The Pennsylvania State University
The Graduate School

INDUSTRY DYNAMICS AND AGENCY

A Dissertation in
Economics
by
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Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

December 2008

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Abstract

This thesis empirically investigates the effects of agency problems on endogenous managerial effort, firm performance, corporate structure and industry-wide productivity.

In the second chapter, I develop an industrial evolution model with endogenous managerial effort and endogenous organizational form. The model has heterogenous firms competing in a monopolistically competitive market, endogenous entry and exit and aggregate uncertainty. It also characterizes the relationship between a manager and an owner by a long term dynamic contract. The structural model allows me to quantify the changes in managerial behavior and distribution of firms' organizational form and, as a result, the change in aggregate productivity in response to heightened competitive pressure.

In chapter three, I estimate the model with exogenous corporate structure. Two versions of the model are considered to be able to demonstrate the differences in managerial responses when the organizational forms are different. The first one is the model where ownership is separated from management, the second is the one in which managers own their firms. The model is estimated using panel data on the Colombian Malt industry. With the estimated parameters, counterfactual experiments are conducted to quantify the importance of agency on endogenous effort and firm performance

The final chapter considers the model described in the first essay with endogenous set of corporate structure. The model is simulated with a plausible set of parameters that generate both corporations and family owned firms in steady state equilibrium. The simulated model is used to show that competitive pressures significantly affects the organizational choice of owners. Heightened competitive pressure induce firms to choose proprietorships over corporations.

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Acknowledgments

I am grateful to my advisor James R. Tybout for his guidance, time, patience and continuous support. I would also thank to Edward Green and Mark Roberts for very helpful comments. Continuous help and encouragement from Nezih Guner and Susanna Esteban is acknowledged with appreciation. I would like to thank Remzicanim, for always believing in me.

Dedication

I dedicate this dissertation to my parents Şükran and Esat , to my lovely sisters Buşra and Tuba and to "canim sevgilim" Remzi...

Chapter 1

Overview

Governments often view competitive pressure, especially driven by import competition, as a tool to discipline the domestic firms. Firms that exhibit heterogeneity in their productivity respond differently to industry-wide changes in the economic conditions. With heightened competitive pressure, some firms exit, new firms enter the market, and the non-exiting incumbent firms determine their level of production by shirking or growing. These changes affect the economy in a number of ways. Heightened competitive pressure increases the default risk. This increase in default risk alters the managerial responses to competitive pressure. In addition, these same forces affect the owner's choice of organizational form. This thesis develops an empirical dynamic model which sheds light on these observations. The model developed here devote particular attention to the effects of competitive pressure on endogenous effort of agents and organizational choice of firms.

The previous studies used industrial evolution models to link the competitive pressure to efficiency . In these studies, competition forces the the least productive firms exit the market (selection effects), the firms closer to technological frontier invest more to take the lead (leapfrogging argument) and the firms invest less because of diminished profit opportunities (Schumpeterian argument). But, they fail to incorporate the agency problems into the analysis. This thesis introduce a structural dynamic industrial evolution model which not only incorporates the selection effects and Shumpeterian effects, but also describes the shirking effects that link competitive pressure to efficiency.

While it is believed that competitive pressure can increase the incentives to exert more effort, it can also increase the managerial slack depending on the business environment they are in. In particular, managers respond to aggregate shocks and competitive pressure by changing their optimal effort level. If the manager bears the risk and pays the cost of failure himself, he is expected to exert more effort when the business becomes more risky. On the other hand, if a firm is owned and managed by the same agent, he internalizes all the costs and benefits. Therefore, the responses to competitive pressure differ for a firm that has separated ownership and management.

Competitive pressure affects the value of firms differently. When profit opportunities change for different corporate forms of firms, the type of entrants is altered. With that in mind, this thesis is also related to the finance literature that tries to understand the determinants of different corporate structures. The main determinants are dual taxation on corporate income, limited liability of asset holders and agency problems between the owners and the managers. In the fourth chapter of my thesis, I choose the agency problems and the differentiated abilities of agent when managing a firm as the source of heterogeneity in the organizational structure. Finally, with a structural dynamic industrial evolution model, I can focus on the importance of agency and competitive pressure on the choice of organizational structure.

This thesis is also linked to the contracting literature that has moved its attention towards dynamic contracts after the introduction of "expected present value of future payments to the manager" statistics that summarizes all the previous realizations to the owner (productivity, outcome, assets etc.). With this technique, the theoretical studies have described optimal dynamic contracts. However, the empirical works has lagged behind the theoretical literature. To my knowledge, this is the first paper that estimates the parameters of a dynamic contract and quantifies the importance of agency on firm performance. It does so by embedding long term dynamic contract representation of Phelan and Townsend (1991) into the industrial evolution model by Hopenhayn(1992).

The model describes an industry populated by heterogenous firms, each producing its own differentiated product. Entrepreneurs create new firms and enter the market if the expected present value of the firms is greater than the entry cost they pay. These potential entrants also decide on the corporate structure of the firm. If the value of the firm as a corporation exceeds its value as a proprietorship, the entrepreneur hires a manager, and signs a contract which both parties are loyal to as long as the firm is active. Otherwise, the potential entrant enters the market as a proprietorship and becomes an owner/manager. Incumbents exit the market if the expected continuation value of their firms falls below their scrap values. Owners and hired managers exert effort to increase the probability of observing higher productivity next period. In a corporation, the relationship between managers and owners is characterized by a long term dynamic contract, sequence of recommended actions, compensations as functions of performance. Both the manager and the owner are loyal to the contract as long as the firm is active. Firms face idiosyncratic shocks. Given the state they are in and the idiosyncratic shocks, agents make optimal choices.

I estimate the model described in this thesis using the simulated method of moments. I do so with the plant level panel data on Colombian industries between 1970 and 1992. These data are specifically chosen because of its rich informative characteristics. First, the data separate firms into nine categories in terms of corporate structure. This gives detailed information about the corporate structure of firms. Second, to be able to estimate the parameters that characterize the dynamic contract, I needed information that links managerial performance and firm characteristics and managerial compensation data is available in the panel data. Third, the industries that I specifically choose to study fit the modeling assumptions.

The third chapter develops two versions of the model: one in which ownership is separated from management (the agency model), and one in which managers are also owners (the proprietorship model). The agency model considers an industrial evolution model with endogenous managerial effort but without endogenous organizational choice of firms. Owners offer contracts to managers that elicit profit-maximizing effort levels, given information asymmetries. Both versions of the model are used to analyze managerial responses to heightened product market competition in a setting where managers lose rents if their firm exits.

The agency version of the model is econometrically fit to the Colombian Malt Industry populated by only corporations. Estimated parameters characterize the degree of risk aversion, the cost of effort, the rents that managers loose in the event that their firm exits, and productivity shocks. Parameters that govern industry dynamics, factor price shocks, and production technologies are also econometrically identified.

The proprietorship model is inferred from the estimates of the agency model by assuming that managers own their firms. Simulations of the estimated model characterize managers' effort choices in response to increased product market competition. Heightened competitive pressures cause managerial effort to increase by 23 percent for the lowest productivity firms, which are most likely to exit. However, among high productivity firms, managers decrease their effort levels by 2 percent. Whereas, in the proprietorship model, managerial effort decreases with heightened competitive pressures for almost all firms, and it does so most dramatically for the low productivity firms. These findings reflect two forces. First, when loss of managerial rents is not an issue, heightened competitive pressures reduce the return to effort. Second, when owners do not internalize the loss of rents that managers suffer in the event of exit, managers use their effort level to try to control exit probabilities. The latter force is at work in the agency model but not the proprietorship model, and it dominates among low productivity firms, which are relatively likely to exit.

Given that owner managers and hired managers working for firms with different organizational forms react competitive pressure differently, the following question arises naturally; "Does competitive pressure play a role in determining the organizational structure of an entrant?" The fourth chapter of my thesis answers this question. By endogenizing the organizational form decision of potential entrants, I allow for a change in the organizational mix of the industry when firms face competitive pressure. The heterogeneity in organizational mix is driven by the difference between the managerial abilities of entrepreneurs and managers. The model still exhibits the key features discussed in the previous chapter. There is still endogenous entry and exit and endogenous effort. Hired managers loose rent in the event of liquidation and the owners do not incorporate this loss when making the exit decision. Simulations of the model characterize the organizational choice of potential entrants. When competitive pressures are strong, potential entrants choose to become proprietors. With heightened competitive pressure the value functions decline. But this decline is not symmetric across different types of firms. Therefore, the changes in the relative values of the corporations versus proprietorships at a given productivity level determine the new mix of firms.

The outline of the thesis is as follows. The second chapter describes the industrial evolution model that incorporates the agency problems at the firm level, endogenous effort, and endogenous organizational structure decision. The third chapter explains how the heightened competitive affects endogenous effort choice of managers compared to proprietorships. The fourth chapter endogenizes the organizational form decision, and studies another channel through which competitive pressure affects efficiency.

Bibliography

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Chapter 2

The Model

The model describes two types of infinitely lived agents: entrepreneurs and managers. Managers have the higher ability to operate a firm, but they are financially constrained. On the other hand, entrepreneurs have the capital to start up a firm, however they are not as able as managers.

Entrepreneurs create heterogeneous firms. After realizing how productive their firms are, they decide on the corporate structure. If managing the firms by themselves is more profitable, they become owner/managers and the governance type is called proprietorships. Otherwise, the entrepreneurs contract with managers to run their firms. If the manager accepts the contract, he and the owner behave according to its terms for the duration of firm's life.

The market is populated by both corporations and proprietorships. At the beginning of each period, the owner of each active firm starts with the knowledge of the previous period's productivity. Next, taking last period's productivity level into consideration, the manager chooses an effort level. (Higher effort from the manager increases the chance of a high productivity realization.) Each firm's productivity depends upon the effort its manager puts into running it, the productivity it inherits from the previous period and an exogenous idiosyncratic shock. Finally, once current productivity is realized, the managers hire labor in a competitive factor market and compete with one another in a monopolistically competitive product market.

Corporate owners cannot monitor either the effort exerted by their managers or the current idiosyncratic exogenous shocks their firms face every period. In order to reduce the agency problem, the owners offer their managers contracts which will be described fully below. The only aspect of the relationship not governed by the contract is the endogenous exit decision. Owners liquidate their firms when the scrap value they receive by doing so exceeds the expected present value of the future profit stream. In the event that a firm is liquidated, its manager suffers a loss of revenues and owners are not liable to pay the promised future expected utilities. Whereas, with unified ownership and management agency problems disappear. Manager/owners exit the industry when the scrap value of the firms is higher than the present value of their firms. Once they exit, they receive the scrap value of their firm.

The model also allows for endogenous entry. Entering a market requires a sunk startup cost, F, paid by each potential entrant. If the expected value of a corporation or a proprietorship in the market is greater than the startup cost, a potential entrant pays that cost and draws an initial productivity from a commonly known distribution and starts the next period as an incumbent after determining the corporate structure.

The trade off between a corporate structure and a proprietorship arises for two reasons. First, in a corporation, the owner's inability to observe the effort exerted by the manager or the exogenous firm specific shock creates agency problems, therefore the owner pays the cost of agency as compensation to the manager. Second, effort is more costly for the entrepreneur. If the later cost is higher, the entrepreneur prefers to hire a manager and creates a corporation. Otherwise, he continues operation as a proprietorship.

Among corporations, cross-firm heterogeneity in the return to effort occurs for two reasons. First, when competition increases, the probability of failure for low productivity firms increases relatively dramatically. Thus, managerial incentives to avoid the loss of rents are strongest among low productivity firms. Second, the sensitivity of profits to managerial effort differs across firms, with the highest sensitivity occurring at firms with large market shares. (This latter effect was first stressed by Schumpeter, and is present in many industrial evolution models.) Therefore, for each firm, the effect of competitive pressures on the return to managerial effort can be positive or negative. The former effect is not present among proprietorships because the exit decision is already optimal for the manager/owner. Therefore, the return to managerial effort moves in the same direction as the change in profits.

