 1984.⁷

The governance model suggests a mechanism through which an increase in firm level volatility can lead to a decrease in aggregate volatility. In fact, the model suggests two such mechanisms.

The first and most straightforward mechanism is an increase in the standard deviation of the h distribution. This will mechanically increase firm level risk. It will also decrease aggregate volatility. The reason is that firms in the tails of the distribution do not change their governance after an aggregate shock. Firms with very low h are conservative in booms, and firms with high h are innovative in recessions. As I have explained above, the aggregate multiplier is a function of how many firms switch for a given aggregate shock. This fraction is smaller when the distribution of the h shocks is more spread out. This leads to less aggregate volatility. I will go a step further and ask what decline in aggregate risk the model predicts based on the actual increase in firm level risk. The model was calibrated using a value for firm level risk of 12%, which corresponds to the pre-1984 period⁸. I will therefore increase the volatility of h by exactly the amount required to create a theoretical volatility of 20% (the post-1984 average), keeping all other parameters constant. The results are summarized in the following table. The actual decline is from 2.71 to 1.5%. The model predicts a decline from 2.74 to 2.1%

⁶I removed outliers by truncating at the 4th and 96th percentiles of the distribution of growth rates.

⁷There are still many issues with these data. Perhaps most important is the issue of Mergers and Acquisitions. We try to correct for these biases in Chaney, Gabaix and Philippon (2002), but the most convincing evidence against a purely M&A driven phenomenon is that Campbell et. al. document the same fact using daily stock returns.

⁸And a log-normal distribution for h :

2 Periods are: 1964 ; 84, 84 ; 2001.	Standard Deviation of Cyclical GDP (HP Filtered)
Actual Change in Volatility	2.71 down to 1.5%
Implied by increase in h_i shocks	2.74 down to 2.1%

The second mechanism attempts to explain both fact by an increase in $\frac{1}{4}$, or equivalently, a decrease in the average markup. The increase in $\frac{1}{4}$ leads to more competition in the goods market. This will amplify the effects of the firm specific shocks, q and ϵ , and lead to an increase in firm level volatility. On the macroeconomic front, a decrease in the average markup also implies a less volatile markup. This will stabilize the economy. The results are summarized in the following table.

2 Periods are: 1964 ; 84, 84 ; 2001.	Aggregate Volatility	Firm Volatility
Actual Changes	2.71 down to 1.5%	12 up to 20%
Implied by increase of $\frac{1}{4}$ from 4 to 7	2.74 down to 2.2%	12 up to 20%

Finally, the last figure shows how the implied labor shocks change once one controls for the increase in firm level volatility. The top panel is the calibrated innovation of the process for the labor supply shock using the benchmark model. The bottom panel shows the same series for the pre-1984 period and shows the innovations calibrated using the economy with large idiosyncratic risk for the post-1984 period. On the top panel, one can clearly see the decrease in volatility starting in 1984. On the bottom panel, the “break” in volatility is much less obvious. In other words, some of the decline in aggregate volatility would have happened even without the decline in the volatility of the “structural” shocks, simply because the economy is now more stable.

10 Conclusion

The main goal of this paper was to study the macroeconomic consequences of the governance conflicts that have been emphasized in the corporate finance literature. The theoretical insight is that governance conflicts amplify aggregate shocks. The mechanism is intuitive. When times are good, insiders enjoy more control over the decisions of their firms, which leads to more hiring and more investment spending. These hiring and investment decisions feed-back into the aggregate and amplify the boom.

The quantitative investigation reveals three interesting properties. The first is that relatively small governance conflicts can lead to substantial aggregate volatility. The calibrated

model implies an amplification factor of 1.5 for technology shocks and 1.9 for non-technology shocks, for agency costs of 2.2% of firm's value. The second result is that insiders' discretion leads to an outward shift in the labor demand curve in good times, which can explain why real wages do not fall in booms without assuming exogenous technological improvements. Finally, the model also led me to consider a new explanation for the recent decrease in aggregate volatility. Firm level volatility seems to have increased substantially since the 1960s. The model offers two ways to relate the evolution of aggregate volatility to the evolution of firm level risk. The first approach is to treat the increase in firm volatility as a mean-preserving spread of the distribution of idiosyncratic shocks, while remaining agnostic about the deep causes of the phenomenon. In this case, the reason for the decline in aggregate volatility is that, when idiosyncratic shocks are large, relatively few firms change their governance in response to aggregate shocks. Based on the actual increase in firm level risk, the model predicts roughly 50% of the actual decrease in aggregate volatility. The second approach tries to explain both the increase in firm level risk and the decline in aggregate volatility with the same structural change. I have suggested that increased competition in the goods market is a natural candidate. It leads to more volatility at the firm level because small differences in productivity between firms lead to large differences in equilibrium quantities. It also leads to a decrease in aggregate volatility because it makes markups less counter-cyclical. When I calibrate the increase in competition that would explain the increase in firm level risk, the model predicts roughly 40% of the decrease in aggregate volatility.

Appendix

A Delegation

The model describes governance choices as technology choices. The purpose of this section is to provide simple micro-foundations for the reduced form used in the paper. The micro-foundations are based on a Burkart, Gromb and Panunzi (1997). At every period, a principal (he) and an agent (she) must decide which business plan the firm should adopt. The specific expertise of the agent allows her to learn which business plan is good, and which one is bad. There is always a good business plan, with productivity $q = 1$, a status quo project with productivity $\underline{q} < 1$; and many bad projects, with productivity less than \underline{q} . If the agent exerts low effort, she discovers only the status quo. If the agent exerts high effort, she discovers all the projects. The principal cannot discover the projects by himself, but he has a monitoring technology that allows him to learn exactly what the agent learns. I will assume that the principal tries to maximize the value of the firm and that the principal always has formal authority. The timing within each period is the following:

1. Market conditions are observed. These include the aggregate shocks (Z_t and μ_t) as well as the firm specific shock (h_{it})
2. The principal chooses to monitor or not: $m_{it} = 1$ or 0 . There are no monitoring costs. If the principal decides to monitor, he will know exactly what the agent knows. If he does not monitor, he will know nothing
3. The agent decides to exert effort or not: $e_{it} = 1$ or 0 . If the agent exerts effort, she finds out which business plan has the high productivity $q = 1$. If she does not, she only finds out the status quo. Effort costs $\phi(e_{it})$ and is normalized such that $\phi(0) = 0$
4. The business plan is implemented. The principal always has formal authority at this stage.
 - (a) If $m_{it} = 1$, the principal is informed, and the agent is useless and receives no compensation. If the agent had made the effort to acquire information, the principal implements the good project ($q = 1$). If not, he implements the status quo ($q = \underline{q}$).
 - (b) If $m_{it} = 0$, the principal is not informed and only the agent can implement the business plan. However, the agent will implement the business plan on a larger scale than what is needed. She will seek to maximize $\hat{p}y + (1 - \hat{p})\frac{1}{4}$ instead of $\frac{1}{4}$, and she will hire overhead labor l^a . She derives private benefits B from doing so.

Assumption 2: $B > \phi(1)$ and the agent does not respond to monetary incentives

Proposition 2 Under assumption 1, the principal monitors if and only if $h_{it} < h_t^a$

Proof. If the principal monitors, the agent expects to be held up ex-post and she chooses the low effort. In this case, only the status quo can be implemented. If the principal does not monitor, the agent expects to receive B . Since $B > \phi(1)$, she chooses to exert high effort and the high productivity project is implemented, with high overhead labor and high output. This setup is isomorphic to the technology choice described in the text. QED ■

Burkart, Gromb and Panunzi (1997) discuss the robustness of the result that delegation fosters initiative. In particular, they show that the result holds with monetary incentives and under more general monitoring technologies.

B Aggregate Setup: Technology and Preferences

The setup takes into account both capacity utilization (u) and adjustment costs (ϕ). I use \bar{C} to denote the fact that C has a trend (to be removed as soon as all the FOCs are derived). Consumers maximize:

$$\max_{L_t, C_t} \sum_{t=0}^{\infty} \beta^t \log C_t - \lambda_t \left(\frac{1}{Z_t} \frac{\bar{A}}{\bar{A}+1} L_t^{\bar{A}+1} \right)$$

Subject to the budget constraint

$$k_{t+1} = (1 - \delta(u_t)) k_t + W_t L_t + u_t R_t k_t + I_t - C_t - \frac{\phi}{2} \frac{k_{t+1}^2}{k_t}$$

I can obtain the Euler equation, the labor supply, and the utilization decision

$$L_t^s = \frac{\bar{A} W_t}{Z_t C_t}$$

$$\frac{1}{C_t} = \beta E_t \left[\frac{k_{t+1}}{k_t} \frac{\bar{A}}{\bar{A}+1} \right] + u_{t+1} R_{t+1} + \frac{\phi}{2} \frac{k_{t+2}}{k_{t+1}}$$

$$\delta(u_t) = R_t$$

Note that the term $\frac{\phi}{2} \frac{k_{t+2}}{k_{t+1}}$ that should appear on the RHS of the Euler equation is negligible in practice and was omitted. Gross output of the final good is

$$Y_t = N \int_0^1 h_{it}^{\frac{1}{3}} y_{it}^{\frac{2}{3}} dy_{it}$$

And the relative shocks are normalized so that $\int_0^1 h_{it} = 1$. There is perfect competition in the final good sector and final good producers solve:

$$\max_{y_{it}} p_t Y_t - N \int_0^1 p_{it} y_{it}$$

So that the demand for good i is

$$\frac{p_{it}}{p_t} = \frac{N y_{it}}{h_{it} Y_t}$$

And the price level must be such that

$$\int_0^1 h_{it} \frac{p_{it}}{p_t} dy_{it} = 1$$

There is monopolistic competition in the intermediate goods markets. The production function is:

$$y_{it} = q_{it} \mu_t k_{it}^{1-\alpha} l_{it}^{\alpha} (1+g)^t$$

Note that k denotes the flow of capital services (including the u term) and l is labor used for production. μ_t is an aggregate productivity shock, q_{it} is firm's idiosyncratic productivity, $(1+g)$ is the Harrod-neutral trend growth. The profits are

$$\begin{aligned} \pi_{it} &= \frac{p_{it}}{p_t} y_{it} - w_t l_{it} - r_t k_{it} \\ \pi_{it} &= \pi_{it} + w_t l_{it}^{\alpha} \end{aligned}$$

There is a fixed cost in terms of goods π_{it} indexed on aggregate productivity to keep the number of firms constant in steady state. There is also some overhead labor l_{it}^{α} . I now remove the trend $(1+g)^t$. Define for the wage (and similarly for all other trending variables):

$$w_t = \frac{W_t}{(1+g)^t}$$

So the marginal cost of firm i is

$$\begin{aligned} c_{it} &= \frac{\hat{A}_t}{q_{it}} \\ \hat{A}_t &= \frac{1}{\mu_t} \frac{r_t}{1-\alpha} \frac{w_t}{\alpha} \end{aligned}$$

But the objective function of the firm is to maximize a weighted average of sales and profits. The weight on sales is λ_{it} . This can be written

$$\max \frac{p_{it}}{p_t} y_{it} + \lambda_{it} \pi_{it}$$

This program leads to λ_{it} introducing the notation $\lambda_{it} = \frac{\lambda_{it}}{\lambda_{it}^{\frac{3}{4}}}$

$$\begin{aligned} y_{it} &= h_{it} \frac{Y_t}{N} \frac{1}{(1-\lambda_{it})^{\frac{3}{4}}} = \frac{Y_t}{N (\hat{A}_t)^{\frac{3}{4}}} h_{it} (1-\lambda_{it})^{\frac{3}{4}} q_{it}^{\frac{3}{4}} \\ \frac{p_{it}}{p_t} &= (1-\lambda_{it}) \frac{\hat{A}_t}{q_{it}} \\ l_{it} &= \frac{y_{it}}{\mu_t q_{it}} \frac{1}{\alpha} \frac{w_t}{r_t} \\ k_{it} &= \frac{y_{it}}{\mu_t q_{it}} \frac{1}{1-\alpha} \frac{w_t}{r_t} \end{aligned}$$

