Product Market Competition and Corporate Governance Structure Change: Evidence from the Telecommunications Industry

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Abstract

In this paper we investigate how product market competition and corporate governance structure are affected by technological, competitive, and regulatory shocks on telecommunications firms brought by the Telecommunications Act of 1996. We find that the effect varies across segments of the Telecommunications industry. Telecommunication equipment and service firms experience increased competition, but no relative strengthening in corporate governance. In contrast, entertainment firms do not experience a change in competition, but adopt stronger governance structures that better control owner-manager agency conflict. We conclude that competition and corporate governance are substitutes, and that both act to mitigate principal-agent problems.

1. Introduction

Corporate governance structures are increasingly studied by academics, regulators, and investors in the wake of scandals at companies like Enron, Tyco, and WorldCom. Given this heightened level of scrutiny, researchers have been investigating what factors affect changes in governance structure. Most recent literature on governance dynamics focuses on the effects of industry-wide deregulation shock on governance structures (Kole and Lehn, 1999; Lehn, 2002; Rennie, 2006). However, this literature tends not to consider the effects of simultaneous changes in product market competition or variation in the effects of industry shocks on different segments within industries.

In this paper, we provide evidence of an association between product market competition and corporate governance structure change. We do so by investigating the effects of competitive and regulatory shocks on telecommunications industry firms between 1993 and 1999. This time period encompasses three years before and after the Telecommunications Act of 1996. During the mid-1990s the telecommunication industry saw growth opportunities increase, barriers between sectors decrease, new entries occur, and competition intensify. The Telecommunications Act of 1996 also reduced regulatory monitoring. Together, these changes create a natural experiment for disentangling links between product market competition and governance structure change.

We have two principle objectives in this study. The first is to investigate the effects of industry shock on the governance structures of telecommunications firms. Prior evidence demonstrates that banks, electric utilities, and airlines adopt governance structures that more effectively control owner-manager agency conflict following

deregulation (Crawford, Ezzell, and Miles, 1995; Hubbard and Palia, 1995; Bryan and Hwang 1997; Bryan, Hwang, and Lilien, 1999; Kole and Lehn, 1999; Rennie, 2006). Our second objective is to investigate whether governance structure changes for different segments of the telecommunications industry depend on the amount of change in their product market competition. Harris and Kraft (1997) and Larson and Mudd (1999) suggest deregulation may increase competition among only some industry segments. Thus, study of a particular industry without specifically considering its different segments may conceal the presence of substantive change in corporate governance structure for specific segments.

We find that product market competition increases for telecommunications firms after 1996. In addition, we find that corporate governance appears to strengthen as the average proportion of CEO pay in options increase 11.4 percent and the size of a company's board decrease 8.6 percent. However, since these shifts are similar to those that occur for our matched sample of industrial firms, we cannot conclude that deregulation leads to improved firm governance. Upon further investigation, we find that various industry segments respond differently to deregulation shock and associated changes in product market competition. In industry segments where competition increases after deregulation, governance structure shifts are similar to those that occur for our matched sample of industrial firms. In contrast, in industry segments where competition does not change after deregulation, firms tend to adopt comparatively better corporate governance structures. We conclude that product market competition substitutes, not only for regulatory monitoring, but also for governance structures, and that, industry shocks can have uneven effects upon the different segments that comprise an industry.

We contribute to the body of knowledge by finding a differential response by firms to deregulation. We show that telecommunication firms in less competitive segments adopt stronger governance structures than telecommunication firms in more competitive segments. These results provide additional information on the relation between competition and corporate governance structure. Some research shows competition complements strong firm governance (Januszewski, Koke and Winter, 2001; Grosfeld and Tressel, 2002; Karuna, 2008), whereas other research shows strong governance is most important in industries with less competition (Giroud and Mueller, 2007; Giroud and Mueller, 2008). The relation between corporate governance and competition is not clear and we provide additional evidence on this relation. Our research also builds on Kole and Lehn (1999) and Rennie (2006) who show the effects of deregulation shock on the governance of firms in the airline and electric utility industries. We document that various industry segments respond differently to deregulation shock, and to the associated changes in product market competition.

The rest of the paper is structured as follows. In Section 2 we discuss the telecommunication industry and corporate governance change, and present our testable hypotheses. Our sample selection and methodology is described in Section 3. In Section 4 we report empirical evidence on the effects of technological, competitive, and deregulation shocks on the governance structures of telecommunication firms. In Section 5 we document similar evidence across various segments of the telecommunication industry. We offer our conclusions in Section 6.

2. The Telecommunication Industry, Governance Change, and Testable Hypotheses

2.1. Background

The Telecommunications Act of 1996 introduced partial deregulation into the telecommunications industry. This Act permitted telecommunications firms from one industry segment to compete with those from other segments. For example, radio and television broadcasters were permitted to own cable television systems. This Act also eliminated ownership restrictions and reduced regulatory oversight by the Federal Communications Commission. In addition, rate structures for cable operators were relaxed to promote competition and flexibility, and incentives were offered to encourage cable companies to compete with local telecommunications firms. Seven regional Bell telephone companies were permitted to market long distance telephone services, and long distance telephone firms and cable companies were allowed to compete with local telephone service providers.

The resulting industry shock from this deregulation obviously affected firms in the telecommunications industry. One such effect is on the governance structures of those firms [Rennie, 2006; Bryan, Hwang, and Lilian, 1999]. This is because technological or regulatory change that increases substitutability of product market goods or services, or lowers barriers to entry, may act to reduce industry concentration and thus increase product market competition. Jensen (1986) suggests product market competition may compel managers to act in value-enhancing ways to ensure their own survival. In this case, increased competition following technological or deregulation shock will affect owner-manager agency conflict, potentially substituting for regulatory monitoring or other governance structures that encourage managers to act in shareholder interests. In addition, Jensen and Meckling (1976) and Demsetz and Lehn (1985) suggest regulators monitor managers, thereby effectively substituting regulatory oversight for managerial monitoring by directors. This implies that less regulatory monitoring leads to increased firm governance structures to control owner-manager agency conflict. Smith and Watts (1992) hypothesize that regulation limits the growth opportunities of regulated firms, which in turn, simplifies managerial jobs and reduces the need for strong governance structures. In support, Joskow, Rose, and Wolfram (1996) show that regulators discourage the use of stock option grants for CEOs. Therefore, if deregulation leads to an increased use of stock options, owner-manager incentives will tend to be better aligned with the interests of shareholders. Conversely, Jensen and Meckling (1976) suggest product market competition does not affect agency conflict created by the separation of ownership and control. Based on this argument it may be suggested that changes in competition stemming from technological or deregulation shock should not affect governance structure.

The empirical evidence investigating the effects of deregulation on the governance structures of deregulating firms generally indicate that firms move towards better governance structures. Kole and Lehn (1999) find evidence that deregulating the airline industry resulted in more concentrated equity ownership, higher CEO pay and options, and smaller boards. Crawford, Ezzell, and Miles (1995), Hubbard and Palia (1995), Bryan and Hwang (1997), and Bryan, Hwang, and Lilien (1999) find evidence that deregulating firms adopt stronger governance structures. Lehn (2002) provides evidence suggesting telecommunications firms adopt stronger internal governance structures post-1996. However, none of these studies explicitly control for trends in

governance that affect all firms, related changes in competition, or for the possibility that effects may vary by industry segment.

2.2 Testable Hypotheses

In this paper, we extend current literature by examining the association between competition and the governance structures for firms in the telecommunications industry and its different segments, while controlling for secular trends among firms in the general economy. Consistent with Kole and Lehn (1999), Core, Holthausen, and Larcker (1999), Lehn (2002), and Rennie (2006), we define governance structure change in terms of changes in the ownership, executive compensation, and board structure characteristics of firms. As suggested by Jensen and Meckling (1976), Demsetz and Lehn (1985), Stulz (1990), and Himmelberg, Hubbard, and Palia (1999), managers bear a greater proportion of any costs associated with over-investment and under-investment problems as their proportions of equity ownership increase. Consequently, similar to Jensen and Murphy (1990) and Grosfeld and Tressel (2002), we interpret greater proportions of CEO ownership as evidence of a reduction in agency costs, and therefore, governance structures that better control owner-manager agency conflict. Furthermore, executive compensation has been shown to affect the principal-agent problem by compensating managers for job complexity, increased risk of termination, and by aligning manager's incentives to those of stockholders. Consistent with Jensen and Murphy (1990) and Kole and Lehn (1999), we view greater proportions of CEO stock option grants to total pay as evidence of governance structures that better align CEO and shareholder interests. Lastly, Fama and Jensen (1983), Weisbach (1988), Hermalin and Weisbach (1991), Jensen (1993), and Yermack (1996) suggest smaller boards, and boards with greater proportions of outside to total directors, are more effective at monitoring managers on behalf of shareholders. Therefore, we also examine board size and the proportion of outside to total directors.

We start by investigating the telecommunications industry in total. As such, we perceive three possibilities. First, if the effect of increased product market competition dominates that of reduced regulatory monitoring, governance structures will become relatively less effective at controlling owner-manager agency conflict. We describe this as the *product market competition dominance hypothesis*. In contrast, if reduced regulatory monitoring dominates, governance structures will become stronger. We refer to this as the *regulatory monitoring dominance hypothesis*. Alternatively, we acknowledge that increased product market competition may substitute for decreased regulation, in which case we would not expect to see any governance structure change. We refer to this as the *substitution hypothesis*.

Next, we test whether product market competition and corporate governance structure change vary by telecommunications industry segment. Harris and Kraft (1997) and Larson and Mudd (1999) suggest deregulation may increase competition among some industry segments but not others. Similarly, we expect reduced regulatory monitoring in some industry segments to be offset by increased competition, potentially leading to little or no net change in the governance structures of firms in these segments. Conversely, we expect the reduced monitoring in other industry segments to be accompanied by a less dramatic change in competition, in which case there will be increased need for governance structures of firms that better control owner-manager agency conflict. Accordingly, we test for evidence of the *product market competition*

dominance hypothesis, the *regulatory monitoring dominance hypothesis*, and the *substitution hypothesis* for various telecommunications industry segments.

3. Sample Selection and Methodology

3.1. Sample Selection

Our initial sample consists of all 93 publicly-traded telecommunications companies listed in *Value Line* between 1993 and 1999.[1] In Table 1 we present the *Value Line* definitions of telecommunication industry segments by Standard Industrial Classification (SIC) codes. After screening for available data on CRSP, Compustat, ExecuComp, and proxy statements our final sample consists of the 62 telecommunications firm-year observations for the pre-deregulation period (1993-1995), and 123 firm-year observations for the post-deregulation period (1997-1999). Our data requirements include financial and governance data for at least two years for each of the pre-deregulation and post-deregulation periods. The increase in observations between these periods reflects the dramatic increase in new entries into the telecommunications industry after the deregulation of 1996.

To control for contemporaneous trends among comparable industrial firms, such as those identified in Hubbard and Palia (1995), Kole and Lehn (1999), Milliron (2000), and Rennie (2006), we also construct a control sample of industrial firms. Following the procedure recommended by Barber and Lyon (1996) and Kothari and Warner (1997), we match by choosing firms with prior three-year average return on assets (ROA) within 10% of our sample firm and then select the industrial firm closest in size, as measured by the book value of total assets. Matching occurs for the first year each telecommunications firm enters the sample. To avoid survivorship bias, matched control firms are used only once. By following this procedure, we generate a control group of 62 firm-year observations for 1993-1995, and 123 for 1997-1999.

3.2 Methodology

This paper employs a two-part study design corresponding to our two objectives. In the first model we investigate how changes in product market competition affects governance structure for firms in the telecommunications industry. This multivariate model controls for other factors that could affect changes in corporate governance, including fixed effects to control for firm invariant omitted variables.

$$(1)\quad Govchar_{it} = \beta_{0i} + \beta_1 Dereg_{it} + \beta_2 Dereg_{it} \times Telecom_{it} + \beta_3 Age_{it} + \beta_4 Age_{it}^{\,2} + \beta_5 Size_{it} + \beta_6 Lev_{it} + \beta_7 MTB_{it} + \varepsilon_{it},$$

The dependent variable, $Govchar_{it}$, represents one of four governance characteristics; CEO ownership, CEO options proportion, board size, and outside directors. The independent variables include a deregulation indicator variable ($Dereg_{it}$), a

[1] Kole and Lehn (1999) compare governance structures of airlines with those of industrial firms and regulated utilities during the period 1971-1992, or 7 years before through 7 years after, and 7 years before through 14 years after, the Airline Deregulation Act of 1978. In this paper, we interpret medium- to long-term as 3 years before and 3 years after the Telecommunications Act of 1976.

telecommunications firm indicator variable ($Telecom_{it}$), and the control variables CEO age (Age_{it}), firm size ($Size_{it}$), leverage (Lev_{it}), and growth opportunities (MTB_{it}) for firm i in year t. Controls for CEO age, firm size, leverage, and growth opportunities are included to control for previously established links between each of these variables and governance structure. The variables used in our analysis are defined in Table 2.

The sum of coefficients $\beta_1+\beta_2$ reflects governance characteristic change for telecommunications firms after deregulation. An F-test on the restriction, $\beta_1+\beta_2=0$, identifies the significance of this change. The coefficient, β_2, reflects governance characteristic change for telecommunications firms adjusted for secular trends among matched industrial firms. We interpret increases in CEO ownership, the proportion of CEO pay in options, the proportion of outside directors on boards, and decreases in board size as evidence of governance structure changes that better control owner-manager agency conflict.

In the second model we investigate how changes in product market competition affects governance structure characteristics separately for three segments of the telecommunications industry.[2]

$$(2)\quad \text{Govchar}_{it} = \beta_{0i} + \beta_1 Dereg_{it} + \beta_2 Dereg_{it} \times Ent_{it} + \beta_3 Dereg_{it} \times TE_{it} + \beta_4 Dereg_{it} \times TS_{it} + \beta_5 Age_{it} + \beta_6 Age_{it}^2 + \beta_7 Size_{it} + \beta_8 Lev_{it} + \beta_9 MTB_{it} + \varepsilon_{it},$$

For model (2), Ent_{it}, TE_{it}, and TS_{it} are indicator variables equal to one if the firm-year observation is in the entertainment, equipment, or service segments of the telecommunications industry, and where other variables are defined previously. The sums of coefficients $\beta_1+\beta_2=0$, $\beta_1+\beta_3=0$, and $\beta_1+\beta_4=0$ reflect governance characteristic change for entertainment, equipment, or service segment firms. F-tests on the restrictions $\beta_1+\beta_2=0$, $\beta_1+\beta_3=0$, and $\beta_1+\beta_4=0$ identify the statistical significance of these changes. The coefficients, β_2, β_3, and β_4, reflect governance structure characteristic change for entertainment, equipment, or service segment firms after controlling for secular trends among industrial firms.

4. Telecommunications Industry Evidence

The univariate evidence indicates that product market competition increases for both the sample of telecommunications firms and for the matched sample of industrial firms. In Figure 1 we find that product market competition increases for telecommunications and industrial firms between 1993 and 1999. Specifically, Figure 1 shows a trend toward a lower Herfindahl Hirschman index of industry concentration both for telecommunications and industrial firms.[3] We interpret reduced industry concentration as evidence of increased product market competition among both groups of firms.

[2] As shown in Table 1, there are six telecommunications industry segments: cable, entertainment, equipment, services, wireless network, and other. Insufficient data pre-1996 firms in the cable and wireless network industry segments in our study. However, we find evidence of differences between the entertainment segment and the equipment and services segments, and conclude that our study design is capable of demonstrating that differences in industry shock across segments are associated with differences in corporate governance structure change.

[3] Herfindahl Hirschman Index is measured as the sum of the squared market shares for each firm in the telecommunications industry, for comparable industrial firms, or for each sector in the telecommunications industry, as applicable.

We also find changes occur in the financial and governance structure characteristics of the sample firms between the pre-deregulation and post-deregulation periods. As shown in Table 3, Panel A, governance structure characteristics of both the sample of telecommunications firms and the matched sample of industrial firms changes during the 1990s. Stock ownership increases and board size decreases for both telecommunication and industrial firm CEOs. However, we find that CEO total pay, options grants, and the proportion of pay made up of options increase significantly after deregulation for the sample of telecommunications firms, but are unchanged for the matched sample. In sum, univariate evidence suggests a strengthening in governance structure characteristics for both telecommunication and industrial firms.

Summary statistics reported in Table 3, Panel B, also indicate that changes occur in the financial characteristics of telecommunications and industrial firms after deregulation. Both sets of firms realize an increase in size, increased leverage, and greater growth opportunities. However, the increase in firm size and growth opportunities are significantly greater for telecommunications firms. This highlights the acceleration of business opportunities for telecommunications firms due to deregulation.

We report multivariate, fixed effects evidence in Table 4. Consistent with the *regulatory monitoring domination hypothesis* we find evidence that telecommunication firms adopt governance structures that better control owner-manager agency conflict after deregulation. Specifically, in Column 2 we find that the proportion of CEO pay from option grants increases by 11.4 percent ($\beta_1+\beta_2 = 0.114$, p = 0.037). Similarly, the board size regression reported in Column 3 indicates telecommunications firms reduce the size of their boards by 8.6 percent after deregulation ($\beta_1+\beta_2 = -0.086$, p = 0.008).

However, we do not find an incremental increase for telecommunication firms above that for industrial firms. The coefficient, β_2, reflects governance characteristic change for telecommunications firms adjusted for matched industrial firms. In Columns 2 and 3, the β_2 coefficients are not statistically significant. Moreover, it can be suggested based on evidence in Column 1 that CEO ownership increases for industrial firms after deregulation ($\beta_1 = 0.018$, t = 3.81), but not for telecommunication firms ($\beta_1+\beta_2 = 0.004$, p = 0.498). Telecommunication firms have marginally less ownership ($\beta_2 = -0.014$, t = -2.33) than industrial firms after deregulation. Also, it is shown in Column 4 there is a higher proportion of outside directors for industrial firms ($\beta_1 = 0.034$, t = 2.30), but not for telecommunication firms ($\beta_1+\beta_2 = -0.010$, p = 0.551).

In sum, the results in Table 4 suggest telecommunications firms tend to adopt governance structures that better mitigate principal-agent problems after deregulation, but do not keep pace with secular trends toward even stronger governance structures among comparable industrial firms. This finding is consistent with the *product market competition dominance hypothesis*, where increased competition dominates reduced regulatory monitoring. However, we acknowledge that the variation in the effects of industry shock among different industry segments may be a factor. This issue is investigated in the next section.

5. Telecommunications Industry Segment Evidence

We present univariate evidence for three segments in the telecommunications industry, equipment, service, and entertainment in Figure 2 and Table 5. In Figure 2 we see that product market competition increases for equipment and service firms, but remains relatively unchanged for entertainment firms. To assess the statistical

significance of changes in competition between industry segments, we perform Wilcoxon rank sum tests on the Herfindahl Hirschman Index of industry concentration for each year. The median Herfindahl Hirschman Index decreases for equipment and service firms, suggesting product market competition increases for these industry segments. Results for entertainment firms suggest that product market competition does not change for this industry segment.

In Table 5, Panel A we find that stock ownership increases for entertainment and equipment firms after deregulation. Moreover, there is a higher proportion of CEO options for equipment and service firms. This evidence suggests the adoption of stronger corporate governance structures by firms in all three industry segments. However, increased ownership dominates for entertainment firms, while increased option use dominates for equipment and service firms. As shown in Table 5, Panel B, financial characteristics of telecommunications firms also vary by industry segment. Firm size and growth opportunities tend to increase for entertainment and service firms, whereas leverage and ROA tend to increase for equipment firms.