Beginning-of-period productivity distributions, firm-specific shocks, exit decisions of incumbents, and entry decisions of potential entrepreneurs determine the distribution of firms every period. In equilibrium, agents' beliefs about the transition density for the distribution of firms must be consistent with the aggregation of optimal individual choices. Thus, the approximate law of motion for the market-wide price index used by the owners is consistent with the one generated in equilibrium by aggregating individual choices. The methodology for finding this equilibrium is taken from Utar (2007) who generalizes technology developed by Krusell and Smith (1998).[1]

2.1 Demand

Demand is determined by the Dixit-Stiglitz (1977) constant elasticity of substitution (CES) utility function. Consumer preferences are defined over the N differentiated products currently available.

$$U = \left(\sum_{i=1}^{N} q_i^{\rho} \right)^{1/\rho}, \tag{2.1}$$

where q_i is the consumption of variety i. The elasticity of substitution between products is $\sigma = \frac{1}{1-\rho} > 1$. The CES utility function implies that demand for the i^{th} product is

$$q_i = \frac{R}{\widetilde{P}^{1-\sigma}} p_i^{-\sigma}, \tag{2.2}$$

[1]In Krusell and Smith (1998) owners approximate the evolution of the wealth distribution using the the Markov process of the first mean of wealth distribution. In Utar (2007) farsighted firms approximate the distribution of firms productivities with an industry-wide price index and the number of firms in the industry. The transition function that maps the distribution of current firm productivities to tomorrow's is approximated as Markov chain on the price index and the number of firms.

where R denotes aggregate expenditure, and $\widetilde{P}$ is the exact price index for U:

$$\widetilde{P} = \left(\sum_{i=1}^{N} p_i^{1-\sigma} \right)^{1/(1-\sigma)} . \tag{2.3}$$

2.2 Production

Labor is the only factor of production. Firms differ in their productivity, but share a common technology:

$$q_{it} = e^{\varphi it} l_{it}^{\theta}, \qquad 0 < \theta \leq 1, \tag{2.4}$$

here l_{it} denotes the labor input of firm i at time t, and φ_{it} is the productivity of firm i at time t. Current productivity is dependent on the current effort choice of the manager, $a_{it} \in A$, previous period's productivity, and an idiosyncratic productivity shock. More precisely, it follows a first order AR(1) process:

$$\varphi_{it} = b_1 \log(a_{it}) + b_2 \varphi_{it-1} + b_3 + \varepsilon_{\varphi} \qquad \varepsilon_{\varphi} \tilde{} N(0, \sigma_{\varepsilon}^2). \tag{2.5}$$

The associated transition density will hereafter be denoted as $g(\varphi_{it}|\varphi_{it-1}, a_{it})$.

2.3 Aggregate States

Wage rates are common across workers and exogenous to the model. They evolve according to the transition density $\Theta(w_{t+1}|w_t)$. The distribution of firms over productivities,φ, and future expected utilities promised to the manager, v_t (to be discussed below) are also common to all firms. This distribution will hereafter be denoted Γ_t, and its transition function, conditional on wages, will be denoted $\Gamma_{t+1} = H(\Gamma_t, w_t)$.

2.4 Agents' Optimization Problems

2.4.1 Proprietorships

When an entrepreneur creates a firm and decides to manage it himself, he becomes a manager/owner and operates a proprietorship. As the manager and the owner of the firm, he makes all the decisions, employment, exit-stay and he exerts effort which is more costly than a manager. Cost of effort is described as $(e^{\eta_{prop} a_{it}} - 1)$ where η_{prop} is the cost of effort parameter of an entrepreneur.

The sequence of actions for a manager/owner is as follows. After observing the aggregate state of the world, wage rate for workers, w_t, and the distribution of firm productivities, Γ_t, the manager/owner exerts effort. Then, the firm realizes its idiosyncratic shock. Together with the effort choice and previous periods productivity, this shock determines the current productivity level. Once the manager/owner observes the productivity level, he makes the employment decision. Finally production takes place and the current period profit-cash flow is realized. At the end of the period, before observing tomorrow's aggregate state, the manager/owner makes exit or stay decision and the period ends. In this model, the firms don't change their organizational structure while they are existing incumbent firms.

For an incumbent proprietor, the current state is his firm's previous period productivity level, $\varphi_{t-1,}$ and aggregate state (w_t, Γ_t). He chooses his effort level to maximize his own expected discounted return, given H, g, Θ. His problem is:

$$U_t^{prop}(\varphi_{t-1}; \Gamma_t, w_t) = \max_{a_t} \sum_{\Psi} \left[\pi_t(\varphi_t | \Gamma_t, w_t) - (e^{\eta_{prop} a_{it}} - 1)\right.$$

$$\left. + \beta \max\{m, E_{\Gamma_{t+1}, w_{t+1}} U_{t+1}^{prop}(\varphi_t; \Gamma_{t+1}, w_{t+1} | \Gamma_t, w_t)\}\right] g(\varphi_t | \varphi_{t-1}, a_t)$$

subject to

$$\Gamma_{t+1} = H(\Gamma_t, w_t)$$

The manager/owner exits the market if the expected value of his continuation utility is less than the scrap value, m of the firm. So the above dynamic problem gives an exit rule.

$$\chi^{prop}(\varphi_{t-1};\Gamma_t,w_t) = \begin{cases} 1 & \text{if } EV < m \\ 0 & \text{elsewhere} \end{cases} \tag{2.6}$$

For each state $(\varphi_{t-1};\Gamma_t,w_t)$, there exists a cutoff productivity level $\varphi_t^{*,prop}$ such that all proprietorships at productivity above $\varphi_t^{*,prop}$ stay in the market and the ones below the cutoff productivity exits.

2.4.2 Corporations

2.4.2.1 Characterization of the contract:Manager's problem

When an entrepreneur creates a new firm, and decides to hire a manager, he makes a contract offer to a member of the pool of potential managers, all of whom are identical. The contract specifies a promised payment to the manager $c_t \in C$ in each period t that the firm is active, where C is a finite set. These payments are contingent upon the firm's previous productivity realizations, $h_t = \{\varphi_0, \varphi_2, \varphi_3, ...\varphi_{t-1}\}$, as well as its current productivity, φ_t. However, they are not contingent on the manager's current or previous effort levels, which the owner cannot observe.

Managers have no prior information about the value of firms, so they accept any offer that delivers expected utility greater than their outside option.[2] If managers reject the offer, they are removed from the pool of potential managers and receive their outside option thereafter. If they accept, they commit to the contract as long as their firm is alive. Once employed, managers choose their effort level $a_t \in A$, each period, where A is a discrete set of values. After managers exert the chosen effort and an idiosyncratic productivity shock is realized, they determine the optimal employment level and price of the product.

The period t utility of a manager is a separable function of consumption and effort, $u(c_t, a_t) : A \times C \rightarrow \mathbb{R}_+$:

$$u(c_t,a_t) = \begin{cases} c_t^{\mu} - (e^{\eta_{man} a_t} - 1) & \text{If the firm is in the market} \\ c_t^{\mu} - K & \text{If the firm exits that period} \\ c_0^{\mu} & \text{If manager worked for a firm before} \end{cases}$$

[2]The outside option is assumed to be zero. With this assumption, if a manager receives a contract that delivers him a positive expected future utility, he accepts the offer.

$$for\ \mu \in (0,1),\, \eta_{man} > 1.$$

Here, μ is the manager's degree of risk aversion of the manager, η_{man} is the cost of effort parameter for the manager. K is the one time loss of rents the manager loses in the event that the firm is liquidated, and c_0 is the per-period payment that former manager receives after their firm is liquidated. Hence, three considerations affect managerial effort choices. First, if the manager exerts more effort, he increases the probability of a high productivity realization, which in turn increases the probability of a high compensation. Second, effort is costly, so the manager has an incentive to shirk. Finally, effort reduces the risk of liquidation and the associated loss of income.

As competitive pressure increases, firms' expected future profits decrease, and the return to cost-reducing activity may decrease for the owner.[3] This reduction in earnings is partly passed backed to managers as reduced compensation, hence it reduces the benefit of extra effort. On the other hand, heightened competitive pressure increases the risk of failure, which induces changes in the effort level of managers at firms susceptible to liquidation.

2.4.2.2 Corporate Owner's problem

The moral hazard problem in this model arises from the owner's inability to observe the effort choices of the manager or the firm-specific productivity shocks, ε_{φ}. The owner must therefore design a contract that indirectly gives the manager the incentive to take the recommended action and the contract must be a function of entire history realizations which is t dimensional. A standard result in the dynamic contract literature is that there is a one-dimensional sufficient statistic for this history of productivity realizations (Phelan and Townsend, 1991). More precisely, the expected discounted future utility of the manager of participating in the contract from this point forward summarizes the relevant information in h_t. This recursive formulation will be used here, with v_{t+1} denoting managers expected discounted future utility.

[3] In this context, the return to a cost-reducing activity decreases as firm's profit decreases. In Boone (2000), the incentives to innovate and increase productivity increases for firms which are on the technology frontier as competition increases.

Expressed this way, a contract specifies a recommended effort level, a_t, a current compensation, c_t, a promised discounted future utility, v_{t+1} as a function of the current promised utility level, v_t and current productivity realization φ_t. For reasons of computational tractability discussed by Phelan and Townsend (1991), lotteries are considered over (a_t, c_t, v_{t+1}) as well as deterministic values. Despite this apparently stochastic formulation computation always results in an optimal contract that is deterministic.[4] Therefore, the model is explained with deterministic contracts, and the details of the lottery contracts are described in Appendix.

An important economic constraint on the contract is that it must be incentive compatible. Incentive compatibility means that the manager prefers the recommended effort level a_t over all alternative effort levels $\widehat{a}_t$,[5]

$$E[(u(a_t, c_t|v_t, \varphi_t) + \beta v_{t+1})|\varphi_{t-1}] = \max E_\lambda[u(\widehat{a}_t, c_t|v_t, \varphi_t) + \beta v_{t+1}|\varphi_{t-1}]$$

I now describe the timing of events. At the beginning of each period, the worker's wage and the distribution of firms over their productivities (w_t, Γ_t) are observed. The owner has already observed the last period's productivity, φ_{t-1} and he has dictated v_t by the contract to the manager in previous period. With those in mind, the owner recommends an effort level, a_t, specified by the contract. By incentive compatibility, the manager is willing to exert the recommended effort level as the owner has specified before observing the firm-specific productivity shock, ε_t. For a given action, a_t and previous period's productivity φ_{t-1}, current productivity is determined by the exogenous technology shock. After the manager observes the current productivity, he makes employment decisions. Since there are no firing or hiring costs, the employment problem is static. Finally production takes place and the profit-cash flow is observed by the owner. Knowing the aggregate state, the owner can also derive the value of current productivity. Conditional on productivity and the recommended action a_t, compensation is determined according to the compensation schedule $\mathbf{c}_t(\varphi_t|a_t, v_t)$. Also, in keeping with the contract, v_{t+1} is determined according to $\mathbf{v}_{t+1}(\varphi_t|c_t, a_t, v_t)$. At the end of the period, before observing

[4]The risk taking behavior of the owner and the manager, in particular a risk neutral owner and a risk averse manager, guarantees that the optimal contract is deterministic.

[5]The expected utility of obeying the recomendation is greater than that of each possible deviations from the recomended effort level.

tomorrow's macro state, the owner makes his exit or stay decision and the period ends.

For every owner who observed φ_{t-1} as last periods productivity, promised v_t to his manager and realized the aggregate state of the world as (Γ_t, w_t), the contract can be expressed as recommended actions, a_t, a compensation schedule $\mathbf{c}_t(\varphi_t|a_t, v_t)$ and promised utility schedule, $\mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t)$ that satisfy the following constraints.

First, the discounted expected future utility of the manager must be equal to the promised value,v_t. So, the *continuation of utility constraint* is

$$v_t = \sum_{\Psi}(u(\mathbf{c}_t(\varphi_t|a_t, v_t), a_t) + \beta\mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t))g(\varphi_t|\varphi_{t-1}, a_t). \tag{2.7}$$

Second, the contract must be incentive compatible for all assigned and alternative action pairs, $a, \widehat{a} \in A \times A$. The *incentive compatibility constraint* explained earlier can be rewritten as:

$$\sum_{\Psi}(u(c_t, a_t) + \beta v_{t+1})g(\varphi_t|\varphi_{t-1}, a_t) > \sum_{\Psi}(u(c_t, \widehat{a}_t) + \beta v_{t+1})g(\varphi_t|\varphi_{t-1}, \widehat{a}_t) \tag{2.8}$$

Lastly; the contract must deliver at least the managers outside option.[6]

$$v_t > \frac{1}{1-\beta}(c_0)^{\mu}$$

In a dynamic setting, the owner's problem is to construct a sequence of recommended action levels, compensation and future utility functions $\{a_t, \mathbf{c}_t(), \mathbf{v}_{t+1}()\}_{t=1}^{\infty}$ as functions of observables; his firm's current productivity realization, and industry states, (w_t, Γ_t).