The profits of the firm are:

$$\begin{aligned} \pi_{it} &= A_t h_{it} q_{it}^{\frac{3}{4}} (1-\lambda_{it})^{\frac{3}{4}} \\ A_t &= (\hat{A}_t)^{\frac{1}{4}} \frac{Y_t}{N} \\ (1-\lambda_{it}) &= \frac{1-\lambda_{it}}{(1-\lambda_{it})^{\frac{3}{4}}} \end{aligned}$$

The price level condition becomes

$$\sum_0^Z h_{it} \frac{q_{it}}{1+i_{it}} = (\hat{A}_t)^{\frac{3}{4}i-1}$$

And the aggregate demands for capital and labor are:

$$\begin{aligned} L_t^d &= \sum_0^Z l_{it} + l_{it}^a \\ L_t^d &= \frac{\mu^0}{1+i_{it}} \frac{W_t}{R_t} \pi_i^{\frac{3}{4}i-1} \frac{a_t}{(\hat{A}_t)^{\frac{3}{4}}} \frac{Y_t}{\mu_t} + N l_{it}^a \\ K_t^d &= \sum_0^Z k_{it} \\ K_t^d &= \frac{\mu^0}{1+i_{it}} \frac{W_t}{R_t} \pi_i^{\frac{3}{4}} \frac{a_t}{(\hat{A}_t)^{\frac{3}{4}}} \frac{Y_t}{\mu_t} \\ a_t &= \sum_0^Z h_{it} (1+i_{it})^{\frac{3}{4}} q_{it}^{\frac{3}{4}i-1} \end{aligned}$$

The equilibrium condition for the labor market is

$$\frac{L_t}{K_t^d} = \frac{W_t}{1+i_{it}} \frac{R_t}{K_t^d} + \frac{N l_{it}}{K_t^d}$$

and for the capital market

$$K_t^d = u_t K_t$$

C Complete Model

Governance decisions lead to:

$$\frac{1}{2} i_{it} = i_{it}^a \quad \left(\right) \quad h_{it} > h_t^a = \frac{W_t}{A_t} \frac{l_{it}^a}{q_{it}^{\frac{3}{4}i-1}}$$

Where I have defined

$$\begin{aligned} a_t &= \sum_0^Z h_{it} (1+i_{it})^{\frac{3}{4}} q_{it}^{\frac{3}{4}i-1} \\ &= (1+i_{it}^a)^{\frac{3}{4}} J(h_t^a) + q^{\frac{3}{4}i-1} (1+i_{it}^a) J(h_t^a) \quad \# \\ &= q^{\frac{3}{4}i-1} [1 + J(h_t^a) (1+i_{it}^a)^{\frac{3}{4}}] \frac{\mu^0}{q} \pi_i^{\frac{3}{4}i-1} \quad \# \end{aligned}$$

So I get

$$\begin{aligned} a_t &= q^{\frac{3}{4}i-1} \text{Inter2}(h_t^a) \\ \text{Inter2}(h_t^a) &= [1 + J(h_t^a) (1+i_{it}^a)^{\frac{3}{4}}] \frac{\mu^0}{q} \pi_i^{\frac{3}{4}i-1} \quad \# \end{aligned}$$

Where

$$J(h_t^a) = \int_{h_t^a}^Z h f(h) dh$$

$$J(0) = 1; J(1) = 0$$

And for the marginal cost I get:

$$\hat{A}_t = \frac{1}{1} \int_0^Z h_{it} (1 - h_{it})^{1-\frac{3}{4}} q_{it}^{\frac{3}{4}} dh_{it}$$

$$\hat{A}_t = \frac{g}{1} [\text{Inter}(h_t^a)]^{\frac{1}{3}}$$

$$\text{Inter}(h_t^a) = 1 + J(h_t^a) (1 - h_t^a)^{1-\frac{3}{4}} \frac{1}{g} \mu^{\frac{1}{3}} \pi^{\frac{1}{3}} i^{\frac{1}{3}}$$

So the complete model is described by the following equations:

2 Labor supply and labor demand:

$$L_t = \frac{\mu Z_t W_t \pi_A}{C_t}$$

$$\frac{L_t}{u_t K_t} = \frac{1}{1} \frac{R_t}{W_t} + \frac{N I_t^a}{u_t K_t}$$

2 Euler equation

$$\frac{1}{C_t} \mu^{1+\frac{1}{2}} \frac{K_{t+1} - K_t}{K_t} = \frac{1}{1+g} E_t \left[\frac{1}{C_{t+1}} (1 + u_{t+1} R_{t+1}) \mu^{1+\frac{1}{2}} + \frac{K_{t+2} - K_{t+1}}{K_{t+1}} \mu^{1+\frac{1}{2}} \right]$$

2 Utilization

$$u_t = R_t$$

2 Capital accumulation

$$(1+g) K_{t+1} = Y_t + (1 - u_t) K_t - C_t - N I_t^a + \frac{1}{2} \frac{(K_{t+1} - K_t)^2}{K_t}$$

2 Capital demand

$$u_t K_t = \frac{1}{\mu} \frac{1}{1} \frac{R_t}{W_t} \pi^{\frac{1}{3}} \frac{a_t}{(\hat{A}_t)^{\frac{1}{3}}} \frac{Y_t}{\mu_t}$$

$$a_t = g^{\frac{3}{4}} \text{Inter}^2(h_t^a)$$

2 Markup pricing. Usually we get $\frac{p}{c} = \mu$ and we consider symmetric equilibria where all prices are the same and therefore $c = \frac{1}{\mu}$. This is what we have here, up to an aggregation factor because not all firms have the same markup.

$$\hat{A}_t = \frac{g}{1} [\text{Inter}(h_t^a)]^{\frac{1}{3}}$$

$$\hat{A}_t = \frac{1}{\mu_t} \frac{R_t}{1} \pi^{\frac{1}{3}} \frac{1}{\mu} \frac{W_t}{\pi^{\frac{1}{3}}}$$

- ² The aggregate factor for pro...ts takes into account the aggregate demand (Y) as well as the factor prices

$$A_t = (1 + \hat{A}_t)^{1/\alpha} \frac{Y_t}{\alpha N}$$

- ² Finally the free entry condition says that (unconditional) expected pro...ts have to be 0. Overhead labor is equal to L^e times the measure of ...rms in the innovative mode.

$$\begin{aligned} E[\pi_{it}] &= 0 \\ L_t^e &= L^e (1 + F(h^e)) \end{aligned}$$

D Steady State

Let's define

$$E(h_t^e) = \frac{a_t}{(1 + \hat{A}_t)^{1/\alpha}} = \frac{1}{g} \frac{Inter(h_t^e)}{[Inter(h_t^e)]^\alpha}$$

Utilization is $u = 1$ in steady state, and the shocks are also normalized: $\mu = 1$ and $Z = 1$. The zero profit condition for each of the N ...rms becomes

$$A E[h_i q_i^{3/4} (1 + J(h^e))^\alpha] = E[\pi_i]$$

Since

$$E[h_i q_i^{3/4} (1 + J(h^e))^\alpha] = g^{3/4} (1 + J(h^e))^\alpha \cdot \frac{\mu}{A} \cdot \frac{1}{g^{3/4} (1 + J(h^e))^\alpha}$$

I get

$$A E[g^{3/4} (1 + J(h^e))^\alpha \cdot \frac{\mu}{g^{3/4} (1 + J(h^e))^\alpha}] = W E[\frac{\pi}{W} + L^e (1 + F(h^e))^\alpha]$$

Remember that

$$\frac{W}{A} = \frac{g^{3/4} (1 + J(h^e))^\alpha}{L^e} h^e$$

so

$$\frac{L^e g^{3/4} (1 + J(h^e))^\alpha}{g^{3/4} (1 + J(h^e))^\alpha} \cdot \frac{\mu}{g^{3/4} (1 + J(h^e))^\alpha} = h^e E[\frac{\pi}{W} + L^e (1 + F(h^e))^\alpha]$$

I can solve for h^e . In practice, I choose h^e such that, in steady state, half of the ...rms are conservative and the other half innovative.

I can get the equilibrium real interest rate from the Euler equation:

$$R = \frac{1 + g}{1 + J(h^e)} + \alpha$$

I then get the wage from the markup pricing equation:

$$\begin{aligned} \frac{g}{1} [Inter(h^e)]^{1/\alpha} &= \frac{\mu}{1 + J(h^e)} \frac{R}{W} \frac{\mu}{W} \\ W &= \frac{g}{1} [Inter(h^e)]^{1/\alpha} \frac{\mu}{R} \frac{1 + J(h^e)}{\mu} \end{aligned}$$

and the capital output ratio from the capital demand

$$\frac{Y}{K} = \frac{1}{\epsilon(h^{\alpha})} \frac{\mu_L}{\mu_K} \frac{W}{R} \frac{1}{1 + F(h^{\alpha})}$$

The consumption capital ratio from the aggregate resource constraint

$$\frac{C}{K} = \frac{Y}{K} \frac{g + \delta}{1 + F(h^{\alpha})} \frac{1}{1 + F(h^{\alpha})}$$

From the labor demand equation, I obtain

$$\frac{N}{K} = \frac{1}{(1 + F(h^{\alpha})) I^{\alpha}} \frac{\mu_L}{\mu_K} \frac{W}{R} \frac{1}{1 + F(h^{\alpha})}$$

and I know I^{α} from the free entry condition

$$I^{\alpha} = \frac{h^{\alpha} \frac{1}{g^{\frac{1}{\alpha}}}}{1 + J(h^{\alpha}) \frac{1}{g^{\frac{1}{\alpha}}}} \frac{W}{R} \frac{1}{1 + F(h^{\alpha})}$$

So I can get a first equation in $\frac{C}{K}$ and $\frac{1}{K}$.

$$\frac{C}{K} = \frac{Y}{K} \frac{g + \delta}{1 + F(h^{\alpha})} \frac{1}{(1 + F(h^{\alpha})) I^{\alpha}} \frac{\mu_L}{\mu_K} \frac{W}{R} \frac{1}{1 + F(h^{\alpha})}$$

Then I use the fact that profits are 0 on the BGP to write

$$\begin{aligned} C + I &= WL + RK \\ I &= (g + \delta) \epsilon K \end{aligned}$$

and to get a second equation

$$\frac{WL}{K} = \frac{C}{K} + (g + \delta) R$$

Combining them, I get

$$\begin{aligned} \frac{WL}{K} &= \frac{Y}{K} \frac{g + \delta}{1 + F(h^{\alpha})} \frac{1}{(1 + F(h^{\alpha})) I^{\alpha}} \frac{\mu_L}{\mu_K} \frac{W}{R} \frac{1}{1 + F(h^{\alpha})} + R \\ \frac{WL}{K} &= \frac{\frac{Y}{K} + \frac{g + \delta}{1 + F(h^{\alpha})} \frac{1}{(1 + F(h^{\alpha})) I^{\alpha}} \frac{\mu_L}{\mu_K} \frac{W}{R}}{1 + \frac{g + \delta}{W} \frac{1}{(1 + F(h^{\alpha})) I^{\alpha}}} R \end{aligned}$$

Then I use the labor supply equation

$$\begin{aligned} L &= \frac{Z W^{\frac{1}{1+A}}}{C} \\ L &= \frac{Z \frac{WL}{K}}{\frac{C}{K}} \end{aligned}$$

I can get the capital stock using

$$K = \frac{WFL}{\frac{WL}{K}}$$

I can get N from the labor demand equation

$$N = \frac{1}{[1 - F(h^*)]^{1/\alpha}} \frac{\mu_L}{K} \frac{R}{1 - \mu_W}$$

Finally, I can get A from its definition

$$\text{Inter}(h^*) A = g^{1/\alpha} \frac{Y}{\frac{3}{4}N}$$

E Numerical Solution

E.1 Log Linearization

State variable: k, h, i

Control variables: $c, b, \lambda, \mu, \nu, \phi, \psi$

Exogenous stochastic process: ϵ, η

1. Capital accumulation

$$gK_{t+1} + (1 - \delta(u_t)) K_t - C_t - Y_t - N \frac{\partial}{\partial K_t} \frac{\mu_{K_{t+1}}}{K_t} = 0$$

is log-linearized into:

$$(1 + g) k_{t+1} + (1 - \delta) k_t - \frac{C}{K} c_t + \frac{Y}{K} \nu_t - R b_t = 0$$