In Table 5, Column 1 we find evidence of a marked increase in CEO ownership for entertainment firms ($\beta_1 + \beta_2 = 0.046$, $p = 0.001$). Entertainment firms also have incrementally greater ownership than the sample of industrial firms ($\beta_2 = 0.031$, $t = 2.95$). These regression results suggest that entertainment firms increase CEO ownership by 3.1 percent more than industrial firms, resulting in a comparatively stronger governance structure. In comparison, equipment firms show lower ownership than industrial firms ($\beta_3 = -0.021$, $t = -2.62$) suggesting weaker governance structure, at least with regard to CEO ownership. These results demonstrate that in an industry segment, namely entertainment, where product market competition does not increase, firms respond to deregulation by increasing CEO ownership. This is consistent with Giroud and Mueller (2007) who show that when firms adopt anti-takeover laws those firms in non competitive industries experience a drop in performance while firms in competitive industries do not. This result is also consistent with Januszewski, Koke and Winter (2001), and with Giroud and Mueller (2008) who show a positive relation between governance and firm performance in non competitive industries and a weaker relation in more competitive environments. For equipment firms the proportion of CEO pay in options in Column 2 increases by 17.2 percent ($\beta_1 + \beta_3 = 0.172$, $p = 0.032$), however, the proportion of outside directors in Column 4 declines. Consequently, it is not clear whether governance structure strengthens for equipment firms. Finally, for service firms we find in Column 3 that board size declines by 11.4% ($\beta_1 + \beta_4 = -0.114$, $p = 0.013$) consistent with more effective monitoring.

In sum, we find that only entertainment firms adopt governance structures that better control owner-manager agency conflict relative to comparable industrial firms. The only regression in Table 6 that has a statistically significant β_2 coefficient is the CEO ownership regression. This is also the same industry segment that does not show an increase in competition. We note that industry shock in the telecommunications industry affects segments differently, and is accompanied by corresponding differences in corporate governance structure change. We conclude that competition impacts how an industry shock may affect how firms respond with changes in corporate governance. Product market competition may substitute not only for regulatory monitoring but also for governance structures.

6. Conclusions

In this paper we investigate the association between product market competition and corporate governance structure change by documenting the effects of technological, competitive, and regulatory shock on telecommunications firms. In general, we find that telecommunications firms adopt governance structures that better control agency conflict, however these governance changes do not better control agency conflicts than those found for a control sample of industrial firms. However, we find that governance changes differ by industry segment and the competitive environment within that segment. For example, the equipment and service segment experience intensified competition in the aftermath of reduced regulatory monitoring, and correspondingly do not strengthen their governance structures relative to a matched sample of industrial firms. In contrast, entertainment segment firms experience reduced regulatory monitoring, but unchanged competition, and adopt stronger governance structures relative to the matched sample. We conclude that competition may substitute, not only for regulatory monitoring, but also for those corporate governance traits that mitigate owner-manager agency conflict.

These results have implications for understanding the relation between product market competition and governance structure change. Existing research on corporate governance dynamics focuses on the effects of deregulation shock on entire industries. A typical assumption is that deregulation leads to lower regulatory monitoring. However, prior studies do not consider the potential effects of contemporaneous changes in product market competition or the effects of variation in shocks across different segments that comprise an industry. Our paper shows that governance structures may respond to reductions in regulatory monitoring and corresponding changes in product market competition, and that various industry segments may be affected differently by shocks to that industry.

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Figure 1
Herfindahl Hirschman Index of Industry Concentration for Sample Telecommunications and Industrial Firms

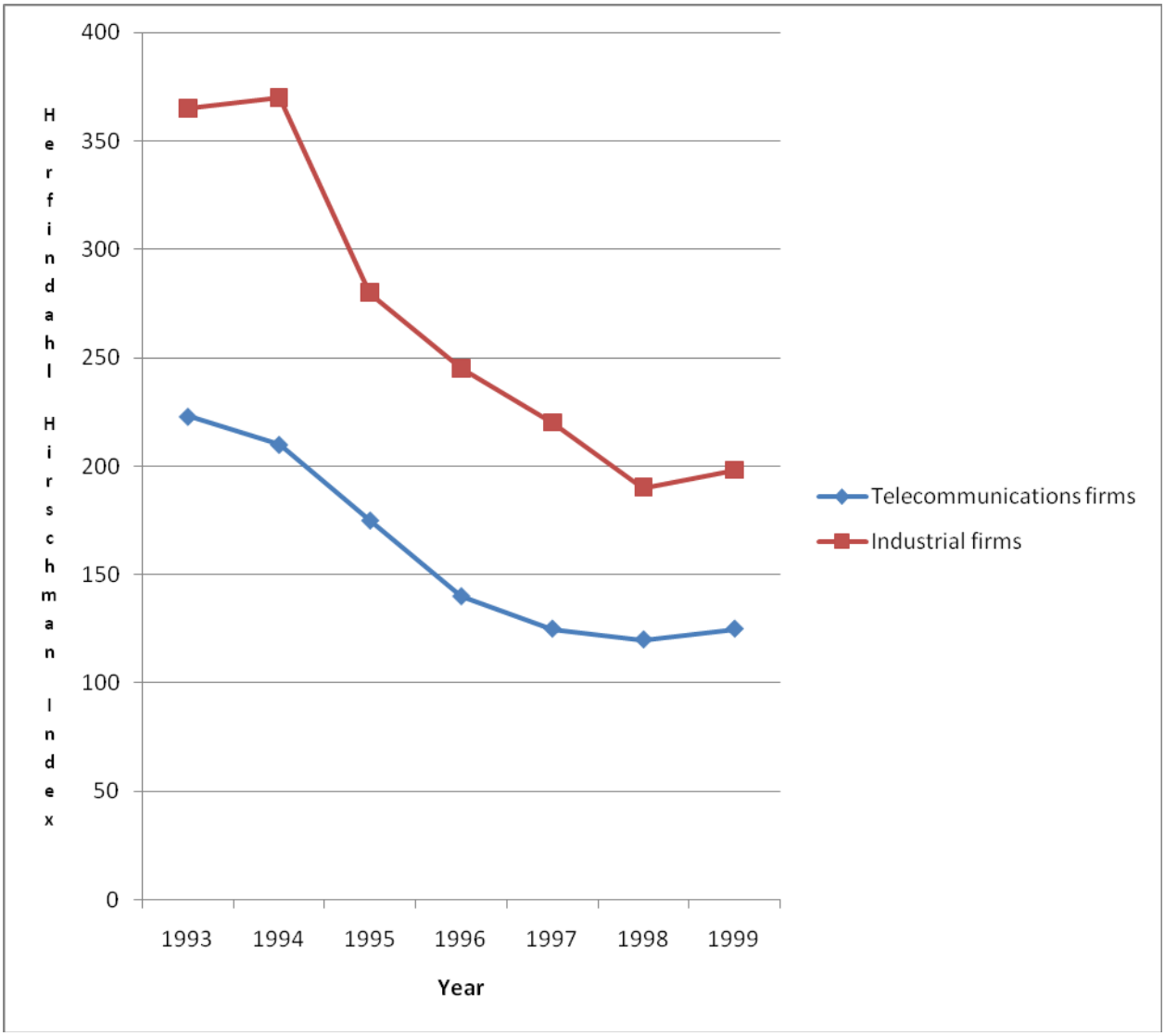

Figure 2
Herfindahl Hirschman Index of Industry Concentration for Entertainment, Equipment, and Service Industry Segment Firms

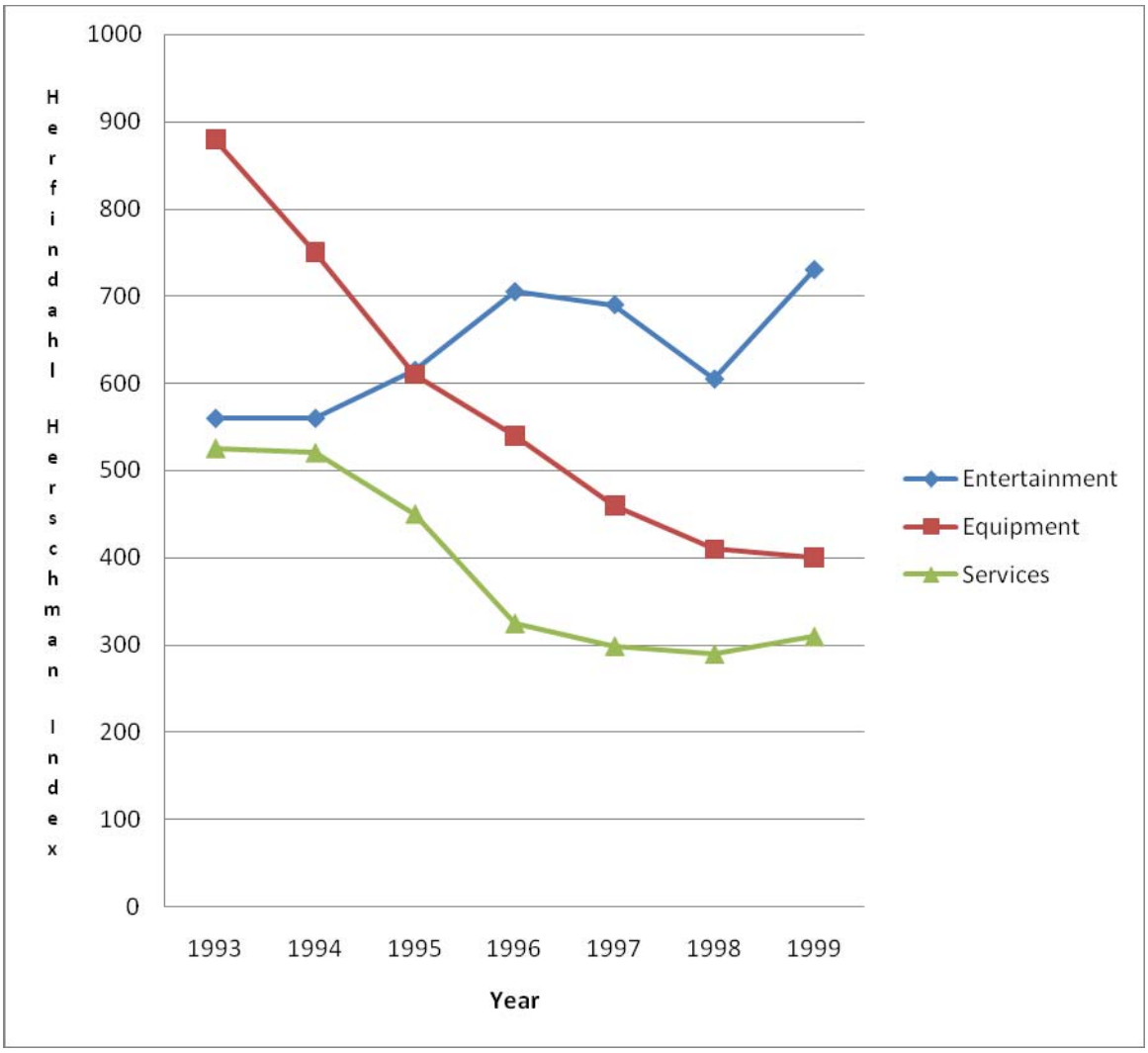

Table 1
Value Line Telecommunications Industry, Segments, and Standard Industrial Classification (SIC) Codes

Value Line telecommunications industry segment	SIC Code	SIC industry name	N (pre-1996)	N (post-1996)
Cable	4841	Cable and other Pay Television	0	5
Entertainment	2711	Newspapers: Publishing	0	0
	4832	Radio Broadcasting Stations	2	3
	4833	Television Broadcasting Stations	3	8
	7812	Motion Picture and Video Tape	0	3
	7900	Amusement and Recreational	2	3
Equipment	3357	Fiber Optic Cable	3	6
	3572	Computer Storage Devices	0	3
	3576	Computer Communications Equipment	0	2
	3661	Telephone and Telegraph Apparatus	5	12
	3663	Radio and TV Broadcasting Equipment	8	18
	3669	Communications Equipment	0	0
	3674	Semiconductors and Related	1	0
	7370	Services, Computer Programming	3	9
	7373	Computer Integrated System Design	0	0
Service	1623	Power and Communication Transmission	0	0
	4812	Radio/Telephone Communications	10	12
	4813	Telephone Communications	11	15
	4899	Communications Services	0	0
	7359	Equipment Rental and Leasing	0	2
	7389	Business Services	0	0
Wireless Network	3571	Electronic Computers	0	0
	3575	Computer Terminals	0	0
	7371	Computer Programming Services	0	3
	7372	Prepackaged Software	0	0
Other	1623	Water, Sewer, Pipeline Construction	1	3
	3060	Fabricated Rubber PDS, NEC	0	3
Total			49	110

Table 2
Variable Definitions

Variable	Definition
	Governance Characteristics Variables (Govchar)
CEO ownership	CEO ownership is the percent of CEO equity to total equity outstanding.
CEO options proportion	CEO options proportion is current year option grants to total CEO compensation.
Board size	Board size is the number of directors on the board.
Outside directors	Outside directors is the proportion of outside directors on the board.
	Deregulation and Industry Variables
Dereg	Deregulation indicator variable, equal to one if the year is later than 1996, and zero otherwise.
Telecom	Telecommunications firm indicator variable, equal to one for, and zero otherwise.
	Control Variables
Age	CEO age is the age of the CEO in years.
Size	Firm size is measured as the natural log of the market value of total assets, expressed in millions of 1997 constant dollars.
Leverage	Leverage is total debt scaled by the market value of firm assets.
MTB	Growth opportunities are measured using the market to book ratio.

Table 3
Governance and Financial Characteristics of Sample Firms

Mean (median) governance and financial characteristics of sample firm-year observations are shown. The sample consists of telecommunications and prior performance- and size-matched industrial firms for the pre-1996 (1993 through 1995) and post-1996 (1997 through 1999) periods for which data are available in CRSP, Compustat, ExecuComp, and proxy statements in Lexis Nexis or Global Access. There are 62 telecommunications firm-year observations and 62 industrial firm-year observations for the pre-1996 period, and 123 telecommunications firm-year observations and 123 industrial firm-year observations for the post-1996 period. Numbers of observations are shown below means. Mean difference in differences tests are also reported. Statistical significance is shown in bold.

	Telecommunications firms		Industrial control firms		Mean
	Pre-1996	Post-1996	Pre-1996	Post-1996	difference
	(1)	(2)	(3)	(4)	(5)
Panel A: Governance characteristics					
CEO ownership	**0.027****	**0.057****	**0.020*****	**0.053*****	-0.017
	(0.001)[b]	**(.004)**[a]	**(0.003)**[b]	**(0.007)**[a]	(0.2673)
CEO options proportion	**0.248*****	**0.425*****	0.190	0.260	**0.288*****
	(0.102)***	**(0.481)***[c]	(0.180)	**(0.211)**[c]	**(0.0001)**
Board size	**11***	**9***	**10*****	**9*****	**2.118****
	(11)***	**(8)*****	**(10)****	**(9)****	**(0.0013)**
Outside directors	0.762	0.703	**0.717*****	**0.754*****	0.030
	(0.786)[b]	**(0.727)**[b]	**(0.750)***[b]	**(0.778)***[b]	(0.1872)
CEO age	54	54	55	57	**4****
	(55)	**(56)**[b]	(54)	**(57)**[b]	**(0.0167)**
Panel B: Financial characteristics					
Size	**14,195*****	**25,447*****	**2,953*****	**5,523*****	**25,246*****
	(2,776)[c]	**(3,542)**[c]	**(937)**[c]	**(524)**[c]	**(0.0001)**
Leverage	**0.228*****	**0.236*****	**0.240***	**0.298***	**-0.155*****
	(0.204)	**(0.209)**[b]	**(0.237)***	**(0.313)***[b]	**(0.0001)**
MTB	**2.276*****	**3.492*****	**1.538***	**1.564***	**1.319*****
	(1.933)*[c]	**(2.678)***[c]	**(1.425)**[c]	**(1.337)**[c]	**(0.0001)**
Stock returns	**0.361***	**0.867***	**0.095*****	**0.089*****	**0.730*****
	(0.275)[c]	**(0.412)**[c]	**(0.079)**[c]	**(0.008)**[c]	**(0.0038)**
ROA	0.065	0.054	0.054	0.037	0.016
	(0.062)	**(0.070)**[b]	**(0.060)***	**(0.038)***[b]	(0.2422)
Panel C: Competition					
Herfindahl-Hirschman Index	**41.842*****	**39.930*****	115.246	48.550	16.620
	(37.779)[c]	**(12.301)**[c]	**(48.849)**[c]	**(44.880)**[c]	(0.5226)
Industry concentration ratio	**0.642*****	**0.660*****	**0.782****	**0.761****	**-0.135*****
(4 largest firms)	**(0.675)**[c]	**(0.754)**[c]	**(0.809)**[c]	**(0.783)**[c]	**(0.0007)**
N	49	110	43	102	304

*,**,*** means (medians) differ for telecommunications firms, or for industrial firms, between the pre- and post-1996 periods, or significance of Pr>|t| for differences in differences means tests, at the 10 percent, 5 percent, or 1 percent level.
[a],[b],[c] means (medians) differ for the pre-1996 period, or post-1996 period, between telecommunications and industrial firms, at the 10 percent, 5 percent, or 1 percent level.

Table 4
Fixed Effects Regressions of Governance Structure Characteristics on Deregulation and Interaction Term

Governance structure characteristics are regressed on a deregulation dummy, interaction term, and controls. Regressions are two-way fixed effects for sample firms for the period 1993-1999, excluding 1996. Firm dummy variables are not reported. Deregulation is the time dummy variable in these regressions. t-statisics are below coefficients and p-values below F statistics.

	CEO ownership (1)	CEO options proportion (2)	Board size (3)	Outside directors (4)
Deregulation dummy (β_1)	**0.018****	0.068	-0.049	**0.034***
	(3.81)	(1.34)	(-1.64)	**(2.30)**
Deregulation x telecom.(β_2)	**-0.014***	0.046	-0.037	**-0.044***
	(-2.33)	(0.68)	(-0.92)	**(-2.21)**
Age	-0.002	-0.003	0.019	-0.006
	(-0.66)	(-0.07)	(0.84)	(-0.52)
Age squared	0.000	0.000	-0.002	0.000
	(1.26)	(0.16)	(-0.87)	(0.60)
Log of firm size	**-0.012****	-0.003	**0.085****	0.009
	(-4.03)	(-0.08)	**(4.28)**	(0.86)
Leverage	0.002	0.045	0.123	0.056
	(0.016)	(0.36)	(1.68)	(1.54)
MTB	0.001	0.013	0.008	**0.008****
	(1.28)	(1.34)	(1.41)	**(2.98)**
F-test on H_0: $\beta_1+\beta_2=0$ (p-value)	0.004	**0.114***	**-0.086****	-0.010
	(0.498)	**(0.037)**	**(0.008)**	(0.551)
N	333	333	333	333
R squared	0.96	0.56	0.89	0.82
F	62.66	2.88	10.44	10.74
p-value	(0.001)	(0.001)	(0.001)	(0.001)

*,** p-values in bold are significantly different from zero at the 5 percent, 1 percent level.

Table 5
Governance and Financial Characteristics of Telecommunications Firms by Industry Segment

Mean (median) governance and financial characteristics of sample firm year observations are shown. CEO total pay and CEO options grants are reported in thousands of 1997 dollars. Stock returns are one-year holding period stock returns net of value-weighted stock market returns. Return on assets is the three-year average of earnings before interest, taxes, depreciation, and amortization, all scaled by total assets. Other variable definitions are provided in Table 2. Numbers of observations are shown below means.

