Firm Size, Profitability, and Growth: A Dynamic Panel Analysis of the U.S. Life Insurance Industry

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Abstract

This paper analyzes the relationship between growth and firm size in the U.S. life insurance industry. Applying a dynamic panel model to a sample of life insurance companies from 1993 to 2010, I find strong support for the law of proportional effect (LPE). The results indicate that there is persistency in the growth of life insurance companies. Moreover, the findings suggest that firm specific characteristics such as age, profitability and leverage explain the size of insurance companies and macroeconomic covariates such as growth in GDP and the real interest rate are significant determinants.

I. Introduction

The issues of whether larger firms grow faster than smaller firms, and whether these larger firms have a better performance than smaller ones, have generated a large body of research in the economics and industrial organization fields. The influential law of proportionate effect (LPE) postulates independence between firm growth and size (Gibrat (1931) and Sutton (1977)). The validity of LPE has been a topic of considerable discussion among academics. The range of influence of the LPE has not been limited to the manufacturing industry. In fact, the LPE has attracted interest in the financial services industry (Goddard et al (2002), Hardwick et al (2002), Goddard et al (2004), Choi (2010), and Adams (2014)).

Companies that grow and become large have the ability to exploit economies of scale and scope. These large firms commend a sizable market share that may allow them to enhance their profitability. In turn, profitability generates internal resources to finance future growth. The empirical results of studies on the relationship between growth and size have been interpreted as part of larger structural models. Although larger companies tend to exhibit decreasing returns to scale (Cummins et al 1998), they also have the opportunity to become more efficient through growth. Without growth, companies cannot acquire the necessary business volume. However, to provide for future growth, an insurance company must generate and maintain sufficient capital to satisfy regulators. This needed capital is generated internally through higher earnings or it could be raised externally as well. Organizational structure in the life insurance industry is somewhat of an impediment to raise funds in the capital market. Many companies are organized as mutual companies and even the majority of stock companies are closely held. In addition, the cost of external capital could be high due to the inability of creditors to assess the assets of the insurer and the adequacy of its reserves.

Increasing competition in the U.S. and worldwide markets, wave of consolidations in the U.S. market, and a move toward deregulation, with the passage of the Financial Services

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Modernization Act of 1999, have shaped the life insurance market in the period covered by this study. To face these market challenges, life insurance companies are seeking to grow and maintain their market share of the financial services industry.

Though most studies on the determinants of firm size have focused on manufacturing firms, few studies analyzed the performance of the banking industry. One of the studies in the financial sector examined the growth of U.S. credit unions by Goddard, McKillop and Wilson (2002). The authors find that larger credit unions grew faster than their smaller counterparts. In the banking industry, the results are mixed. In the insurance industry, a study by Hardwick and Adams (2002) found no significant difference between the growth rates of small and large UK life insurance companies. Choi (2010) tests the LPE hypothesis for the U.S. property and liability insurance companies. Choi finds evidence that the LPE hypothesis holds for the property and liability industry. The author used a balanced data which may cause survivorship bias; however, he checks for the survivorship bias by splitting the sample into two periods. I believe that unbalanced data with the correct estimation procedure would better address the issue and would provide unbiased estimates. The latest study by Adams et al (2014) tested Gibrat's law using Swedish life insurance companies in a historical context. The data period covered goes back to the mid-twentieth century.

Because of the inherent differences between the two countries' markets in terms of regulation, organization and size, I seek to empirically investigate the growth of U.S. life insurance companies and their profitability. This article contributes to this strand of research by presenting results on a segment of the insurance industry that has not been studied before, and improves upon earlier research by considering macroeconomic variables as explanatory variables. I use an estimation procedure known as the generalized method of moments (GMM) that is appropriate for a panel data and accounts for endogeneity in some of the explanatory variables. This method was developed by Arellano and Bond (1991).

The reminder of the paper is organized as follows: Section 2 discusses the empirical model and the estimation procedure, Section 3 analyzes the results, and Section 4 concludes the paper and summarizes its findings.

II. Estimation Procedure, Empirical Model, and Sample

The theoretical basis for Gibrat's law or the law of proportional effects stipulates that growth of firms is random meaning it is independent of their size.
I estimate the following model:

$$(1) \quad S_{it} = \beta_1 S_{it-1} + \beta_2 Profitabilty_{it} + \beta_3 Age_{it} + \beta_4 Cost_{it} + \beta_5 Leverage_{it} \beta_6 Organization_{it} + \beta_7 Affiliation_{it} + \beta_8 GDP_t + \beta_9 RealRate_t + \varepsilon_t + \nu i + \tau i$$

Where S_{it} is the natural log of total assets of life insurer i at time t, with i= 1,..,N and t=1,...,T
Definitions of the independent variables used and their expected signs are reported in Table1.
Gibrat's Law holds if β_1 is insignificantly different from one implying that firm growth is independent of its size. Statistically significant values of $\beta_1 < 1$ would imply that smaller companies grow faster than larger ones.

