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# TESTING THE VALIDITY OF GIBRAT'S LAW IN THE CONTEXT OF PROFITABILITY AND LEVERAGE

**Ibrahim Nandom Yakubu**

*PhD Student, Department of Banking and Finance, Ankara Yildirim Beyazit University, Turkey.*
*Email: kassiibrahim@gmail.com*

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## *ABSTRACT*

This study seeks to test the validity of Gibrat's Law of Proportionate Effect for listed firms in Ghana over the period 2008-2017. The study also investigates whether firms' profitability and leverage affect the validity of Gibrat's Law. Employing the fixed effects regression technique, the results show that Gibrat's Law does not hold for all firms when the effect of firm size on growth is directly examined. In the presence of profitability, Gibrat's Law is valid for both financial and non-financial firms. The findings further observe that, while Gibrat's Law holds for non-financial firms in the presence of leverage, it is rejected for financial firms. Given the direct and significant impact of size on firm growth, the study concludes that Gibrat's proposition that the growth rate of a given firm is independent of its size does not hold for listed firms in Ghana. The study discusses relevant recommendations based on the findings.

**Contribution/Originality:** This study seeks to test the validity of Gibrat's Law of Proportionate Effect for listed firms in Ghana over the period 2008-2017.

## 1. INTRODUCTION

The work of Gibrat (1931) entitled "Les Inégalités économiques," is one of the most important studies on firm growth. Gibrat (1931) examined French manufacturing firms and concluded that "firm growth is a random effect, independent of firm size in any given period". In other words, "the probability of a given proportionate change in size during a specified period is the same for all firms in a given industry - regardless of their size at the beginning of the period" (Mansfield, 1962). This idea is known as Gibrat's Law or sometimes referred to Gibrat's rule of proportionate growth or the law of proportionate effect. Since the formulation of Gibrat's Law, it has served as a theoretical foundation for empirical investigations on firm growth.

Employing different analytical techniques and data of different sectors, several studies have tested the validity of Gibrat's Law. Results from these empirical works have been inconclusive given the mixed findings. While some studies have fully accepted that Gibrat's Law holds, others evidenced otherwise. Also, there are some findings validating the law for a part of the sample period and rejecting its validity for the rest of the period under study. Likewise, for studies involving multi-sectoral analysis, Gibrat's Law is valid for some sectors and does not hold for others.

Noticeably, the extant studies largely examine the direct effect of firm size on growth to test the validity of Gibrat's Law. This approach ignores how firm size may affect growth through other channels, thus presenting a yawning gap in the literature. This study seeks to fill this lacuna in the literature in the testing of the validity of Gibrat's Law by employing data of listed firms in Ghana. The study evaluates the validity of Gibrat's Law in the context of non-financial and financial firms. This paper differs from prior studies in that, in addition to establishing the direct impact of firm size on growth, the study considers the interactive effects of firm size and firm profit on growth. Second, the study also examines how firm size affects growth through leverage. The study included profitability and leverage as moderating factors for several reasons. For instance, a larger firm with high profitability is expected to exhibit a higher growth rate. Likewise, larger firms easily obtain debt finance (leverage) given their ability to diversify their activities (Titman & Wessels, 1988). As a result of their diversification strategies, larger firms are considered less risky and have the potentials to enhance growth.

The rest of the paper is organized as follows. The next section reviews the literature on the impact of firm size on growth with reference to Gibrat's Law. In Section 3, the methodology is explained. Section 4 discusses the empirical findings, and the conclusion is presented in Section 5.

## 2. LITERATURE REVIEW

In the firm growth literature, several studies have tested empirically the validity of Gibrat's Law. Some studies confirmed that Gibrat's Law is valid whereas others do not accept its validity. The evidence supporting Gibrat's Law, those rejecting the law, and the findings reconciling both arguments are discussed below.

Ward and McKillop (2005) for instance, investigated the relationship between firm size and growth of credit unions in the United Kingdom for the period 1994-2000. The study observed that smaller credit unions grow faster than the larger ones. The study further observed that growth variability was independent of credit unions' size. Hence, rejecting Gibrat's rule of proportionate growth. Santarelli, Klomp, and Thurik (2006) examined whether the growth of firms is independent of firms' size using data of small-scale service firms operating in Italy and the Netherlands. The authors found that while Gibrat's Law is valid for Dutch firms, it does not hold for Italian firms.