	Entertainment		Equipment		Service	
	Pre-1996	Post-1996	Pre-1996	Post-1996	Pre-1996	Post-1996
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Governance characteristics						
CEO ownership	**0.050****	**0.187****	**0.030****	**0.033****	0.007	0.010
	(0.021)*	**(0.145)***	(0.006)	(0.007)	(0.000)	(0.000)
CEO options	0.294	0.279	**0.215****	**0.502****	**0.309****	**0.424****
proportion	(0.000)	(0.000)	**(0.047)****	**(0.550)****	(0.293)	(0.350_
Board size	9.750	8.958	9.321	7.844	13.161	12.021
	(10)	(8)	**(9)***	**(7)***	**(14)***	**(11)***
Outside directors	0.620	0.657	**0.790****	**0.747****	0.782	0.762
	(0.667	(0.714)	(0.789)	(0.750)	(0.833)	(0.762)
CEO age	50	55	**55***	**54***	56	55
	(51)	(55)	(55)	(56)	(57)	(57)
Panel B: Financial characteristics						
Size	**14,899***	**28,241***	6,599	14,683	**34,148***	**60,520***
	(2,890)	(4,202)	(1,471)	(1,499)	(22,164)	(34,911)
Leverage	0.268	0.262	**0.094****	**0.100****	0.300	0.386
	(0.217)	(0.256)	(0.100)	(0.019)	(0.335)	(0.355)
MTB	**2.608***	**5.750***	3.403	4.318	**1.695****	**2.405****
	(2.123)	(2.805)	(3.323)	(3.010)	**(1.644)****	**(2.285)****
Stock returns	**0.267***	**0.758***	0.729	0.557	0.220	1.249
	(0.117)	(0.451)	(0.698)	(0.156)	**(0.186)****	**(0.497)****
ROA	0.023	0.015	**0.103****	**0.053****	0.052	0.031
	(0.017)	(0.027)	(0.092)	(0.085)	(0.059)	(0.054)
N	12	24	28	64	31	47

*,** medians differ for the pre-1996 from the post-1996 period at the 5 percent, 1 percent level.

Table 6
Fixed Effects Regressions of Governance Structure Characteristics on Deregulation and Interaction Terms

Governance structure characteristics are regressed on a deregulation dummy, interaction terms, and controls. Regressions are two-way fixed effects for sample firms for the period 1993-1999, excluding 1996. Firm dummy variables are not reported. Deregulation is the time dummy variable in these regressions. t-statisics are below slope coefficients and p-values below F statistics.

	CEO ownership (1)	CEO options proportion (2)	Board size (3)	Outside directors (4)
Deregulation dummy (β_1)	**0.015****	0.066	-0.049	**0.034***
	(3.47)	(1.31)	(-1.66)	**(2.28)**
Deregulation x entertainment (β_2)	**0.031****	0.030	0.012	0.020
	(2.95)	(0.25)	(0.16)	(0.58)
Deregulation x Equipment (β_3)	**-0.021****	0.106	-0.032	**-0.069****
	(-2.62)	(1.17)	(-0.60)	**(-2.60)**
Deregulation x Service (β_4)	-0.014	-0.001	-0.065	-0.041
	(-1.87)	(-0.01)	(-1.29)	(-1.64)
Age	-0.000	-0.007	0.022	-0.001
	(-0.08)	(-0.18)	(0.94)	(-0.13)
Age squared	0.000	0.000	-0.000	0.000
	(0.60)	(0.28)	(-0.99)	(0.17)
Log of firm size	**-0.012****	0.004	**0.087****	0.007
	(-4.15)	(0.12)	**(4.35)**	(0.74)
Leverage	0.006	0.033	0.128	0.067
	(0.58)	(0.26)	(1.75)	(1.84)
MTB	0.000	0.012	0.007	**0.007***
	(0.30)	(1.23)	(1.13)	**(2.51)**
F test on H_0: $\beta_1+\beta_2=0$	**0.046****	0.096	-0.037	0.054
	(0.001)	(0.400)	(0.579)	(0.109)
F test on H_0: $\beta_1+\beta_3=0$	-0.006	**0.172***	-0.081	-0.035
	(0.429)	**(0.032)**	(0.086)	(0.131)
F test on H_0: $\beta_1+\beta_4=0$	0.001	0.065	**-0.114****	-0.007
	(0.842)	(0.404)	**(0.013)**	0.743
N	333	333	333	333
R squared	0.97	0.78	0.88	0.83
F	52.50	2.69	10.96	11.62
p-value	(0.001)	(0.001)	(0.001)	(0.001)

*,** p-values in bold are significantly different from zero at the 5 percent, 1 percent level.

An Assessment of OECD Health Care System Using Panel Data Analysis

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Abstract

The health care delivery system of twenty five OECD nations is analyzed in this paper. This study seeks to assess the significance of various factors contributing to life expectancy and infant mortality for the 1990-2002 period. A fixed-effects panel data model was used to examine the factors influencing life expectancy and infant mortality. More specifically the impact of economic, institutional, and social factors in determining the dependent variables are measured and evaluated.

1. Introduction

Expenditure on health and healthcare has escalated considerably in the OECD countries especially due to advancement and dissemination in medical technologies, population ageing and rising public demand. Health expenditure as a percentage of GDP was around 8.5% in 2002. In 1984, the average per capita health care expenditure of the OECD countries was $870 (with purchasing power parity adjustment). This figure rose to $2144 in 2002. Relative to the overall mean of the OECD countries, per capita health care expenditure growth has doubled compared to economic growth in the U.S. over the past 20 years. Lately, due to concerns over national security, there is an increasing trend in the OECD nations to reallocate resources from health care spending to expenditures related to security threats.

Figure 1 shows the comparison of life expectancy and health care expenditures for OECD countries in 2002. While trying to minimize healthcare costs, both developed and developing nations are making an effort to improve access to and quality of health care services for their citizens. Thus, identifying the relative role of various factors contributing to health care outcome is essential in understanding the issue and devising relevant policies to address it.

The majority of research on OECD health systems has focused on correlations between health care expenditures and economic performance of the member countries. These studies attempted to assess factors contributing to health using qualitative measures. Quantitative studies on the subject are limited, and a majority of the existing studies have used either time series or cross section analysis.

The objective of this paper is to apply the panel data model to measure and assess the importance of factors determining the two commonly accepted measures of health care outcomes: life expectancy and infant mortality. In this study, the factors used as independent variables are divided into economic, institutional, and social aspects. The aim of the study is to look at the comparative significance of each of the factors in determining life expectancy and infant mortality. The rest of the paper is structured as follows: section 2 presents a literature review and section 3 outlines the data and empirical methodology. Section 4 discusses the empirical findings, followed by conclusions in section 5.

2. Literature Review

The health care system plays a vital role in any economy as discussed in a study by Bloom et al. (2003). There are studies that concentrated on the relationship between income inequality (using GDP per capita as a proxy) and health care in different countries (Preston, 1975; Deaton, 1999; Pritchett and Summers, 1996; Subramaniam et al, 2002; Asafu-Adjaye, 2004; Murthy, 2006; Cutler et al., 2006; Alsan et al., 2006). However, Bloom and Canning (2007) extended Preston's (1975) work and questioned the appropriateness of using GDP per capita as a proxy for economic well-being. In this study, health care expenditure is used as an alternative.

There are a number of recent comparative analyses of health care systems in the literature. Among the studies, only a few focused on the correlations between health care outcomes; i.e., life expectancy and infant mortality, and the contributing elements such as institutional, economic and social factors. None of the other OECD studies in the literature concentrated on these factors.

The magnitude of correlation between health care expenditure and GDP has been tested and reported by some published research. MacDonald and Hopkins (2002) using the OECD samples, confirmed a strong correlation between the two variables cited above and suggest the presence of unit root in both GDP and health care expenditure data. Okunade et al. (2004) by calibrating annual growth rate of OECD health care expenditure data, tested the stationary nature of health care expenditure and illustrated the advantages of using jackknife re-sampling method for short time series. They further argue that the health care spending growth is driven by economic and institutional factors. In addition, Carrion-I-Silvestre (2005) using OECD panel data, verified the presence of structural breaks for real per capita health care expenditures and real per capita GDP.

To assess the elasticities of healthcare expenditure and GDP, Okunade and Suraratdecha (2000) used maximum likelihood estimates of the Box-Cox transformation regression model. They concluded that health care expenditures and GDP elasticities among OECD nations showed that health care is not a luxury commodity. A similar study by Anindya (2005) using OLS technique on OECD data for the period of 1990-98, confirmed the earlier findings of health care as being a non-luxury service among the fifteen-nation sample. Using health production function for the United States, Thornton (2002) contended that additional medical care utilization is ineffective on improving health as measured by life expectancy and mortality rate. Thus, this suggests that policies to promote health in the U.S. should focus on socioeconomic status and lifestyle.

Anderson and Hussey (2001) using OECD data focused on how performance of the health care systems varied among the twenty-nine members. In a five-nation (New Zealand, UK, US, Canada, and Australia) study, Blendon et al. (2003) found that a significant number of citizens are unhappy with their health care system. Anell and Willis (2000) suggest that instead of expenditure measures, using a resource profile is more desirable alternative for an international comparison of health care systems. Anderson et al. (2003) revealed that differences in health care spending patterns between the U.S. and the rest of the OECD member nations are mostly explained by higher prices in the U.S.

Mirmirani and Mirmirani (2005) concentrated on the efficiency of OECD health care systems using Data Envelopment Analysis (DEA), a linear programming technique which ranked member nations according to their respective DEA scores. For the period of investigation (1990-2000), the efficiency results were mixed. Although some nations had high ranking in both measures of health care outcomes, none had been ranked as inefficient for both measures. On the other hand, some members have improved

efficiency in life expectancy, but had done poorly in infant mortality, or visa versa. Evans et al. (2001), with a sample of 191 countries worldwide, conducted a comparative efficiency of national health care systems. Using life expectancy as health output, and health expenditures and average schooling as inputs, they conclude that increasing resources result in improved health. In addition, more efficient use of resources can also contribute to the overall health care of a nation. Shaw et al. (2005) investigates the impact on changes in life style and pharmaceutical expenditure on life expectancies among OECD countries. With a specified cohort of the population; i.e., males and females at the age of 40 (for the period of 1960-1999), they find that increasing pharmaceutical expenditure, lowering tobacco consumption and increasing fruit and vegetable consumption have noticeable and positive but different impact on life expectancies of the observed population.

3. Empirical Methodology

3.1. Data and Variables

The study uses annual data from OECD Health Data 2004. Countries under investigation include all OECD member nations except Korea, Luxembourg, Norway, Slovak Republic and Turkey. These countries were excluded due to many missing observations. The concentration of the paper is for the period of 1990-2002. Running a time series analysis of individual countries for 12 years is not statistically advisable (less than 30 sample size). So, we decided to pool the data and run a panel data analysis for 25 OECD countries.

The variables used in the regression and their definitions are given in this section. In the first regression, the dependent variable is life expectancy at birth for the total population. It was estimated using the unweighted average of life expectancy of men and women. Life expectancy represents the typical number of years that a person at that age can be anticipated to live, presuming that age-specific mortality levels stay constant. In the second regression, the dependent variable is maternal and infant mortality. It encompasses the number of deaths of children under one year of age that occurred in a given year, expressed per 1000 live births.

The independent variables used in the regressions are: medical technology (computed tomography scanners per million populations), health employment (practicing physicians' density per 1000 people), in-patient utilization per capita (number of acute care bed days), prevention immunization (% of measles children immunized 2000), total expenditure on health per capita (US$ PPP), alcohol consumption in litres per capita, and educational level (school expectancy years). Table 1 and 2 provides acronyms, descriptions, expected signs, and justifications for using the variables in the two regressions. Like alcohol consumption, another common factor that influences health status of any nation is the prevalence of smoking. However, because of limitation on data availability, we are unable to include any proxy of smoking in our study. Also, we encountered similar constraint in incorporating measures of income inequality, i.e. GINI coefficient. As indicated earlier in the literature review, using real GDP per capita for capturing inequality between nations may not be appropriate for this study (see Bloom and Canning (2007) for details).

3.2. Regression Analysis

For the panel data analysis, the data set consists of i = 1,…..,N cross sections (number of groups), and several points of time series for each group t = 1,….,T(i), or a cross section of N time series each of length T(i). Panel data analysis can be divided into fixed effects (FE) and random effects (RE) models[1]. FE model is also known as least squares with group dummy variables. In the FE model, variation across groups (individuals) or time is confined in shifts of the regression function; i.e., changes in the intercepts. On the other hand, the RE model treats the individual effects as a random component of the error term. The RE model assumes a structure on the error term, and a feasible generalized least-square technique determines the parameters. The major drawback of the RE model is the assumption that the unobserved individual effect is uncorrelated with the observed regressors. GLS estimation yields biased and inconsistent parameters in the presence of such correlation. The RE model is appropriate when correlated omitted variables are not an issue. The estimation technique that best fit the data were chosen based on Likelihood ratio, Breush and Pagan's LM test, and Hausman's Chi-squared statistics. The FE model turned out to be the best specification.

The fixed effects regression specification was estimated in the form of:

$$Lit = \eta_1 \delta_{1it} + \eta_2 \delta_{2it} + \ldots\ldots\ldots + \beta' Q_{it} + \mu_{it}$$

where Lit is the average life expectancy (or infant mortality in the second regression) in country i =1,……, N, year t = 1,….,T(i).

Q_{it} is the vector of independent variables.

δ_{jit} is the group specific year dummy variables.

η_i is the individual specific constant or the country effect.

μ_{it} is a classical disturbance term with $E[\mu_{it}] = 0$, $var[\mu_{it}] = \sigma^2_{\mu}$.

4. Empirical Results

The primary objective of this study is to identify the determinants of life expectancy and infant mortality in the OECD countries. Our goal was to be as inclusive as possible by incorporating independent variables that are relevant as well as considering variables from the existing health care literature. In choosing the variables, comprehensive factors that directly and indirectly (social) influence health care outcomes have been considered. However, some variables were dropped (smoking and GINI coefficient) due to missing data for the period of this study.

In Table 3, regression results of the FE of life expectancy for 25 OECD countries are reported. Life expectancy was regressed on various independent variables using panel data. The signs of the parameter estimates of all the variables in the life expectancy regression were as expected. Six of the seven variables (except ALCO) were statistically significant at the 5% level or better. Table 4 presents regression results of the FE of infant mortality for 25 OECD countries. Three of the seven variables were statistically significant at the 5% level or better. With the exception of CT scan as a proxy for medical technology (TECH) and alcohol consumption (ALCO), all other variables in the infant mortality regression followed the expected sign. Nevertheless, neither of the two variables cited earlier were statistically significant at the 5% level.

[1] See Chamberlain (1982, 84), Hsiao (2004) and Baltagi (2005) for a comprehensive analysis of panel data.

Parameter estimate of health employment (PHYS) was strongly significant (at 1% level) in influencing life expectancy and infant mortality in OECD countries. The empirical estimate of PHYS was the most significant in both regressions, which connote that the availability of the health care personnel is really crucial. This indicates that larger number of physicians means better access to health services - especially in rural areas, and shorter waiting times for medical attention, lead to better health care delivery. Thus, investment in health related human capital especially physicians and nurses has a greater impact on improving life expectancy and reducing infant mortality. Looking at the data, one observes significant differences in numbers of practicing doctors and nurses per 1000 population among OECD countries, ranging from less than two to more than four. Our empirical results indicate that scarcity of health related human capital will have a substantial adverse impact on life expectancy and infant mortality in many OECD countries.

Preventive immunization (IMMUNI) was significant (at the 1% level) in both the regressions. However, immunization plays a more important role in reducing infant mortality than increasing life expectancy. The data showed that on average OECD countries only spend less than 3 percent of total health expenditure on preventive health awareness programs[2.] Our regression results suggest that even with current low health expenditure on preventive medicine, such investment have a relatively high impact on influencing life expectancy and infant mortality. According to the OECD Indicators 2005, awareness of better life-style alternative will significantly increase life expectancy. It is evident that 38% of people in OECD countries die because of heart diseases and strokes due to lack of public consciousness on diet, exercise and healthy food choice. In-patient utilization (PATIENT) as a proxy for health services utilized was a fairly important factor in the life expectancy regression but statistically insignificant in the mortality regression.

One would expect higher per capita health care expenditure would improve the overall health in the society. Our empirical results indicate that the level of health care expenditure among OECD countries has been an important factor in extending life expectancy but does not have much impact on lowering infant mortality. Alcohol consumption (in litres per capita aged 15 and over) (ALCO) is commonly regarded as one of the health risk factors in the health care literature. However, it is noteworthy that in our analysis, the estimates were not statistically significant at the 5% level in both regressions. Perhaps one argument could be the fact that the methods in measuring alcohol consumption differ across OECD countries as mentioned in the data. As expected, educational level (EDU), used as an indicator of health awareness, was significant at the 5% level in both the regressions.

Overall, the panel data regression results provide some useful information on the healthcare assessment. For life expectancy as a dependent variable, supply of physicians, inpatient hospital bed days, overall financing of the health care, technology, preventive care, and education level, have played an important role. Judging from the regression coefficients, we concluded that the most influential factor is hospital bed days, followed by supply of physicians and education level. The proxy for social factor, alcohol consumption was not statistically significant.

However, for the infant mortality regression, empirical results were somewhat different. Physician supply, immunization and education are factors that were

[2] Health at a Glance - OECD Indicators 2005 can be found at http://www.oecd.org/health/healthataglance

statistically significant. This result follows the common perception that lowering the mortality rates requires pre- and post-natal care and services. Among those, education, preventive care and availability of physicians are commonly cited in the literature. The estimated coefficients revealed that the most influential factor determining infant mortality rate is the supply of physicians, followed by the level of education and immunization. As in life expectancy regression, contrary to the findings of other studies, alcohol consumption is statistically insignificant in the infant mortality regression. One plausible explanation is the non-uniform definition and measure of alcohol consumption among OECD countries. The measurement complexity stems form the fact that different countries have varied consumption preferences for alcohol beverages. For example, wine is preferred alcohol in France compare to beer in Germany. Also, beverages have a different degree of alcohol contents within and among OECD countries.

The empirical results suggest that supply of physicians and education levels are highly significant and the determining factor in both the life expectancy and infant mortality regressions. Policy implications that can be drawn from this study are as follows. One key component of improved health is education; particularly the education of mothers on child care and health, both in prenatal and neonatal stages. A recent study on infant mortality in the United States released by the US Department of Health and Human Services (2006) shows that comparatively mothers who received education on prenatal care had five times more chances for their babies to survive.

This study confirmed that supply of physicians (particularly primary care physicians), and investment in medical training and education should be prioritize in the OECD national healthcare policy. Emphasis on preventive care is another key element to improve healthcare in any given country. According to a report by the World Medical Association (2005), among different aspects of preventive care, effective immunization policy plays a crucial role in the national healthcare system.

Lately, social service provisions in industrialized nations such as education, defence, national security, social security and retirement plans draw considerable public attention. Significant and continuous rise in health care costs further add to the social and political tensions of the citizens. Reform and restructuring of healthcare are among a few policy initiatives that these nations have been trying to implement as a way to control their health care industries. Before devising any policy initiatives or restructuring plan, it is important to know the role of various factors that determine the health outcome.