Equation (1) has a lagged dependent as an explanatory variable therefore fixed effects estimation yields biased estimates especially when the time-period (T) is small compared to the number of cross sections (N). The most commonly used estimator for dynamic panels in the

literature is the GMM estimator by Arellano and Bond (1991). The procedure entails an instrumental variable estimation of the differenced equation (or levels) is performed. As instruments for the lagged difference of the endogenous variable all lagged levels of the variable in question are used, starting with lag two and potentially going back to the beginning of the sample. Consistency of the GMM estimator requires a lack of second order serial correlation in the residuals of the differenced specification. The overall validity of instruments can be checked using the Sargan test of over-identifying restrictions (Arellano and Bond (1991)). One limitation of the procedure is finding appropriate instruments to endogenous regressors. A second limitation is when the time period is short compared to the number of cross sections, the estimated coefficient of the lagged dependent maybe biased.

Empirical Model:

In this paper, I hypothesize that the growth of life insurance companies depends on a number of explanatory variables that are firm specific and others that are macroeconomic in nature, and in line with previous research in the insurance industry.

Profitability. A main source of growth for any companies is profits. Generating sizable net revenues help companies expand their business. Internal funding is important for insurance companies which rarely raise external funds, especially mutual companies. The vast majority of stock life insurance companies are not publicly traded which limits their access to the wider capital market. It is expected that more profitable companies are more likely to get larger and grow faster.

Age. Defined as the difference between the year of observation and the business start date. There are two possibilities. One is that young companies could grow faster at the beginning and later, as they reach economies of scale, will grow at slower pace or may reach a plateau by facing more competition by new comers. Goddard, McKillop, and Wilson (2002) argue that the effect of age could be either positive or negative. There are low barriers to entry and high barriers to exit, as life insurance companies are prevented from exiting the market because policyholders buy life insurance coverage and annuity products for the long run. Those requirements maybe circumvented through mergers, sales, or liquidation. In addition, capital requirements to start a life insurance company are modest. This implies that young firms grow faster than older firms (Choi, 2010). On the other hand, one can argue that insurance buyers are drawn to established companies given the name recognition those companies enjoy. Several insurance companies advertise heavily through mass media and have become household brand names.

Cost. A measure of efficiency is defined as operating expenses over total direct premiums written. The effect of the cost input is related to the economies of scale. It is hypothesized that companies that have lower expenses relative to the total business revenues are more efficient, will have a competitive edge and attract more business. Greene and Segal (2004) find that the U.S. life insurance industry present significant cost inefficiencies with direct impact on growth. Their findings imply that companies that are able to exploit those cost inefficiencies by reducing their own costs will be more profitable and hence realize higher growth. Therefore, I predict a negative relation between the cost measure and the growth of insurance companies.

Leverage. This explanatory variable is used to control for risk by increasing the likelihood of insolvency (Carson and Hoyt (1995)). It is defined as the ratio of net premiums written to policyholders' surplus. Lower leverage means lower risk. Companies that are perceived to be financially strong attract more customers. Many of the products sold by life insurance companies

are of long-term nature such as annuities, whole life insurance and, long term care. Therefore, the financial solvency of these companies is important to customers, investors and regulators. Hence, I predict an inverse relationship between leverage and firm growth.

Organization. There are two dominant organizational structures in the life insurance industry: mutual and stock companies. The mutual form combines the functions of owners and customers and maybe more efficient in controlling the owner-customer conflict. The expense preference hypothesis, that managers may have objectives other than profitability, predicts that mutual companies will have higher costs than stock companies due to lack of effective mechanisms to control and discipline managers (Cummins and Zi (1999)). I include a dummy variable equals to one if the company is a mutual and zero otherwise. The expense preference hypothesis predicts a negative relation between growth and organization form.

Affiliation. Insurance companies are organized as either single non-affiliated companies, or they can be part of fleet of companies under common management. Groups tend to be larger and more diversified across lines of business and geographically than single companies. Consequently, companies that are member of a group can share expertise with fellow members on complex insurance problems and may get financial, legal and other assistance if needed. I predict that companies that are part of an insurance group will be larger.