For an incumbent firm's owner, the current state is his firms's previous period productivity level,$\varphi_{t-1,}$ the value promised to the manager last period v_t, and the aggregate industry state (w_t, Γ_t). He finds the optimal contract among all contracts that satisfies the above constraints. The optimal contract maximizes the owner's

[6]Manager's outside option is assumed to be zero.

expected discounted return given H, g, Θ. One can define the owner's problem as:

$$U_t^{corp}(\varphi_{t-1}, v_t; \Gamma_t, w_t) = \max_{a_t, \mathbf{c}_t(), \mathbf{v}_{t+1}()} \sum_{\Psi} [\pi_t(\varphi_t|\Gamma_t, w_t) - c_t)$$

$$+\beta \max\{m, E_{\Gamma_{t+1}, w_{t+1}} U_{t+1}^{corp}(\varphi_{t,} v_{t+1}; \Gamma_{t+1}, w_{t+1}|\Gamma_t, w_t)\}]\, g(\varphi_t|a_t, \varphi_{t-1})$$

subject to

$$\begin{aligned} v_t &= \sum_{(\varphi \geq \varphi_t^*) \in \Psi} (u_t(c_t, a_t) + \beta v_{t+1}) g(\varphi_t|a_t, \varphi_{t-1}) \\ &\quad + \sum_{(\varphi < \varphi_t^*) \in \Psi} (u_t(c_t, a_t) - K) g(\varphi_t|a_t, \varphi_{t-1}) \end{aligned}$$

$$\begin{aligned} v_t &> \sum_{(\varphi \geq \varphi_t^*) \in \Psi} (u_t(\mathbf{c}_t(\varphi_t|a_t, v_t), \widehat{a}_t) + \beta \mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t)) g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t) \\ &\quad + \sum_{(\varphi < \varphi_t^*) \in \Psi} (u_t(\mathbf{c}_t(\varphi_t|a_t, v_t), \widehat{a}_t) - K) g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t) \end{aligned}$$

$$\begin{aligned} v_t &> \frac{1}{1-\beta}(c_0)^\mu \\ c_t &= \mathbf{c}_t(\varphi_t|a_t, v_t) \\ v_{t+1} &= \mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t) \\ & \quad \textit{and} \\ \Gamma_{t+1} &= H(\Gamma_t, w_t) \end{aligned}$$

The owner exits the market if the expected value of his continuation utility is less than the scrap value, m of the firm. So the above dynamic problem gives an exit decision.

$$\chi^{corp}(\varphi_{t-1}, v_t; \Gamma_t, w_t) = \begin{cases} 1 & \text{if } EV < m \\ 0 & \text{elsewhere} \end{cases} \tag{2.9}$$

For each state $(\varphi_{t-1}, v_t; \Gamma_t, w_t)$, there exists a cutoff level $\varphi_t^{*,corp}$ such that all corporations at productivity levels above $\varphi_t^{*,corp}$ stays in the market and all others exit.[7]

2.4.3 Entrepreneur's problem

In each period, there is a pool of potential entrants from a pool of entrepreneurs. Ex-ante, all entrepreneurs are identical. Therefore, each potential entrant faces the same ex-ante problem: he draws a fixed entry cost from a common distribution which is assumed to be uniform over $[0, F_H]$. If the expected value of entering the market and being an owner of a proprietorship or a corporation exceeds the fixed entry cost, the potential entrant pays the fixed cost and enters the market. Then, entrants draw their initial productivity level from a common distribution, $\mathcal{F}(\varphi)$. If ex-post, the expected value of the firm at the initial productivity draw as a proprietorship or a corporation is negative, the owner exits the market immediately. Otherwise, he compares the expected value of the firm at the initial productivity draw as a proprietorship to being a corporation. If the former is higher, he starts the next period as an incumbent proprietor. Otherwise, he hires a manager and starts production. Note that the new entrants choose to promise $v_1(\varphi_0)$ that maximizes their expected return: $v_1(\varphi_0) = \arg\max_{v_i} U(\varphi_0, v_i(\varphi_0); \Gamma_t, w_t)$. Thus, a potential entrant's problem, given the incumbent corporations and proprietorships owner's value functions U^{corp}, U^{prop} and $\mathcal{F}(\varphi)$ is:

$$U^E(\Gamma_t, w_t | \mathcal{F}(\varphi)) = \max\{E_{\varphi_0} U^{corp}, E_{\varphi_0} U^{prop}\}. \tag{2.10}$$

The potential entrant will create a new firm if

$$U^E(\Gamma_t, w_t | \mathcal{F}(\varphi)) > fe, \tag{2.11}$$

and he will stay in the market as a proprietor if

$$U^{prop}(\varphi_0; \Gamma_t, w_t) > \max\{m, U^{corp}(\varphi_0, v_1(\varphi_0); \Gamma_t, w_t)\},$$

[7]Note that $\varphi_t^{*,corp}$ need not be equal to $\varphi_t^{*,prop}$.

and he will stay in the market as a corporation if

$$U^{corp}(\varphi_0, v_1(\varphi_0); \Gamma_t, w_t) > \max\{m, U^{prop}(\varphi_0; \Gamma_t, w_t)\},$$

2.5 Equilibrium

The equilibrium is a set of value functions U^{prop},U^{corp} and U^E for incumbent proprietorships, incumbent corporations and potential entrants respectively and a corresponding contract,and exit rule χ^{corp} for corporations and a policy function for optimal effort choice and an exit rule χ^{prop} for proprietorships, given H, Θ, g, F.

1-Given H, Θ, g, the corporate owner solves his problem and the value function gives the contract and corresponding recommended action a_t, the compensation function $\mathbf{c}_t()$, and the promised utility function $\mathbf{v}_{t+1}()$.

2-Given H, Θ, g, the proprietor solves his problem and the value function gives the corresponding policy function for actions.

3- Given U^{corp},U^{prop} and H, U^E characterizes the problem of potential entrants-entrepreneurs.

4- Firms' optimal decisions are consistent with H.

Solution of the equilibrium

The solution of the problem requires the computation of the law of motion of the distribution of firms and promised utilities, which immediately creates a dimensionality problem. In order to solve the problem Utar's (2007) version of the Krusell-Smith (1998) algorithm is used.[8] The main assumptions behind this algorithm are that agents have a limited ability to predict the evolution of the distribution and individual agents take the market aggregates as exogenous. Therefore, one can use $\widetilde{P}$ as aggregates of the distribution to approximate the equilibrium. Define $\widetilde{P}_{t+1} = \overline{H}(\widetilde{P}_t, w_t)$ to be the Markov process for $\widetilde{P}_{t.}$

[8]Khan and Thomas(2003) used Krusell-Smith algorithm to decrease the infinite dimension of the distribution of firms over capital holdings by a finite number of moments. They simply divide the distribution into equal measure parts and use the mean of each partition as one moment. Recently, Utar(2007) analyzes the effect of openness on employment dynamics in a dynamic industrial evolution model. She uses the number of domestic firms and average price as two aggregates of the distribution to approximate the equilibrium. She also uses an unconstrained first order markov process instead of a switching AR(1).

The solution proposed in the previous paragraph requires the knowledge of $\widetilde{P}_{t,}w_t$ and the Markov process defined on $\widetilde{P}_t$ to solve the owner's optimization problem. Although these information is sufficient to find the policy functions, we need to keep track of the distribution of firms over their productivities and promised utilities. The distribution itself gives pricing decision rules of firms,which gives the endogenous aggregates, $\Gamma_{t+1} = j(\Gamma_t, w_t, \widetilde{P}_t, \overline{H})$. The Markov process also maps current aggregates to tomorrow's aggregates; $\widetilde{P}_{t+1} = \overline{H}(\widetilde{P}_t, w_t)$. In equilibrium, the Markov process must be consistent with individual firms' decisions.

The algorithm to solve the approximate equilibrium is described as follows.

1- Start with an initial guess on the Markov Process $\overline{H}$.

2- Given $\overline{H}$, Θ, g solve for the value functions of incumbents and entrants.

3- Simulate the environment over a long period of time, solving for the spot market equilibrium each period.

4- Update $\overline{H}$ by calculating the number of times the market switches from $[\widetilde{P}_k]$ to $[\widetilde{P}_m]$.

5- If updated $\overline{H}$ is sufficiently close to the previous $\overline{H}$, stop. Otherwise, use the updated $\overline{H}$ and go back to step 2.

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Chapter 3

Empirical Evidence from Colombian Malt Industry

3.1 Introduction

Governments often view trade and antitrust policies as means to heighten competition within their own countries, and thereby to improve aggregate productivity. However, the effects of competition on efficiency are not well understood. Two basic types of linkages have been explored in the literature. First, even when firms' productivity is unaffected, competition may induce the least productive firms to exit, increase the market share of efficient incumbents, and set a higher standard for the productivity of new entrants. That is, competition can create selection effects. Second, intra-firm productivity may respond to competition because it changes the return to effort and/or innovation. This may occur because, by increasing demand elasticities, competition increases the sensitivity of firms' market shares to variation in efficiency. Alternatively, *given* firms' demand elasticities, reductions in their market share can reduce the payoff to efficiency improvements. And finally, when managers enjoy firm-specific rents, they may react to heightened competitive pressures by working harder to keep their firms from liquidating.

The empirical literature (described below) generally supports the notion that competition affects efficiency. But most of this literature is reduced-form, and does not isolate the quantitative importance of individual mechanisms. This paper generates new evidence on the importance of selection and shirking effects using a dynamic structural model. It has several key features. First, since managers are compensated by long term contracts rather than hired in spot markets, I characterize owner-manager relationships using the dynamic contracting problem developed by Phelan and Townsend (1991). Second, in order to incorporate selection effects, I embed the contracting problem in an industrial evolution model with monopolistically competitive, heterogeneous firms. The model exhibits aggregate uncertainty, endogenous effort, and endogenous entry and exit. Finally, to create a wedge between the objectives of owners and managers, I assume that managers lose some job-specific rents if their firm is liquidated. Owners place no weight on these potential rent losses when deciding whether to liquidate their firms, so managers choose their effort levels partly to influence owners' exit decisions.

I estimate this model using plant level panel data from the Colombian malt industry. This industry suits my purposes for several reasons. First, it has a large number of significant players. It is thus closer to monopolistic competition than to oligopoly, and not likely to reflect much strategic interactions between producers. Second, the industry is populated exclusively by corporations, so ownership and management are separated. Finally, the available plant-level panel data on this industry include information on managerial compensation, which helps to identify the parameters of agency problem.

Using the parameters estimated from the agency model, I perform counterfactual analysis concerning the effects of procompetitive policies. (This policy change is represented as a decrease in the mean fixed entry cost which sufficient to raise the mean entry rate nearly 8 percentage points.) Then, to isolate the effect of the agency problem on managerial behavior, I compare the predictions of this model with those of an otherwise identical model in which managers own their firms (the "proprietorship model").

My simulations show that heightened competitive pressure induce significant selection-based productivity effects, as do earlier applied industrial evolution studies. But more interestingly, I find that effort levels respond dramatically to competitive pressure differently at certain firms. In the agency model, managers of the lowest productivity firms increase their efforts by 23 percent when competitive pressures rise, while managers of the highest productivity firms *reduce* their effort level by 2 percent. These differences in responses reflect the fact that low productivity firms face the greatest probability of failure, and their managers thus have the greatest incentive to improve their performance. In the proprietorship model, the effort choice of the owner/manager of the lowest productivity firm drops by 0.13 percent when competitive pressure rise, whereas it drops only by 0.06 percent for the highest productivity firm's owner/manager. Since the manager/owner incorporates all the losses that are incurred when the firm is liquidated, the risk of failure doesn't play any role in the incentive mechanism. Rather, standard Schumpeterian forces dominate in the proprietorship model, and managers work less as the return to effort decreases.