2. Labor demand

$$L_t \frac{\partial}{\partial L_t} \frac{u_t R_t K_t}{1 - \mu_W} - N^{1/\alpha} (1 - F(h_t^*)) = 0$$

$$k_t \frac{\partial}{\partial L_t} \frac{KR}{1 - \mu_W} + \frac{\mu_L}{1 - \mu_W} \frac{KR}{L} f(h^*) - \frac{NI^{\alpha} h^{\alpha}}{L} f(h^*) \nu_t = 0$$

3. Labor supply

$$L_t \frac{\partial}{\partial C_t} \frac{\mu_{Z_t} W_t}{C_t} = 0$$

$$\lambda_t + \nu_t - \lambda_t \nu_t = 0$$

4. Marginal cost/Markup

$$\frac{1}{\mu_t} \frac{\partial}{\partial h_t} \frac{R_t}{1 - \mu_h} - \frac{\mu_{W_t}}{1 - \mu_W} \frac{\partial}{\partial h_t} \frac{W_t}{1 - \mu_W} - \frac{g}{1} [Inter(h_t^*)]^{1/\alpha} = 0$$

$$(1 - \mu_h) \nu_t + \frac{1}{\alpha} Inter(h_t^*) \nu_t + \frac{1}{\alpha} Inter(h_t^*) \nu_t = 0$$

5. Capital demand

$$u_t K_t + \frac{1}{R_t} \frac{W_t}{R_t} \lambda_t \frac{Y_t}{\mu_t} = 0$$

$$k_t + \frac{1}{R_t} \frac{W_t}{R_t} \lambda_t \frac{Y_t}{\mu_t} = 0$$

6. Definition of A

$$\text{Inter} (h^a) A_t i g^{1-\alpha} \frac{Y_t}{N} = 0$$

$$\text{Inter} w_t i b_t + 1 i \text{Inter} b_t = 0$$

7. Optimal utilization

$$\lambda^0(u_t) = R_t$$

$$b_i \gg b_t = 0$$

where \gg is the elasticity of the depreciation rate. For a discussion, see King and Rebelo, 1999.

8. Euler equation

$$\frac{1}{C_t} \frac{\mu}{1 + \frac{K_{t+1}}{K_t} i} \frac{1}{(1+g)} E_t \frac{1}{C_{t+1}} \frac{\mu}{1 + u_{t+1} R_{t+1} i} \lambda_{t+1} + \frac{K_{t+2}}{K_{t+1}} i \frac{1}{(1+g)} = 0$$

$$E_t \frac{R}{1 + R_i} b_{t+1} + \frac{R}{1 + R_i} b_{t+2} + \frac{R}{1 + R_i} b_{t+1} + b_t + \frac{R}{1 + R_i} b_t = 0$$

Note that $\lambda^0(1) = R$ simplifies this equation. In other words, because of the envelope theorem the capacity utilization does not appear in the Euler equation. And finally I have the parameters:

$$\text{Inter} = \frac{\mu \text{Inter} (h^a) (1 + \frac{K_{t+1}}{K_t} i)^{-\alpha} \frac{1}{g} i}{\mu \text{Inter} (h^a) (1 + \frac{K_{t+1}}{K_t} i)^{-\alpha} \frac{1}{g} i}$$

$$\text{Inter2} = \frac{\mu \text{Inter} (h^a) (1 + \frac{K_{t+1}}{K_t} i)^{-\alpha} \frac{1}{g} i}{\text{Inter2} (h^a)}$$

E.2 Matrix Format

Using a version of Uhlig's method for dynamic analysis, I define the matrices and then invert the system using rational expectations. There is one state variable (k), 7 endogenous variables and 2 driving process (b, β). The format for the endogenous variables is $x = b, b, \beta, w, \beta, b, b$. Matrices have two letters. The first for the type of equation (F for forward looking, M for the law of motion and the other equations), the second refers to the type of

variable (S for state, X for endogenous (jump) and Z for the shocks). Applied to the Euler equation:

$$\begin{aligned}
 FX &= \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\
 FX_1 &= \begin{bmatrix} 1 & \frac{R}{1+R_i} & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\
 FS &= \begin{bmatrix} 0 \end{bmatrix} \\
 FS_1 &= \begin{bmatrix} 2 \end{bmatrix} \\
 FS_2 &= \begin{bmatrix} 0 \end{bmatrix}
 \end{aligned}$$

And for the backward looking equations

$$\begin{aligned}
 MS_1 &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \\
 MS &= \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \end{bmatrix} \\
 MZ &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}
 \end{aligned}$$

And

$$\begin{aligned}
 MX &= \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}
 \end{aligned}$$

With these matrices the system is simply

$$\begin{aligned}
 MS_1 E S_{t+1} + MS E S_t + MX E x_t + MZ E z_t &= 0 \\
 E_t [FS_2 S_{t+2} + FS_1 S_{t+1} + FS S_t + FX_1 x_{t+1} + FX x_t + FZ_1 z_{t+1} + FZ z_t] &= 0 \\
 z_{t+1} &= 0
 \end{aligned}$$

And I can invert it to get the 4 matrices \mathcal{S} ; \mathcal{Z} ; \mathcal{X} ; \mathcal{Z} such that.

$$\begin{aligned}
 S_{t+1} &= \mathcal{S} E S_t + \mathcal{Z} E z_t \\
 x_t &= \mathcal{X} E S_t + \mathcal{Z} E z_t
 \end{aligned}$$

Note that in doing so I also need to check that the model does not have multiple equilibria. In practice there is enough idiosyncratic uncertainty to make sure this does not happen.

F Firm level risk

The sales of firm i at time t are

$$\frac{p_{it}}{p_t} y_{it} = \frac{Y_t}{N (1-\bar{A}_t)^{\frac{1}{1-\mu}} h_{it}} \frac{q_{it}}{1 - \mu}$$

Taking logs and removing the part that is common to all firms I get:

$$s_{it} = \log h_{it} - \frac{q_{it}}{1 + \frac{q_{it}}{h_{it}}}$$

It is clear that the distribution of s_{it} is time-varying since the cutoff h^* moves at business cycle frequency. I will not attempt to capture the deformation of the distribution, because a casual look at the evolution of the empirical variance shows that there are very large year to year changes that are due to merger waves. It is not possible in COMPUSTAT to perfectly control for this problem. One might hope that the issue is less severe for the long run trend in volatility. So I evaluate the variance of the growth rate of sales on the BGP. Also in practice, I use the 4 quarters log growth rate to remove seasonal effects that may differ across firms. Since I have assumed that h shocks are iid:

$$\text{var}[s_{it+1} | s_{it}] = 2 \text{E} \text{var}[s_i]$$

And

$$\begin{aligned} \text{E} s_i^2 &= \int f_h(h) dh \int f_{q_i}(q_i | h) \log h \frac{q_i}{1 + \frac{q_i}{h}} \\ &= \int \psi(h; h^*) f(h) dh \end{aligned}$$

Where

$$\begin{aligned} \psi(h; h^*) &= e^{-\frac{h}{h^*}} \log^2 \left(\frac{h}{h^*} \right) \frac{1}{1 + \frac{h}{h^*}} \frac{1}{A} + e^{-\frac{h}{h^*}} \log^2 \left(\frac{h}{h^*} \right) \frac{1}{1 + \frac{h}{h^*}} \frac{1}{A} \\ \frac{h}{h^*} &= \text{E}(h > h^*) \\ e^{-\frac{h}{h^*}} &= 1 - \text{E}(h > h^*) \end{aligned}$$

The variance of the growth rate of firms' sales increases with the variance of h , the size of the deviation from profit maximization $\frac{1}{g}$ and the difference in productivity $\frac{1}{g}$.

References

- [1] Aghion, Philippe and Bolton, Patrick. "An Incomplete Contracts Approach to Financial Contracting." *Review of Economic Studies*, 1992, 59(3), pp. 473-494.
- [2] Aghion, Philippe and Tirole, Jean. "Formal and Real Authority in Organization," *Journal of Political Economy*, 1997, 105(1), pp. 1-29.
- [3] Andrade, Gregor and Kaplan, Steven. "How costly is financial (not economic) distress? Evidence from Highly Leveraged Transactions that Became Distressed." *Journal of Finance*, October 1998, 53(5), pp. 1443-93.
- [4] Berger, Philip and Ofek, Eli. "Causes and Effects of Corporate Refocusing Programs." *Review of Financial Studies*, Summer 1999, 12(2), pp. 311-45.
- [5] Bills, Mark and Kahn, James. "What Inventory Behavior Tells Us About Business Cycles." *American Economic Review*, 90(3), June 2000, pp. 458-480.
- [6] Berger, Philip ; Ofek, Eli and Yermack, David. "Managerial Entrenchment and Capital Structure Decisions." *Journal of Finance*, September 1997, 52(4), pp. 1411-38.
- [7] Bernanke, Ben; Gertler, Mark and Gilchrist, Simon. "The financial accelerator in a quantitative business cycle framework." in John B. Taylor and Michael Woodford, eds., *Handbook of macroeconomics*. Volume 1C. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 1999.
- [8] Bertrand, Marianne and Mullainathan, Sendhil. "Enjoying The Quiet Life," Working Paper, MIT, 2001.
- [9] Blanchard, Olivier Jean; Florencio Lopez-de-Silanes and Shleifer, Andrei. "What do firms do with cash windfalls?" *Journal of Financial Economics*, December 1994, 36(3), pp. 337-60.
- [10] Blanchard, Olivier Jean and Kiyotaki, Nobuhiro. "Monopolistic Competition and the Effects of Aggregate Demand." *American Economic Review*, September 1987, 77(4), pp. 647-66
- [11] Blanchard, Olivier Jean and Simon, John "The Long and Large Decline in U.S. Output Volatility," *Brookings Paper on Economic Activity* 2001:1, pp. 135-164
- [12] Brealey, Richard and Myers, Stewart. *Principles of Corporate Finance*, 6th edition. New York, London, Toronto and Sydney: McGraw-Hill, 2000.
- [13] Bronars, Stephen and Deere, Donald. "The Threat of Unionization, the Use of Debt, and the Preservation of Shareholder Wealth," *Quarterly Journal of Economics*, February 1991, 106(1), pp.231-54.
- [14] Burkart, Mike; Gromb, Denis and Panunzi, Fausto. "Large Shareholders, Monitoring, and the Value of the Firm," *Quarterly Journal of Economics*, August 1997, 112(3), pp. 693-728.
- [15] Campbell, John Y.; Lettau, Martin; Malkiel, Burton and Xu, Yexiao. "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk." *Journal of Finance*, 56(1), February 2001, pp. 1-43.
- [16] Chaney, Thomas; Gabaix, Xavier and Philippon, Thomas. "Firm Volatility," Mimeo, MIT, 2001.