Other policies that have direct link to the overall national health are those addresses social norms and practices. For example, Japan is ranked much higher on infant mortality rate and life expectancy than the United States. The disparity is explained by problems related to teenage pregnancy and obesity rates (CommonDreams.org, 2006). Dietary habits and more relaxed abortion regulations in Japan are cited as important factor explaining such disparities. Other social norms that contribute to the differences in the life expectancy and mortality among nations are policies on homicide and other serious crimes, environmental regulations, and social support for the elderly population.

5. Conclusion

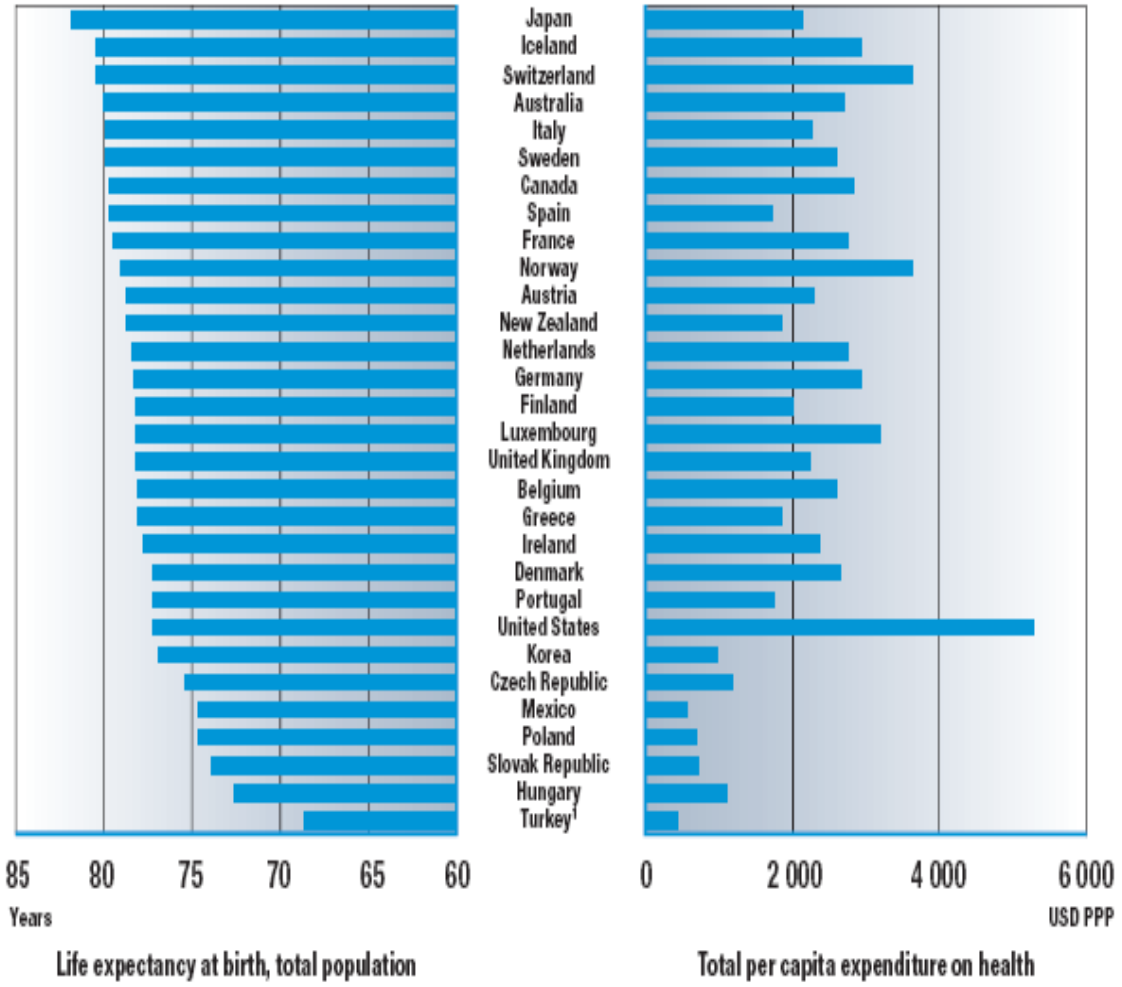
The health care delivery system of twenty five OECD nations is analyzed in this paper. This study seeks to assess the significance of various factors contributing to life expectancy and infant mortality for the 1990-2002 period. A fixed-effects panel data model was used to examine the factors influencing life expectancy and infant mortality.

More specifically the impact of economic, institutional, and social factors in determining the dependent variables are measured and evaluated.

The majority of research papers on national health care systems have concentrated on the two commonly accepted outcomes, life expectancy and infant mortality. However, the OECD-focused studies tend to assess cross variations of the health outcomes among individual member nations. The limited number of existing studies that concentrated on the factors influencing life expectancy and infant mortality had some drawbacks. The studies were limited in their approach (qualitative) or scope (either time horizon or the number of countries investigated). In this paper, we attempted to address the shortfalls mentioned above.

The selection of life expectancy and/or infant mortality as a proxy for health care outcome poses a challenge for researchers in the field. It has been noted that while a nation is receiving high marks for its achievements in prolonging life expectancy, they may be marginal on the infant mortality gains. This is of particular concern when such measures are used for international comparisons. For example, Mirmirani and Mirmirani (2005) consider the same health care outcomes as in this study and ranks efficiencies of OECD members. The study suggests that there may not be a correlation between the two outcomes. As a remedy, future research needs to concentrate on a single, uniform yet comprehensive health care outcome that is constructed from the available data.

Figure 1: Comparison of Life Expectancy at Birth and Health Expenditure in 2002 for OECD Countries



1. Expenditure data for Turkey refer to 2000.

Source: OECD Health Data 2005, June 2005

Table 1: Variables, Descriptions, and the Relationships with Life Expectancy

Acronym	Description	Expected sign	Rationale
TECH	Medical technology -- computed tomography scanners per million population	+	CT scan is a proxy for better access to disease diagnosis, thus higher life expectancy.
PHYS	Health employment -- practicing physicians density /1000	+	Higher physician's density, better health care for society.
PATIENT	In-patient utilization-- acute care bed days number per capita	–	High in-patient utilization indicates poor health, which means lower life expectancy.
IMMUNI	Prevention Immunization-- measles % children immunized 2000	+	Immunization is a preventive measure, increases life expectancy.
HEXP	Total expenditure on health per capita (US$ PPP)	+	Higher health expenditure will improve health services available, thus higher life expectancy.
ALCO	Alcohol consumption litres per capita (age 15+)	–	High alcohol consumption implies high health risk, less life expectancy
EDU	Educational level School expectancy Years	+	Higher literacy rate increases health awareness, therefore longer life expectancy.

Table 2: Variables, Descriptions, and the Relationships with Mortality

Acronym	Description	Expected sign	Rationale
TECH	Medical technology -- computed tomography scanners per million population	−	Better access to medical technology results in lower mortality.
PHYS	Health employment -- practicing physicians density /1000	−	More medical resources results in better health care for society, thus lower mortality.
PATIENT	In-patient utilization-- acute care bed days number per capita	−	High in-patient utilization indicates poor health, leads to high mortality.
IMMUNI	Prevention Immunization-- measles % children immunized 2000	−	Immunization as a proxy for preventive medicine results in lower mortality.
HEXP	Total expenditure on health per capita (US$ PPP)	−	Higher health expenditure will improve health services available, thus lower mortality.
ALCO	Alcohol consumption litres per capita (age 15+)	+	High alcohol consumption implies higher health risk for mothers, therefore leads to high mortality.
EDU	Educational level School expectancy Years	−	Higher literacy rate create better health awareness, therefore lower mortality.

Table 3: Empirical Results of Life Expectancy

	Coefficient	T-Statistics
TECH	0.0349**	2.189
PHYS	1.2245***	4.806
PATIENT	-1.5172***	-4.835
IMMUNI	0.0213**	2.551
HEXP	0.0004**	2.015
ALCO	-0.0031	-0.040
EDU	0.1851***	4.322
R^2	0.9845	
Adjusted R^2	0.9796	
F-Value	202.28 ***	

Note: ***, and ** denotes significance at the 1%, and 5% levels respectively.

Table 4: Empirical Results of Infant Mortality

	Coefficient	T-Statistics
TECH	0.0459	0.731
PHYS	-2.4649**	-2.461
PATIENT	1.2225	0.991
IMMUNI	-0.0819**	-2.496
HEXP	-0.0002	-0.273
ALCO	-0.0003	-0.001
EDU	-0.4852***	-2.883
R^2	0.9322	
Adjusted R^2	0.9109	
F-Value	43.89***	

Note: ***, and ** denotes significance at the 1%, and 5% levels respectively.

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The Economic Freedom Index as a Determinant of Firm Births and Firm Deaths

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Abstract

We investigate the relationship between economic freedom, firm formation and firm deaths in the U.S. states. Economic freedom should be positively and significantly correlated to business formation, and significantly related to firm deaths. We find that policy selection leads to more or less economic freedom; as freedom increases, entrepreneurs start new ventures. Furthermore, more economic freedom leads to more firm failures, as a result of increased competition.

Introduction

Entrepreneurship's role in economic development has been widely established (Sherman & Chappell, 1998). Much of the entrepreneurship literature in the popular and in the academic press focuses on the creation of new ventures to meet the needs of prospective buyers in the market. The creation of these new ventures naturally raises many questions. Among them is the question of what are the determinants of new firm formation. Academics have wrestled with this issue for decades, especially as improvements in statistical software packages have allowed researchers to consider increasingly complex models (Acs & Storey, 2004).

The literature has identified several factors as key determinants of new venture formation (Sutaria & Hicks, 2004, Kreft & Sobell, 2005). These determinants include, but are not limited to, per capita bank deposits, unemployment level (Reynolds, Story, & Westhead, 1994; Ritsila & Tervo, 2002), local market demand (Reynolds, 1994), technology (Shane, 2001), and industrial restructuring (Sutaria & Hicks, 2004), among many others (See Acs & Storey, 2004, Wagner & Sternberg, 2004, Johnson & Parker, 1996). Research has also emphasized the spatial variations in business formation rates (e.g., Johnson, 2004). These variations in business formation rates occur across countries as highlighted by the Global Entrepreneurship Monitor (GEM) Studies (Reynolds, Bygrave, Erkko, & May, 2002), as well as within countries (Reynolds et al., 1994).

The purpose of this paper is to investigate the relationship between economic freedom and new firm formation, also called entrepreneurial activity in the literature (See, e.g., Kreft & Sobell, 2005). Economic freedom is measured as a combination of favorable legal institutions and tax and regulatory policies. First, we briefly describe the literature on determinants of entrepreneurship and economic growth. Then, using the work of Kreft and Sobel (2005) as a point of departure, we evaluate the relationship between economic freedom and firm deaths and firm births for each of U.S. States for the period 1990–2001. In the following section, we describe the results of our analysis.

Literature Review

The past twenty years has seen an explosion in research regarding new firm formation. Clearly, entrepreneurship involves more than simply the study of new venture creation (Acs & Storey, 2004). Yet, new firm formation is the straw that stirs the drink. No other topic seems to capture the interest of scholars, casual readers, and policy makers better than the actual creation of a new business. Rather than attempt an exhaustive review of past research, this section will emphasize selective research relevant to new firm formation.

A summary of our understanding of new firm is a guest editorial paper by Acs and Storey (2004) in *Regional Studies*. They note that new formation has been a subject of great interest to readers of *Regional Studies*, returning to this subject after having evaluated it in special issues in each of the past two decades. They point out that earlier research on new firm formation served to demonstrate that new firms are a source of economic dynamism and job creation and that the distribution of enterprises is spatially uneven. Later research emphasized explaining regional variations in new firm formation using evidence from different countries, and found that urban regions with high rates of in-migration and a high proportion of employment in small firms had high rates of new firm formation. Acs and Storey lament the fact that "key influences were not clearly amenable to policy-makers" (Acs & Storey, 2004, p. 872). In the most recent special issue on new firm formation in *Regional Studies*, new variables were evaluated by some of the participants. Lee, Florida, and Acs (2004) found that new firm formation is impacted by creativity as measured by a "Bohemian Index" that measures the number of authors, designers, musicians, composers, etc, in a region. In the same model they also found that their "Melting Pot Index," a measure of the proportion of the population that is foreign born, was a determinant of new firm formation. It is the recent use of these indices as possible determinants of new firm formation that serves as the catalyst for this study.

Freedom Indices

Among the "economic freedom" indices that have gained researchers' attention are the Economic Freedom of the World indices. These indices have established themselves as fixtures in the social sciences literature, especially in the economic growth literature. (Atukeren, 2005; Berggren & Jordahl, 2005; Gwartney, Lawson & Clark, 2005; Powell, 2005; Gwartney, Holcombe & Lawson, 2004; Nieswiadomy & Strazichich, 2004; Cole, 2003; Gwartney & Lawson, 2003; Gwartney, Block & Lawson, 1996) Researchers have used these indices, or their constituent components, as variables to explain income or income growth rates.

Karabegovic, Samida, Schlegel and McMahon (2003) provide a similarly derived index featuring differences between U.S. states and Canadian provinces, rather than the difference between nations. Hereafter, we refer to the various editions of the Karabegovic, et al, index as "the freedom index." Similar to the world freedom indices researchers, Karabegovic, et al, argue that economic freedom of the states—proxied by their index—will be positively related to income levels and income growth. They use their index to explain income differences among the U.S. states and Canadian provinces, offering evidence that the freedom index is significantly, positively related to state levels of income and growth of economic activity. Various researchers have established the

freedom index (e.g., Kreft & Sobel, 2005; Doucouliagos & Ulubasoglu, 2006) as an effective means to evaluate income determination.

Karabegovic, et al., choose to group ten variables—usually expressed as ratios of GDP—into three categories: size of government; takings and discriminatory taxation; and labor market freedom. For *size of government*, the authors measured general consumption expenditures by government as a percentage of GDP, transfers and subsidies as a percentage of GDP, and Social Security expenditures as a percentage of GDP. For *takings and discriminatory taxation*, the authors measured total government revenue from own source as a percentage of GDP; top marginal income tax rate and the income threshold at which it applies; indirect tax revenue as a percentage of GDP; and sales taxes collected as a percentage of GDP. They rate top personal income tax rates by the income thresholds at which they apply, where higher thresholds result in a better score. Karabegovic, et al., surmount the criticism that they are a double counting by using both sides of the government balance sheet by examining sub-national jurisdictions. Due to extensive and unequal intergovernmental transfers, the link between taxation and spending is broken. For *labor market freedom*, the authors measure minimum wage legislation, government employment as a percentage of total state employment, and union density. A number of factors affect union density, notably laws and regulations, size of government employment, and manufacturing density. Government employment is excluded, and the effect of government employment is held constant in calculating the variable. The size of the manufacturing sector has an insignificant effect on union density. Please see Karabegovic, McMahon, and Mitchell, (2005) for a discussion of why these variables were included and others excluded.

Karabegovic, et al., construct a scale from zero to 10 to represent the underlying distribution of the 10 variables in the index, with higher values indicating higher levels of economic freedom. Thus, the freedom index is a relative ranking of economic freedom across jurisdictions and across time. In the final construction each area was equally weighted and each variable within each area was equally weighted.

In much of this literature, the relationship between freedom and entrepreneurship is not fully specified. Kreft and Sobel (2005) address this issue, albeit using a different methodology than do we. They argue "that a state's underlying economic freedom is an essential determinant of the state's ability to create and attract entrepreneurial activity. Put simply, an environment of low taxes, low regulations, and secure property rights (as measured by the economic freedom index) is what is necessary to encourage growth in entrepreneurial activity" (Kreft & Sobel, 2005, p. 608). Their research supports their contention that the economic freedom index is significantly related to entrepreneurial activity for the years of their study (1996 – 2000). While their research represents an important step in evaluating whether economic freedom will lead to more entrepreneurial activity, we believe their dependent variable may understate the relationship. In particular, they do not measure firm creation, but rather use annualized growth rate in sole proprietorships as their independent variable. We use a more conventional measure of entrepreneurial activity, the births and deaths of businesses. In addition, we propose to study the relationship over a longer period of time, an improvement suggested by Acs and Storey (2004).

Model, data and variables

Thus, rather than apply the freedom index to the question of income determination, we choose to apply it to the question of new firm formation as did Kreft

and Sobel (2005). Specifically, we ask whether the governmental, judicial, and social activities observed in the index are significantly related to the formation of new businesses. Karabegovic, et al., (2003) argue that their index measures economic freedom in states; furthermore, they argue that greater economic freedom results in higher income levels for state residents. The underlying argument is that greater economic freedom consists of greater opportunity to seek and exploit economic opportunities; that is, to pursue entrepreneurial activity. We argue that such freedom also should be positively and significantly correlated to business formation, especially the birth of new firms. The birth of a business is the key expression of entrepreneurial activity, a key element of economic development and growth.

This discussion leads to the following testable hypothesis:

H1: *Firm Births, by state, will be positively related to economic freedom.*

We believe the literature has predominantly focused on the formation of new firms. However, we recognize that our primary independent variable, economic freedom, may have implications for the long-term success of a newly-formed or existing business. More importantly, the literature distinguishes between the determinants of firm births and the determinants of firm deaths (Lussier, 1995; Finnerty & Krzystofik, 1985). Initially, one could argue that small businesses will be easier to sustain in an economically free environment. Therefore, economic freedom should be negatively and significantly related to firm deaths. However, operating from the Schumpeterian view of entrepreneurial creative destruction, an economically free environment is also consistent with wide-open competition for the consumer's dollar. As a result of this competition, many entrepreneurial ventures will not survive. If so, then economic freedom should be positively and significantly related to firm deaths. This discussion leads to the following testable hypothesis:

H2: *Firm Deaths by State will be (positively or negatively) significantly related to economic freedom.*

In our first pass at the data, we evaluate firm formation using the following generic model:

Births = f(Freedom, Deaths, Income, Ag-Mfg, Age, Minority, C & I, Pop Den, U Rate, Emplyee).

Similarly, we evaluate firm deaths by estimating the following model:

Deaths = f(Freedom, Deaths, Income, Ag-Mfg, Age, Minority, C & I, Pop Den, U Rate, Emplyee).

Where:

Births = business births by state as a percentage of total firms in a state.
Deaths = business deaths measured similarly.
Freedom = the Economic Freedom Index.
Income = natural log of real personal income per capita.

Ag-Mfg = Combined percentage of gross state product accounted for by agriculture and manufacturing.
Age = natural log of median age of the state's population.
Minority = combined percentage of African Americans and Latinos in the state's population.
C & I = natural log of commercial and investment lending per firm
Pop Den = natural log of population density
U Rate = state unemployment rate.
Emplyee = natural log of average number of employees per firm.

Table 1 presents summary statistics and correlation coefficients for these variables.

To capture the full potential relationship between the freedom index and new firm formation, we use the number of business births as a percentage of total businesses by state. Observing cross-sectional differences in firm births and deaths, Johnson and Parker discuss the need to scale the dependent variable to account for differences in the economies of the cross-sectional units. For example, directly comparing the number of firms formed in North Dakota with the number of firms formed in California would be inappropriate due the vast size differences of these states' economies. Johnson and Parker (1994, 1996) also demonstrate that researchers cannot study firm births and firm deaths in isolation. They argue that firm births (or deaths) may create spill-over effects, such as when a new retail business in a strip shopping center decreases the likelihood of other firms in the center failing. They also argue that firms directly compete with one another, and the arrival of a new competitor often means the demise of an incumbent firm. Lastly, they argue that nearly all firms have a finite life-span: a firm is formed, possibly it thrives for a while, but then the same firm dies. *A priori*, they are agnostic as to which effect will prevail, but they are adamant that firm births and firm deaths be studied together.

