



GIBRAT'S LAW AND LIQUIDITY CONSTRAINTS: EVIDENCE FROM MALAYSIA INDUSTRIAL SECTOR COMPANIES

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ABSTRACT

Gibrat's Law, or the Law of Proportionate Effect (LPE), presupposes that the growth rate of a given company is independent of its initial size. While older studies have a tendency to confirm the LPE, recent studies generally reject it. Only very few empirical studies have examined the validity of Gibrat's Law in developing countries, with most studies focused on developed countries. In this study, we investigated the validity of the LPE in Malaysia. We also investigated whether liquidity constraints have any influence on firm growth and firm growth-size dynamics. By employing the Generalized Method of Moments (GMM) system to estimate a panel data model of the firm growth of 210 firms that were part of the Malaysian industrial sector from 2005 to 2014, we found that Gibrat's Law was invalid and liquidity constraints had no role in explaining both the firms' growth and growth-size dynamics, whereas age was found to positively affect the firms' growth.

JEL classification: D92, L11

Key words: Gibrat's law, Liquidity constraints, Firm growth, Firm size, Generalized Method of Moments

1. INTRODUCTION

The cost of and access to finance are two elements that impact the potential of a given firm to grow (Binks and Ennew, 1996a). A firm's growth, particularly when young and small, is restricted by the amount of internal finance at hand, and Butters and Lintner (1945) highlighted some previous studies to back up this theory. They stated that "(m)any small companies – even companies with promising growth

opportunities – find it extremely difficult or impossible to raise outside capital on reasonably favourable terms,” thereby almost all small companies obtain their financed growth exclusively by means of retentions. Evidence from recent empirical studies suggests that, because of asymmetric information as well as variety in terms of the collateral amount between firms with different sizes, the gap between the internal finance cost and external finance cost could be massive for small firms.¹ Based on this, the theory of financing constraints is seen as a supplement to modern studies that have confirmed the influence of finance availability on firm structure, growth and survival.²

This study gathers two aspects of the literature pertinent to investment studies and related to firm growth studies. With regard to the literature on investment, the aim is to improve the work done by Fazzari et al. (1988) that shed light on the link between liquidity constraints and the sensitivity between investment and cash flow. Fazzari et al. (1988) and Carpenter and Petersen (2002) concentrated on the linkage between financing constraints and firm growth. As a result, and developing from Carpenter and Petersen (2002) and Goddard et al. (2002), while also taking into consideration the criticism directed at Fazzari et al. (1988), this study considers the financing constraint to illustrate the firm growth dynamics. We utilized dynamic panel data techniques to broaden the firm growth specification that involves the persistence of chance and liquidity constraints as represented by cash flow. This study provides an important addition to the ongoing studies related to firm growth dynamics. Firstly, we investigated the validity of Gibrat's Law; secondly, we investigated the impact of internal finance on firm growth in the context of Malaysian manufacturing firms. The aim was to determine whether stylized facts of firm growth could be better illustrated by considering the relationship between liquidity constraints and the growth of the firm. This differs from the majority of previous studies that have concentrated on the analysis of the conventional growth of a firm, and tend to demonstrate the link between the three variables of firm growth, size and age. On the other hand, the firm growth dynamic model employed in this study also integrates the liquidity constraints to discuss the trace of the persistence of chance, in other words what can be learnt by serial correlation with the firm growth. Lastly, the dynamic panel data technique, developed by Blundell and Bond (1998), was employed in this study, and it is well known as the GMM-system estimator. The usefulness of the GMM method lies in putting biases under control,

and this is due to the lagged endogenous variables and unobserved firm-specific impacts. The study was constructed as follows: part 2 presents an overview of the literature related to liquidity constraints and the firm growth law, which is known as Gibrat's Law or the Law of Proportionate Effect (LPE), whereas part 3 presents a firm growth dynamic model that was subject to liquidity constraints and the hypotheses under examination. Part 4 details the data and samples used, and part 5 presents the results of the regression and tests the robustness of our outcomes. Finally, part 6 summarizes our outcomes as well as the policy implications.

2. LIQUIDITY CONSTRAINTS AND FIRM GROWTH

To address the firms' growth behavior and to illustrate the likely deviations from Gibrat's Law we utilized the literature about financing constraints. Fazzari and Athey (1987) were the first to link theoretical work about asymmetric information and capital market imperfections with empirical research on investment. Since then, many researchers have analyzed this relationship deeply. According to Fazzari et al. (1988) and Gilchrist and Himmelberg (1995), it is remarkable that small and young firms do not tend to invest more. However, they are sensitive to liquidity constraints. Fazzari et al. (1988), Gilchrist and Himmelberg (1995) and Devereaux and Schiantarelli (1990) showed that if there was a significant influence exerted by financial constraints on firm investment decision, the size and growth dynamics were prone to be affected. As an example of this, firms facing high financial constraints are supposed to encounter severe project difficulties as well as low future growth rates. The firm's capacity to weaken liquidity constraints depends on its age and size, while by means of growth and investment these constraints are expected to be weakened over the long-run. Even firms that are old and large are expected to have trouble financing their investments. Cooley and Quadrini (2001) found that financial markets and technological differences may result in a passive relationship between the firm's growth and its age, provided that the size is controlled.