In an empirical analysis on the relationship between firm size and growth, Falk (2008) considered a panel data of 20000 firms in 15 European countries over the period 2000-2004. The results established a negative significant effect of firm size on growth, hence rejecting Gibrat's Law. Employing a sample of manufacturing and services firms in Kosovo, Hoxha (2008) rejected the validity of Gibrat's Law as the growth of the sampled firms was not proportionate. Using data of 45 European countries for the period 1992-2001, Fujiwara, Di Guilmi, Aoyama, Gallegati, and Souma (2004) tested the validity of Gibrat's Law for a sample of 260000 firms. The study showed that Gibrat's Law holds only for the beginning of the sample period.

Applying the panel unit root technique, Aslan (2008) employed a sample of 103 firms in Turkey operating in different sectors to test Gibrat's Law. While the author showed that Gibrat's Law holds for some sectors (e.g. plastic, mechanical, steel, etc.), it was rejected in some other sectors (e.g. electronics, transportation, food, etc.).
In the USA, Choi (2010) analyzed the impact of firm size alongside other variables on the growth of 823 insurance companies. He established that firm size and growth showed independence, validating Gibrat's Law. Leitão, Serrasqueiro, and Nunes (2010) examined the validity of Gibrat's Law using listed companies in Portugal over the period 1998-2004. The authors accepted Gibrat's Law given that the growth rates of the Portuguese firm were found to be independent of their size.

Mukhopadhyay and AmirKhalkhali (2010) tested the validity of Gibrat's Law using 500 U.S industrial firms for the period 2000-2007. Applying a dynamic model, the authors noted that the sampled firms have no uniform growth rate, as larger firms depicted higher growth rates. The study, therefore, rejected the validity of Gibrat's Law. Levratto, Zouikri, and Tessier (2010) assessed the validity of Gibrat's Law for French manufacturing firms over the period 1997-2007. The authors rejected the validity of Gibrat's Law. They evidenced that size, firms'

market share, and legal structures significantly predict firm growth. Similarly, Park and Sydnor (2011) analyzed how firm size affects the growth of 5818 U.S companies for the period 1995-2006. The results invalidated Gibrat's Law especially for restaurant firms in the sample.

Lunardi, Micciché, Lillo, Mantegna, and Gallegati (2014) tested the validity of Gibrat's Law by assessing whether firms' growth rate distribution is shared across firms. Using a panel data of manufacturing firms in the U.S and European Union countries, the authors evidenced that at the sectoral level, the growth rate of firms is not common, hence rejecting Gibrat's Law. The study however accepted the validity of the law at the sub-sectorial level.

Tang (2015) investigated the validity of Gibrat's Law using 18137 energy firms in Sweden for the period 1997-2011. The results documented that Gibrat's Law holds in some cases (about 70%). More recently, Bojnec and Fertő (2020) examined the validity of Gibrat's Law using Slovenian firms for the period 2007-2015. Applying the panel unit root tests, they revealed that Gibrat's Law holds for the sampled firms, and this is independent of the firm size proxy and the unit root test employed.

From the literature review, it can be observed that while several studies have tested Gibrat's Law for developed countries, little evidence exists in the case of developing countries. This study, therefore, adds to the scanty attempts in developing economies by employing data of listed firms in Ghana to test the validity of Gibrat's Law.

## 3. METHODOLOGY

### *3.1. Sample and Data*

This study employs data of 22 firms listed on the Ghana Stock Exchange over the period 2008-2017. To ensure a fair comparison, 11 non-financial firms and 11 financial firms are included. Data are gleaned from the financial statements of the selected firms. The choice of our sample and the study period is based on complete data availability.

### *3.2. Description of Variables*

The dependent variable is firm growth (GRO), measured by the percentage change in total assets. Firm size (SIZE) serves as the main independent factor. Natural logarithm of total assets proxies firm size. The study examines the mediating role of profitability and leverage. Profitability (ROA) is defined as the ratio of banks' net income to total assets. Leverage (LEV) is measured as the ratio of total debts to total assets.

### *3.3. Model Specification and Estimation Technique*

This study takes a panel approach and the model can be generally expressed as:

$$Y_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} \quad (1)$$

where Y is the dependent factor and X represents the explanatory factors. The cross-sectional dimension of the data is denoted by *i* and the time dimension is indicated by *t*. α, β, and ε represent the constant, coefficients of the independent variables, and error term respectively.

To examine the direct effect of firm size on growth, the model can be specified as:

$$GRO_{it} = \alpha_0 + \beta_1 SIZE_{it} + \varepsilon_{it} \quad (2)$$

In analyzing the interactive effects of firm size and profitability and firm size and leverage, the model can further be expanded as,

$$GRO_{it} = \alpha_0 + \beta_1 SIZE_{it} + \beta_2 SIZE*PRO_{it} + \beta_3 SIZE*LEV_{it} + \varepsilon_{it} \quad (3)$$

The study applies the fixed effects technique as an estimation strategy. The Hausman (1978) test is performed to check that the fixed effects method is an appropriate technique for estimating the model. A probability value of less than 5% significance level of the Hausman (1978) test suggests the preference of the fixed effects technique, and a p-value greater than 5% indicates rejection of the technique.