Otherwise, our model is an amalgam drawn from the economic freedom literature and the firm formation literature. On the one hand, it is essentially a derivative of traditional growth models (e.g., Solow, 1956) applied in a different context. Such growth models are common in the literature on freedom indices (e.g., Dawson 1998, 2006; Gwartney, Lawson, & Holcomb 2004, 2006). Similar to those models, we include income and population density (a proxy for the labor force) as explanatory variables. Also similar to those models, we include capital investment via a proxy measure, the volume of commercial and industrial loans in a state. We also include the unemployment rate, and the average number of employees per firm, as well as the combined percentage of GSP accounted for by agriculture and manufacturing. These variables are also similar to firm birth and firm death models such as those of Johnson and Parker (1994, 1996), and as reviewed in Keeble, Walker, and Robson (1993).

Similar to factors identified in Keeble, Walker and Robson (1993), we include the median age of each state's population, and the combined percentage of African Americans and Latinos in the state's population. Keeble and Walker (1994), Black, De Meza and Jeffreys (1996), and Johnson and Parker (1996) include variations in the amount of net housing wealth per cross-sectional element. The general argument is that housing equity provides collateral to back commercial lending in support of a business start-up. Similarly, as an independent variable, we include the dollar volume of all commercial and industrial loans by all FDIC-insured institutions by state per year.

Dawson (1998, 2006) and Gwartney, Holcombe, and Lawson (2004, 2006) discuss the direct versus the indirect effects of economic freedom on economic outcomes.

Suppose one argues that income growth depends on labor force growth, capital growth, and economic freedom. Capital formation, itself, is likely to be a function of economic freedom. We argue that in addition to the "total" or "direct" effect that economic freedom has on creating economic opportunities and allowing individuals to pursue those opportunities through entrepreneurship, economic freedom may also have an "indirect" impact on labor productivity (changes in income) and capital productivity (proxied by our commercial and industrial loans variable). To account for this "jointness" in determination, we present instrumental variable models.

We draw our data from a variety of sources. Freedom index data are from the Fraser Institute website (www.freetheworld.com) while firm and employment data are from the Small Business Administration Office of Advocacy (www.sba.gov/advo/research), and all other data are from the census and the FDIC. We construct a panel using the U.S. states as our cross-sectional element, covering the years 1990 through 2001. Given our data set and research question, we estimate "fixed effects" models fitting an intercept adjustment for each state. The essential structure of a fixed effects model is that variation across groups (such as across states) is captured in shifts of the regression function, by calculating a separate adjustment to the intercept for each group (state). In each model include dummy variables for the observation years, to capture nationwide, time-varying effects. In all estimates we correct for the heteroskedasticity commonly found in data sets such as ours.

Empirical Results

Table 2 reports our regression results for Freedom and Income. The standard goodness-of-fit measures indicate the models are generally well-specified. To address the issue of freedom's direct effects versus indirect effects, in the first column we regress income on freedom and a vector of ceteris paribus variables, while in the second column we regress freedom on income and the same vector of control variables. These models indicate an endogenous relationship between freedom and income, despite the low correlation between freedom and income. Ordinarily such endogeneity calls for instrumental variable methods.

Table 3 present our firm births models, and Table 4 present our estimates of firm deaths. By standard measures we obtain estimates that fit the data well, although much of the explanatory power in the model derives from the state fixed effects and year effects. In general, our firm birth models are somewhat better specified than our firm death models. Model 1 in each table is a baseline model fitted without income or freedom, and without using instrumental variable estimators. We fit Models 2 and 3 in both tables using two-stage least squares for panel data, and we instrument for both Freedom and Income for the sake of comparison. We observe that population density and the average number of employees per firm have a correlation coefficient of 0.6. Due to this high correlation between regressors, we fit Models 2 and 3 with the *Emplyee* variable and use *Pop Den* solely as an instrument for *Freedom* and *Income*.

These models support previous research which finds that firm births and firm deaths follow different dynamics. As predicted by Johnson and Parker (2004, 2006), firm deaths have a significant impact on firm births, and vice versa. In the Johnson and Parker parlance, the "multiplier effect" predominates in our sample; that is, spillovers are more significant than direct competition. Firm births are conditioned on the population's minority percentage. *Ceteris paribus*, more racially mixed states experience more business venturing. The minority effect may represent a tendency for minority

populations to patronize minority businesses. As the minority percentage grows, small business owners may have a larger market for their business. Firm deaths are conditioned on the state's unemployment rate. Higher unemployment rates, an indicator of state economic conditions, are associated with more business failures.

As hypothesized, more economic freedom leads to more business venturing. Freedom has a positive and significant impact on firm births. However, observation of Models 2 and 3 in Table 3 and combined with the evidence in Table 2 indicates that Freedom has both a direct and an indirect effect on business venturing. The direct effect of Freedom is that more economic freedom is directly related to greater business venturing activity. This is consistent with the Kreft and Sobel (2005) argument that greater economic freedom permits would-be entrepreneurs to more easily identify and act upon potential market opportunities. Economic freedom also has an indirect impact on business venturing through its impact on income. Consistent with the general body of the literature, economic freedom has a positive impact on income. In turn, higher incomes spur more business venturing.

Also as hypothesized, economic freedom has a significant impact on business dissolution as well. Over our sample, the coefficient on Freedom was positive and strongly significant. That is, as economic freedom increases, there are more business failures as well as more business births, *ceteris paribus*. As we argued might be possible, operating from the Schumpeterian view of entrepreneurial creative destruction, an economically free environment is consistent with wide-open competition. As a result of this competition, many existing firms or entrepreneurial ventures do not survive.

Concluding Remarks

Our findings support the hypothesis that state governments' policy selection leads to more or less entrepreneurial activity within a state; as economic freedom increases due to favorable government policies, entrepreneurs are more likely to start new ventures over the eleven-year period of our study (1990–2001). Furthermore, more economic freedom leads to more firm failures, as a result of increased competition.

These findings also support the contention that where one chooses to start a new business venture may have a profound impact on whether one is successful. (Sorenson & Audia, 2000) Given the relative spatial immobility of entrepreneurs (Wagner & Sternberg, 2004), entrepreneurs would be wise to carefully consider whether they are starting a new business venture in a state that has the economic freedoms necessary to initiate the business. We also suggest that it is incumbent upon state-level public policy makers to consider the impact their policies will have on economic freedom, as economic freedom is one determinant of the ability of nascent entrepreneurs to start a new firm or for existing entrepreneurs to thrive in their state.

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Table 1: Summary Statistics and Correlation Coefficients

Variable	Obs	Mean	SD	Min	Max
Births	650	12.044	1.848	8.029	21.279
Deaths	650	10.643	1.256	7.899	15.033
Freedom	650	6.916	0.695	5.100	8.400
Income	650	5.119	0.715	4.628	10.264
Ag-Mfg	650	18.852	7.035	2.774	33.873
Age	650	3.534	0.061	3.266	3.671
Minority	601	16.672	11.997	0.979	49.766
C & I	500	4.308	0.789	1.432	7.723
Pop Den	650	4.243	1.363	-0.192	6.880
U Rate	500	4.817	1.472	1.600	10.500
Emplyee	649	2.781	0.154	2.284	3.079

	Births	Deaths	Freedom	Income	Ag-Mfg	Age	Minority	C & I	Pop Den	U Rate	Emplyee
Births	1										
Deaths	0.778	1									
Freedom	0.275	0.221	1								
Income	-0.095	-0.014	0.046	1							
Ag-Mfg	-0.317	-0.464	0.142	-0.238	1						
Age	-0.206	-0.035	-0.113	0.079	-0.071	1					
Minority	0.376	0.432	0.193	0.067	-0.228	-0.178	1				
C & I	-0.337	-0.303	-0.087	0.127	0.074	-0.005	-0.08	1			
Pop Den	-0.256	-0.142	0.125	0.219	0.14	0.261	0.18	0.372	1		
U Rate	0.154	0.225	-0.421	-0.157	-0.082	-0.169	0.14	-0.081	0.017	1	
Emplyee	0.033	0.078	0.412	0.19	0.213	0.062	0.23	0.311	0.598	-0.151	1

Table 2: Income and Freedom

Dep. Var:	**Freedom**		**Income**	
Freedom			0.029	***
			4.46	
Income	1.286	***		
	3.84			
Ag-Mfg	0.010		-0.001	
	1.48		*-0.84*	
C & I	0.032	**	0.002	
	2.53		*0.82*	
Pop Den	0.781	***	-0.021	
	3.16		*-0.42*	
U Rate	-0.061	***	-0.0004	
	-5.23		*-0.19*	
Emplyee	-0.120		0.512	***
	-0.23		*4.9*	
Constant	-2.763		3.682	***
	-1.33		*10.64*	
R-sq:	0.52		0.90	
F-stat	31.64		302.54	

All models estimated with year effects and robust standard errors; t-statistics in italics
*-Significant at 90%, **-Significant at 95%, ***-Significant at 99%

Table 3: Birth Models

Dep. Var: Births						
	Model 1		**Model 2**		**Model 3**	
Freedom			0.939	*		
			1.82			
Income					9.469	*
					1.87	
Deaths	-0.258	***	-0.200	***	-0.291	***
	-3.58		*-3.32*		*-3.9*	
Ag-Mfg	0.009		0.007		0.015	
	0.45		*0.4*		*0.8*	
Age	-0.482		-0.511		-0.149	
	-0.44		*-0.47*		*-0.13*	
Minority	0.026		0.053	**	0.053	**
	0.89		*2.43*		*2.28*	
C & I	0.055		-0.009		0.002	
	0.96		*-0.16*		*0.03*	
Pop Den	2.342	*				
	1.71					
U Rate	-0.053	88%	0.011		0.020	
	-1.59		*0.25*		*0.41*	
Emplyee	-0.508		-0.912		-4.334	89%
	-0.3		*-0.62*		*-1.61*	
Constant	6.841		10.552	*	-21.621	
	0.840		*1.76*		*-1.05*	
Instrmntd:			Freedom		Income	
Instrmnts:			Income		Freedom	
			Pop Den		Pop Den	
R-sq:	0.76		0.75		0.72	
F-stat	64.59		71.25		63.37	

All models estimated with year effects and robust standard errors; t-statistics in italics
*-Significant at 90%, **-Significant at 95%, ***-Significant at 99%

Table 4: Death Models

Dep. Var: Deaths						
	Model 1		**Model 2**		**Model 3**	
Freedom			2.418	***		
			3.64			
Income					1.493	
					0.38	
Births	-0.174	***	-0.247	***	-0.154	***
	-3.43		*-3.83*		*-3.73*	
Ag-Mfg	-0.021		-0.032		-0.011	
	-1.29		*-1.51*		*-0.77*	
Age	-1.544		-1.752		-1.699	*
	-1.38		*-1.38*		*-1.85*	
Minority	-0.039	*	0.015		-0.007	
	-1.93		*0.57*		*-0.38*	
C & I	0.036		-0.101	88%	-0.016	
	0.71		*-1.57*		*-0.37*	
Pop Den	3.829	***				
	4.64					
U Rate	0.126	***	0.294	***	0.165	***
	4.02		*5.49*		*4.88*	
Emplyee	0.191		-1.127		0.208	
	0.12		*-0.65*		*0.1*	
Constant	1.250		4.924		9.172	
	0.18		*0.71*		*0.56*	
Instrmntd:			Freedom		Income	
Instrmnts:			Income		Freedom	
			Pop Den		Pop Den	
R-sq:	0.70		0.35		0.68	
F-stat	55.19		25.12		49.78	

All models estimated with year effects and robust standard errors; t-statistics in italics
*-Significant at 90%, **-Significant at 95%, ***-Significant at 99%

A Cross-Country Analysis of the Employment Intensity of Economic Growth

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Abstract

In this paper, we examine the relationship between economic growth and employment in six developed nations from 1990 to 2006. Models are developed to estimate the employment intensity of economic growth within each nation. Among those for whom a significant relationship was found, employment intensity is estimated to range from 0.14 to 0.33. Once the model is augmented to account for persistence in employment growth, employment intensity diminished in a majority of the nations, but remained significant in most, ranging from 0.16 to 0.33. The model was further modified to examine the dynamic nature of the relationship between employment and economic growth using impulse response analysis. As before, differences in the responsiveness of employment to economic growth are found between the nations studied. Reasons for the differences in the employment intensity of economic growth between nations are discussed. Evidence is found suggesting that nations with high labor force growth rates and/or relatively large service sectors tend to exhibit higher levels of employment intensity of economic growth.

Introduction

During the 1990s, several nations experienced moderate economic growth with little increase in employment while other nations with similar growth rates experienced higher levels of job creation. During the first year of the most recent economic recovery in the US (2002), employment actually fell. Several explanations have been suggested as to why this may occur. Perhaps the recovery was uneven and the growing sectors of the economy increased the utilization of labor rather than increase the number of jobs. Also, coming out of a recession, companies are thought to be reluctant to hire many more workers until they are convinced about the sustainability of a new economic recovery. Another possibility is that companies employed new technologies, resulting in increased productivity instead of more employment.

In this paper, we examine the relationship between economic growth, as measured by real GDP, and employment in the G7 nations for which comparable data were available[1]. A review of the existing literature on the topic is undertaken to provide both the underpinnings of the relationship as well as the context for the current research. Both the employment intensity of economic growth and the persistence of employment growth are estimated. Next, some of the factors that help explain the differences between nations are explored.

The period of this study begins in 1990 and ends in the third quarter of 2006. The statistical properties of each variable (the growth rates of employment and real GDP) are examined. Empirical models are then developed to estimate the employment intensity of economic growth. Employment intensities (the elasticity of employment with respect to real GDP) are estimated to range from 0.14 to 0.33 in the nations considered for whom a significant relationship was found. Once the model is augmented to account for

[1] Comparable data were not available for Japan.

employment persistence, a smaller but still significant relationship is found for most of the countries considered. Next, the dynamic nature of the relationship between employment and economic growth is examined using impulse response analysis, providing further evidence of differences in the employment elasticities in the nations studied. Characteristics of the labor market help to explain some of the differences in the results.

Review of Literature

Several authors have estimated employment elasticities (a measure of the relationship between employment and economic growth) for a variety of nations. Significant differences in employment elasticities between different countries were detected by Padalino and Vivarelli (1997), with an elasticity of approximately 0.5 for the United States and Canada while elasticities for Japan, France, Germany, Italy and the UK were close to zero. Pini (1997) estimated that the employment elasticities in Germany and Japan rose between the period 1979-95 compared to 1960-79 while it declined in France and Sweden and showed little change in Italy, UK and US. He also detected negative employment elasticities in Italy and Sweden for the period 1990-95. Elasticities in the order of 0.5 to 0.6 for a set of OECD countries were detected by Boltho and Glyn (1995). In a study of industrialized countries by the International Labour Organization Report (1996), a country-by-country analysis revealed mixed results with little relationship found in Germany, Italy and the UK in the 1990s, thus implying a jobless recovery. It also concluded that the responsiveness of employment growth to GDP growth has not declined in industrialized countries as a whole. Evidence suggesting that restructuring of major economic sectors reduced the relationship between economic growth and employment was discovered by Pianta, Evangelista and Perani (1996). Among the G7 countries studied (Canada was excluded), a positive and significant relationship between growth in value added and employment was found only in Germany and the US. Walterskirchen (1999) found employment elasticities for the EU of 0.65 when employing a cross-country analysis of EU countries from 1988-98. Using data from 1970-98 for 7 countries plus the EU as a whole, employment elasticities ranged from 0.24 for Austria to 0.76 for Spain (the elasticity for the US was 0.53).

Though some work has been conducted applying this technique to multinational studies, it has yet to account for employment persistence. The absence of this key component of the model may have led to misleading and biased results. Results of such an analysis should provide insight into the differences in the behavior of national labor markets as well as increased understanding as to why employment in different nations may respond differently to changes in economic growth. Furthermore, the dynamic nature of the relationship has received scant attention in the literature. A time-series model is developed to capture the total response of employment to economic growth, not just the response for one period.

There has been little empirical work concerning the factors affecting the employment intensity of economic growth, but some previous studies help to provide some insight. Walterskirchen (1999) found that a higher growth of the labor supply tends to raise employment and reduce productivity, thus suggesting a higher level of employment intensity of economic growth. Mourre (2006) found that employment intensity tends to be highest in the service sector, suggesting that nations with large service sectors should exhibit higher employment intensities.

Descriptive Statistics

Quarterly data from 1990 to 2006 for both national employment and real GDP were obtained from *OECD Statistics*[2]. As can be seen in table 1, the nations exhibited different patterns of economic growth during the study period. Italy had the slowest average quarterly growth in GDP of 1.38% (measured at an annualized rate) while the US had the highest rate, 2.89%. Canada, like the US, experienced relatively high economic growth while France and Germany experienced similar economic growth rates averaging about 1.8% and 1.9%, respectively. Germany experienced the least average growth in employment (just under 0.2% per quarter at an annualized rate) while the Canada and the US saw employment growth rates averaging in excess of 1%.

Table 1a

Descriptive Statistics: Economic Growth

	Mean	Median	Standard Deviation
Canada	2.61%	2.63%	2.42
France	1.81%	2.01%	1.72
Germany	1.92%	1.52%	3.06
Italy	1.38%	1.45%	2.01
United Kingdom	2.35%	2.64%	1.76
USA	2.89%	2.93%	2.07

Table 1b

Descriptive Statistics: Employment Growth

	Mean	Median	Standard Deviation
Canada	1.42%	1.40%	1.62
France	0.72%	0.68%	1.34
Germany	0.19%	-0.09%	1.95
Italy	0.53%	0.77%	2.87
United Kingdom	0.42%	0.93%	2.16
USA	1.24%	1.24%	1.47

Methodology and Empirical Results

Similar to Boltho and Glynn (1995) and Padaline and Vivarelli (1997), the employment intensity of economic growth is estimated using the following model:

[2] OECD Statistics can be found at http://stats.oecd.org

$$\text{empgrowth} = B_0 + B_1 \text{ economic growth} + \varepsilon \quad (1)$$

where empgrowth is the annual percent change in employment for the respective nation; economic growth is the annual growth rate of real GDP and B_1 is the estimated elasticity. The estimated elasticity provides a measure of the employment intensity of economic growth. In other words, how much growth in employment results from a one-percent growth in output? A high employment intensity indicates that growth in output leads to considerable job creation while low estimates of employment intensity suggest little correlation between economic growth and employment.

Empirical Results

All of the models specified were estimated using OLS[3]. Results of the regressions are shown in table 2:

Table 2

Model with Economic Growth

Nation	constant	Economic growth
Canada	***0.19	***0.25
France	0.04	***0.32
Germany	-0.02	**0.14
Italy	***0.24	-0.09
UK	-0.03	***0.33
US	***0.17	***0.17

where *** indicates significance at the 1% level; ** indicates significance at the 5% level

As seen in table 2, employment growth was positively and significantly related to the growth rate of real GDP in every nation except Italy. Statistically significant elasticities ranged from a low of 0.14 in Germany to a high of 0.33 in the UK.