Notably, previous studies related to industry dynamics that concentrated on persistent technological shocks as well as technology learning, managed only to illustrate that growth is unconditionally dependent on the age and size. Cabral and Mata (2003) examined the development of the log size distribution of a certain group of firms in a Portuguese dataset. It was found that the size distribution was highly skewed toward the right side at birth, while it approaches a log-normal

distribution once the firm's age had increased. This was the case even after the entry and exit of firms (selection pressure) was taken into consideration. They claimed that, with time, financial constraints weakened thus paving the way for firms to attain an optimal size, which in turn brings about a normal size distribution. Fagiolo and Luzzi (2006) showed that financial constraints illustrated the link between the firm's growth and its age linked to size. Their result showed that a panel of firms moved so that they matched Gibrat's growth-size dynamics over time where all companies grew at 4.3287 % during the period 1995-2000, and the decrease in the firm-size correlation throughout the years may be due to the fact that the whole manufacturing sector had grown. Small firms were found to be young, but they were faced with liquidity constraints compared to large ones.

Finally, it was detected that liquidity constraints might weaken with the passage of time, and once the liquidity constraints were controlled, small firms were found to grow faster, and the more the firm was constrained financially, the more its growth was affected by size. Audretsch and Elston (2002) examined the link between investment behavior and liquidity constraints. They concluded that medium-sized firms faced more liquidity constraints in their investment behavior compared to small and large firms, which suggested that the German infrastructure was structured to support small firms. The results supported the hypothesis that access to capital for certain firms was enhanced by the rising competition and internationalism that characterized the German financial markets in the 1980s. In an attempt to fill the gap that only surviving firms were taken into consideration, by taking all possible determinants of growth, such as size, age, external financing, access to foreign markets, and market trends, Becchetti and Trovato (2002) used data for small and medium sized Italian firms in the period 1995-1997, for which their sample was divided as follows: 1,144 with less than 50 employees and 1,427 with less than 100 employees. A control sample of 462 firms with more than 100 employees was also analyzed. It was found that Gibrat's Law was valid for large firms, whereas it was invalid for small and medium sized firms under financial constraints.

A significant term in the context of this theory is information asymmetry. Myers and Majluf (1984) proclaimed that some information possessed by a manager is not accessible to investors, despite both sides being conscious of this. Subsequently, investors demand a higher cost of equity, and this will be in terms of a risk premium for capital. We were able to find this information was an asymmetry between the firm and the debt holders of the firm. Yet, the

costs of the debt were expected to be less than that of the equity, since debt holders have priority over others when it comes to receiving money if firms become liquidated, after which the residual money would be passed to the investors. Therefore, it is acceptable that investors require a higher cost of equity. One more reason is that banks are able to compel the firm to adhere to some clauses in the contract between both sides. In return, this will reduce the risk encountered by the bank. As firms mature, the issue of information asymmetry will disappear (Fazzari et al. 1988).

3. GIBRAT'S LAW (GROWTH-SIZE DYNAMIC)

The concept of growth has been studied from the theoretical and empirical viewpoints. One well-known law that embodies corporate growth is Gibrat's Law, which is known as the Law of Proportionate Effect (LPE). The law argues that there is no linkage between the initial size of the firm and its growth rate.³ In other words, a firm's initial size has no influence on its growth rate (Vlachvei and Notta 2008). One assumption made by Gibrat's Law is that a firm's growth rate moves in a random manner along with its size at the start of the sample period (Gibrat, 1931). Much research on industrial organisation focuses on the market structure as well as the link between firm growth and size. Industrial organization refers to industrial dynamics. Attempts to establish or disprove Gibrat's Law have expanded over the years. Mansfield (1962) interpreted the law as, "it is the probability of a given proportionate change in size during a specific period being the same for all firms regardless of their size at the beginning of the period." Sutton (1997) stated that Gibrat's Law was the first attempt to study industry dynamics and firm size by offering a primary model. Nowadays, the law established by Gibrat is known as the LPE, as documented in an article published in the book *Inégalités Économiques*, in 1931. Mansfield (1962) and Chesher (1979) published a paper on Gibrat's Law referred to by the vast majority of studies in this field.