## 4. EMPIRICAL RESULTS

### *4.1. Descriptive Statistics and Correlation Analysis*

The descriptive statistics illustrating the average, standard deviation, minimum, and maximum values of all the variables are presented in Table 1. For non-financial firms, firm growth shows an average of 6.972 with a maximum of 14.047 and a minimum of 3.722. The mean of firm size is 6.085. Profitability has a mean of -7.9%. The estimated leverage value which shows firms debt level is 0.111 indicating that the sampled non-financial firms employ less debt. For financial firms, growth and size are averaged at 0.255 and 14.283 respectively. The mean value of profitability is 4.3% and the average value of leverage is 0.853. For non-financial firms, the volatility of profits is high given the higher standard deviation value relative to the mean. Financial firms compared to non-financial firms, are highly leveraged. In the correlation analysis, the correlation coefficients show that there is no multicollinearity problem in the study.

**Table-1.** Descriptive statistics and multicollinearity analysis.

| *Non-financial firms* | | | | |
|---|---|---|---|---|
| | GRO [1] | SIZE [2] | PRO [3] | LEV [4] |
| Mean | 6.972 | 6.085 | -0.079 | 0.111 |
| Std Dev. | 3.125 | 1.068 | 0.913 | 0.214 |
| Maximum | 14.047 | 8.032 | 0.634 | 1.000 |
| Minimum | 3.722 | 4.340 | -7.742 | 0.000 |
| Observations | 110 | 110 | 110 | 110 |
| [1] | 1.000 | | | |
| [2] | -0.088 | 1.000 | | |
| [3] | 0.122 | -0.001 | 1.000 | |
| [4] | 0.063 | -0.107 | 0.045 | 1.000 |
| *Financial firms* | | | | |
| | GRO [1] | SIZE [2] | PRO [3] | LEV [4] |
| Mean | 0.255 | 14.283 | 0.043 | 0.853 |
| Std Dev. | 0.214 | 0.885 | 0.028 | 0.043 |
| Maximum | 1.023 | 16.080 | 0.093 | 0.956 |
| Minimum | -0.310 | 12.070 | -0.047 | 0.690 |
| Observations | 110 | 110 | 110 | 110 |
| [1] | 1.000 | | | |
| [2] | 0.077 | 1.000 | | |
| [3] | 0.132 | 0.297 | 1.000 | |
| [4] | -0.019 | -0.018 | -0.300 | 1.000 |

### *4.2. Regression Results for Non-financial Firms*

Table 2 outlines the regression results on the impact of firm size on growth, and the interactive effects of firm size and profitability and leverage on growth for non-financial firms. From the diagnostics analysis, the 5% significance of the Hausman test suggests the use of the fixed effects estimation. The F-statistics of the fixed effects estimations prove that the estimated models are valid.

Column (1) shows the direct impact of firm size on growth. The results indicate that firm size without the control factors exerts a positive significant influence on growth. This suggests that the growth rates of non-financial firms are not independent of their size, meaning that size matters for growth. Hence, Gibrat's Law of proportionate effect is rejected. In column (2), profitability and leverage are included as control variables. Similar to column (1), size maintains a significant positive effect on growth.

Turning to the interactive effects of firm size and profitability in column (3), size has a negative insignificant effect on growth through profitability. This suggests that firms' growth rates are independent of their size in profitable firms, thus supporting the Gibrat's Law. Likewise, in column (4), firm size through leverage negatively and insignificantly predicts growth, implying that firm growth is not dependent on size in the presence of leverage. Hence, validating Gibrat's Law.