- [17] Chari, V. V.; Kehoe, Patrick J. and McGrattan, Ellen R. "Business Cycle Accounting," Working Paper 625, Federal Reserve Bank of Minneapolis, October 2002.
- [18] Chevalier, Judith A. "Capital structure and product-market competition: Empirical evidence from the supermarket industry." *American Economic Review*, June 1995, 85(3), pp. 415-35.
- [19] Chevalier, Judith A. "Do LBO supermarkets charge more? An empirical analysis of the effects of LBOs on supermarket," *Journal of Finance*, September 1995, 50(4), pp. 1095-1112.
- [20] Chevalier, Judith A. and Scharfstein, David. "Capital-market imperfections and countercyclical markups: Theory and evidence.," *American Economic Review*, September 1996, 86(4), pp. 703-25.
- [21] Denis, David and Denis, Diane. "Performance Changes Following Top Management Dismissals," *Journal of Finance*, September 1995, 50(4), pp. 1029-57
- [22] Denis, David and Kruse, Timothy "Managerial discipline and corporate restructuring following performance declines," *Journal of Financial Economics*, March 2000, 55(3), pp. 391-424.
- [23] Gilson, Stuart. "Creating Value through Corporate Restructuring," Working Paper, Harvard Business School, July 1998.
- [24] Gorton, Gary and Schmid, Frank "Class struggle inside the ...rm: a study of German codetermination," NBER paper 7945, 2000.
- [25] Grinblatt, Mark and Titman, Sheridan. *Financial Markets and Corporate Strategy*, 2nd ed. Boston, London : McGraw-Hill/Irwin, 2001.
- [26] Hall, Robert. "Labor Market Frictions and Employment Fluctuations." in John B. Taylor and Michael Woodford, eds., *Handbook of macroeconomics*. Volume 1A. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 1999, pp. 1138-1167.
- [27] Hall, Robert. "Industry Dynamics with Adjustment Costs," Mimeo, 2002
- [28] Hart, Oliver. "Financial Contracting," NBER Working Paper 8285, 2001.
- [29] Hart, Oliver; Moore, John. "Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management," *American Economic Review*, June 1995, 85(3), pp. 567-85.
- [30] Holmström, Bengt "Moral Hazard and Observability," *Bell Journal of Economics*, Spring 1979, 10(1), pp. 74-91.
- [31] Huson, Mark; Parrino, Robert and Starks, Laura. "Internal Monitoring Mechanisms and CEO Turnover: A long term perspective," *Journal of Finance*, December 2001, 56(6), pp. 2265-2297
- [32] Jensen, Michael "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review*, May 1986, 76(2), pp. 323-29.
- [33] John, Kose; Lang, Larry P and Netter, Jerry. "The Voluntary Restructuring of Large Firms in Response to Performance Decline," *Journal of Finance*, July 1992, 47(3), pp. 891-917.

- [34] Kaplan, Steven. "The Effects of Management Buyouts on Operation and Value," *Journal of Financial Economics*, October, 1989, pp.217-54.
- [35] Kim, C.-J and Nelson, C.R. "Has the US Economy Become More Stable? A Bayesian Approach Based on a Markov Switching Model of the Business Cycle," *Review of Economics and Statistics*, 1999, pp. 608-616
- [36] King, Robert and Rebelo, Sergio. "Resuscitating Real Business Cycles." in John B. Taylor and Michael Woodford, eds., *Handbook of macroeconomics*. Volume 1B. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 1999.
- [37] Kiyotaki, Nobuhiro and Moore, John. "Credit Cycles." *Journal of Political Economy*, April 1997, 105(2), pp. 211-248.
- [38] Kovenock, Dan and Phillips, Gordon. "Capital Structure and Product Market Behavior: An Examination of Plant Exit and Investment Decisions." *Review of Financial Studies*, Autumn 1997, 10(3), pp. 767-803.
- [39] Lichtenberg, Frank and Siegel, Donald. "The Effect of Leveraged Buyouts on Productivity and Related Aspects of Firm Behavior," *Journal of Financial Economics*, 1990, 27, pp. 165-94.
- [40] Lichtenberg, Frank and Siegel, Donald. "The Effect of Ownership Changes on the Employment and Wages of Central Office and Other Personnel," *Journal of Law & Economics*, 1990, 33, pp. 383-408.
- [41] Lie, Erik "Excess Funds and Agency Problems: an empirical study of incremental cash disbursements," *Review of Financial Studies*, Spring 2000, 13(1), pp. 219-248.
- [42] McConnell, M.M and Perez-Quiros, G. "Output Fluctuations in the United States: What has Changed Since the Early 1980's" *American Economic Review*, 2000, 90(5), 1464-1476.
- [43] Maksimovic, Vojislav and Phillips, Gordon. "Asset Efficiency and the Reallocation Decisions of Bankrupt Firms." *Journal of Finance*, October 1998, 53, 1495-1532
- [44] Opler, Tim and Titman, Sheridan. "Financial Distress and Corporate Performance," *Journal of Finance*, July 1994, 49(3), pp. 1015-40.
- [45] Phillips, Gordon. "Increased Debt and Industry Product Markets; An Empirical Analysis," *Journal of Financial Economics*, February 1995, 37(2), pp. 189-238
- [46] Rotemberg, Julio and Woodford, Michael. "Oligopolistic Pricing and the Effects of Aggregate Demand on Economic Activity" *Journal of Political Economy*, December 1992, 100(6), pp. 1153-1207.
- [47] Rotemberg, Julio and Woodford, Michael. "The Cyclical Behavior of Prices and Costs" in John B. Taylor and Michael Woodford, eds., *Handbook of macroeconomics*. Volume 1B. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 1999, pp. 1051-1135.
- [48] Sa...eddine, Assem and Titman, Sheridan. "Leverage and Corporate Performance: Evidence from Unsuccessful Takeovers," *Journal of Finance*, April 1999, 54(2), pp.547-80.

- [49] Scharfstein, David and Stein, Jeremy. "The Dark Side of Internal Capital Markets: Divisional Rent-Seeking and Inefficient Investment," *Journal of Finance*, December 2000, 55(6), pp. 2537-64
- [50] Sharpe, Steven. "Financial Imperfections, Firm Leverage and the Cyclicity of Employment," *American Economic Review*, September 1994, 84(4), pp. 1060-74.
- [51] Smart, Scott and Waldfogel, Joel. "Measuring the Effect of Restructuring on Corporate Performance: The Case of Management Buyouts," *Review of Economics and Statistics*, August 1994, 76(3), pp. 503-11.
- [52] Stein, Jeremy. "Agency, Information and Corporate Investment," Working Paper 8342, NBER, June 2001.
- [53] Stock, James and Watson, Mark. "Has the Business Cycle Changed and Why?" NBER Working Paper 9127, September 2002.
- [54] Vafeas Nikos. "Board Meeting Frequency and Firm Performance," *Journal of Financial Economics*, July 1999, 53(1), pp. 113-42.
- [55] Yafeh, Yishay and Yosha, Oved. "Large Shareholders and Banks: Who Monitors and How?," Centre for Economic Policy Research, Discussion Paper 1178, 1995.