Related Literature

This paper is related to a handful of earlier theoretical papers concerning the effect of competition on managerial effort in the presence of agency problems. The basic message of these papers is that managers' incentives to work can go either way, depending on modeling assumptions. On one hand, as discussed in Hart (1983), competition may reduce managerial slack if marginal and total costs are positively correlated and the relative size of entrepreneurial firms to managerial firms is sufficient. On the other hand, as Scharfstein (1988) shows, Hart's results are reversed if managers' are highly responsive to income. These models don't treat entry and exit, so they do not capture managers' incentive to work harder when liquidation risk increases. However, several recent studies have done so. Schmidt (1997) shows owners' optimal contract offers induce managers to put higher effort as competition increases. Similarly, Raith (2003) incorporates liquidation risk into manager's optimization problem. However he abstracts from any positive profits by assuming free entry exit. This removes any changes to returns to effort due to loss of profits. Therefore, unambiguously, the manager increases effort with competitive pressure due to increased risk. The current paper extends this literature by considering the agency problem in the context of a dynamic industrial evolution model.

This paper is also related to a theoretical literature concerning the effect of competition on productivity in the absence of agency effects. One strand of this literature treats firms' productivity levels as exogenous, so that selection effects are the only source of industry-wide productivity gain (Hopenhayn (1992) and Melitz (2003)). Another strand combines selection effects with endogenous innovation or efforts. Boone (2000), Aghion,Harris and Vickers (1997) find that firms closer to the technological frontier innovate more with competitive pressure because they want to distance themselves from their close competitors. Also, consistent with standard Schumpeterian arguments, they find that firms far from the technological frontier decrease their innovative activities. Erickson and Pakes (1995), Pakes and McGuire (1994), Atkeson and Burstein (2006), and Constantini and Melitz (2007) study innovative behavior of heterogenous firms in an industrial evolution model. Most of these studies, too, find that Schumpeterian effects are important. My paper has both selection effects and endogenous effort, but it extends this literature by introducing an agency problem, and hence considers another channel through which competition affects productivity.

Finally, the present paper is related to an empirical literature on competition and productivity. Most of these studies which find a positive association between competition and performance (Blundell, Griffith, and Von Reenan (1995), Nickell (1996), Baily and Gersbach (1995)). Nickell (1996) also shows that if his data sample is divided into high and low rent firms, the firms with high-rent firms experience a lower productivity growth than low-rent firms. Griffith's (2001) paper is most closely related to the present study. She uses the introduction of the European Union Single Market Program (SMP) as an instrument to product market competition. She shows that increase in product market competition increases the overall levels of efficiency and growth rates. More interesting results are found when the firms are sorted according to their ownership. The increase in efficiency occurs in the group that consists of principal agent type firms. On the other hand, the firms, where ownership and management are closely linked, don't have efficiency gains even after the SMP. This paper discusses the same issue – how competition affects industry-wide productivity– but it extends the empirical literature by introducing a structural model that incorporates industry equilibrium. The structural approach allows me to conduct counter-factual analysis.

The rest of the paper is organized as follows. Section 2 details specifics of the model. Next section describes estimation methodology. Section 4 summarizes the findings. Section 5 concludes.

3.2 Review of the Model and the Equilibrium

The model described in chapter 2 is restricted as the potential entrants don't choose the organizational structure of their firms. The entrepreneurs become owners and create corporations. Therefore, the current chapter only deals with the problem of corporations.

In each period, there is a pool of potential entrants. The potential entrants' problem is similar to their problem in the main model described in chapter 1. They draw a fixed entry cost from a common distribution which is assumed to be uniform over $[0, F_H]$. Those for whom the expected gain from entering the market exceeds the loss from paying the fixed entry cost, pays the entry cost and creates a new firm as a corporation. Then, they draw their initial productivity level from a common distribution, $\digamma(\varphi)$. Those for whom, the expected value of the firm at the initial productivity draw is less than the discounted scrap value exit the market immediately; the rest hire managers and start production and become incumbents the next period. Note that the new entrants choose to promise $v_1(\varphi_0)$ that maximizes their expected return: $v_1(\varphi_0) = \arg\max_{v_i} U(\varphi_0, v_i(\varphi_0); \Gamma_t, w_t)$.

We can define the potential entrant's problem, given the incumbent firm owner's value function U^{corp} and $\digamma(\varphi)$:

$$U^E(\Gamma_t, w_t|\digamma(\varphi)) = E_{\varphi_0} U(\varphi_0, v_1(\varphi_0); \Gamma_t, w_t|\digamma(\varphi)). \tag{3.1}$$

The potential entrant will create a new firm if

$$U^E(\Gamma_t, w_t|\digamma(\varphi)) > fe, \tag{3.2}$$

and he will stay in the market if $U(\varphi_0, v_1(\varphi_0); \Gamma_t, w_t) > m$.

3.3 Estimation Approach

Several parameters can be estimated before solving the structural model. First, I estimate the Markov process for the wage rate as an AR(1) fit to the cross-firm average wage for blue-collar workers (obreros):

$$w_t = \underset{(0.175)}{0.485} w_{t-1} + \underset{(9.847)}{29.576}$$

Second, I measure the level of aggregate expenditures, R, as the average of yearly industry revenues over the period 1977 through 1991 which amounts to $1,062,089,951$ (2005 US Dollars). Finally, following the standard parametrization in the literature, I set $\beta = 0.9$.

The remaining parameters to be estimated are:

$$\Omega = (\theta, \quad b_1, \quad b_2, \quad b_3, \quad \sigma_\varepsilon, \quad z, \quad \rho, \quad \mu, \quad \eta_{man}, \quad K, \quad F_H, \quad f, \quad m)$$

where θ is the production function parameter, the vector $(b_1, b_2, b_3, \sigma_\varepsilon)$ characterizes the AR(1) process of plant level productivity evolution, ρ is the demand parameter, the vector (μ, λ, K) parameterizes the utility of manager. Finally, (F_H, f, m) are the cost parameters to be estimated. f is the fixed cost per period, m is the scrap value of the firm if the firm is ever liquidated, and F_H is the upper bound on the fixed entry cost distribution. I start the structural estimation by making some distributional assumptions. First, fixed costs are drawn from a uniform distribution with support $[0, F_H]$. Second, the distribution of initial productivity levels for entrants is normal with mean; z and standard deviation $\left(\frac{\sigma_\varepsilon^2}{1-b_2^2}\right)$. This allows the new entrants to draw from a different distribution than the incumbents'.

The vector Ω is estimated using a simulated method of moments procedure. The procedure is as follows. For a candidate value of Ω, the value functions and the policy functions are calculated for incumbents and new entrants. (These functions depend upon the AR(1) for wage rates, and they reflect beliefs that are consistent with the productivity evolution as described in Krusell-Smith algorithm.) Then these policy functions are used to simulate a set of moments, M_s, including mean entry rates, mean firm sizes, ... (See table 3.1 for a complete list). Theses simulations require randomly drawn innovations in w_t, and firm-level productivity shocks, ε_{it}, and entry costs fe. I simulate the model N_T time periods and S times. The shocks, and fixed cost draws (call them Λ) are kept constant so that changes in simulated moments are a result of changes in parameters. Finally, the distance between the simulated moments and data counterparts is calculated. The estimated parameters values, $\widehat{\Omega}$, are the ones that create simulated moments as close to data moments as possible. Formally, the below problem is solved:

$$\widehat{\Omega}(W) = \arg\min_{\Omega}(M_D - M_s(\Omega, \Lambda))W(M_D - M_s(\Omega, \Lambda))'$$

and W is the weighing matrix. The weighing matrix is the identity matrix.

The standard errors of the estimated parameters are calculated using the bootstrapping methodology. The sample data is considered to be the population and I randomly select one firm at a time. The firm is taken with its own time series data and added to the new sample. Once the firm's information is recorded, the firm is put back into the sample and a new random draw is made. Totally, I make 21 draws for each resamppled group.[1] Each group of firms' statistics are calculated and treated as the industry statistics. Then, the model parameters are estimated using the new statistics. The variance across the parameters estimated using the bootstrapped data is considered to be the standard errors of the estimated parameters.

The Colombian Malt Industry Data

I used the Colombian malt industry (SIC code 3133) for the period 1977 through 1990. As mentioned earlier, this industry suits my purposes because the industry is composed of corporations. Thus, the data were generated by an industry with agency problems. The mean number of firms in the market is around 21. There is a large number of firms in the market supporting the monopolistic competition assumption rather that a strategic oligopoly setup. The firms in the market do not export, this is also consistent with my non-tradable good economy assumption. The mean entry rate is 3.8 percent and the mean exit rate is 3.2 percent.

Finally, the available plant-level panel data on this industry reports information on employment, cost , firm types and managerial compensations. The panel data, not only allows us to link producer heterogeneity and productivity dynamics, with firm types and managerial compensations, it also allows us to calculate moments to pin down the manager's utility parameters; risk aversion, the disutility paid when the firm exits, and cost of effort. I include mean and variance of firm entry, exit and number of firms as general industry characteristics to identify costs of entry and exit. Managerial compensation and its covariance with firm characteristics help to

[1] 21 is the mean number of firms in the real data sample.

identify managers' utility parameters. Intertemporal covariances help to identify parameters that govern the dynamic features of the model. In the structural model, the productivity of the firms is related to the employment level of the firm. Therefore, the employment and employment growth moments are used. Table(3.1) gives the full list of the moments.

A number of issues arise when constructing the simulations. First, all variables must be discretized in order to use standard techniques to calculate the value functions. For this, I use Tauchen's (1991) method. Second, I cannot observe the potential entrants in the market. Therefore, I arbitrarily fix, the number of potential entrants to $N_{pe} = 3$. This number exceeds the maximum number of entrants in one year. Finally, given the potential for discontinuities in the model and the discretization of the state space, a simulated annealing algorithm is used to perform the minimization.

3.4 Preliminary Estimates

Table (3.2) reports the estimation results for the set of parameters, Ω. The estimated value of the mean entry cost is about 2652 (billion 2005 Us dollars) or about a thousand times the average revenue,R,firms make in one period. The strikingly high value of fixed entry cost is due to low turnover rate of the industry . We even observe no entry for some years. Therefore, because of a high support on the fixed entry cost, only the firms, which can draw relatively low entry costs can enter the market. Also, if I look at the fixed entry costs of firms that actually entered the market in simulations, the average is around one million which is more consistent with the total revenue of the industry. These simulated results match what we see in the data: low level of entry to the market. The sunk entry costs should be considered as any expenditure prior to entry that does not add to the value of firm or the product.

The scrap value of a firm is about 51.5 (million 2005 Us dollars) which is quite low when compared to the revenue made per period. The relatively low magnitude of the scrap value of firms is probably traceable to the fact that it is identified by entry and exit patterns. The exit rate is relatively low when compared to the total number of firms in the market. The fixed cost paid by firms each period is about 16.01 (million 2005 Us dollars) which amounts to approximately 20 percent of average total sales.

Now I turn to the parameters of interest, which are the manager's utility parameters. The estimated value of his disutility payment, K, is about $11,178$ (2005 Us dollars) which is almost one third of the mean manager compensation. One can think of the disutility parameter as the loss of wages during unemployment, loss of rents associated to being a manager, or loss of reputation. The risk aversion parameter, μ, is 0.974, suggesting that managers are almost risk neutral.

The simulated moments are reported in table (3.3). The model does a good job of matching the data moments in sign. However, it does a poor job matching most compensation and employment moments. The main reason is the model's complexity. The contract in the model creates computational limitations which force me to use only a few grid points for the state variables. Therefore, the simulated moments, mainly the variances, do not match the actual data moments well.

3.5 Preliminary Simulation Results

Given all the parameter estimates, I want to quantify the effects of heightened competition on endogenous effort choice when either the ownership and management are separated and there exists agency problems between the manager and the owner, or the management and ownership of the firms are one in the same. To do so, I increase competitive pressures by decreasing the mean fixed entry cost by a factor of 10^5, holding all other parameters constant. As a government policy, this can be thought of as diminishing the bureaucratic burdens to enter a market.

Given the simulated path for wage rates and that owners have rational expectations, the agency model is simulated for 400 years and 10 times. The figures in Table(3.4) are calculated by taking the average of these 10 sets of results. Similarly, with the estimated parameters of agency model, the proprietorship model is simulated assuming the manager owns the firm. The results of this version of the model is presented in Table (3.5).