GDP. Life insurance sales are impacted by the general health of the economy more so than property and liability insurance coverage. These latter are either required by state law such as liability auto insurance or are a prerequisite to secure mortgage such homeowners' insurance. Most buy life insurance, annuity, health, and income replacement insurance on a voluntary basis often those benefits are employment based. Employers offer employee benefits at their own discretion. As the economy grows, and unemployment decreases more individuals/families will have access to benefits through their employers. Therefore, growth in the economy measured by the change in the gross domestic product will have a positive effect on the size of the U.S. life insurance industry. Studies show that changes in gross domestic product (GDP) induce growth in the insurance sector. According to Outreville (2013), most papers examining the relation between insurance and economic development focus on the demand side. Meanwhile, Cummins (1973) analyzes the effect of macroeconomic indicators on the U.S. life insurance industry. He concludes that total life insurance reserves and insurers' administrated pension reserves are correlated with gross national product (GNP) and permanent income. Webb, Grace and Skipper (2002) test the same hypothesis about the causal relationship between life insurance demand and the economy. The authors find strong evidence that insurance and banking spur capital stock productivity, which drives the level of output and investment.

Interest Rate. Insurance companies face several risks ranging from the traditional insurance risk, asset risk, legal risk, and interest rate risk. Insurance companies as financial intermediaries issue contingent claims and use premiums to invest in a variety of assets. Insurers' liabilities are measured by policy reserves and their assets are mainly comprised of bonds and stocks that are affected by changes in interest rate. The economic value of a financial asset or liability is the discounted value of its future cash flows. Thus, if interest rates increase, the economic value of future cash flows will decrease; if interest rates decrease, economic value will increase. The direction of the movement in values of both the assets and the liabilities, according to this principle, will be the same if durations of assets and liabilities are perfectly matched than there would be no effect from changes in interest rates. The problem, however, is that asset and liability values will

generally not move by the same amount in response to a particular change in interest rate. If they do not move in tandem, the net worth of an insurer will change over time due to the volatility of interest rates. The liabilities of insurers also vary with interest rates due to the correlation of interest rates with inflation. If the value of policyholders' surplus decreases then the degree of leverage increases, and the cost of capital will increase. Another implication of the increase in leverage is the potential for likelihood of default. Given that insurance companies have a large portion of their assets invested in the bond market, their value will be affected by the interest rate. The last decade was marked by a major financial crisis, a higher volatility in interest rates, and unprecedented growth in asset accumulation products such as annuities and mutual funds. These factors make earnings of insurance companies more volatile as a higher proportion of insurance business is linked to equity markets. I predict a negative relationship between interest rates and life insurance growth.

Sample:

Our sample consists of 719 companies using financial data from the NAIC Tapes for a panel of life insurers. This sample represents 90 percent of industry assets and 87 percent of insurance in force. The analysis uses company data and not group data for two reasons. First, organizational structure of group companies changes due to mergers and acquisitions. Second, group companies can file either a consolidated tax return or each member of the group files an individual return. I eliminated companies with peculiar characteristics such as zero or negative surplus, zero or negative premiums written. I also eliminated companies with unusual financial ratios. These companies seem to be in either financial distress or non-operating.

The sample covers the period from 1993-2010. I use accounting measures because a large number of life insurance companies are not publicly traded. To avoid survivorship bias, the sample is not restricted to companies having complete data for the entire eighteen-year period. Some companies drop out of the sample either due to merger, bankruptcy or surrender of license and new companies join the industry.

Table I reports the definition of the variables used in the analysis, their expected direction, and summary statistics for the entire sample and separately for mutual and stock companies. Stock companies outnumber mutual companies by a ratio of 1 to 16 in 2010 for example but mutual companies tend to be larger than stock companies. There were 48 mutual companies out of 832 but those 48 companies accounted for 16% of total assets. Those mutual companies tend to have been in business longer than stock companies. Another aspect of the life insurance industry is that companies could be operating as independent companies or as a member of a group. The number of companies that operate independently is about 192 in 2010. The average return on equity is about 2.3%.