The above model estimated the simple relationship between employment growth and economic growth. However, one should consider the possibility of persistence in employment growth. That is, quarters with positive growth in employment are likely to be followed by further increases in employment and vice-versa. Thus, equation (1) was augmented by the inclusion of lagged employment growth, resulting in equations (2):

$$\text{empgrowth} = B_0 + B_1 \text{ economic growth} + B_2 \text{ lagged empgrowth} + \varepsilon \quad (2)$$

[3] Results for all models in this study were tested for standard econometric problems including structural stability, ARCH effects, serial correlation, etc. Dummy variables were included when appropriate to account for changes in data methods. For example, beginning in January 2000, US data was adjusted for new population controls. Previous data did not incorporate this change. Thus, a one-period dummy for the first quarter 2000 was included for the US.

In the augmented model, B_1 represents the *partial* elasticity of employment while B_2 is an estimate of the degree of persistence of employment growth. By persistence, we mean the relationship between past and current employment growth; in other words, does employment growth have momentum such that periods of positive growth are followed by further growth while periods in which employment growth declines tend to be followed by further declines? By ignoring the potential effect of lagged employment growth, the previous studies may have obtained misleading results. Equation (2) was estimated in a similar manner to the original model.

Table 3

Model with Economic Growth and Lagged Employment Growth

Nation	constant	Economic growth	Lagged employment growth
Canada	0.03	***0.21	***0.50
France	-0.003	***0.23	***0.45
Germany	-0.03	0.08	0.16
Italy	**0.20	-0.10	*0.18
UK	-0.07	***0.33	**0.19
US	0.07	***0.16	***0.35

where *** indicates significance at the 1% level; ** indicates significance at the 5% level and * indicates significance at the 10% level

Coefficients on lagged employment growth were positive and significant in five nations, with estimates ranging from a low of 0.18 in Italy to a high of 0.50 in Canada (for those nations for which a significant result was found). Augmenting the model to include lagged employment growth provides further insight into the relationship between employment growth and economic growth. The degree of persistence seems to be a significant factor in explaining employment growth in virtually every nation.

Compared to the model without lagged employment growth, the elasticities of employment with respect to real GDP declined somewhat in several cases. Employment elasticity became noticeably smaller for France and insignificant for Germany. Thus, the omission of lagged employment growth appears to have led to a positive bias in some of the estimated elasticities.

Dynamic Model of Employment and Economic Growth

Building on the model specified in (2), the appropriate lag structure of both employment and economic growth are determined followed by an impulse analysis to identify the total response of employment to economic growth as opposed to just one period. The model takes the form:

$$\text{empgrowth} = B_0 + B_{1i}\ \text{economic growth}(t\text{-}i) + B_{2j}\ \text{empgrowth}(t\text{-}j) + \varepsilon \qquad (3)$$

where i = 0 to n and j = 1 to n. Thus, current economic growth is an independent variable as well as its lagged value(s). Akaike's information criterion was used to determine the number of lags for both employment and economic growth. The model was estimated and the results are presented in table 4.

Table 4

Model including Appropriate Lag Structure (determined by AIC)

Nation	constant	Economic growth	Economic Growth (t-1)	Employment growth (t-1)	Employment growth (t-2)
Canada	-0.04	0.08	***0.30	***0.38	
France	-0.06	**0.17	*0.13	0.21*	***0.36
Germany	***-0.12	0.04	***0.16	0.11	*0.15
Italy	0.09	0.10	-0.02	-0.01	***0.40
UK	***-0.20	0.07	***0.48	**0.16	
US	-0.04	*0.10	***0.28	*0.15	

where *** indicates significance at the 1% level; ** indicates significance at the 5% level and * indicates significance at the 10% level

As before, a degree of persistence was found for each country. A positive and significant relationship between employment and economic growth was found in five of the six nations (the exception was Italy). In most cases, lagged economic growth tended to have a more noticeable impact than current economic growth. To assess the full effect of economic growth on employment, an impulse analysis was conducted with the results presented in figures 1 to 5 (Italy was excluded since a significant relationship was not detected).

Figure 1
Canada: Response of Employment to an Innovation in Economic Growth

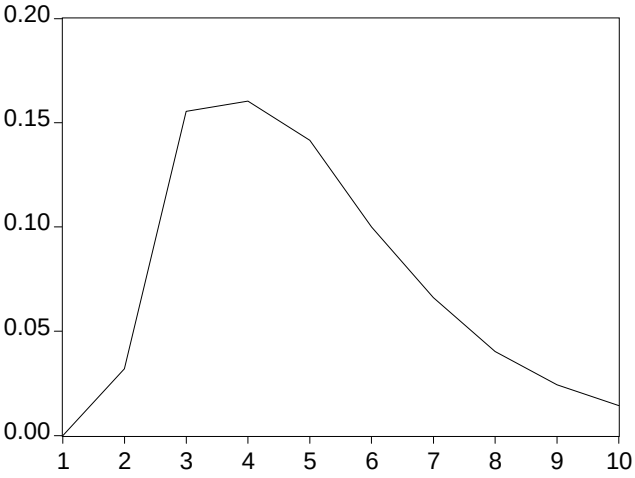


Figure 2
France: Response of Employment to an Innovation in Economic Growth

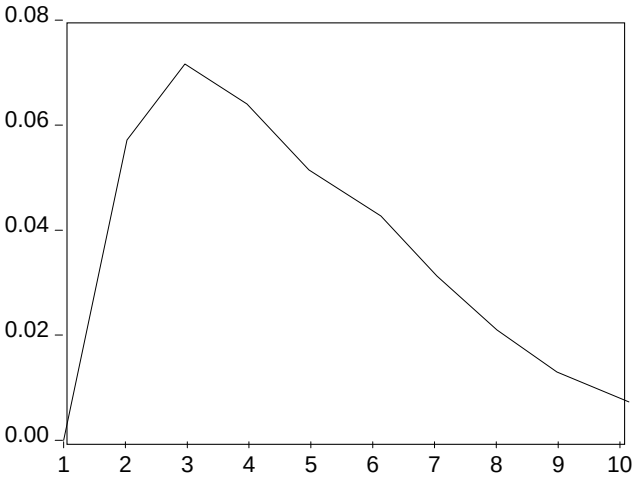


Figure 3
Germany: Response of Employment to an Innovation in Economic Growth

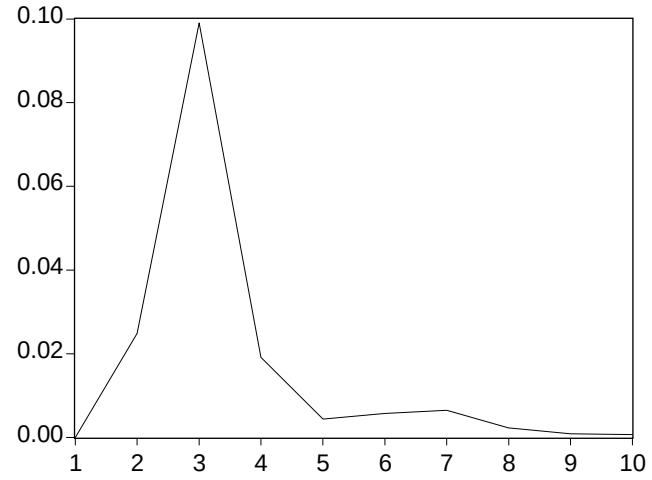


Figure 4
US: Response of Employment to an Innovation in Economic Growth

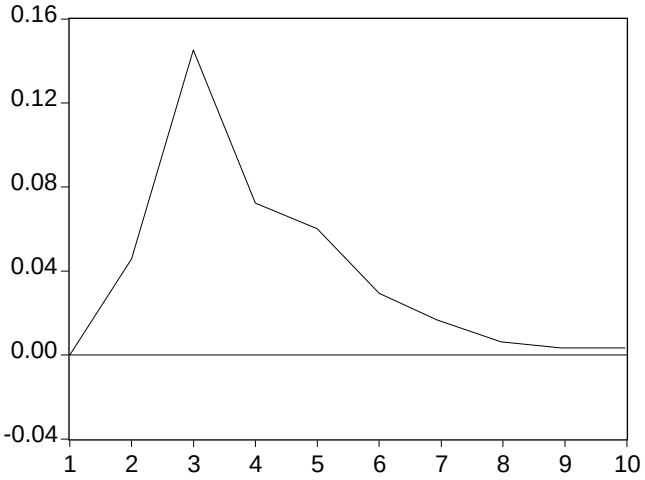
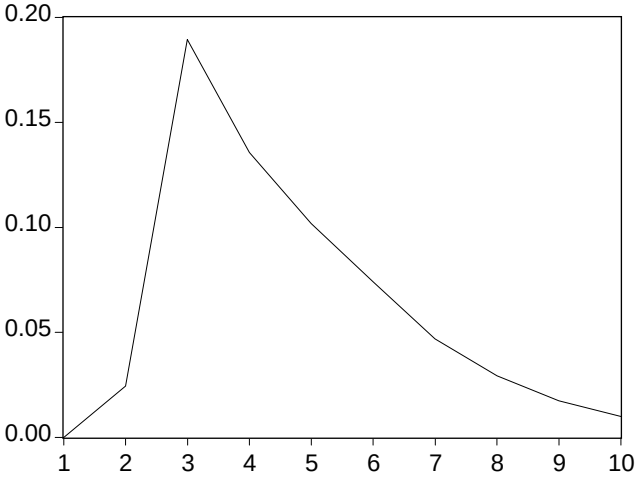


Figure 5
UK: Response of Employment to an Innovation in Economic Growth



As can be seen from the above figures, Canada, the UK and the US display the largest response of employment to economic growth while France and Germany show the smallest response (recall Italy had an insignificant relationship). This supports the earlier findings which indicated that Canada, the UK and the US displayed the largest responses of employment to economic growth while France, Germany and Italy showed the smallest response (or in the case of Italy, an insignificant response).

Reasons for the Differences in Estimated Employment Elasticities

Previous studies suggest several characteristics of the labor market that may influence the employment intensity of economic growth. In particular, the growth of the labor force and the relative size of the service sector help explain differences in employment elasticities. Walterskirchen (1999) found that increases in the labor supply tend to raise employment but reduce productivity. As a result, the employment intensity of economic growth increases. Mourre (2004) finds that the job intensity of growth is highest in the service sector – once again likely due to slower growth in productivity in services. Table 5 shows the growth of the labor force and size of the service sector in each of the countries for which comparable data were available.

Table 5

Characteristics of Labor Market

Nation	**Growth in Labor Force, 1990-2006**	**Service Sector Employment as a Percent of Total Employment in 1990**
Canada	23%	72%
France	11%	N/A
Germany	1%	55%
Italy	0.6%	58%
UK	3.9%	68%
US	13.7%	71%

The two nations with the slowest growth in their labor force had either insignificant (Italy) or the lowest employment elasticity (Germany). Meanwhile, the nations with the highest labor force growth rates (Canada and the US) had two of the three highest employment elasticities. In addition, the nations with the three largest service sectors (Canada, UK and US) also had the highest employment intensity of economic growth while those with the smallest service sectors (Italy and Germany) had the lowest or insignificant levels of employment intensity[4]. Together, this lends support to earlier findings that provided evidence that the characteristics of the labor market helped explain differences in the employment intensity of economic growth.

[4] Comparable data for service sector employment were not available for France.

Summary and Conclusions

In this study, we examined the nature of the relationship between employment and economic growth in the G7 nations. The elasticity of employment with respect to real GDP was estimated to be significantly different from zero in five of the six nations studied – ranging from 0.14 in Germany to 0.33 in the UK. Once the model was augmented to include lagged employment growth, partial elasticities were found to be smaller, but still statistically significant in most cases. Persistence in employment growth was found in almost every nation – ranging from a low degree of persistence in Italy and the UK (it was insignificant in Germany) to a high degree in Canada and France. The employment elasticity was found to be not statistically different from zero in Italy. Furthermore, the results of the dynamic model incorporating impulse analysis supported the earlier findings of a larger response of employment to economic growth in Canada, the UK and the US relative to France and Germany with no significant relationship found for Italy. This result is similar to the finding of the ILO report (1996) and Padalino and Vivarelli (1997) that also found no relationship for Italy. However, similar to Pianta, Evangelista and Perani (1996), a positive and significant relationship was found between employment and economic growth for the remaining nations in the study.

The results help provide insight as to the nature of the relationship between employment and economic growth. The difference between the original model and the one incorporating lagged employment growth suggests that though economic growth may provide an impetus to employment, employment growth tends to take on a momentum of its own such that periods of poor employment growth are likely to be followed by further periods of poor employment growth. Also, the impulse analysis indicates the total response of employment to economic growth in that the effect may be felt over several periods, not just one as suggested in previous models of employment intensity.

Potential reasons for differences in the estimated employment intensity of economic growth were explored. Evidence was presented suggesting that the characteristics of the labor market help to explain these differences. Similar to Walterskirchen (1999) and Mourre (2006), it was found that nations that are experiencing higher labor force growth rates and/or have sizeable service sectors are likely to exhibit relatively high levels of employment intensity of economic growth.

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Financial Statements, Attestation Level and Lending Decision by Small Banks

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Abstract

The loan decision model of small banks is known to differ from loan decision model of large banks. This study focuses on small banks and examines whether financial statements are an important consideration in the loan decision and whether the level of attestation affects loan officers' perception of the importance of those financial statements. The survey results of 55 loan officers from 6 small banks indicate that while financial statements are perceived as important information in the loan decision of small banks, loan officers may not adequately consider the credibility of the financial statements when evaluating loans.

Introduction

Lending to small businesses constitutes an important area of research in finance. Small business borrowers tend to be more informationally opaque than their larger brethren and thus pose greater challenges to lenders (Cole, et al., 2004; Berger and Udell, 2006). It is well known that commercial banks use both financial and non-financial information for their loan decision making. Novice loan officers are generally taught to seek and organize information using a framework called the five C's of credit (character, capacity, capital, conditions, and collateral), giving a common structure to their judgments (Beaulieu, 1994). However, large banks rely more on hard financial information, computer-based financial models and centralized decision making, as a basis for their loan decision, while small banks whose loan clients are mostly small business borrowers rely more on non-financial information collected by personal contact, community ties and close lender–borrower relationships. As large banks have more branches that are more geographically dispersed than do smaller banks, it becomes more difficult for the top management of large banks to monitor the behavior of employees, and agency problems arise (Jensen and Meckling, 1976). To ensure that loans are evaluated in an appropriate manner, large bank managers develop loan approval systems that employ readily available and verifiable information about the loan applicants, such as financial statements information. In contrast, small banks face agency and control problem that are less severe than large banks. Small banks are likely to have private non-financial information about borrowers because small banks have a better understanding of local business and economic conditions through informal meetings and conversations with customers (Feldman, 1997).

Cole, Goldberg, and White (2004) found evidence that the lending decisions of large banks are more likely to be a function of financial variables, whereas the lending decisions of small banks are more likely to be a function of variables indicating pre-existing relationships between the bank and loan applicants. Many other studies confirm our understanding that non-financial information is important in the lending decision of small banks. (Cowen and Page, 1982; Whiteman, 1998; Cole, 1998; Berger and Udell, 1995; Berger and Udell, 2002; Elyasiani and Goldberg, 2004; Ebben, 2004; Berger et al., 2005).

Despite those previous study results that confirm the importance of non-financial information in small banks, it is also well known that small banks require financial information, including business and personal financial statements, in a loan application package (Barret 1990). Small banks require updated financial statements to manage loan clients. The majority of small banks require some form of auditor association in the preparation of financial statements. Some small banks require audits or reviews while others accept financial statements either compiled by the independent public accountant (CPA) or prepared by the borrower. Nevertheless, it is not clear whether these financial statements are actually an important consideration in the lending decision of small banks or whether small banks require them simply because government regulatory agencies require banks to obtain such documentation in loan processing.

The primary purpose of this study is to investigate whether financial statements are an important consideration in lending decisions of small banks. The secondary purpose of this study is to examine whether the different types of attestation influence the loan officers' perception of the importance of financial statements in the lending decisions. This study also investigates whether that perception differs among different groups of loan officers such as more experienced vs. less experienced, and those with undergraduate business (or accounting) degrees vs. those with non-business degrees.

Background and Hypotheses

Though many prior studies stressed the importance of non-financial data in the lending decisions of small banks, the approval procedures of small business bank loans have become more formal and the relationship with loan officers less personal (Barret 1990). Berger and Udell (2006) found that various lending technologies that are based on 'hard' quantitative information are targeted to both large and small business borrowers. Small banks may have adopted those technologies as they grew larger in size. The average size of small banks grew through a striking amount of consolidation in the banking industry in the last two decades. Since 1985 the average asset size of U.S. banks (in real terms) has more than tripled and the number of commercial banks in the United States has fallen to half.(Mester, 2007). Stanga and Tiller (1983) suggested that the financial information needs of loan officers who make lending decisions involving small private companies are actually similar to the information needs of loan officers who make lending decisions involving large public companies. Beaulieu (1994) found that though loan officers use non-financial information to assess the credibility of financial statements by judging the credibility of borrowers, the officers use non-financial information only when financial information supports loan approval. They tend to ignore non-financial information when financial information does not support approval. The authors' initial interview with senior officers of four small banks revealed that financial statements are one of many variables considered important in the lending decision. Examination of loan evaluation working papers of two small banks revealed that information from financial statements were included in the data evaluated. The preceding findings lead to the first hypothesis:

H1: Financial statements are an important consideration in the lending decision of small banks.

The independent public accountant has been permitted to perform three levels of financial statement service since July 1, 1979 (Martin et at. 1988). These are compilation,

review and audit. Each level of service results in a different level of assurance and an appropriate accountant's report. The Statements on Standards for Accounting and Audit Services (SSARS) 1 issued by the Accounting and Review Services Committee of AICPA clearly states the different level of assurance among these three services. The compilation report provides statement users no assurance. The review report offers limited assurance. The highest level of assurance is provided by the audit report.

When loan officers consider financial statements in a lending decision, they should find that audited financial statements are more credible than reviewed financial statements and, in turn, reviewed financial statements are more credible than financial statements compiled by a CPA or prepared by the borrower. Three prior studies considered different levels of auditor attestation associated with financial statements. Bandyopadhyay and Francis (1995) presented loan officers with a commercial loan application that included financial information. Three different case versions included compilations, reviews, and audit reports. Using loan officers as subjects, they found that both the decision to lend and the interest rate to be charged were related to the level of attestation. Higher loan approval rates and lower interest rates were associated with audited statements.

Two other studies, however, reported conflicting findings. Johnson, Pany and White (1983) asked loan officers to evaluate financial statement information, approve a loan, and determine an interest rate. Four levels of attestation were provided: no attestation at all, compilation, review, and audit. The results of their study indicated that the level of attestation had no economic effect on either the loan acceptance or interest rate decision. Wright and Davidson (2000) examined the effect of auditor attestation on commercial lending. Results of their study indicated that auditor attestation had no effect on risk assessment, and, in turn, on the decision to recommend the loan.

Initial interviews with senior officers of small banks also revealed that audited financial statements are rarely required for a loan application in small banks. Small business borrowers' ability to use audit-level services is limited because audits are often prohibitively expensive (Martin et al. 1988). During the initial interview, a bank officer mentioned that the high cost involved in auditing and the competition among small banks prohibit those banks from requiring audited financial statements. Other officers stated that compilation by a CPA is sufficient for a loan evaluation in small banks. They suggested that rather than assessing the credibility of financial statements through independent attestation services, they evaluate the credibility of financial statements by judging the credibility of the borrower who provides them. Based on the previous conflicting research results, a second research hypothesis is tested in the null form.

H2: The level of attestation has no significant difference in the perception of the importance of financial statements in the lending decision of small banks.