The reduction in mean entry costs increases the number of firms in the market by allowing more firms to enter. With more firms and a lower aggregate price index, incumbents face more competition. As a result, aggregate productivity increases in both models (Table 3.6 and Table 3.7). There are three sources of this productivity gain. The first is market selection. With more competition, the exit rate increases, and the average productivity among survivors is higher. This result is consistent with Hopenhayn (1992) and Melitz (2003). The second is the market reallocation of resources. With competition, the output share of high productivity firms increases (Table 3.6 and Table 3.7) increasing the covariance between productivity and market shares. This effect is also predicted by Hopenhayn (1992) and Melitz (2003), and can found in earlier empirical studies (e.g. Olley and Pakes (1996), Pavnick (2002))

Both of the effects described above are present in the agency model and the proprietorship model. The third source of increase in aggregate productivity is the change in the managerial effort choices. Although, markets respond to heightened competition in the same direction in both models, the magnitude of these responses differ. In the agency model, lowest productivity firm's manager increases his effort level by 23 percent. On the other hand, the manager of the highest productivity firm decreases his effort by 2 percent(Figure 3.1). When firms face heightened competition, in this model, exit occurs disproportionately among the lower productivity firms. A manager, who pays disutility when his firm exits, works harder when he faces higher risk of failure. By doing so, he indirectly affects the owners decision on exit. Moreover, probability of exit diminishes as firms become more productive. Therefore, the positive effect of risk on managerial incentives diminishes as firms become more productive. In addition, competition reduces market shares of firms and therefore profits. Lower profits is reflected as lower compensations to the managers which reduces the incentives to exert higher effort. As productivity increases, the weight of risk on managerial incentives decreases and the reduced compensations are still in effect. Eventually two effects almost offset each other and results in a decrease in managerial effort of 2 percent. The change in managerial responses reflect as changes in industry mix. Consequently, low productivity firms experience higher productivity growth compared to high productivity firms. Therefore, the mean employment growth of firms jumps from 0.0151 to 0.1541 (Table (3.6)).

In proprietorship model, the managerial responses are opposite. The change in the ownership structure of the firm changes how risk and reduced profits affect the incentives. In this version of the model, the risk of failure doesn't play a role among the firms, as managers already incorporate the loss of rents when they are making their exit decision. With competitive pressure, reduced profits decrease the firm values. Therefore, it becomes optimal for manager/owners to decrease effort and exit if the utility of keeping the firm is less than the utility equivalence of scrap value. As a result, lowest productivity firm's manager/owner decrease his effort level by 0.13 percent with competitive pressure. Similarly, the manager of highest productivity firm decreases his effort level by 0.06 percent (Figure 3.2). The decrease in the change of managerial effort as productivity increases can be explained with the market reallocation effect. Although, with competition firm profits decrease, the production also shifts towards more productive firms. Therefore, the decrease in effort level for high productivity firms is less than the decrease in lower productivity firms. Moreover, relatively smaller changes in effort levels also creates relatively less employment growth (0.01307 to 0.03905) compared to agency model (Table (3.5)). This, as well, shows that the market doesn't experience productivity growth among low productivity firms.

3.6 Conclusion

In this chapter, I develop and estimate a dynamic industrial evolution model with monopolistically competitive heterogenous firms and aggregate uncertainty using the Colombian Malt industry panel data from 1977 to 1990. The firms' ownership and management are separated, and owners cannot observe the amount of effort exerted by managers. This creates a principal-agent problem between the owners and the managers. The problem is solved using the dynamic contract framework developed by Phelan and Townsend (1991).

The simulated GMM estimation method is used to estimate the model parameters. The low turnover rate in the industry can be explained by big difference between the scrap value of firms and mean entry costs in the market In addition, the disutility managers incur if firm exits is about one fifth of the mean yearly managerial compensation.

To explore the effects of competitive pressure on managerial behavior, I resimulate the agency model with lower average entry costs, holding other estimated parameters fixed. Also, to determine how agency problems interact with competitive pressures, I simulate a low-competition and a high-competition scenario for a variant of the model in which managers own their firms, receive all profits, and make the entry and exit decisions (the proprietorship model).

Three sources of industrial efficiency are observed in the simulations results. Common to both versions of the model, the turnover rates increase with competitive pressure. As a result, the unproductive firms exit the market. Second, with competition, the covariance between firm productivity and market share increases. Higher covariance is due to the reallocation of resources towards more productive firms.

The third source of efficiency is the change in endogenous managerial incentives. In contrast to selection effect and reallocation of resources effects, the third source is not acting in the same direction in the two versions of the model. In the agency model, competitive pressure increases the effort level of lowest productivity firms' managers and the change in effort declines with productivity. Moreover, the highest productivity firms' manager drops his effort level. On the other hand, in the proprietorship model, all the managers/ owners decrease their managerial effort mostly among the lower productivity firms mainly due to reallocation of resources.

One area for future work is to link foreign competition to endogenous managerial effort choice and industrial efficiency. This will involve adapting the demand system to incorporate imported foreign goods, and it mean estimating the parameters with data on a tradeable-goods industry.

Table 3.1. Data Moments

Mean Entry Rate	Mean Log Employment
Variance of Entry Rate	Variance Log Employment
Mean Exit Rate	Mean log(revenue/cost)
Variance of Exit Rate	Variance log(revenue/cost)
Mean Number of Firms	Mean Employment Growth
Variance of Number of Firms	Variance employment Growth
Mean log Compensation	Cov LogEMP at t and t-1
Variance of log Compensation	Cov logCOMP at t and t-1
Cov LogCOMP and logEMP	Cov of logRev/Cost and logEMP

Table 3.2. Estimated Model parameters for Agency Model for Colombian Malt Industry

	Parameters	Standard Errors
Manager's utility function parameter, μ	0.97	0.04
Cost of effort parameter, η	1.85	0.52
Manager's disutility parameter, K	11178.4	4488.6
Incumbent's productivity process, intercept, $b3$	1.99	0.21
Incumbent's productivity process, root, $b2$	0.23	0.02
Incumbent's productivity process, effort, $b1$	0.12	0.11
Incumbent's productivity process, variance σ_ε	0.09	0.09
Returns to scale, θ	0.73	0.04
Elasticity of substitution between goods, σ	2.31	0.10
Mean entry cost, $\frac{FH}{2}$ (billion in 2005 $US)	2652	1551.6
Fixed Cost, f (million 2005 US dollars)	16.01	11.26
Scrap Value, m (million 2005 US dollars	51.5	9.39
Initial productivity distribution,mean, z	-0.48	0.35

Table 3.3. Model Fit - with Agency Problem

	Simulated Moments	Data Moments
Mean Entry Rate	$1.2316e-05$	$3.8295e-02$
Variance of Entry Rate	$3.6225e-07$	$0.2787e-02$
Mean Exit Rate	$6.6746e-04$	$3.2176e-02$
Variance of Exit Rate	$1.9608e-05$	$1.6014e-03$
Mean Number of Firms	1.4259	1.0583
Variance of Number of Firms	0.0208	0.0026
Mean Log Employment	8.6668	5.4340
Variance Log Employment	0.0239	0.6863
Mean log(revenue/cost)	0.3863	0.6478
Variance log(revenue/cost)	0.0026	0.1622
Mean Employment Growth	0.0151	0.0221
Variance employment Growth	0.0320	0.0145
Mean log Compensation	2.8982	6.4541
Variance of log Compensation	2.1536	0.2534
Cov LogCOMP and logEMP	0.0124	0.0657
Cov LogEMP at t and t-1	0.0087	0.6565
Cov of logRev/Cost and logEMP	0.0076	0.0414
Cov of logRev/Cost at t and t-1	0.0009	0.07132

Table 3.4. Experiment: in an Agency (benchmark) model

	$\frac{FH}{2} = 2.652e12$	$\frac{FH}{2} = 2.652e7$
Mean Entry Rate	$1.2316e-05$	$1.38182e-02$
Variance of Entry Rate	$3.6225e-07$	$1.09671e-02$
Mean Exit Rate	$6.6746e-04$	$8.24316e-02$
Variance of Exit Rate	$1.9608e-05$	$4.17595e-02$
Mean (Number of Firms/20)	1.4259	7.77435
Variance of (Number of Firms/20)	0.0208	2.16776
Mean Log Employment	8.6668	8.6572
Variance Log Employment	0.0239	0.0332
Mean log(revenue/cost)	0.3863	0.3804
Variance log(revenue/cost)	0.0026	0.0041
Mean Employment Growth	0.0151	0.1541
Variance employment Growth	0.0320	0.0426
Mean log Compensation	2.8982	2.6535
Variance of log Compensation	2.1536	1.7268
Cov LogCOMP and logEMP	0.0124	0.0009
Cov LogEMP at t and t-1	0.0087	0.0080
Cov of logRev/Cost and logEMP	0.0076	0.0113
Cov of logRev/Cost at t and t-1	0.0009	0.0008

Table 3.5. Comparison with the Benchmark Model, Proprietorship Model

	$\frac{F_H}{2} = 2.652e12$	$\frac{F_H}{2} = 2.652e7$
Mean Entry Rate	0.	$1.28826e-01$
Variance of Entry Rate	0.	$2.65282e-02$
Mean Exit Rate	$2.51256e-04$	$4.69849e-02$
Variance of Exit Rate	$2.51257e-04$	$3.96992e-02$
Mean (Number of Firms/20)	1.1328	5.35190
Variance of (Number of Firms/20)	0.018975	1.08536
Mean Log Employment	8.36921	8.39869
Variance Log Employment	0.02129	0.02952
Mean log(revenue/cost)	0.26097	0.27181
Variance log(revenue/cost)	0.00313	0.00467
Mean Employment Growth	0.01307	0.03905
Variance employment Growth	0.02988	0.04072
Cov LogEMP at t and t-1	0.00679	0.01029
Cov of logRev/Cost and logEMP	0.00768	0.01122
Cov of logRev/Cost at t and t-1	0.00080	0.00137

Table 3.6. Aggregate Productivity-When there is Agency Problem

	competition is low	competition is high
Aggregate Productivity	2.29083	2.69801
Mean Productivity	2.26652	2.66671
Covariance between market shares and productivity	$2.431e-02$	$3.130e-02$

Table 3.7. Aggregate Productivity-When there is no Agency Problem

	competition is low	competition is high
Aggregate Productivity	2.02951	2.81969
Mean Productivity	2.01288	2.79040
Covariance between market shares and productivity	$1.662e-02$	$2.929e-02$

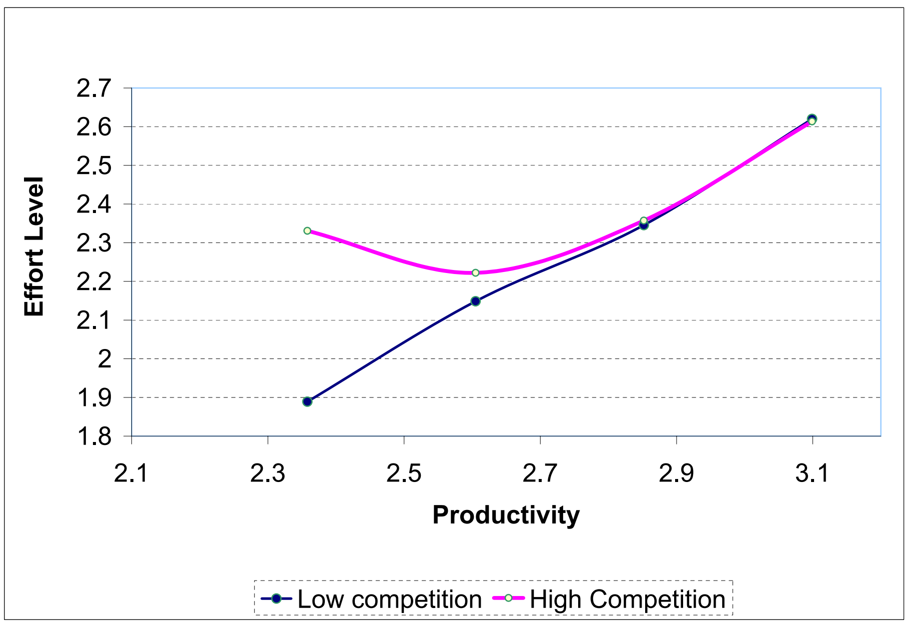

Figure 3.1. Managerial responses to competitive pressure when there is agency problem.