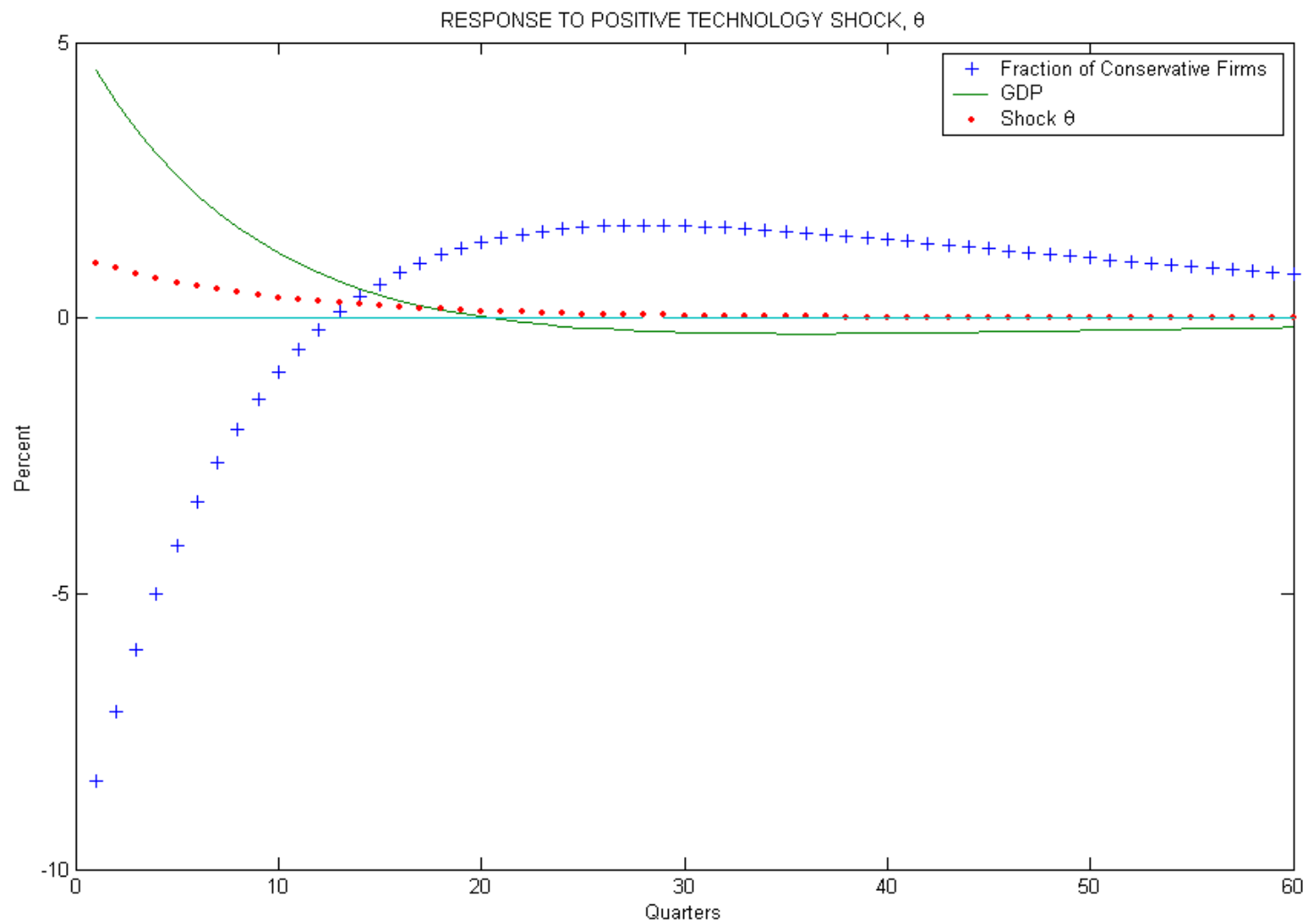


Figure 1

GDP RESPONSE TO TECHNOLOGY SHOCK

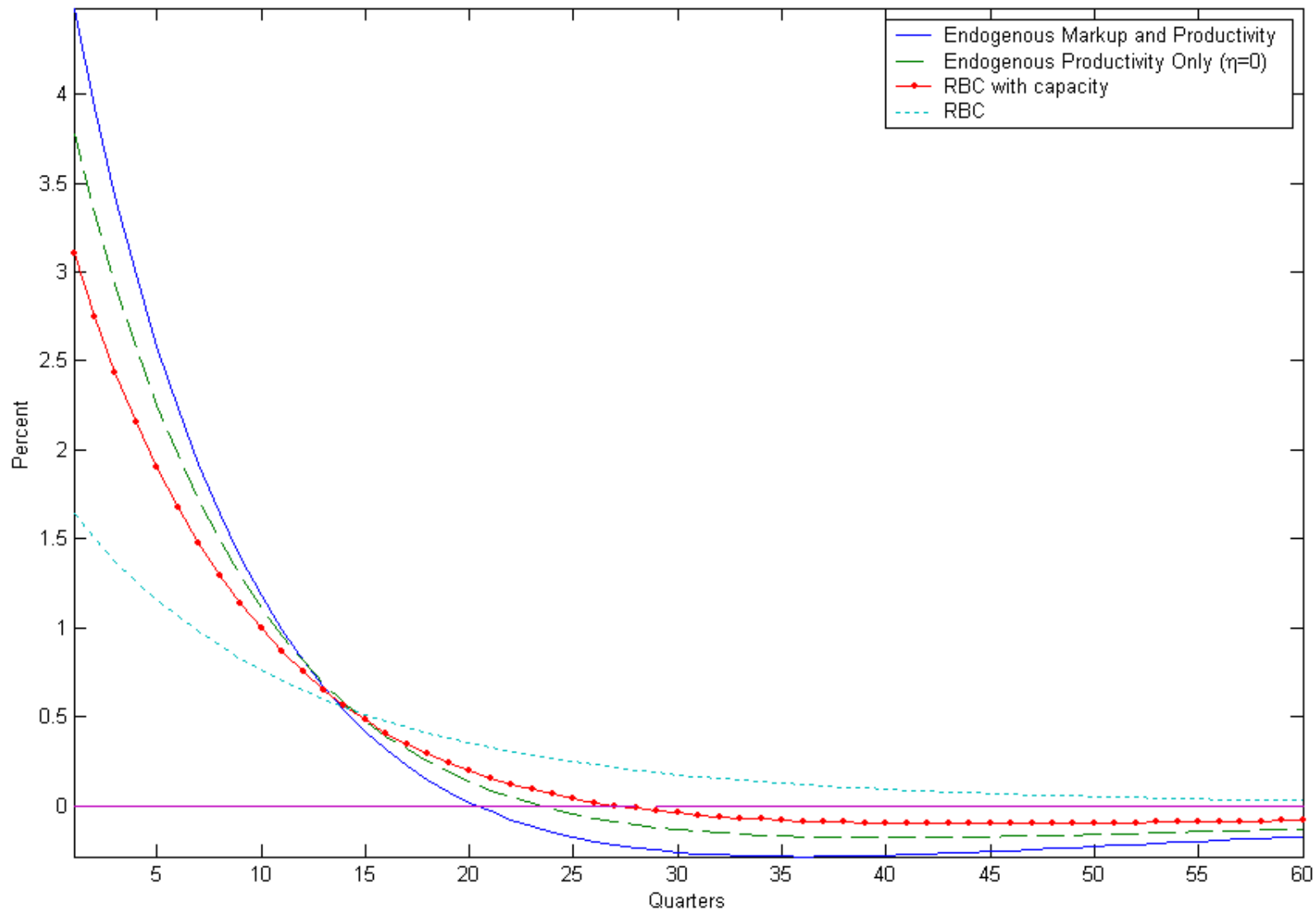


Figure 2

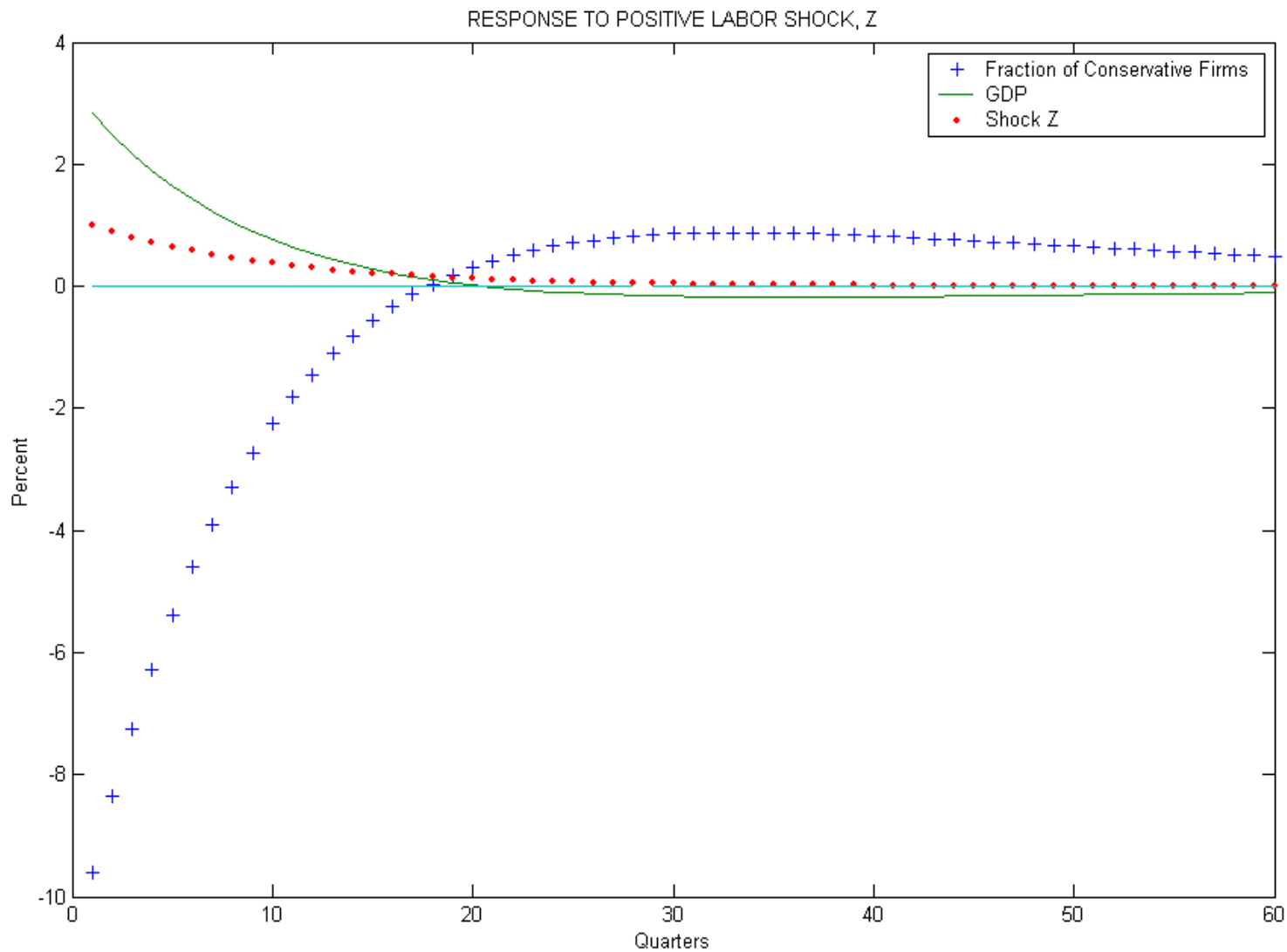


Figure 3

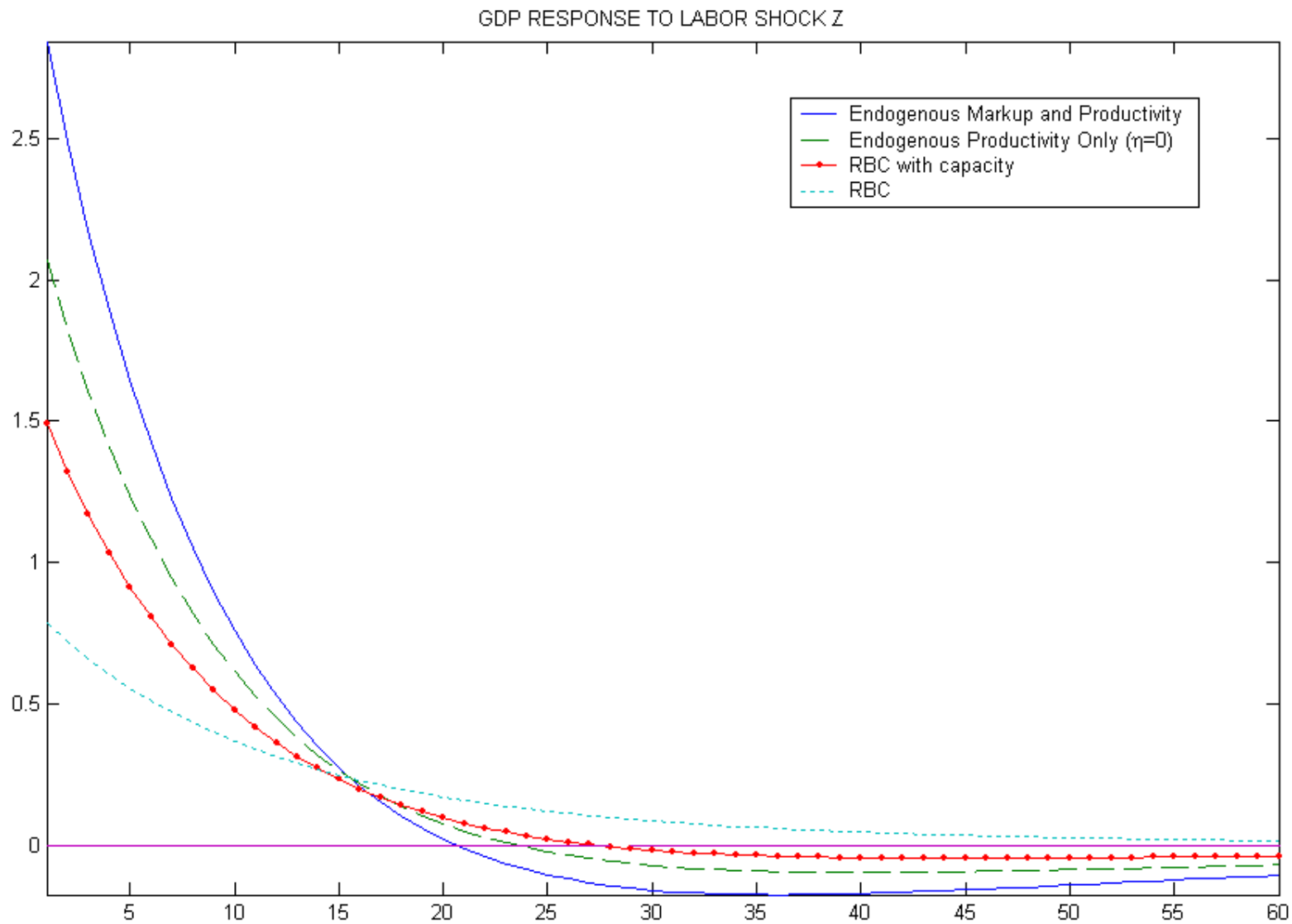