A possible reason why the level of attestation has no effect in the loan decision by loan officers is suggested by Waterston (1979): loan officers may not understand the differences among audits, reviews, and compilations. Wright and Davidson (2000) proposed training and educating loan officers to explain the difference among audits, reviews, compilations and information prepared by management. If we assume that training and education are effective methods of teaching loan officers such knowledge, the response of loan officers who have more banking experience and those with a business degree may be different from those of loan officers with less experience and those with non-business degrees. Loan officers with more banking experience might have

more training and loan officers with business degrees might have taken accounting courses, thereby learning the different levels of attestation of financial statements. Thus, a final research hypothesis is tested.

H3: There are significant differences in the perception of the importance of different levels of attestation based on banking experience and business coursework in college.

Research Method

Sample Selection

The sample for this study consisted of loan officers of six small banks in the Southern California area. The size of total assets of these banks ranged from about four hundred million dollars to three billion dollars. Authors contacted either the president or vice president of operations at each bank and asked for their cooperation on data collection. A total of 105 survey forms with self-addressed envelopes were delivered for them to distribute to loan officers, and 57 surveys were collected. Members of each bank's board-level loan committee were allowed to participate in the survey as well. After eliminating surveys with missing responses, the usable sample consisted of 55 responses. The survey included several demographic questions such as banking experience and college major (or minor). Table 1 presents demographic characteristics of the respondents.

Table 1
Demographic Characteristics of Loan Officers
(N = 55)

Banking Experience	N
3 years or more	26
Less than 3 years	29
Major (Minor) in College	
Business Administration or accounting	30
Non-business	25

Survey Instrument

In order to measure the loan officers' perception of the importance of financial statements in lending decisions, an opinion survey questionnaire was developed. It included 19 variables that may be considered in lending decisions. Sixteen variables were selected from results of initial interviews with senior bank officers and from loan evaluation worksheets of two community banks. Three variables—client education, legal

structure of the business and client's personal net worth—were selected from the study of Page, Trombetta and Werner (1977). Respondents were instructed to record their opinion on the importance of loan decision variables on a seven-point scale ranging from "not at all important" to "extremely important." Respondents were asked to assume that the borrower applied for a commercial line of credit loan that is significant in dollar amount, but less than the respondent's legal lending limit. From the initial interviews with senior bank officers, authors found that most commercial line of credit loans are less than two million dollars. Respondents were assured of complete anonymity and were requested to disregard whether such data including financial statements attested by a CPA is required by any other parties including regulatory agencies.

Research Results

To test the importance of financial statements in the lending decision, the overall means for considerations in lending decision was calculated. The results are presented in the Table 2. Three non-financial variables—loan purpose, collateral and years in current business—were the three top-ranked considerations in the lending decision. These three variables were identified as very important by the senior officers whom the authors interviewed. The importance of personal collateral in relationship lending was also found in the study by Brick and Palia (2007). Financial statements with CPA involvement—whether audited, reviewed or compiled—were also perceived as important considerations. The mean scores of the first three non-financial variables and the second three financial statements variables are not statistically different. Other information like nature of the business, tax return, credit scores and physical observation of the business are perceived as important information in the loan decision of small banks. Client education, client race/nationality and client gender were not considered as important in the loan decision. Therefore, H1 is supported.

Table 2
Mean Scores of Consideration in Lending (Overall)

Consideration	Mean
Loan purpose	6.20
Collateral	6.18
Years in current business	6.07
F/S audited by CPA	6.01
F/S reviewed by CPA	5.98
F/S compiled by CPA	5.94
Nature of business	5.94
Tax return	5.90
Client credit score	5.89
Physical observation of business	5.81
Client personal net assets	5.63
Guarantor	5.56
Other business experience	5.49

Reputation of client	5.12
F/S prepared by client	5.00
Legal structure of business	4.70
Client education	3.74
Client race/nationality	1.98
Client gender	1.72

Scale	1 Not at all important
	4 Neutral
	7 Extremely important

The difference of mean scores of the three different levels of financial statements involving a CPA is not significant. Though three levels of financial statements involving CPAs were perceived as important, financial statements prepared by the client (mean = 5.0) were not considered as important as financial statements involving a CPA (mean = 6.01 for audits, 5.98 for reviews and 5.94 for compilations). The t-value of the comparison of means between financial statements prepared by clients and those complied by a CPA was 5.69 ($p<.01$). With regard to the perceived importance, only financial statements prepared by the client are significantly different from the statements involving a CPA. Based on these results, H2 is partially rejected. As long as a CPA is involved, the level of attestation does not affect the perceived importance. However, financial statements prepared by clients are not perceived as important information, compared to those financial statements with CPA involvement.

Table 3 shows mean scores of considerations by different groups. It is noteworthy that financial statements compiled by a CPA were perceived as most important among three kinds of financial statements involving CPAs in the less experienced group and the non-business major group. T-test results (Table 4) show that between the more experienced group and the less experienced group, there is a statistically significant difference in mean scores of financial statements compiled by a CPA (t-value=2.10, $p<.05$) and financial statements prepared by clients (t-value=2.06, $p<.05$). More experienced loan officers recognized that the compiled financial statements and financial statements prepared by clients are less credible than the two types of financial statements with some form of attestation.

The other three variables that have significant differences between the more experienced and the less experienced groups are client experience in current business, client personal net worth and guarantor. The more experienced group put more emphasis on these three variables than the less experienced group. There is no statistically significant difference in any one of 19 variables for college major background at the .05 significance level. Therefore, H3 can be supported on the basis of banking experience only.

Table 3
Mean Scores of Consideration in the Lending Decision by Group

Consideration	More Experience	Less Experience	Business	Non Business
Loan purpose	6.23	6.17	6.20	6.20

Collateral	6.23	6.13	6.23	6.12
Years in current business	6.23	5.93	6.16	5.96
F/S audited by CPA	6.03	6.00	6.10	5.92
F/S reviewed by CPA	6.00	5.96	6.03	5.92
F/S compiled by CPA	5.69	6.17	5.83	6.08
Nature of business	5.96	5.93	5.96	5.92
Tax return	5.96	5.86	5.83	6.00
Client credit score	5.96	5.82	5.80	6.00
Physical observation of business	5.80	5.82	5.83	5.80
Client personal net assets	5.88	5.41	5.66	5.60
Guarantor	6.00	5.17	5.73	5.36
Other business experience	5.61	5.37	5.43	5.56
Reputation of client	5.26	5.00	4.96	5.32
F/S prepared by client	4.69	5.27	4.86	5.16
Legal structure of business	4.65	4.75	4.73	4.68
Client education	3.69	3.79	3.73	3.76
Client race/nationality	1.98	1.75	2.00	1.52
Client gender	1.80	1.65	1.83	1.60

Scale 1 Not at all important
4 Neutral
7 Extremely important

Table 4
Results of t-tests (Difference in Experience)

Consideration	t-value
F/S prepared by client	2.06*
F/S compiled by CPA	2.10*
Experience in current business	2.03
Client personal net worth	2.26*
Guarantor	4.89**

* $p<.05$, one tailed test
** $p<.01$, one tailed test

Conclusions

The results of this study provide evidence that financial statements information is perceived as important information used in the loan decision of small banks when those statements have CPA involvement. The finding of previous studies that small banks rely heavily on non-financial information is also confirmed in this study.

The findings suggest that loan officers of small banks do not realize the significant difference in credibility among financial statements of different levels of attestation. The implications for practice are that small bank loan officers may not adequately consider the credibility of financial information when evaluating commercial loans. Some loan officers may not think that the size of the difference in credibility among financial statements of different levels of attestation does not justify the significant amount of cost related with the attestation services provided by CPAs. Loan officers with a business degree should have taken some accounting classes in college and were expected to recognize the difference in credibility among different levels of attestation. But results of this study indicate that their perception of the importance of attestation is not significantly different from that of loan officers with a non-business degree. Introductory accounting courses taught in college should be designed to cover the difference in credibility among audits, reviews, compilations and information prepared by the management.

The results of this study also indicate that loan officers may have learned, through banking experience, that the credibility of compilations and client-prepared information is much lower than that of independent reviews and audits. Training may also be warranted to teach the difference in credibility among financial statements with different levels of attestation.

This study does not provide insight into the possible interactive effect of loan officers' educational background and experience on the loan officers' perception of the importance of attestation. A future study in the form of a multivariate analysis is warranted to provide insight into the interactive effects among such variables.

Finally, it is important that the findings and conclusion of this study be considered in light of the limitations of a small and regional sample and possible nonresponse bias. The findings of this study may not be generalized to all loan officers of small banks.

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The Economic Potential of the Arkansas Sweet Potato Industry: Some Evidence from Dallas

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Abstract

This paper examines the Arkansas sweet potato industry, which appears to have succeeded in moving the market for its agricultural product from the traditional perfect competition to monopolistic competition. Transport costs are found to play a major role in getting the product to market. Since Arkansas is unlikely to be able to economically compete directly with producers from much larger entities such as California and China, the fact that marketing and distribution differentiators have been used to turn around what was considered a dying industry is somewhat remarkable,. The authors hope that this industry will serve as a success story for product differentiation and niche marketing.

I. Introduction

The purpose of this paper is to explore the potential of sweet potatoes as a reliable money crop for small farmers in the Arkansas Delta region, an economically depressed area. A national trend has been toward large farm operations and away from smaller farms. This paper will present evidence that Arkansas sweet potatoes, a product sold largely in Dallas, may provide the best opportunity for local farmers to strategically reverse the trend and benefit from marketing a previously overlooked commodity.

Widely acknowledged throughout the world as an extremely nutritious vegetable (Low, et. al., 2007; Peet, 2001; Prakash, 1994), the sweet potato has been the subject of much recent research. Some authors have suggested that sweet potatoes might be the answer to some of the world's thorniest problems: efficient feeding of the masses and sustainable agriculture (Peet, 2001; Prakash, 1994). China is the world leader in sweet potato production, as shown in Table 1, producing over 80 percent of the world's crop in 2007. However, China appears to consume most of the sweet potatoes it grows (largely for animal feed). Figure 1 depicts Chinese trade in sweet potatoes, shown in a logarithmic scale so that both imports and exports can be portrayed on the same graph even though the two measures have vastly different scales.[1] Both imports and exports of sweet potatoes have grown in China recently, indicating that China is not so large a threat to other sweet potato producing countries as its sheer volume of production might indicate.

Fairly easy to grow in well-drained, sandy loam, it is well-adapted to the southern United States. North Carolina is the leading producer of sweet potatoes in the United States, followed by California, Mississippi, Louisiana, Alabama, and Texas, in order (NCSPC, LASPC). Figure 2 shows that the four-firm concentration ratio (by state) for sweet potatoes has been almost steadily increasing over the past thirty years, indicating that the sweet potato industry in the United States is tending to consolidate in the top four states. However, the composition of the top four producing states has changed over the

[1] To put the numbers plotted in Figure 1 in perspective, the Chinese imports in tonnes from a low of 2 in 1987 to a high of 177 in 1998. Chinese exports of sweet potatoes in tonnes varied from a low of 310 in 1966 to a peak of 96932 in 1991.

past thirty years with California and Mississippi surpassing Louisiana in sweet potato production. This indicates a potential opportunity for a state whose sweet potato industry is willing to become more efficient and/or market its product better.

Table 1
World Production of Sweet Potatoes by Country, 2007

Rank	Country	Production (Metric Tons)	Share of Total
1	China	102,000,000	80.91%
2	Nigeria	3,490,000	2.77%
3	Uganda	2,602,000	2.06%
4	Indonesia	1,829,042	1.45%
5	Viet Nam	1,450,000	1.15%
6	Japan	1,000,000	0.79%
7	India	980,000	0.78%
8	Tanzania	960,000	0.76%
9	Rwanda	940,000	0.75%
10	Madagascar	870,000	0.69%

Sources: **USDA National Agricultural Statistics Service and UN Food and Agricultural Organization**

Figure 1

China Sweet Potato Trade, 1966 - 2005

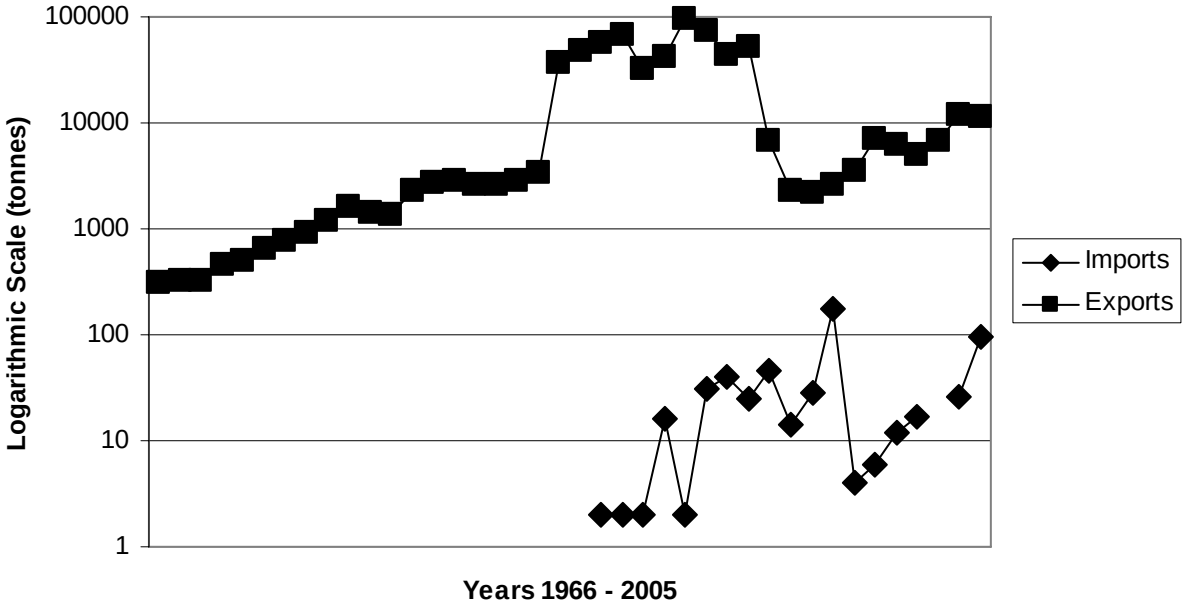
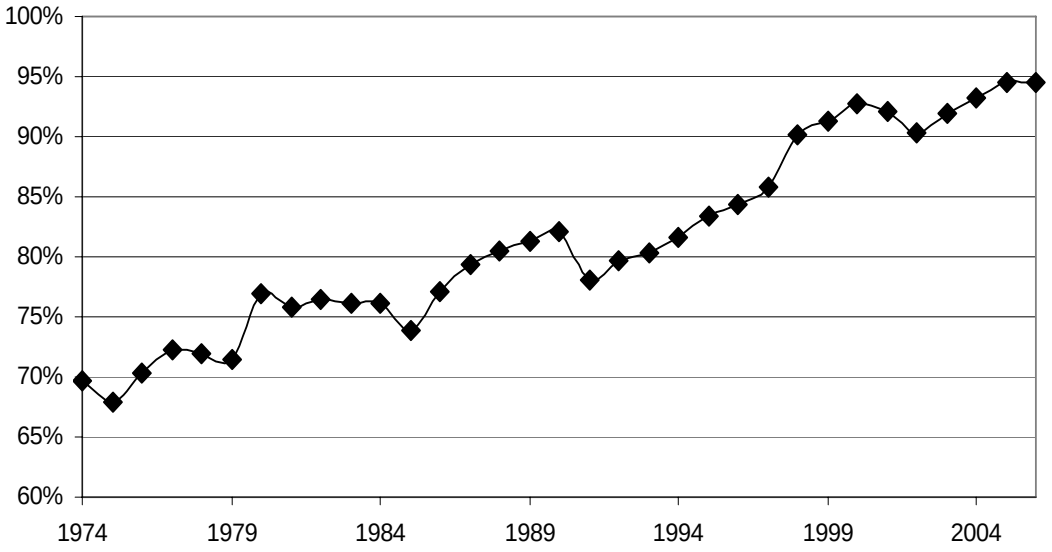


Figure 2

Four-firm (state) Concentration Ratio for Sweet Potato Production in U.S., 1974-2006



Why is the position of the top states so fluid in market share? The example of Arkansas illustrates some of the dynamics of the U.S. sweet potato industry. One of the most impoverished areas in the United States, the Arkansas Delta region that was deposited by the Mississippi River and its western tributaries is a prime sweet potato potential growing area (Gaul and Morgan, 2007). As recently as 1977, Arkansas produced about 1 percent of the United States production in sweet potatoes (the same as Arkansas' percentage of U.S. population). This share has fallen dramatically during the past thirty years as technological advantages in production, storage, and marketing have paid off for other states such as California and Mississippi. Around 2000, in dire need of a cash crop, Arkansas sweet potato farmers sought economic development efforts centered on their primary product (FSMIP Report, 2000). Hoping to use vertical relationships with users of sweet potatoes, the farmers sought one-time payments tied to particular marketing and distribution strategies rather than ongoing price supports (Gaul and Morgan, 2007). In market structure terms, the approach was to turn a short-term niche into long-term competitive advantage.

Recognizing the need for assistance in the region, the U.S. Department of Agriculture Federal-State Marketing Improvement Program awarded more than $285,000 in grants to the Arkansas State Plant Board from 2000 to 2005 to help Arkansas Delta farmers market their products (FSMIP Reports, 2000 – 2005). Some of these funds were used for technical assistance from Louisiana State University for improved growing and marketing techniques. Much of the funding was to complement the $1.9 million sweet potato storage facility in Helena-West Helena. The facility, completed in 2007, received a $500,000 grant from the U.S. Department of Commerce (News Release, 2006). The facility is designed to accommodate 120,000 bushels of sweet potatoes for up to 12 months and can be expanded to accommodate 300,000 bushels (FSMIP Report, 2005).[2]

II. The Economics of Sweet Potato Storage and Distribution

Intended for use in both curing and storing[3] sweet potatoes, the facility has been projected as a means to store the product while the selling price is low. Then, when the price is higher, the product can be brought out of storage to be sold at a premium. In this regard, the purpose of a storage facility is the same as that of a futures market[4]: to reduce price volatility. Since agriculture is a noted example of an industry in which price swings result in zero long-run economic profit, a steady price would allow sellers to at least cover fixed cost (such as the cost of a storage facility) and thereby stay in business.

For the minority farmers of the Arkansas Delta Produce Marketing Association (ADPMA) (notably Lee, Monroe, and Phillips Counties), contracts negotiated by the non-profit Winrock International provided a steady market for virtually all of their produce. The Fort Smith, Arkansas, plant of Gerber Foods, the largest baby food manufacturer in the world, and Bright Harvest, a Clarksville, Arkansas, processor of frozen food products,

[2] The actual USDA Grant Report states that the facility opened in Fall, 2006, at a cost of $2.5 million.

[3] Curing is necessary to bring out the required flavor of sweet potatoes. After curing, sweet potatoes must be stored at temperatures from 55 to 60 ° F to minimize losses from pests and diseases. Uncured sweet potatoes are referred to as "green." The Phillips County, Arkansas, facility is designed to be adaptable to long-term storage. Thus far, because of the effectiveness of marketing efforts, the facility has functioned as a sorting, curing, packaging, and distribution site only, since contractual demand has provided a ready market for the entire crop. This means that the effectiveness of the facility for smoothing demand has not yet been needed or tested.

[4] No futures market exists for sweet potatoes.

agreed to purchase No. 2 graded, cured, sweet potatoes in bulk from January through June. In addition, Glory Foods, an Ohio-based retailer of Soul Food, agreed to purchase green sweet potatoes during the months of November and December. Furthermore, ADPMA has succeeded in selling fresh sweet potatoes to Affiliated Foods for distributed in Arkansas grocery stores and is seeking certification to bid on USDA contracts for public school lunch programs (FSMIP Report, 2005). Sweet potatoes grown in Arkansas are also sold to the public in farmer's markets, most notably the Dallas market as mentioned below.