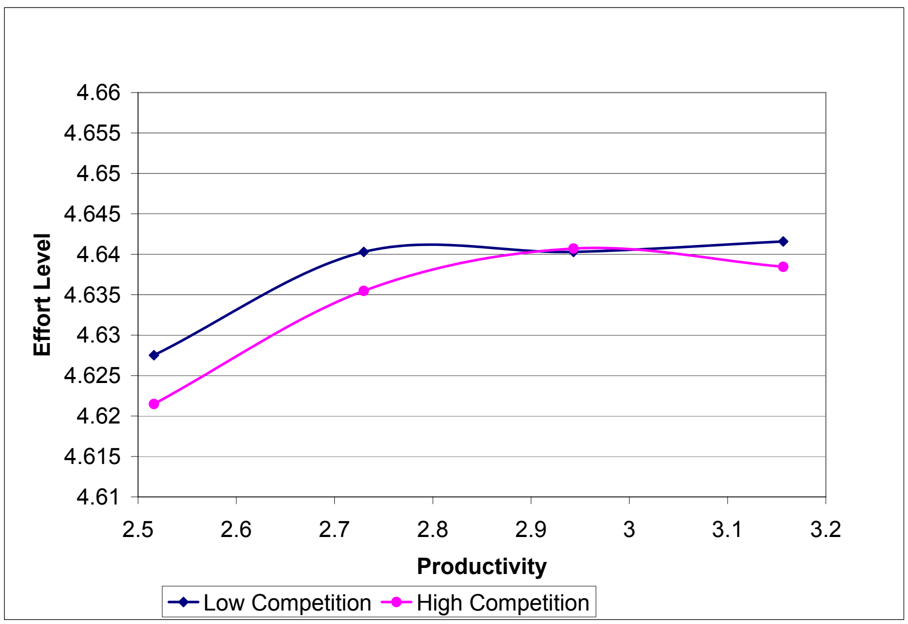

Figure 3.2. Owner's responses to competitive pressure when there is no agency problem.

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Chapter 4

Numerical Evidence on the Effects of Competitive Pressure on Organizational Choice of Firms

4.1 Introduction

When choosing the organizational form of a firm, owners make an important decision. It affects how the firm owners' income and the residual claimants' income are taxed, a firm's lifespan and how it grows. It also affects how a firm determines its financial structure. As discussed in the previous chapter, hired managers respond differently to competitive pressure than the owner managers. In this chapter, by endogenizing the organizational choice of owners in a structural dynamic industrial evolution model, we can also study the importance of organizational structure of the industry in aggregate productivity change when the industry responds to competitive pressure.

The analysis is based on the model which has several key features. First, in order to incorporate the agency problems into the model, two types of agents are introduced, a pool of entrepreneurs and a pool of managers. Entrepreneurs' managerial ability is lower than that of managers. However, they have the capital to start up a firm. In addition, their relationship within a corporation is characterized by a long term dynamic contract. Second, the choice of organizational form is endogenized. Entrepreneurs choose to corporate if the value of the new firm as a corporation is higher than a proprietorship. On one hand, costly effort exerted by entrepreneurs decreases the likelihood of proprietorships, on the other hand agency cost increases it. While deciding on the organizational form, potential entrants face this trade-off.

The model generated in the second chapter has aggregate uncertainty. To incorporate aggregate uncertainty into the estimation is time consuming. Therefore, I shut down the macro uncertainty. To get interesting results, the set of parameters is determined such that the parameters create both corporations and proprietorships in a steady state as the model anticipated. With the generated parameters, I perform counterfactual analysis. By decreasing the fixed entry cost, more firms enter the market and as a result competitive pressure increases. The value of firms is affected. However, the rate at which firms are affected depends on whether they are proprietorships or corporations. The change in the expected value of being a corporation or a proprietorship affects the decisions of potential entrants. My simulations show that potential entrepreneurs's decision of organizational form is affected by how competitive the market is.

This chapter is related to a line of empirical finance literature concerning the determinants of organizational form. These studies model the organizational choices as determined by taxation considerations, limited liability, and agency problems. The empirical studies suggest that dual-taxation on both corporate and personal income is the most important. These studies are reduced form analysis of these determinants. I am also interested in the same problem, but I'll use a structural model. This chapter uses the agency problems as well as the differences in managerial abilities among entrepreneurs and managers as determinants of different organizational choice. Firms face different taxation depending on the organizational form. Proprietors pay tax on residual claims at their personal tax rate, whereas corporate owners pay taxes on their income at the corporate rate and any income distributed to owners in the form of dividends is taxed at their personal tax rate. An increase in corporate tax rates relative to income tax rates discourages the formation of corporations. (Goolsbee (1998), Gordon and MacKie-Mason (1990, 1994), and MacKie-Mason and Gordon (1997).) Business risk is also a factor that works in favor of corporations. The proprietors are legally and financially responsible for all business activities. On the other hand, corporate owners have limited liability. They are only responsible for the capital they have invested in the firm. Hulse and Pope(1996) claim that limited liability is the most important determinant of incorporation, whereas MacKie-Mason and Gordon (1997) argues that its role is unclear. On the other hand, the empirical work lacks to support the agency problems as compared to the other factors (Cavalluzzo and Geczy (2003)).

The theoretical literature considers the agency problems as one of the main determinants of the choice of organizational form. The deviation from the proprietorship is seen as a trade-off between agency costs, and the bearing of residual risk (Jensen and Meckling (1976), Fama and Jensen (1985)). Hart(1983) , Scharfstein(1988) , Schmidt(1997) and recently Raith (2003) focus on how competitive pressure affects firms performance when there is moral hazard problem. These studies try to construct optimal contracts to induce managers to exert the recommended actions. This chapter also characterizes a long term dynamic contract between the firm owner and the manager based on Phelan and Townsend (1992). In addition, it goes one step further and endogenize the organizational form. By doing so, entrepreneurs increase the value of their firm by moving towards proprietorships.

This chapter is also related to a theoretical literature concerning the relationship between competition and industrial evolution and productivity. Hopenhayn (1992) and Melitz (2003) treat the firm level productivity as exogenous and selection effects are the only source of productivity gain. Other studies add the endogenous innovation or effort and find that Schumpeterian effects are also an important element of industry productivity increases (Boone (2000), Aghion,Harris and Vickers (1997) ,Erickson and Pakes (1995), Pakes and McGuire (1994), Atkeson and Burstein (2006), and Constantini and Melitz (2007)). The previous chapter extended this literature by incorporating agency problems as the third channel that competition affects productivity. This chapter goes one step further by endogenizing the organizational choice, and introduce another channel that influence the productivity distribution of firms and as a result aggregate productivity.

The rest of the chapter is organized as follows. Section 4.2 details the differences of the model used in this chapter to the model described in the second chapter. section 4.3 describes the numerical exercise results. Section 4.4 concludes.

4.2 Review of the Model and the Equilibrium

The model proposed in this chapter is the same as the general model as the potential owners make the organizational choice endogenously at the entry. That mean the wage rate is constant for all firms over time, w. In addition, omitting aggregate uncertainty bring the stationary distribution of firm types over their productivities, Γ. Here, I rewrite the proprietors and corporate owners problem,

A proprietor's state of his firm is the previous periods productivity φ_{t-1}. Given g, the distribution of firm productivities conditional on their previous periods productivity and the effort exerted, and state of his firm, a proprietor chooses his optimal effort level to maximize the expected value of his firm:

$$U_t^{prop}(\varphi_{t-1}) = \max_{a_t} \sum_{\Psi} \Big[\pi_t(\varphi_t) - (e^{\eta^{prop} a_t} - 1))$$

$$+\beta \max\{m, U_{t+1}^{prop}(\varphi_t)\}\Big]\, g(\varphi_t | a_t, \varphi_{t-1})$$

Similarly, a corporate owner's state of his firm is his firm's last period's productivity, φ_{t-1}, and the expected future utility promised to his manager, v_{t+1}. The corporate owner chooses an optimal contract, $\{a_t, \mathbf{c}_t(), \mathbf{v}_{t+1}()\}_{t=1}^{\infty}$ that maximizes his expected return given the observables of his firm and g. We can redefine his problem :

$$U_t^{corp}(\varphi_{t-1}, v_t) = \max_{a_t, \mathbf{c}_t(), \mathbf{v}_{t+1}()} \sum_{\Psi} [\pi_t(\varphi_t) - c_t)$$

$$+\beta \max\{m, U_{t+1}^{corp}(\varphi_t, v_{t+1})\}\Big]\, g(\varphi_t | a_t, \varphi_{t-1})$$

subject to

$$\begin{aligned} v_t &= \sum_{(\varphi \geq \varphi_t^*) \in \Psi} (u_t(c_t, a_t) + \beta v_{t+1}) g(\varphi_t | a_t, \varphi_{t-1}) \\ &\quad + \sum_{(\varphi < \varphi_t^*) \in \Psi} (u_t(c_t, a_t) - K) g(\varphi_t | a_t, \varphi_{t-1}) \end{aligned}$$

$$
\begin{aligned}
v_t &> \sum_{(\varphi \geq \varphi_t^{*,corp}) \in \Psi} (u_t(\mathbf{c}_t(\varphi_t|a_t, v_t), \widehat{a}_t) + \beta \mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t)) g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t) \\
&+ \sum_{(\varphi < \varphi_t^{*,corp}) \in \Psi} (u_t(\mathbf{c}_t(\varphi_t|a_t, v_t), \widehat{a}_t) - K) g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t)
\end{aligned}
$$

$$
\begin{aligned}
v_t &> \frac{1}{1-\beta}(c_0)^{\mu} \\
c_t &= \mathbf{c}_t(\varphi_t|a_t, v_t) \\
v_{t+1} &= \mathbf{v}_{t+1}(\varphi_t|a_t, c_t, v_t)
\end{aligned}
$$

The potential entrants solve the same problem described in chapter one, given U^{prop}, and U^{corp}. When an entrepreneur pays the fixed cost and draws his firm's initial productivity, he compares the value of his firms as a corporation or a proprietorship and chooses the one that maximizes the value of his firm. The difference in the value of firms arises for two reasons. First, effort is more costly for entrepreneurs. Therefore, the entrepreneur prefers to hire a manager who can exert the same effort at a less cost. Second, on the other hand, agency problems causes the compensation paid to the manager to be higher than his cost of effort. Therefore, the entrepreneur chooses to incorporate unless the cost of exerting effort himself is less than the current and future compensations to his manager in return to his effort.

Since there is no aggregate uncertainty in this version of the model, the equilibrium definition is adapted as follows:

The equilibrium is a set of value functions U^{prop}, U^{corp} and U^E for incumbents and potential entrants respectively and a corresponding contract for the corporations and policy functions for owners of the proprietorships, $h(a)$,and exit rule χ^{corp}, χ^{prop} given g, F and the wage rate $\overline{w}$.

1-Given g, the owner of a proprietorship solves his problem and the value function gives the policy function for the optimal effort level, $h(a)$.

2-Given g, the owner of a corporation solves his problem and the value function gives the contract, i.e corresponding recommended action a_t, the compensation function $\mathbf{c}_t()$, and the promised utility function $\mathbf{v}_{t+1}()$.

2- Given U^{prop}, U^{corp}, U^E characterizes the problem of potential entrants.

3- Firms' optimal decisions are consistent with steady distribution of firms over their productivities and the firms structures.

Solution of the equilibrium

The agents in the market solve their problems knowing that the market is in a steady state equilibrium. Therefore, the price index, P, of the goods sold in the market is constant. As a result, the agents in the market only require to know the price index,P, wage rate $\overline{w}$ to solve their optimization problems.

The algorithm to solve the equilibrium is described as follows.

1- Start with an initial guess on the price index, P.

2- Given $P, \overline{w}, g$ solve for the value functions of incumbents and entrants.

3- Simulate the environment over a long period of time, solving for the spot market equilibrium each period.

4- Update P by calculating the price index of the products when it reaches a steady state.

5- If updated P is sufficiently close to the previous P, stop. Otherwise, use the updated P and go back to step 2.