Figure 4

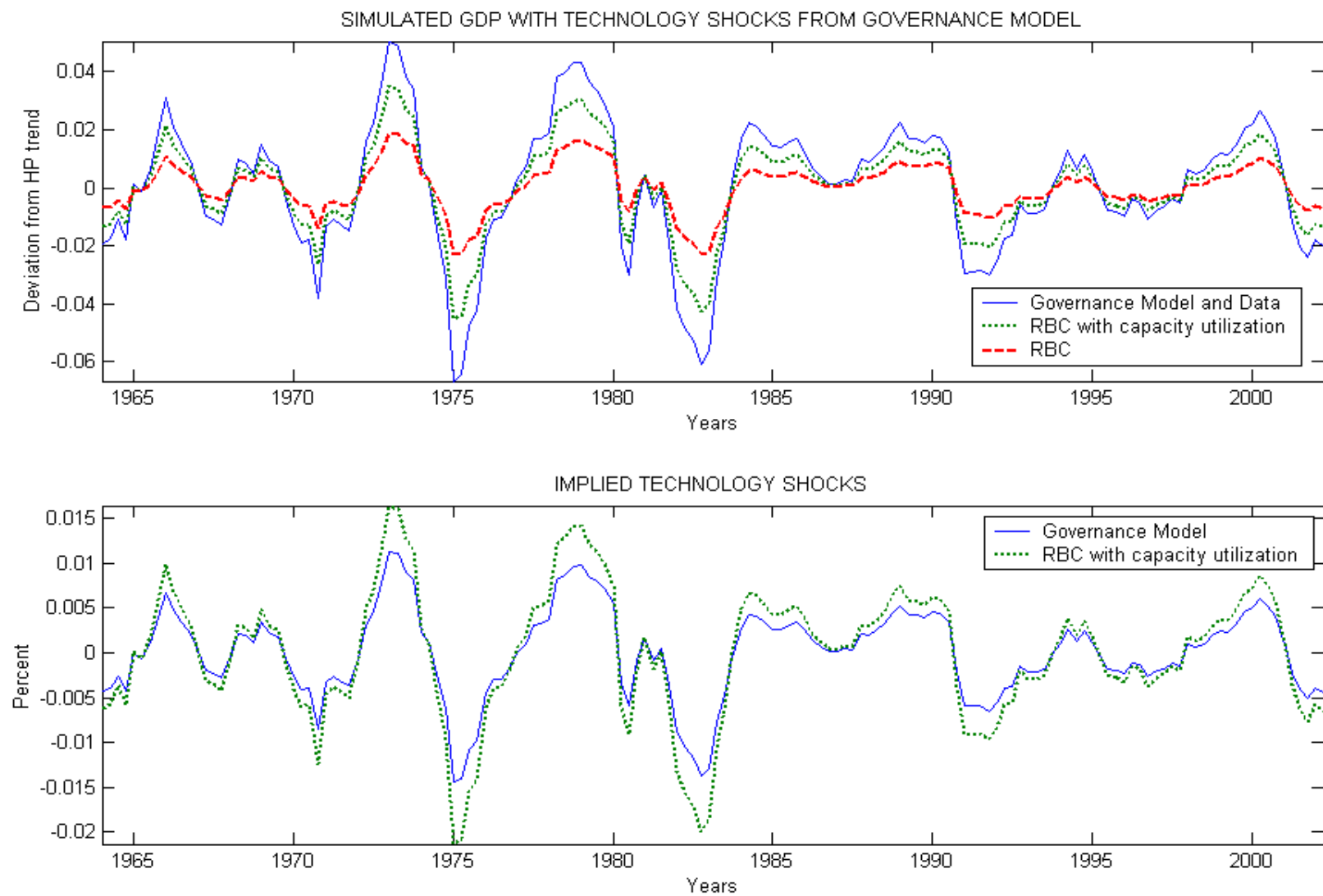


Figure 5

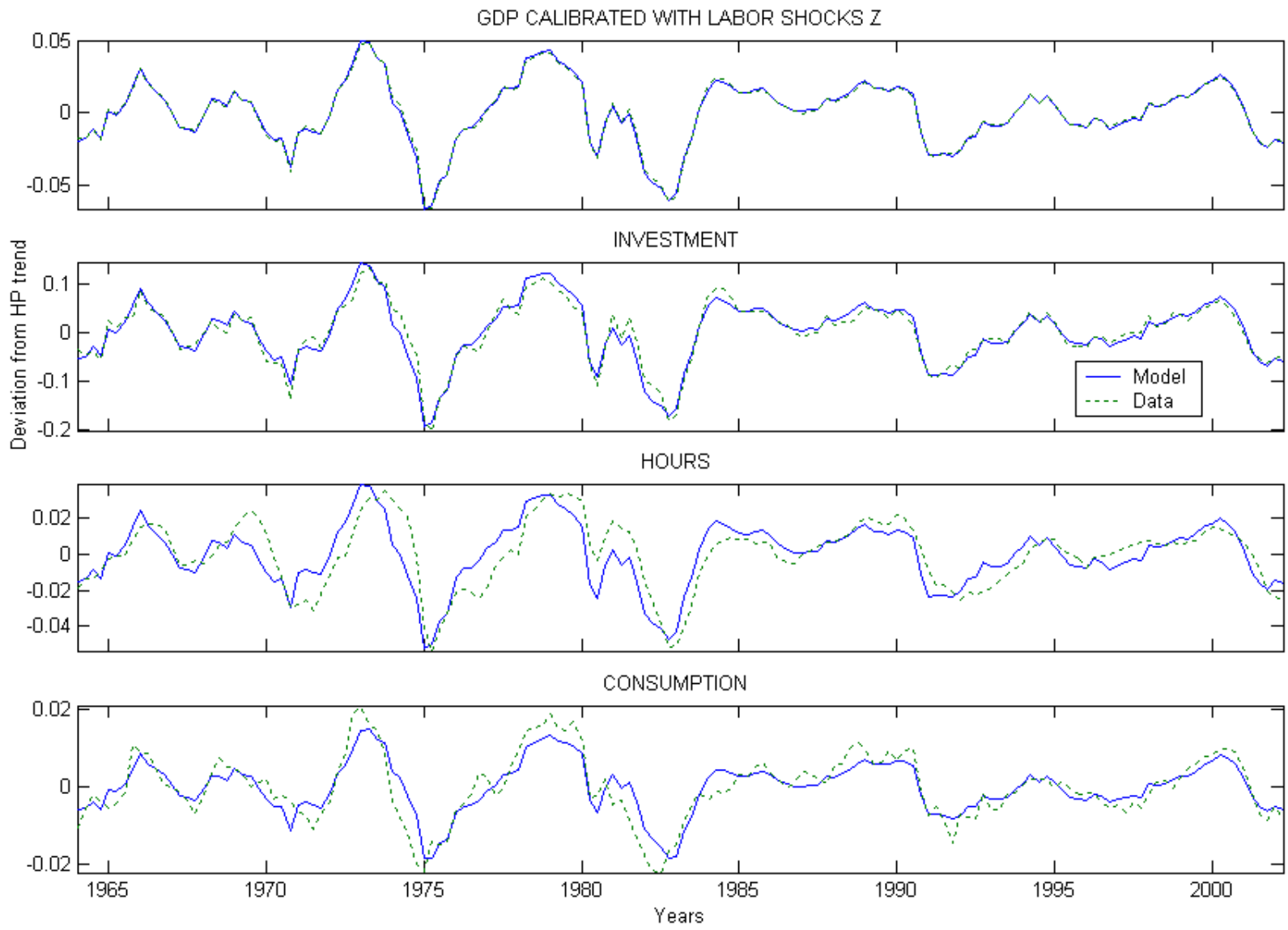


Figure 6

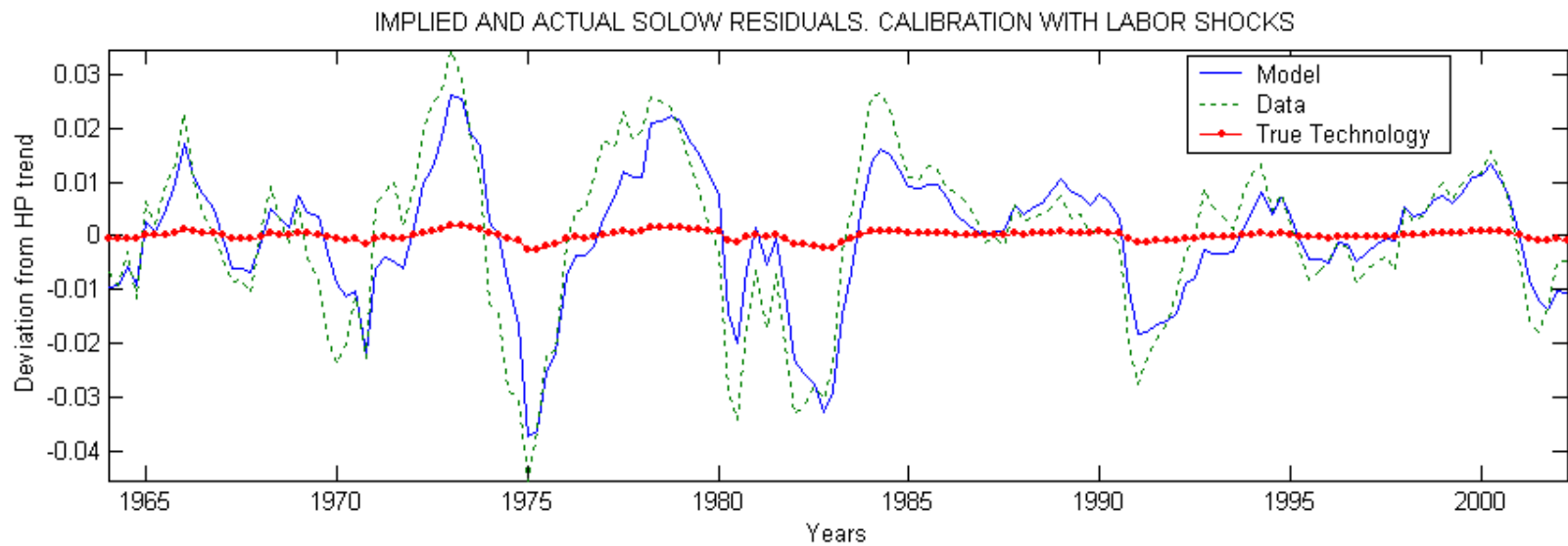
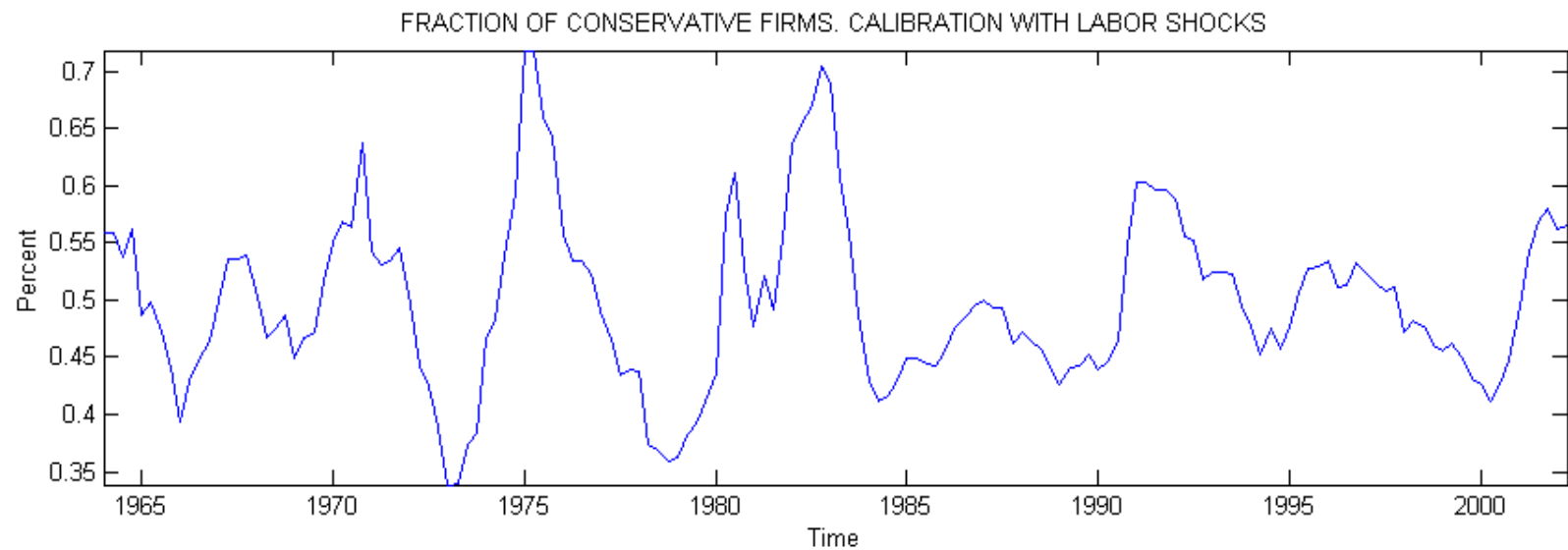