III. Data

The primary source of price information on Arkansas sweet potatoes is The Agricultural Marketing Service (AMS, 2007) of the U.S. Department of Agriculture (USDA). These data are micro, consisting of daily prices for agricultural commodities, including sweet potatoes, grown in the U.S. and sold as fresh in fourteen major agricultural markets throughout the U.S.

The USDA data indicate that no Arkansas sweet potatoes have been sold in the following markets from 1998 to 2007: Atlanta, Boston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, or Seattle. Negligible amounts have been sold in Baltimore, Chicago, and Detroit. No Louisiana sweet potatoes have been sold in Atlanta for over a year. Since most sweet potatoes are sold from trucks, it is little wonder that the high transport cost to far-flung markets may not justify the effort. In spite of this, California, further removed from the Dallas market than Arkansas or Louisiana are located from Atlanta or St. Louis, still sells substantial numbers of sweet potatoes in Dallas.

From the USDA data, it would appear that Arkansas sweet potato farmers were selling their product primarily in St. Louis from October, 1998. The market was very thin, representing only a couple of farmers selling differing varieties, grades, and sizes. The seasonal nature of Arkansas sweet potato sales resulted in fragmented price series with substantial breaks for long periods of time.

However, in late June, 2005, Arkansas sweet potato farmers began selling their product in Dallas. Sales quickly shifted from St. Louis to Dallas, with the last St. Louis sales occurring in November, 2006. The Dallas market has proven much more reliable than the St. Louis market for Arkansas sweet potatoes, with the only significant break in sales occurring for 14 days over Christmas, 2006.

Since Dallas is the dominant Arkansas sweet potato market, we analyzed price series for the Dallas market to estimate Arkansas farmers' perceptions of solidity or softness of the market for their products and to compare and contrast Arkansas farmers' potential relative to those from other states that are represented in the Dallas market. Sweet potato prices are quoted for forty pound cartons. To construct a price series, we averaged the prices for a particular product across all sellers that day. For the popular southern Beauregard variety, ungraded, Jumbo size sweet potato, we found only six breaks in Dallas sweet potato sales from all sources. Most of these breaks were for three weeks or less. The longest break was for 100 days, during the first half of 2002.

We conjecture that high transport costs are a major factor in explaining why China's sweet potato growers are not major competitors with Arkansas farmers. Although China leads the world by far in the production of sweet potatoes, as of 2001 the U.S. exported about four times as many sweet potatoes as did China (FAO Stat, 2007).

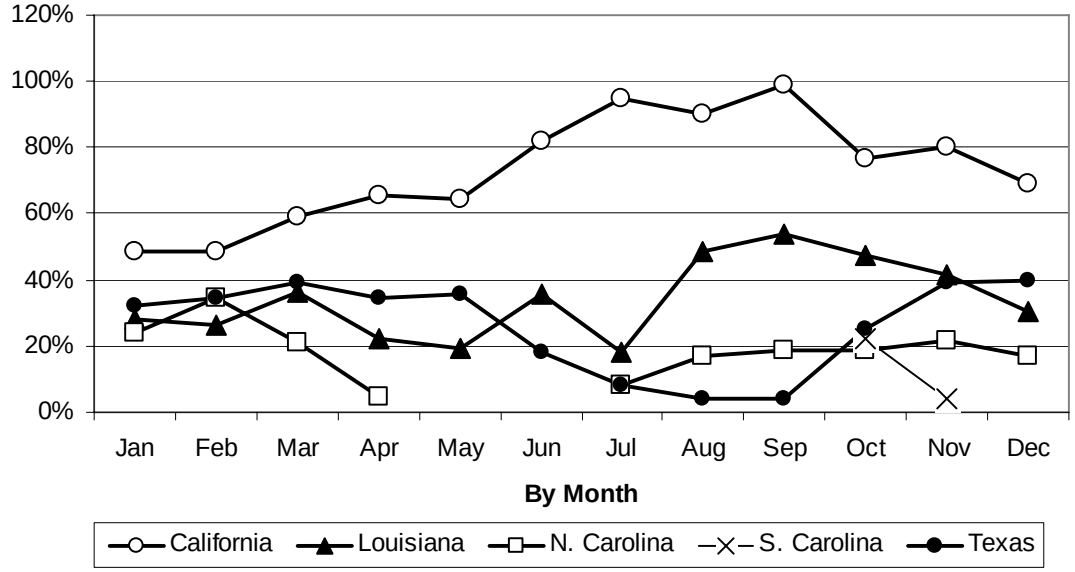
Although we did not have access to fuel costs for China, we analyzed United States data to evaluate the proposition that transport costs work in favor of Arkansas farmers.

IV. Methodology and Results

We compared Dallas market data for Arkansas, California, Louisiana, North Carolina, South Carolina, and Texas sweet potatoes. Figure 3 shows the percentage of days that the various states sold sweet potatoes in Dallas from 1998 to 2005. California was obviously the dominant state selling sweet potatoes in Dallas during this period, selling in Dallas for the entire month of September and never showing up less than 49 percent of the time. By contrast, Arkansas producers sold no sweet potatoes in the Dallas fresh market from 1998 to 2005. South Carolina sold only in October and November, showing up 22 and 4 percent of the time, respectively.

Figure 3

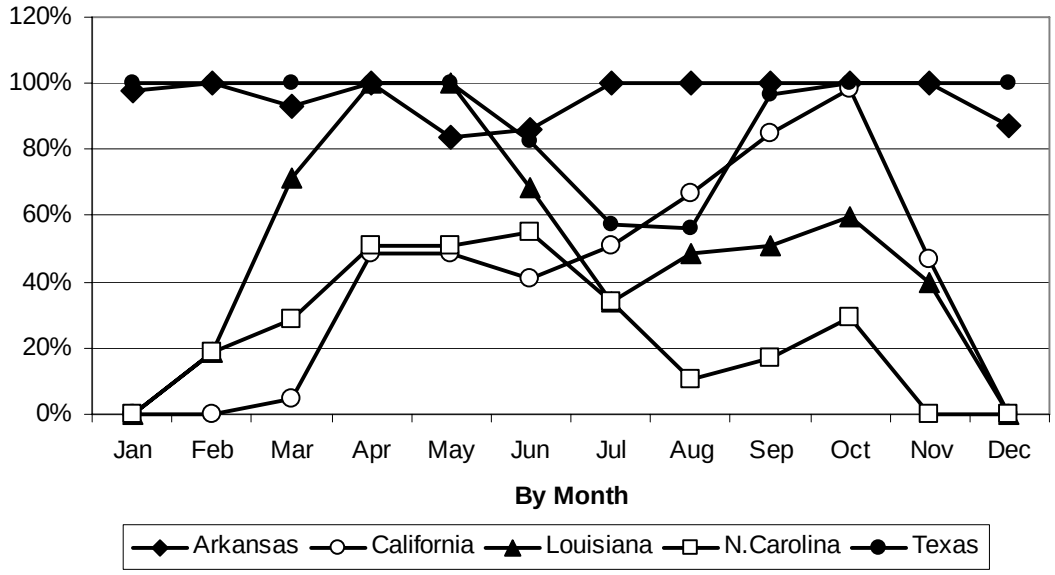
Percentage of Market Days that Sweet Potatoes were Sold in Dallas, 1998-2005



The situation changed dramatically when Arkansas entered the market in June, 2005, as shown in Figure 4. California sellers were represented in the Dallas market 100 percent of the time in October, but none of the time in January, February, and December. South Carolina dropped out completely. Sales of North Carolina and Louisiana sweet potatoes became more seasonal. Arkansas and Texas sellers showed up almost the whole time. It is probably no accident that the market change accompanied large spikes in fuel prices.

Figure 4

Percentage of Market Days that Sweet Potatoes were Sold in Dallas, 2005-2007



As a proxy for fuel costs, we used the Producer Price Index (PPI, 2007) for gasoline as reported monthly by the U.S. Bureau of Labor Statistics. The results of simple OLS regressions of monthly sweet potato prices against the gasoline PPI are shown in Table 2. Of Arkansas, California, and Texas, only California's sweet potato prices were significantly correlated with fuel prices.[5] Figures 5, 6, and 7 plot the prices of California, Arkansas, and Texas sweet potatoes, respectively, alongside prices estimated from the OLS model using fuel costs. Consistent with the regression results, only California's prices closely track the prices that fuel costs explain. As might be expected, transport costs in general and fuel costs in particular remain a primary consideration for sweet potato farmers.

[5] Since we model transportation costs, the fuel PPI is the only dependent variable we consider in Table 2. In each case (for all three states), the Durbin-Watson statistic lies below the critical lower bound, indicating positive autocorrelation (see Gujarati, 1978, pp. 226, 235-239). This is also borne out by a plot of the residuals from the regressions. Were we to use our F or t ratios for statistical inference (relying on the p values), this would be cause for concern, since the presence of autocorrelation results in inefficient, but unbiased and consistent OLS estimates. Since we are merely showing R^2 (and plotting the fit) for the three locations, however, we see no need to correct for positive autocorrelation. A possible extension of the paper is to derive a comprehensive pricing model for sweet potatoes, for which additional variables and corrections for autocorrelation would be needed, including the use of possible co-integrating factors.

Table 2
Regression Results with Producer Price Index for Gasoline as Explanatory Variable for Sweet Potato Prices by State of Origin

	California	Arkansas	Texas
R^2	0.4212	0.0506	0.0290
Adjusted R^2	0.4128	0.0154	0.0074
Number of Observations	71	29	47
Overall F Ratio	50.2187	1.4385	1.3450
Significance F	9.27E-10	0.2408	0.2523
Intercept (t ratio)	8.3006 (12.1125)	10.9930 (5.1133)	12.7260 (19.0880)
P value	9.63E-19	2.25E-05	3.33E-23
PPI – Gasoline (t ratio)	0.0394 (7.0865)	0.1292 (1.1994)	0.0446 (1.1597)
P value	9.27E-10	0.2408	0.2523
Durbin-Watson D	0.4006	0.2812	0.9332

Figure 5

Average Price of California Sweet Potatoes sold in Dallas and Results of Model Using Gasoline PPI, 1999-1007

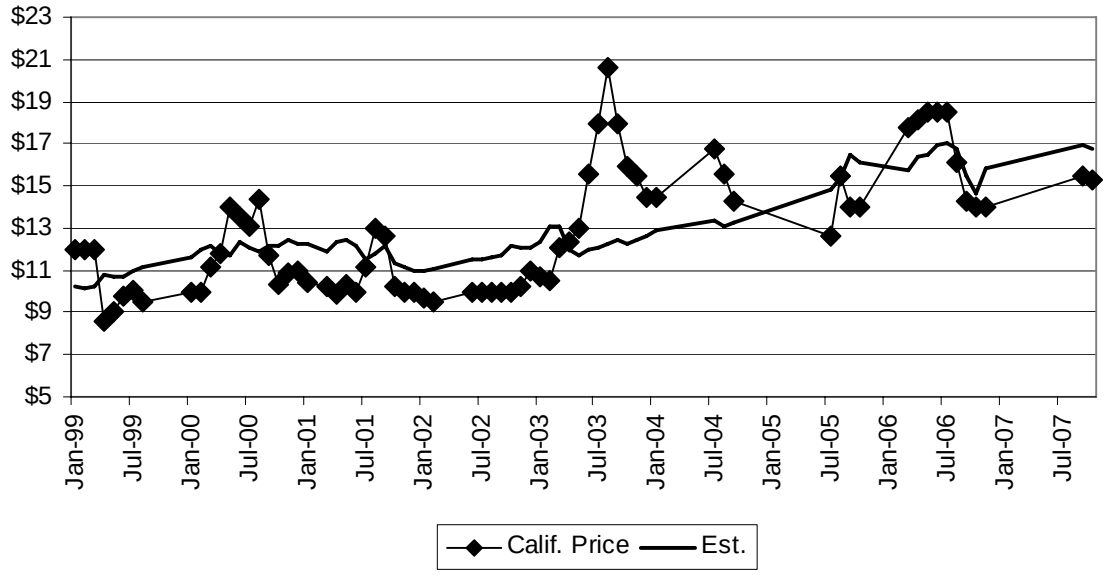


Figure 6

Average Price of Arkansas Sweet Potatoes sold in Dallas and Results of Model Using Gasoline PPI, 2005-2007

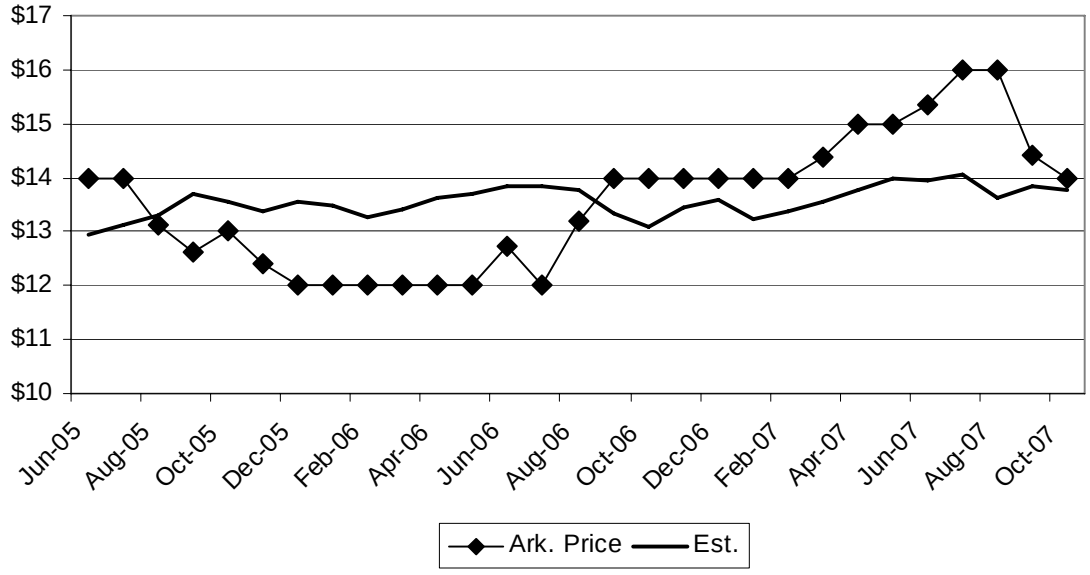
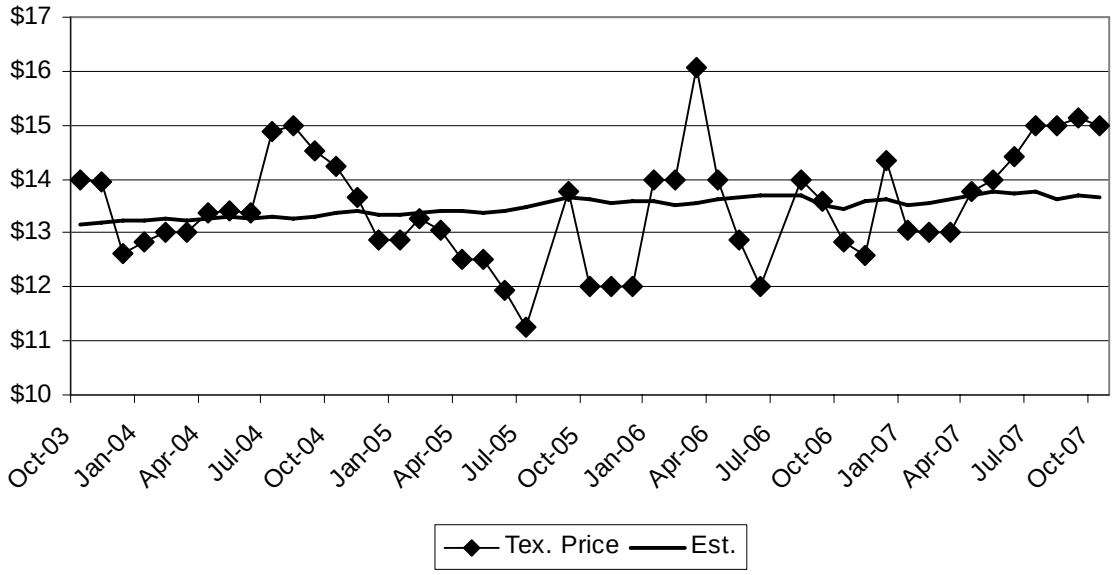


Figure 7

Average Price of Texas Sweet Potatoes sold in Dallas and Results of Model Using Gasoline PPI, 2003-2007



V. Conclusion

Sweet potatoes remain primarily a regional commodity. Even though China has a significant comparative advantage in their production and remains the world's leading producer, China consumes most of the sweet potatoes it produces. On the other hand, Arkansas has carved out a small, profitable, niche in selling sweet potatoes inside Arkansas and Texas. In terms of market structure, the Arkansas sweet potato industry would appear to be closer to monopolistic competition than the traditional market structure for agricultural products: perfect competition. If as successful as it appears, the Arkansas sweet potato industry would appear to be breaking out of the dominant firm/competitive fringe situation in which it had operated for over thirty years.

The most important factor in this success is likely product differentiation.[6] For example, one of the sweet potato's beneficial ingredients is beta-carotene. Since beta-carotene is found only in orange vegetables, varieties other than Beauregard (including the purple-fleshed varieties more popular in the Orient) may not have the nutritional value of the sweet potatoes traditionally grown in the southern U.S. (van Jaarsveld, *et. al.*, 2005) Arkansas farmers appear to have been careful to grow only Beauregard sweet potatoes, unlike California. Other product aspects that Arkansas farmers seem to have successfully exploited in differentiating their product include the proximity to the world's leading producer of frozen sweet potato products and the world's leading producer of baby food. The fact that both of these users of Arkansas' product are located in Arkansas, within a few hundred miles by highway and river, means that Arkansas'

[6] To be fair, we should not neglect the influence of the weather and acts of God. For example, Mississippi's sweet potato industry was sent reeling by an abnormal number of hurricanes drenching the fields one year and an unprecedented drought the next (LSUAgC, 2006).

advantage in transport costs is significant. Given the recent widespread concern over food products imported from China, Arkansas' reputation as a provider of a safe product is beneficial.

Unlike farmers in other states, Arkansas sweet potato farmers seem to have concentrated on the size and grade of product that their end users most request: medium size and number one grade. Another important aspect of branding Arkansas sweet potatoes is that of culture. As pointed out in Horton and Robbins (2007), Arkansas sweet potato producers have been successful in marketing their product to Glory Foods, an Ohio-based producer of Soul Food. Alternative uses of the product, such as sweet potato French fries, have also been successfully marketed.

Much additional work remains to be done. The dynamics of the Chinese sweet potato market are difficult to discern because of limited data. In addition, different sweet potato varieties make comparisons between states, regions, and countries difficult to interpret. Also, in spite of advances in growing, transportation, and storage over the past thirty years, most sweet potato markets have remained primarily local, again making comparisons between different locations subject to error.

A fully developed time series model of sweet potato prices, while beyond the scope of this paper, may be developed using the USDA databases referred to in the reference section. As mentioned in a footnote above, such a model should investigate possible co-integrating factors since commodity prices tend to be non-stationary. In addition, a production model of sweet potatoes, again using input data available from the USDA, is needed for Arkansas and surrounding states. Another possible extension of the current paper would be a case comparison of the Arkansas sweet potato industry with that of its less successful neighbor in the industry, Mississippi.

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