4.3 Numerical Exercise Results

The model is capable of explaining how the organizational structure of a firm is determined for a given level of competition. To simulate the environment and see how an increased competitive pressure affects the potential entrants organizational choice, I determine a set of parameters .The set of parameters are chosen so that there is turnover among both types of firms.

The basic parameters are based on the Colombian Dairy Industry where there are both corporations and family owned firms operating at the same time. Firms take the wage rate common and constant over time. I take the average of labor payments as the wage rate for the dairy industry. Second, I take the average of yearly industry revenues as a measure of total expenditure of the industry, R which amounts to 7047 (2005 US Dollars). Finally, following the standard parametrization in the literature, I set $\beta = 0.99$.

The remaining parameters to be determined are:

$$\Omega = (\theta, \quad b_1, \quad b_2, \quad b_3, \quad \sigma_\varepsilon, \quad z, \quad \rho, \quad \mu, \quad \eta_{man}, \quad \eta_{prop}, \quad K, \quad F_H, \quad f, \quad m,)$$

where θ is the production function parameter, the vector $(b_1, b_2, b_3, \sigma_\varepsilon)$ characterizes the AR(1) process of plant level productivity evolution, ρ is the demand parameter, the vector (μ, η_{man}, K) parameterizes the utility of manager. Entrepreneurs cost of effort is characterized with η_{prop} which is greater than that of the manager's, η_{man}. (F_H, f, m) are the cost parameters to be estimated. f is the fixed cost per period, m is the scrap value of the firm if the firm is ever liquidated, and F_H is the upper bound on the fixed entry cost distribution. Firms draw their fixed cost from a uniform distribution with support, $[0, F_H]$. Second, the distribution of initial productivity levels for entrants is normal with mean; z and standard deviation $\left(\frac{\sigma_\varepsilon^2}{1-b_2^2}\right)$. This allows the new entrants to draw from a different distribution than the incumbents'.[1]

A number of issues arise when constructing the simulations. First, all variables must be discretized in order to use standard techniques to calculate the value functions. For this, I use Tauchen's (1991) method. Second, I cannot observe the potential entrants in the market. Therefore, I arbitrarily fix, the number of potential entrants to $N_{pe} = 18$. This number exceeds the maximum number of entrants in one year in the Colombian dairy industry. Finally, given the potential for discontinuities in the model and the discretization of the state space, a simulated annealing algorithm is used to perform the minimization.

The simulated model with the chosen set of parameters generates value functions as in figure (4.1). The value function for corporations is steeper that the value function for proprietorships. The difference in the relative slope of different firms types can be explained as follows. The cost of effort for a proprietors is just a function of the level of effort exerted and the cost of effort parameters. This evaluation

[1] I used the Colombian dairy industry (SIC code 3112) for the period 1977 through 1990. The industry is composed of both corporations and proprietorships. The mean number of firms in the market is around 87 where 26 percent of which are corporations. There is a large number of firms in the market. The firms in the market do not export, this is also consistent with my non-tradable good economy assumption. The corporations and proprietorships differ in their turnover rates. The mean entry rate is 15 percent among family owned firms, where as it is 6 percent among corporations. Similarly exit rate is 11 percent among proprietorships, and 7 percent among corporations.

of cost is independent of the productivity level of the firm, the competitiveness of the market etc. However, the cost of effort for the owner of a corporation is the amount of compensation that is defined by the contract. The compensation is such that the manager exerts the recommended action. The compensation is not only a function of the level of effort and the cost of effort parameter and the risk aversion of the manager, it is also a function of the productivity level of the firm, the probability of failure it faces, the competitiveness of the environment. Therefore, the value function for corporations responds to changes in the environment more dramatically than that of proprietorships. For this specific set of parameters, the value of being a corporation is lower than the value of being a proprietorships at low levels of productivity. When the productivity is low, the owner is restricted with the profit potential of the firm. The compensations should not exceed the profits the firm can generate. As a result lower compensations at low levels of productivity results in lower efforts exerted by the managers which in turn lowers the value of the firm. As productivity increases the value of being a corporation increases faster than that of a proprietorship. Increased profit potential of a firm increases the marginal benefit of exerting extra effort by the manager. Therefore, it becomes cheaper for the owner to compensate the manager. In addition, higher profits decreases the restriction on compensation levels.

Given the preliminary set of parameters, I want to quantify the effects of heightened competitive pressure on organizational mix of the industry. To do so I decrease the fixed entry cost by 40 percent, holding all other parameters constant.

The simulations of value function, given the set of parameters, provide the policy functions for the entrepreneurs and managers. The model is then simulated for 400 years and 10 times. The simulated moments are calculated by averaging these 10 simulations and are presented in table (4.2).

The reduction in mean entry costs increases the total number of firms in the market. With more firms, incumbent firms face more competition. The new value functions and their relative position with respect to less competitive market values are in figure (4.2). With heightened competitive pressure, the value of being both a corporation and a proprietorship declines. The decline in the value of being a corporation is lower relative to a proprietorship. The reason can be explained with the findings of the previous chapter of my thesis. Competition lowers the potential profits firms can make. But for a corporate manager to avoid the increased risk of failure, he exerts more effort and require less compensation.[2] On the other hand, proprietors not only loose from the increased compensation they also loose production to more productive firms. As productivity increases, risk of failure effect declines and the decline in the value of being a corporation *might* exceed that of proprietors. The managers of corporations decrease their efforts because the decline in potential profits decrease the marginal benefit of exerting effort and the risk of failure is no longer in effect. Proprietors decrease their optimal efforts because of the same reason as corporate managers. The relative decline in the values depends on how risk averse the managers are and how much more expensive to exert effort for a proprietor relative to a manager.

The above numerical exercise shows that the model is capable of generating both types of firms in steady state equilibrium. When the industry faces more competitive pressure, the potential entrants optimal decisions at a given initial productivity changes as the values of firms change. A tougher new market for potential entrants requires higher initial productivities to enter the market. As a result it becomes even a rarer event[3] to draw a high enough productivity such that value of being a corporation exceed the value of being a proprietorship[4]. The numerical exercise supports this argument . When the competitive pressure is increased, the potential entrants choose to become proprietorships. Therefore, the steady state distribution of firms become all proprietorships.

[2]The incentive compatibility constraint becomes less if a constraint as the risk of failure increases. Therefore, the required compensation for the same amount of effort becomes lower in a more competitive environment.

[3]The potential entrants draw from a distribution which is different than the distribution of incumbents and is not a function of F_H (the upper bound of the support of the fixed entry cost distribution). That also means that the initial productivity is not affected by the increased competition in the market. In addition, higher competition increases the cutoff productivities of entering the market as a corporation or a proprietorships. That makes it even harder to draw a high enough productivity that favors being a corporation over proprietorships.

[4]The changes in the value function of being a corporation or a proprietorships depends on the parameters values mainly the cost of efforts, the risk aversion of the manager, the disutility he exerts when the firm is liquidated. Therefore, we might also observe an increase in the percentage of corporations for a different parameter sets.

4.4 Concluding Remarks and Future Work

The reason why a given industry have a mix of organizational structure is a question that gets a significant attention from the finance literature. The explanations in a broad classification are limited liability, dual taxation and the agency problems. The model generated here doesn't consider limited liability or dual taxation. The agency problems as well as the different managerial abilities among agents are used to generate mix types of firms in equilibrium.

The numerical exercise shows that when an industry faces heightened competitive pressure, the existence of agency problems among corporations and the different managerial abilities cause different types of firms respond differently. Heightened competitive pressure changes the optimal contracts offered to managers. Therefore, the change in the value of being a corporation at a given productivity level differs than the change in the value of being a proprietorship at the same productivity. However, the relative change is a function of how risk averse the managers are, how different the managerial abilities of proprietors and managers are and how competitive the environment is. The model, therefore, supports the previous literature claiming that agency is one of the reasons of different organizational structures. This study adds the level of competition to the list. The numerical exercise shows that higher competitive pressure affects the potential entrants decision on organizational structure.

The question , whether the competitive pressure increases the number of proprietorships or corporations does not have a clear answer. As I mentioned before, changes in the value functions depends on the managerial abilities and risk aversions. In other words, it depends on how severe the agency problems are.

The competitive pressure also increases the aggregate productivity of the industry. The selection effects and the Schumpeterian forces are two reasons why we observe an increase in industry-wide productivity. The previous chapter of my thesis describes the shirking effect as a third ling between competitive pressure and aggregate productivity. This chapter describes another link. The competitive pressure changes the organizational mix of industries. The previous work suggest that the small corporations (which are usually the new entrants) grow faster than small proprietorships if they can survive. With this in mind, any change in the corporate mix of an industry will have an additional affect on the change in aggregate productivity through the change in firm types. The future work on the study is to decompose the effect of organizational mix on the industry productivity.

The future work on this study is to estimate the parameters of the model using an industry where we observe mix types of firms. The estimated parameters will improve our understandings of whether the competitive pressure favors corporations or entrepreneurs prefer to avoid any agency problems when the market is more competitive.

Table 4.1. Model Parameters

	Parameters
Manager's utility function parameter, μ	0.92
Cost of effort parameter for the managers, η^{corp}	1.89
Cost of effort parameter for the entrepreneur, η^{prop}	2.83
Manager's disutility parameter, K	10.03
Incumbent's productivity process, intercept, $b3$	0.39
Incumbent's productivity process, root, $b2$	0.39
Incumbent's productivity process, effort, $b1$	0.37
Incumbent's productivity process, variance σ_{ε}	1.22
production function parameter, θ	0.56
Elasticity of substitution between goods, σ	1.58
Mean entry cost, FH(2005 US dollars)	2599547.53
Fixed Cost, f (2005 US dollars)	10529.85
Scrap Value, m (2005 US dollars)	15584.88
Entrants initial productivity draw distribution,mean, z	-0.07

Table 4.2. Experiment: When Competitive Pressure is High

	$\frac{FH}{2} = 1299773$	$\frac{FH}{2} = 649886.$
Mean Entry Rate_corp	$7.50\ e-03$	0
Mean Exit Rate_corp	$3.23\ e-02$	0
Mean (Number of Firms/20)_corp	$2.10\ e-02$	0
Mean Entry Rate_prop	$7.66\ e-03$	0
Mean Exit Rate_prop	$7.19\ e-03$	0
Mean (Number of Firms/20)_prop	0.14	0.41
Mean Log Employment_corp	6.32	0
Mean Log Employment_prop	6.30	6.32
Mean log(revenue/cost)_corp	-0.01	0
Mean log(revenue/cost)_prop	-0.10	-0.08
Mean Employment Growth	0.25	0
Mean log Compensation	4.12	0
Cov LogCOMP and logEMP	0.35	0
Cov LogEMP at t and t-1	0.15	0.15
Cov of logRev/Cost at t and t-1	$9.43e-02$	$9.33e-02$

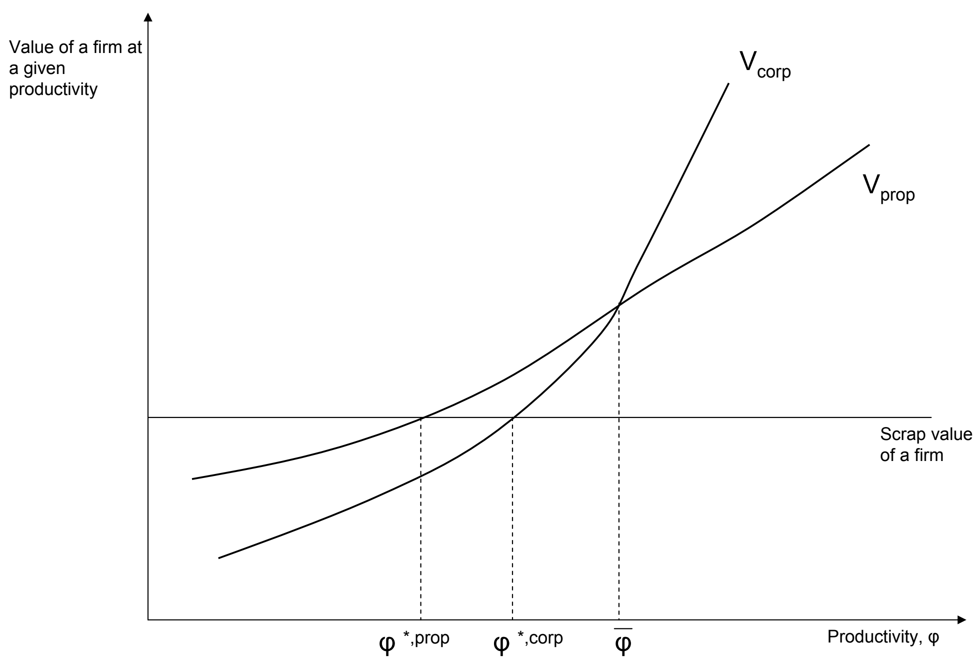

Figure 4.1. Value functions of being a corporation and a proprietorship.