Figure 7

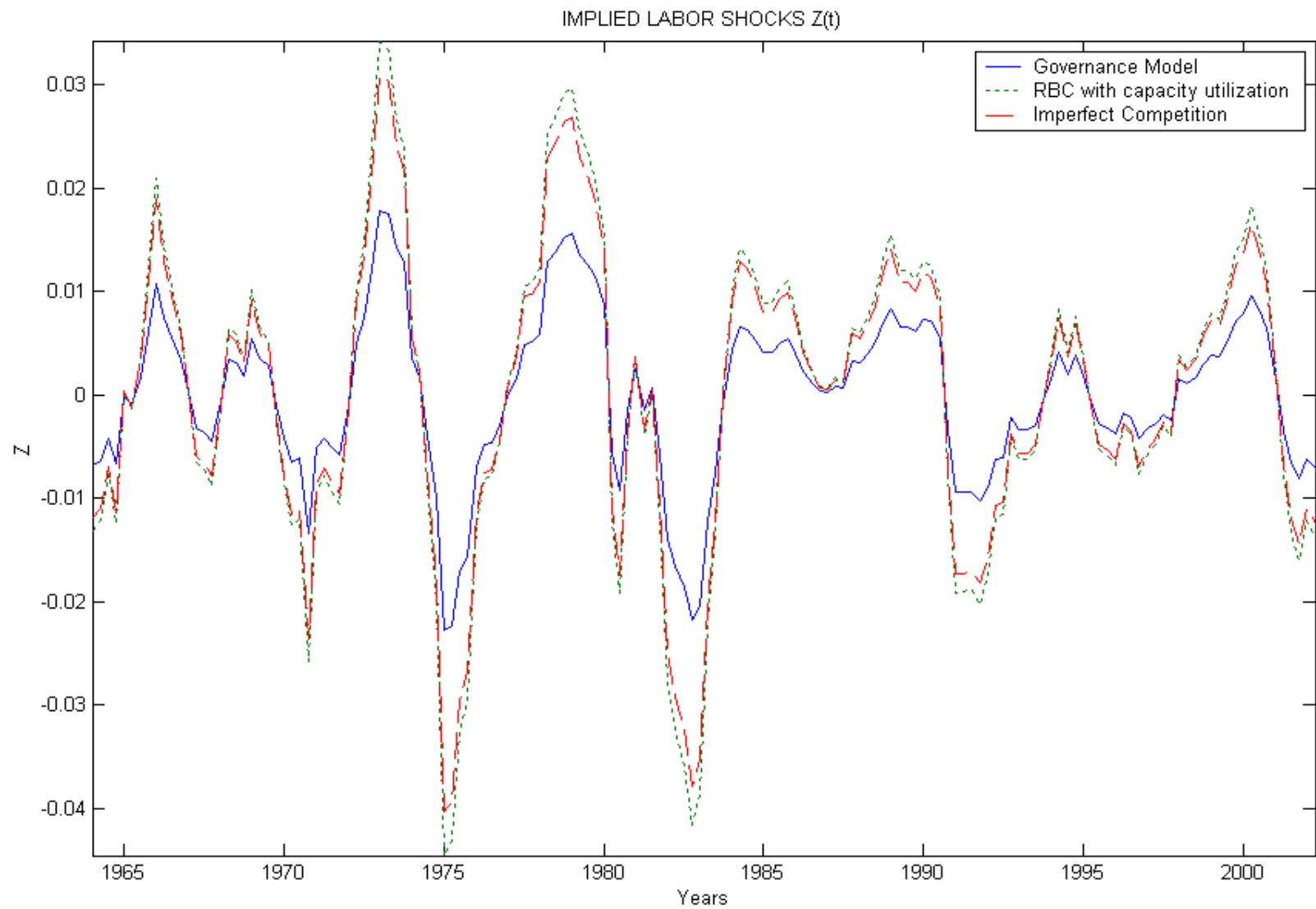
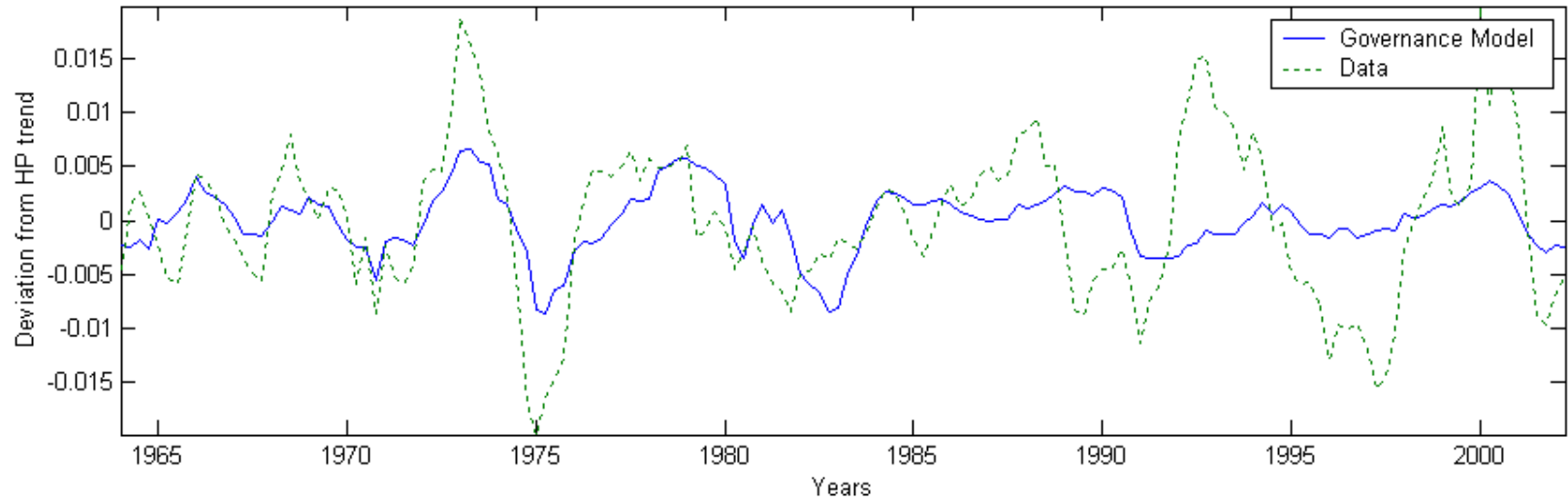


Figure 8

IMPLIED AND ACTUAL REAL WAGE. CALIBRATION WITH LABOR SHOCKS



IMPLIED AND ACTUAL REAL WAGE. CALIBRATION WITH LABOR SHOCKS

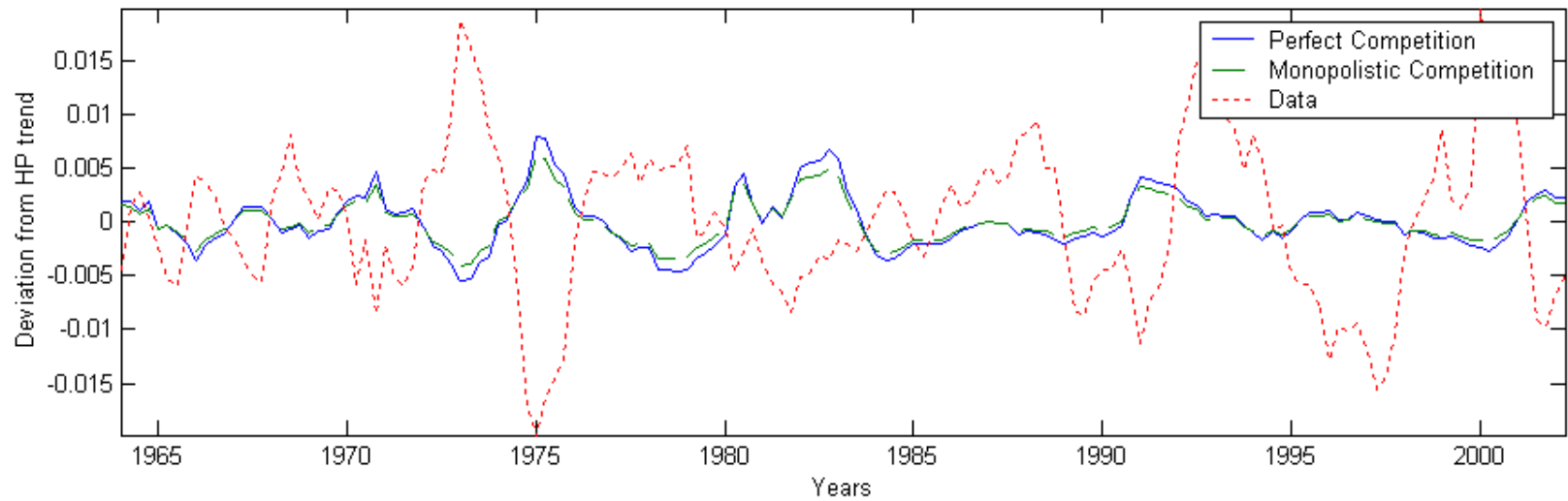
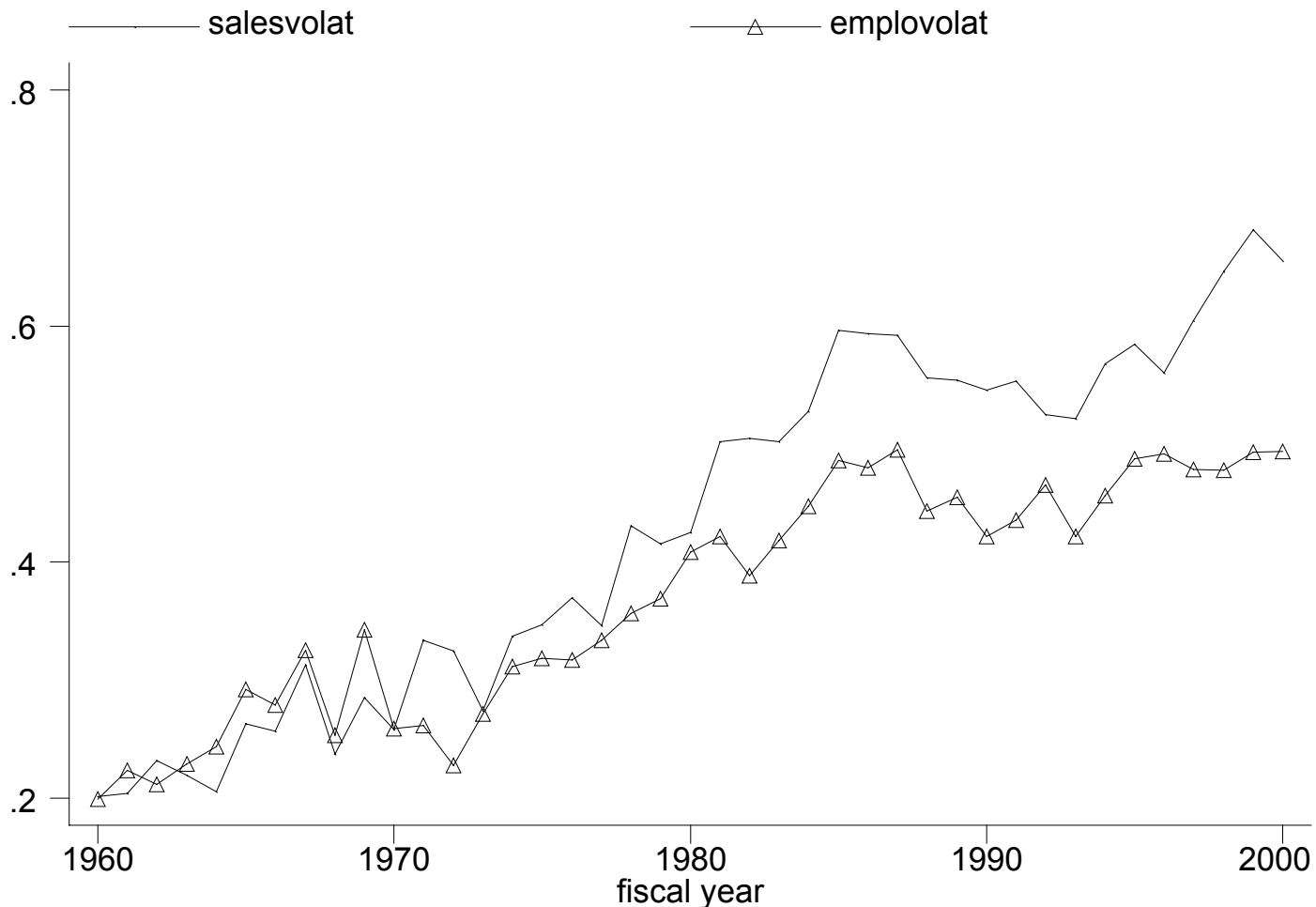