Table I Variable Definitions, Descriptive Statistics, and Expected Sign
Time Period 1993-2010, Number of Observations = 18309

Variable	Definition	Mean Total	Mutual	Stock	Min	Max	Expected Sign
Size	Log(Assets)	18.4112	20.1112	18.3111	10.0242	26.4198	+
Profitability	Net income	0.1397	0.0889	0.1397	-9.9478	17.4389	+

	over equity						
Age	Number of years in business)	38.9367	88.6379	42.7788	1	166	+/-
Cost	Total expenses over direct premiums	6.6887	3.3379	5.6269	0.0198	33.0786	-
Leverage	Liabilities over surplus	2.0267	2.1476	2.0169	0.2959	5.5189	-
Organization	Mutual =1; Stock=0	0.0811			0	1	+
Affiliation	Member =1; Single=0	0.7222			0	1	-
GDP	Growth in GDP	0.0269			-0.0278	0.0469	+
Interest Rate	3-month rate	0.0161			0.0161	0.0311	-
Observations		18309	1414	16895			

III. Estimation Results

Table II reports the results for two variations of the model estimated. Most of the coefficient of the independent variables are statistically significant and have the predicted sign. The GMM model applies the instrumental variables procedure to deal with endogeneity problems. The Sargan test of over-identification and suitability of the instruments shows that model is robust and indicates that the instruments chosen are appropriate. The test of no first order autocorrelation cannot be rejected at the 0.01 significance level. This result is not surprising given the inclusion of the lag of the dependent variable in the model. The test of no second order autocorrelation is statistically significant at conventional levels.

Table II Life Insurer Growth Determinants

$$S_{it} = \beta_1 S_{it-1} + \beta_2 Profitabilty_{it} + \beta_3 Age_{it} + \beta_4 Cost_{it} + \beta_5 Leverage_{it}$$
$$\beta_6 Organization_{it} + \beta_7 Affiliation_{it} + \beta_8 GDP_t + \beta_9 RealRate_t + e_t + \nu_i + \tau_{it}$$

	Model 1 GMM		Model 2 GMM	
Explanatory Variables	Coefficient	T Stat	Coefficient	T Stat
Lag(size)	0.2272	7.6101***	0.3461	10.6298***
Profitability	0.5289	2.1689**	1.2007	2.8102**

Age	0.0311	8.5869**	-	-
Leverage	-2.4832	-6.3897**	-1.0825	-2.8298**
Organization	-0.8942	-0.1801	-3.6796	-3.7214***
Affiliation	0.4881	2.4941**	0.8984	4.6608***
GDP	0.3286	1.8422*	-0.6391	2.6486**
RealRate	-0.8082	-2.8012**	-0.5918	-1.7209*
AR(1)	-4.10***		-4.95***	
AR(2)	-1.17		-1.39	
Sargan Test	422.07***		453.86	

The table reports the parameter estimates of the GMM model, t-statistics are based on robust estimates of standard errors. AR(1) and AR(2) are tests for first and second serial correlation respectively. The null hypothesis no serial correlation in the first order is rejected. It is expected to have first order correlation due to the presence of the lagged dependent variable in the model. The null hypothesis of no serial correlation in the second order is not rejected. The Sargan test of overriding restrictions is statistically significant.
*10% significant, **5% significant, ***1% significant.

In Model 1 that includes all independent variables, the coefficient of the lagged size variable is 0.2272 and is statistically significantly different from one. I reject the null hypothesis that β_1 is equal to one at the 0.01 significance level. Therefore, the test results support Gibrat's Law that growth is independent of company size in the life insurance industry. The results are consistent with Choi's (2010) findings for U.S. property and liability insurance companies and Hardwick and Adams (2012) for UK life insurance companies. It seems that the body of empirical evidence supports Gibrat's law in the insurance industry. Those results reinforce the findings in the financial services industry including banks and credit unions. I find that age has a positive and significant effect on growth implying that established companies have a higher growth than younger ones as reported by Adams (2014) for Swedish life insurance companies. Profitability has a positive and significant impact on company size. Large profits generated by companies are used as a source for investments in new markets and new products. Companies perceived profitable will be able to attract new customers and get larger. Within the structure conduct paradigm known in the industrial organization literature, companies that commend a sizable market share are likely to attain higher profits. The insurance industry is presumed to be an oligopoly where few companies command a large market share. Efficient firms have a lower cost and are able to capture a higher market share.

The cost variable is not statistically significant though it has the correct sign. As a robustness check, I included several variations of the cost variable with similar results. Among the tried variables are marketing expenses over direct premiums written, and total operating expenses over net premiums written. The statistical insignificance of the cost variable in this study suggest that companies in this sample are operating at the minimum efficient scale.

The coefficient of the leverage variable is negative and significant. Higher leverage is associated with an increasing risk of insolvency which would adversely affect the growth of the company. The ratio of liabilities to policyholders' surplus is a measure of capacity in the insurance industry. It measures to what extent insurance companies can assume liabilities without jeopardizing the financial solvency of the company. Policyholders' surplus is cushion against unfavorable experience.