**Table-2.** Results of fixed effects estimation (Non-financial Firms).

| Variables | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| SIZE | 4.266*** | 4.788*** | 4.786*** | 4.957*** |
| | (1.105) | (1.303) | (1.309) | (1.323) |
| PRO | | -0.362 | 2.327 | 1.772 |
| | | (0.455) | (5.792) | (5.829) |
| LEV | | -0.011 | -0.066 | 12.054 |
| | | (1.745) | (1.756) | (13.392) |
| SIZE*PRO | | | -0.472 | |
| | | | (1.013) | |
| SIZE*LEV | | | | -1.968 |
| | | | | (2.156) |
| C | -25.291*** | -28.497*** | -28.492*** | -29.594*** |
| | (6.731) | (7.988) | (8.021) | (8.118) |
| *Diagnostics* | | | | |
| $R^2$ | 0.216 | 0.221 | 0.223 | 0.230 |
| F-statistic | 2.450 | 2.095 | 1.945 | 1.867 |
| Prob (F-statistic) | [0.010] | [0.021] | [0.031] | [0.036] |
| Hausman test $\chi^2$ | 12.398 | 16.401 | 14.898 | 15.759 |
| Prob.> $\chi^2$ | [0.000] | [0.001] | [0.005] | [0.008] |
| Observations | 110 | 110 | 110 | 110 |
| Number of Firms | 11 | 11 | 11 | 11 |

**Note:** *** denotes significance at 1%. Values in ( ) and [ ] are standard errors and *p*–values respectively.

### *4.3. Regression Results for Financial Firms*

In Table 3, the empirical results for financial firms are presented based on the fixed effects estimation.

**Table-3.** Results of fixed effects estimation (Financial firms).

| Variables | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| SIZE | 0.057** | 0.045 | 0.112** | -1.480*** |
| | (0.027) | (0.028) | (0.057) | (0.396) |
| PRO | | 2.102** | 29.813 | 8.708 |
| | | (0.936) | (20.317) | (19.549) |
| LEV | | 0.296 | 0.632 | -24.415*** |
| | | (0.557) | (0.607) | (6.202) |
| SIZE*PRO | | | -1.879 | |
| | | | (1.376) | |
| SIZE*LEV | | | | 1.798*** |
| | | | | (0.443) |
| C | -0.556 | -0.725 | -2.004* | 20.223*** |
| | (0.392) | (0.689) | (1.161) | (5.586) |
| *Diagnostics* | | | | |
| $R^2$ | 0.166 | 0.208 | 0.223 | 0.339 |
| F-statistic | 1.772 | 1.936 | 1.947 | 3.209 |
| Prob (F-statistic) | [0.069] | [0.035] | [0.031] | [0.000] |
| Hausman test $\chi^2$ | 4.470 | 14.289 | 13.107 | 18.599 |
| Prob.> $\chi^2$ | [0.035] | [0.003] | [0.011] | [0.002] |
| Observations | 110 | 110 | 110 | 110 |
| Number of Firms | 11 | 11 | 11 | 11 |

**Note:** ***, **, and * denote significance at 1%, 5%, and 10% respectively. Values in ( ) and [ ] are standard errors and *p*–values respectively.

In column (1), firm size exerts a direct significant impact on growth indicating that in the absence of the control factors, firm growth is dependent on size. Hence, rejecting Gibrat's Law. Including profitability and leverage as control variables in column (2), firm size has a positive albeit insignificant effect on growth. Though the effect is positive, the insignificant relationship depicts the independence of size and growth, thus confirming the validity of Gibrat's Law. In column (3), the interactive effect of size and profitability insignificantly influence growth. This suggests that in highly profitable financial firms, firm size and growth are independent. Therefore,

Gibrat's Law in the presence of profitability is valid for financial firms. In column (4), firm size through leverage significantly and negatively influences growth. The negative result indicates that size in highly leveraged financial firms reduces growth. The significant effect, however, suggests that size in the presence of leverage is important for growth, hence violating the proposition of Gibrat's Law.

## 5. CONCLUSION

The determinants of firm growth have been considerably investigated. Whereas research on growth drivers in developed countries is well deliberated, little is known in the context of developing and emerging economies. The effect of firm size on growth has been extensively investigated in light of testing the validity of Gibrat's Law. The empirical evidence on Gibrat's Law validity is inconclusive given the varying findings. This study contributes to Gibrat's Law validity testing by relying on data of listed non-financial and financial firms in Ghana. The results for the sample show that Gibrat's Law is rejected for non-financial firms when the effect of firm size on growth is directly examined. However, firm size through profitability and firm size through leverage insignificantly affect growth, implying that in the presence of profitability and leverage, Gibrat's Law holds for non-financial firms. The findings also indicate that Gibrat's Law is not valid for financial firms in the case of the direct effect of size on growth. With the interactive effect of size and profitability, Gibrat's Law is valid for financial firms while it is rejected when size and leverage interact. In a nutshell, the study concludes that firm size has a direct and significant impact on growth. Therefore, growth and size cannot be independent for both financial and non-financial firms.

Given the direct influence of firm size on growth, firms must make efforts to increase their asset base to enhance growth. The main limitation of this study is data availability. Future research may enhance the sample size and period. Cross-country studies in the context of developing countries are also necessary.

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