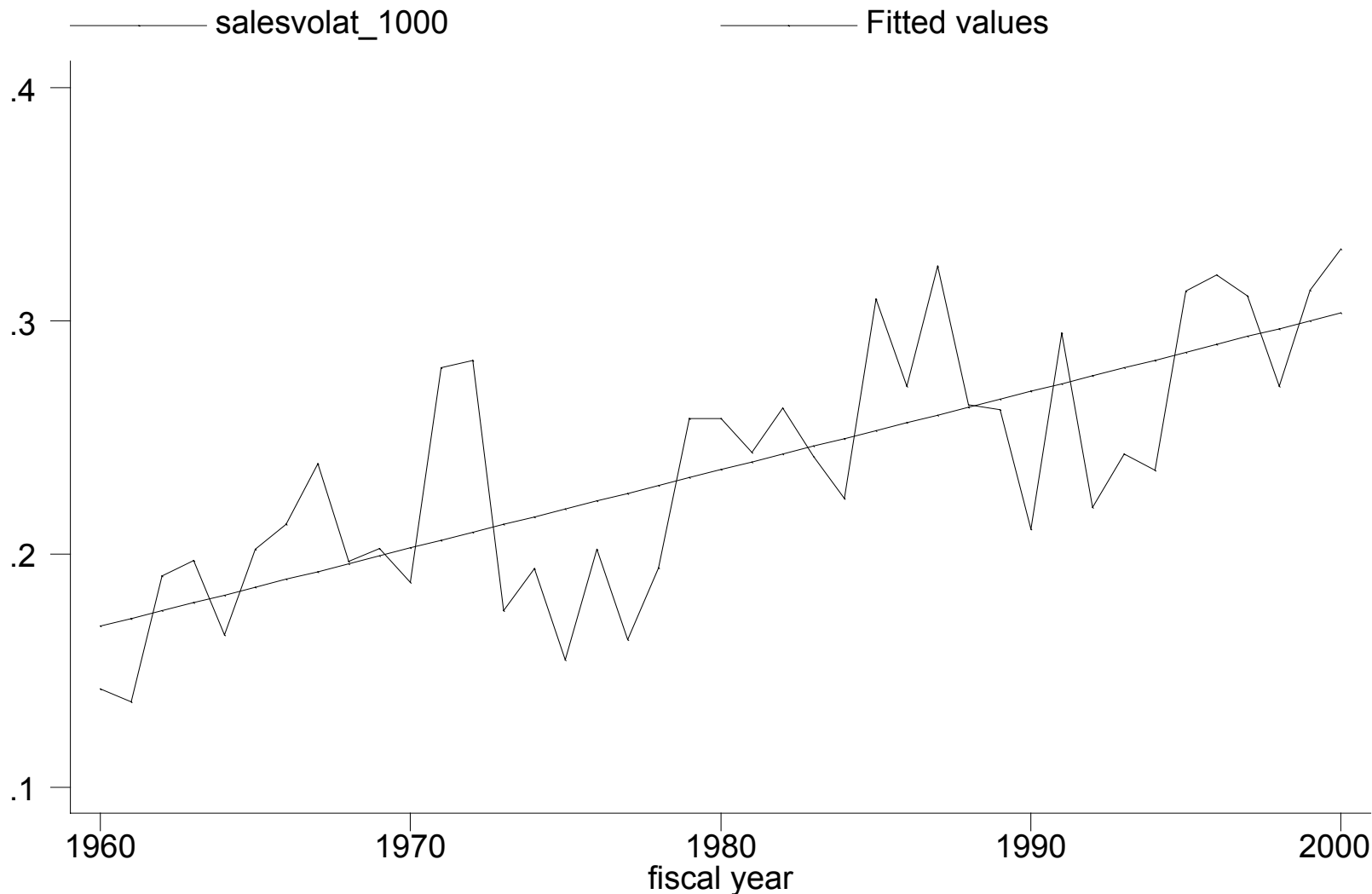
Figure 9



Firm level Volatility of Sales and Employment Growth, All Firms

Figure 10

Raw standard deviation of log growth rate
Annual Compustat files



Firm level Volatility of Sales Growth, Large Firms

Figure 11

Raw standard deviation, firms with more than 1000 employees
Annual Compustat files

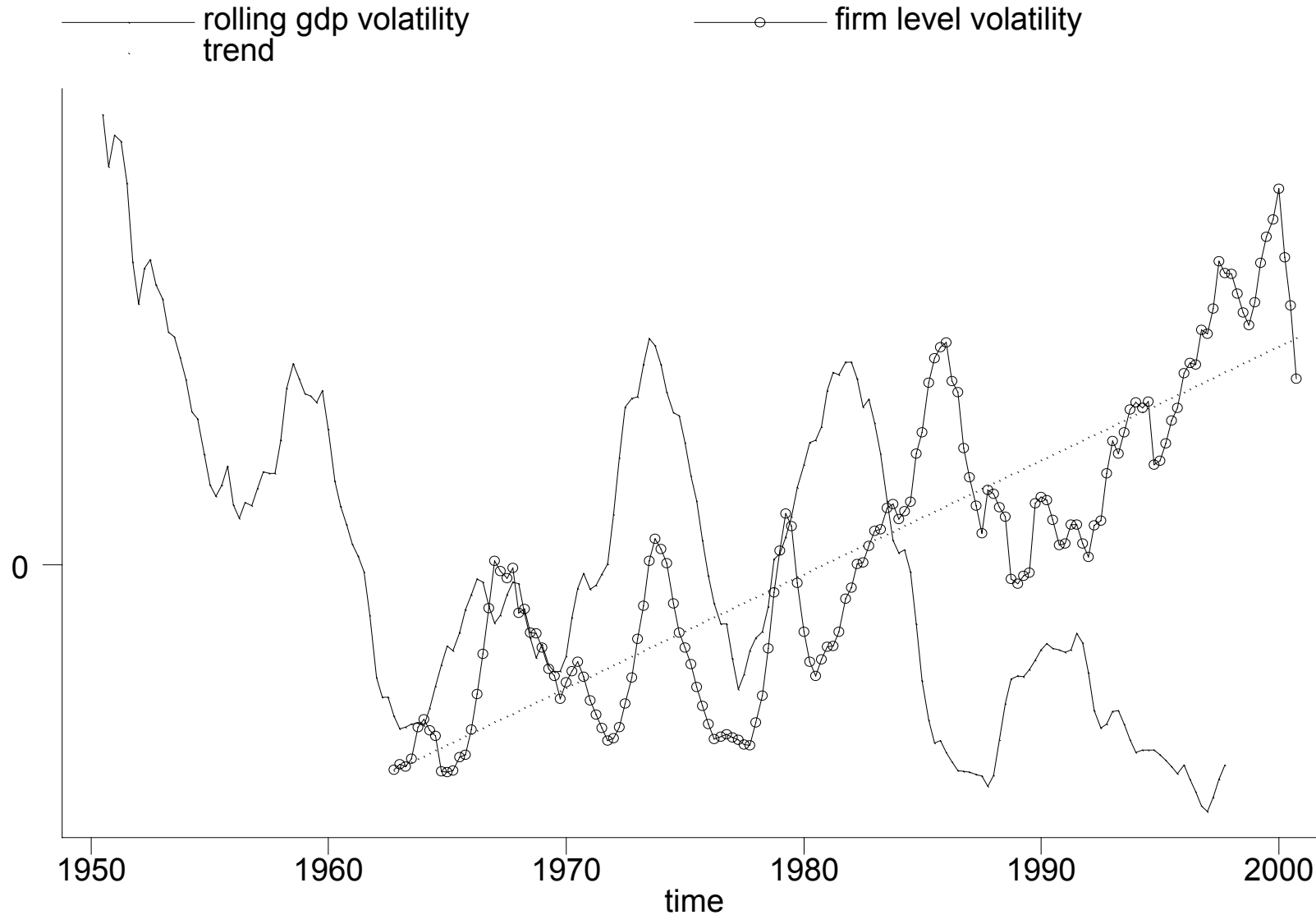


Figure 12

Aggregate rolling window Volatility
and size weighted Firm Level Volatility from Quarterly Compustat files
Scaled and demeaned to fit on figure

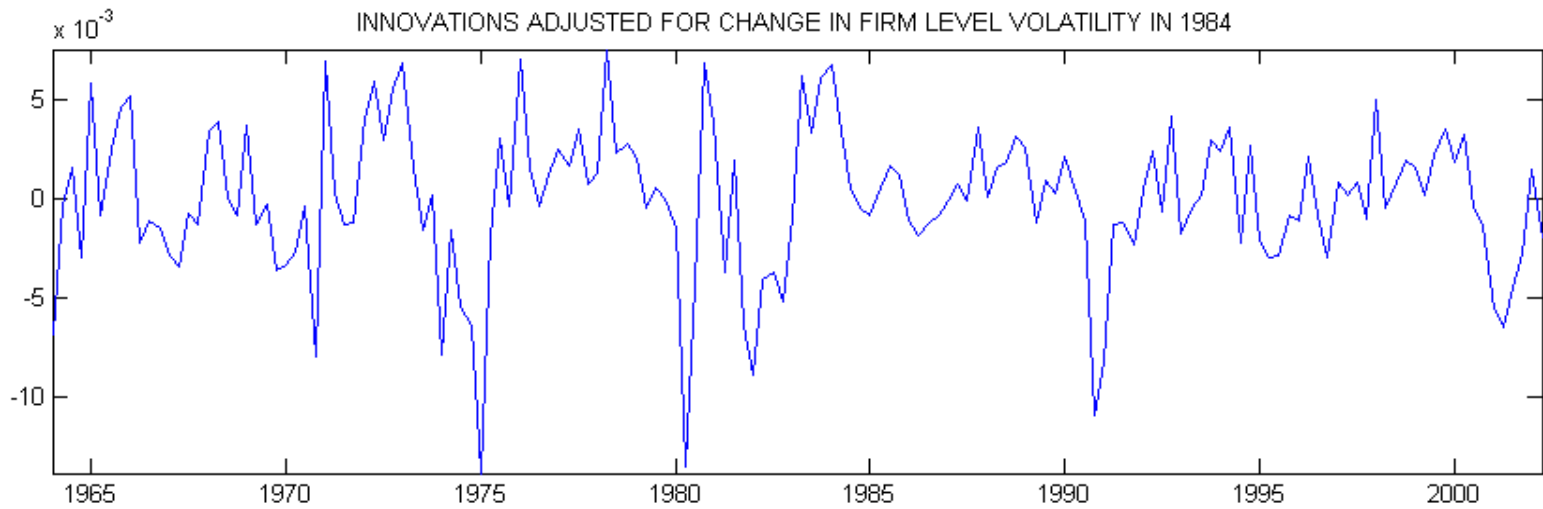
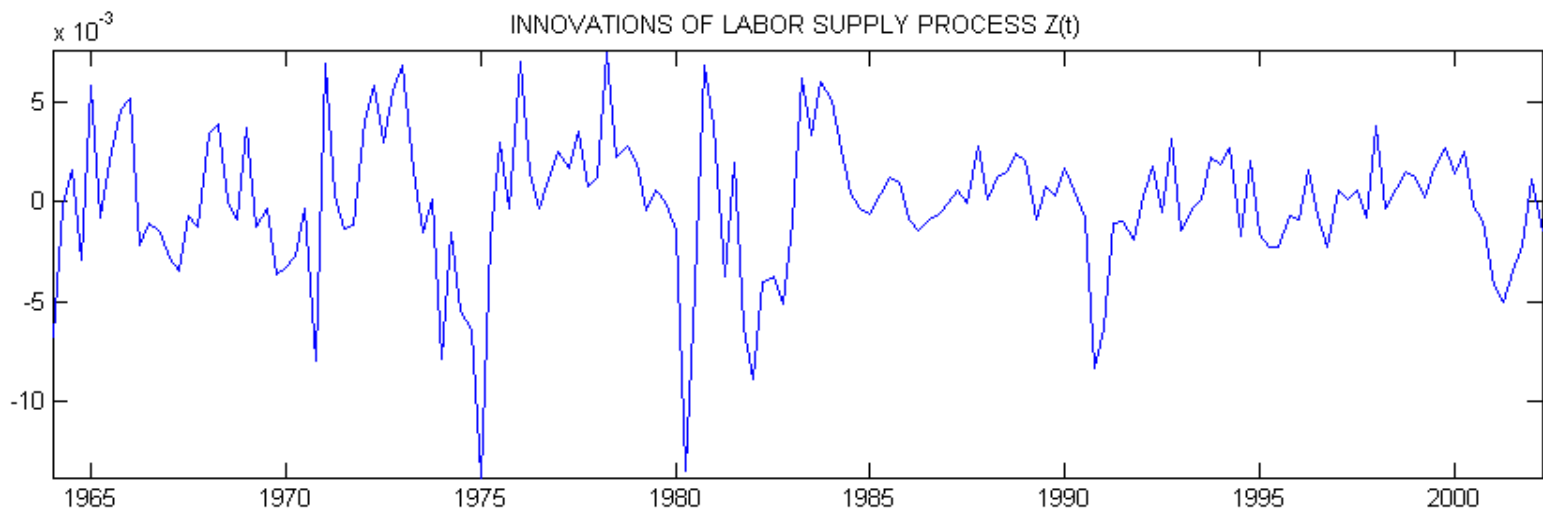


Figure 13