One of the characteristics of the insurance is its group affiliation. Life insurance companies affiliated with a group tend to be larger than independent companies. This is consistent with the findings by Choi (2010) for property liability insurance companies. This result seems to suggest that group members share financial, legal, and underwriting expertise which would help all members of a group to grow faster than single unaffiliated companies. The variable organization is not statistically significant in the first specification, but the coefficient in the second specification, excluding the age variable, is statistically significant. Mutual companies tend to grow slower than stock companies. This finding can be attributed to either that mutual companies are very large and have reached an optimum size, or that stock companies have easier access to the capital markets for funding to finance growth.

As expected, I find a positive and significant association between GDP growth and the size of life insurance companies. Higher economic growth increases discretionary income, and more individuals will buy life insurance products, or increase their contributions to annuities to save for retirement. Life insurance coverage offered as part of employee benefits is usually a multiple of annual salary. Therefore, as more individuals are employed and those employed get pay raises their life insurance coverage increases.

The second macroeconomic covariate is the real interest rate. The results show that there is an inverse relation between interest rate and firm size. When interest rates are low, life insurance profitability decreases, and life insurance products become less attractive to customers who shift their investment in other financial products with potentially higher returns. Life insurance companies are forced to increase premiums to compensate for the decreased rates of return on guaranteed products. A recent study by the NAIC (2018) examining the impact of interest rates on the profitability of life insurance companies found that during the period of 2006-2016 the spread between their portfolio yield and the interest they credit on insurance policies and other products has been declining thus impacting profitability.

Table III Growth and Organizational Structure

$$S_{it} = \beta_1 S_{it-1} + \beta_2 Profitabilty_{it} + \beta_3 Age_{it} + \beta_4 Cost_{it} + \beta_5 Leverage_{it}$$
$$\beta_6 Organization_{it} + \beta_7 Affiliation_{it} + \beta_8 GDP_t + \beta_9 RealRate_t + e_t + \nu_i + \tau_{it}$$

	Mutual Companies N= 130		Stock Companies N=1474	
Explanatory Variables	Coefficient	T Stat	Coefficient	T Stat
Lag(size)	0.5149	4.9329***	0.2435	6.9521***
Profitability	-0.0051	-0.0768	0.7419	2.3487**
Age	0.0109	1.3689	0.0309	8.1519***
Cost	0.0002	0.2469	-0.0003	-1.2825
Leverage	-1.2067	-2.1783**	-2.5713	-6.5145***
Affiliation	0.2727	2.2341**	0.3231	2.0338**
GDP	0.0506	0.14975	0.4004	2.0938**
RealRate	-1.3281	-2.5771**	-0.7079	-2.2678**

AR(1)	-2.98**	-4.36***
AR(2)	-1.64	-1.46
Sargan Test	243.87***	375.76***

The table reports the parameter estimates of the GMM model, t-statistics are based on robust estimates of standard errors. AR(1) and AR(2) are tests for first and second serial correlation respectively. The null hypothesis no serial correlation in the first order is rejected. It is expected to have first order correlation due to the presence of the lagged dependent variable in the model. The null hypothesis of no serial correlation in the second order is not rejected. The Sargan test of overriding restrictions is statistically significant.
*10% significant, **5% significant, ***1% significant.

Table III reports the statistical analysis separately for mutual companies and stock companies. The results reinforce the findings on Table 2. Mutual companies' growth is not impacted by age, while stock companies results mirror the findings for the entire sample in terms of direction and magnitude of the coefficients of the control variables. For mutual companies, profitability and growth in GDP are no longer significant. This leads to the interpretation that mutual companies once they reach a certain size have no room for growth; a certain inertia hits.

IV. Conclusion

This study set out to test whether growth is independent of size in the life insurance industry. Using a GMM statistical estimation technique consistent with Choi (2010) I reject the hypothesis that growth is independent of firm size. This study contributes to existing literature by examining the growth factors with a specific emphasis on the life insurance industry and by considering macroeconomic factors which have not been included in previous insurance studies. Furthermore, the positive relation between growth and size exists in the life insurance industry regardless of ownership structure. Mutual insurance companies show a significantly stronger growth than stock companies. The empirical evidence suggests that the growth of life insurance companies is determined by several company specific variables including age, profitability, leverage, organization form, and group affiliation. The macroeconomic factors, growth in gross domestic product and the level of the real interest rate are statistically significant factors in affecting life insurance company growth. I believe that the results are statistically strong given the estimation procedure appropriate for large cross section over a relatively short time series.

V. References

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