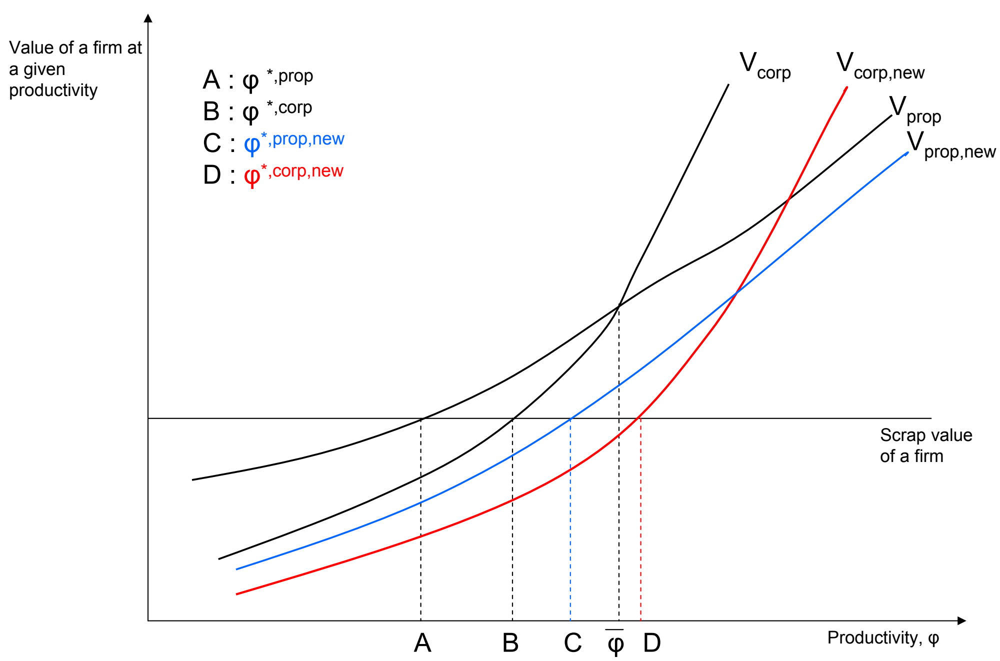

Figure 4.2. Value functions of being a corporation and a proprietorship when the competitive pressure is heightened

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Appendix A

The formal description of the lottery contract

The formal description of the lottery contract is below:

A contract specifies a recommended effort level, $a_t \in A$, a current compensation, $c_t \in C$, a promised discounted future utility, $v_{t+1} \in V$ as a function of the current promised utility level, v_t and current productivity realization φ_t. For reasons of computational tractability discussed by Phelan and Townsend (1991), lotteries are considered over (a_t, c_t, v_{t+1}) as well as deterministic values.

Finally, the contract with lotteries is a joint probability measure of $\lambda(a_t, c_t, v_{t+1}|v_t, \varphi_t)$. In this notation, a deterministic contract is represented by a triple of degenerate lotteries, each of which assigns probability 1 to some single alternative. An important economic constraint on the contract is that it must be incentive compatible. Incentive compatibility means that the manager prefers the recommended effort level a_t over all alternative effort levels $\widehat{a}_t$[1],

$$E_\lambda[(u(a_t, c_t|v_t, \varphi_t) + \beta v_{t+1})|\varphi_{t-1}] = \max E_\lambda[(u(\widehat{a}_t, c_t|v_t, \varphi_t) + \beta v_{t+1})|\varphi_{t-1}]$$

I now describe the timing of events. At the beginning of each period, the worker's wage and the distribution of firms over their productivities are observed. The owner has already observed the last period's productivity, φ_{t-1} and he has

[1]Expected utility of obeying the recomendation is greater than that of each possible deviations from the recomended effort level.

promised, v_t to the manager in previous period. With those in mind, the owner offers the joint probability of $(a_t, c_t, v_{t+1}, \varphi_t)$ specified by the contract. By incentive compatibility, the manager is willing to randomize over effort levels as the owner has specified, before observing the firm-specific productivity shock, ε_t. For a given action,a_t and previous period's productivity φ_{t-1}, current productivity is determined by the exogenous technology shock. After the manager observes the current productivity, he makes employment decisions. Since there are no firing or hiring costs, the employment problem is static. Finally production takes place and the profit-cash flow is observed by the owner. Knowing the aggregate state, the owner can also derive the value of current productivity. Conditional on productivity and the recommended action a_t, compensation is determined according to conditional probability measure $\lambda(c_t|a_t, \varphi_t)$. Finally, v_{t+1} is promised according to $\lambda(v_{t+1}|a_t, c_t, \varphi_t)$. At the end of the period, before observing tomorrow's macro state, the owner makes his exit or stay decision and the period ends.

At this point, the problem is not a linear programming problem. To make the problem a linear programming problem, restate the joint distribution $\lambda()$ as a product of marginal and conditional distributions:[2]

$$\lambda(a_t, c_t, \varphi_t, v_{t+1}) = \lambda(v_{t+1}|a_t, c_t, \varphi_t)\lambda(c_t|a_t, \varphi_t)g(\varphi_t|\varphi_{t-1}, a_t)\lambda(a_t) \tag{A.1}$$

and make the joint distribution $\lambda(a_t, c_t, \varphi_t, v_{t+1})$ be the contract that is offered by the owner. If the owner chooses $\lambda(a_t, c_t, \varphi_t, v_{t+1})$ that satisfies the technology constraint; eq(A.1), that means he has implicitly chosen $\lambda(a_t), \lambda(c_t|a_t, \varphi_t)$, and $\lambda(v_{t+1}|a_t, c_t, \varphi_t)$.

For every owner who observed φ_{t-1} as last periods productivity, promised v_t to his manager and the aggregate state of the world,Γ_t, w_t , the contract is defined as such a probability measure that satisfies the following constraints.

First, the contract implies the conditional probabilities of productivities given the effort level which are the choice variables. These implied probabilities must coincide with the conditional probabilities of productivities imposed by the exogenous technology, $g(\varphi_t|\varphi_{t-1}, a_t)$. Therefore, for every $\overline{a}, \overline{\varphi} \in A \times \Psi$, the *technology*

[2]The detailed explanation of the linearization of the owner's problem is explained in Prescott (2001). Application of this theorem here is sound not withstanding the fact that random variables are involved our endogenous ones.

constraint has to be satisfied.

$$\sum_{C,V} \lambda(\overline{a}_t, c_t, \overline{\varphi}_t, v_{t+1}) = g(\overline{\varphi}_t|\varphi_{t-1}, \overline{a}_t) \sum_{C,V,\Psi} \lambda(\overline{a}_t, c_t, \varphi_t, v_{t+1}) \tag{A.2}$$

Second, the discounted expected future utility of the manager must be equal to the promised value,v_t. So, the *continuation of utility constraint* is

$$v_t = \sum_{A,\Psi,C,V} (u(c_t, a_t) + \beta v_{t+1})\lambda(a_t, c_t, \varphi_t, v_{t+1}). \tag{A.3}$$

Third, the joint distribution has to represent a valid probability measure,

$$\begin{aligned} \sum_{A,\Psi,C,V} \lambda(a_t, c_t, \varphi_t, v_{t+1}) &= 1 \text{ and } \lambda(a_t, c_t, \varphi_t, v_{t+1}) \geq 0 \\ \text{for all } a, c, \varphi, v &\in Q, \Psi, C, V \end{aligned} \tag{A.4}$$

Lastly; the contract must be incentive compatible for all assigned and alternative action pairs, $a, \widehat{a} \in A \times A$. So given the way the contract has been linearized, the *incentive compatibility constraint* explained earlier can be rewritten as:

$$\sum_{\Psi,C,V} (u(c_t, a_t) + \beta v_{t+1})\lambda(a_t, c_t, \varphi_t, v_{t+1})$$

$$\geq$$

$$\sum_{\Psi,C,V} (u(c_t, \widehat{a}_t) + \beta v_{t+1})\frac{g(\varphi_t|\varphi_{t-1}, \widehat{a}_t)}{g(\varphi_t|\varphi_{t-1}, a_t)}\lambda(\widehat{a}_t, c_t, \varphi_t, v_{t+1})$$

In a dynamic setting, the owner's problem is to construct sequence of probability measures $\{\lambda_t(a_t, \varphi_t, c_t, v_{t+1})\}_{t=1}^{\infty}\}$.

For an incumbent firm's owner, the current state is his firms's previous period productivity level,$\varphi_{t-1,}$ the value promised to the manager last period v_t, and the aggregate states w_t and Γ_t. He finds the optimal contract among all contracts that satisfies the above constraints. The optimal contract maximizes the owner's expected discounted return given H, g, Θ. One can define the owner's problem as:

$$U_t(\varphi_{t-1}, v_t; \Gamma_t, w_t) = \max_{\lambda} \sum_{A,\Psi,C,V} [\pi_t(\varphi_t|\Gamma_t, w_t) - c_t$$

$$+\beta \max\{m, E_{\Gamma_{t+1},w_{t+1}} U_{t+1}(\varphi_t, v_{t+1}; \Gamma_{t+1}, w_{t+1}|\Gamma_t, w_t)\}\big] \lambda(a_t, \varphi_t, c_t, v_{t+1})$$

subject to

$$\sum_{C,V} \lambda(\overline{a}, c_t, \overline{\varphi}, v_{t+1}) = g(\overline{\varphi}|\varphi_{t-1}, \overline{a}) \sum_{C,V,\Psi} \lambda(\overline{a}, c_t, \varphi_t, v_{t+1}) \qquad \text{for all } \overline{a}, \overline{\varphi} \in A \times \Psi,$$

$$\begin{aligned} v_t &= \sum_{A,C,V} \sum_{(\varphi \geq \varphi_t^*) \in \Psi} (u_t(c_t, a_t) + \beta v_{t+1}) \lambda(a_t, \varphi_t, c_t, v_{t+1}) \\ &+ \sum_{A,C,V} \sum_{(\varphi < \varphi_t^*) \in \Psi} (\frac{1}{1-\beta} u(c_t, a_t) - K) \lambda(a_t, \varphi_t, c_t, v_{t+1}) \end{aligned}$$

$$\sum_{A,\Psi,C,V} \lambda(a_t, \varphi_t, c_t, v_{t+1}) = 1 \quad \text{ and } \quad \lambda(a_t, \varphi_t, c_t, v_{t+1}) \geq 0 \text{ for all } a_t, \varphi_t, c_t, v_{t+1}$$

$$\begin{aligned} v_t &> \sum_{A,C,V} \sum_{(\varphi \geq \varphi_t^*) \in \Psi} (u_t(c_t, \widehat{a}_t) + \beta v_{t+1}) \frac{g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t)}{g_t(\varphi_t|\varphi_{t-1}, a_t)} \lambda(a_t, \varphi_t, c_t, v_{t+1}) \\ &+ \sum_{A,C,V} \sum_{(\varphi < \varphi_t^*) \in \Psi} (\frac{1}{1-\beta} u(c_t, \widehat{a}_t) - K) \frac{g_t(\varphi_t|\varphi_{t-1}, \widehat{a}_t)}{g_t(\varphi_t|\varphi_{t-1}, a_t)} \lambda(a_t, \varphi_t, c_t, v_{t+1}) \end{aligned}$$

$$v_t > outside\_option$$

$$and$$

$$\Gamma_{t+1} = H(\Gamma_t, w_t)$$

Vita

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Esra Durceylan Kaygusuz was born in Eskisehir, Turkey on May 15, 1979. In 2001 she received her B.S. degree in Mathematics, from Bilkent University in Ankara, Turkey. In 2001 she enrolled in the Ph. D. program in economics at the Pennsylvania State University. Since 2001 she has been employed in the Economics Department of the Pennsylvania State University as a teaching assistant.