According to Loti et al. (2003), the most common explanation of Gibrat's Law was that firm size and growth were independent, but this is only one suggestion within Gibrat's model. For instance, Sutton's (1997) definition of the law is, "expected value of the increment to a firm's size in each period is proportional to the current size of the firm." It is worth differentiating between the absolute and relative growth, whereas Gibrat's model only considers the notion that relative growth is independent of the firm's size.

According to Sutton (1997), Gibrat first applied the law to test the distribution of income, then to the size of the manufacturing establishment. Large amounts of data related to establishments were subject to size distribution tests to allow for comparisons among national economy sectors (agriculture and commerce), regional sectors (industrial establishment in Alsace-Lorraine) and other small industries (electrochemical, explosives, metallurgy). Calvo (2006) found that the product and innovation process were the two key elements generating higher growth in some firms, which caused Gibrat's Law not to hold for innovative small firms. It was long assumed, as a norm, that there is no relationship between the firm growth rate and size, which means they are independent of each other. This was the idea embodied in the well-known law of Gibrat. Many studies have emerged to diagnose this norm. Previous studies related to growth focused on the impact that size and age exerted upon the growth. Recently differences were found to depend on the industry area within which the firm operated. Small firms that have a great minimum efficient size (MES) and operate in industry are supposed to have a tendency to grow faster as long as they pass the MES to ascertain a substantial size to carry on in the sector. Prais (1976) showed that variations in the firm size distribution throughout time mirror the interplay of both the emergence and the disappearance of firms along with the growth pattern of the surviving firms. However, even without systematic fluctuation in the growth rates by size, concentration in terms of a steady population of firms would grow since some random fluctuation across firms exists and grow as the fluctuation occurs; the propensity toward a concentration to increase is multiplied given that small firms exit the market very often in contrast with the large firms, provided there is a positive correlation or that large firms are characterized by speedy growth. Davies and Lyons (1982) stated that this increased propensity will be substituted with the substantial founding rates of small firms. This would be the case if those small surviving firms obtained higher growth compared to large firms; it would be triggered in the case where small firms have to reach the MES for production, while firms over the MES are characterized by stochastic growth. Jovanovic (1982) found that the potential of concentration to increase may carry on at a lower speed due to low variance in the growth rates in large firms. This is because their maturity enables them to produce a balance in growth as firms deeply examine their efficiency levels and cost structure accurately, or it may result from substantial diversification by large firms.

Accordingly, large firms are not surprised by their profit earnings, and hence less likely to revoke investment projects.

Dunne and Hughes (1994) used data for unquoted UK companies between 1975 and 1985. They found that smaller firms had speedy but variable growth rate patterns compared to large firms. They were the same in terms of exit rates stemming from the acquisition by larger firms, whereas medium sized firms were not prone to acquisition. Moreover, younger firms obtained faster growth compared to old ones. Glancey (1998) examined the relationship between firm characteristics, including firm size, age, location, industry group and profitability, and growth. He found that large firms tended to grow faster than small firms. This mirrors the fact that this type of firm is financially induced instead of being life cycle-oriented. Moreover, he found remarkable proof that young firms grow faster compared to old ones. Elston (2002) examined the relationship between firm growth and size in technology-based firms in the German Neuer Markt. She found that large firms had a faster growth than small ones in the context of the old economy, except for R & D where Gibrat's Law holds. In contrast, small firms have faster growth than large companies within the framework of the new economy.⁴ The element of age had little significance once liquidity constraints were controlled. Moreover, when controlling for the latter, small firms were found to grow faster than large ones.

By examining the relationship between firm growth, size and age in 20,000 U.S. manufacturing firms in the period 1976-1982, Evans (1987b) found that the firms' growth decreased as their size grew; even when the sample selection bias was controlled, the growth was observed to decrease in 89%. He concluded that the LPE was invalid, especially for small firms, and the growth rate for both old and young firms declined as the firms grow in age (for 79 %). Piergiovanni (2015), using the data of 9,051 service firms over the period 1989-1994, examined whether the assumption that the growth rate of the firm had no relationship with its size could be disproved for the services sector, as it has been for manufacturing. Based on a large sample of Italian new firms in five business groups in the hospitality industry it was found that Gibrat's Law was not valid in three out of the five sub-sectors. According to Heshmati (2001), employing the data of 18,525 manufacturing firms operating in Sweden from 155 industries between 1983 and 1991, the growth-size relationship and age was quite sensitive based on the evaluation method. The growth-size relationship was negative within the employment model, whereas it was positive in the model of sales. This indicates the existence of a

scale effect when accounting for sales; even the effect of size was not found to be of statistical significance in this model. Nassar, Almsafir and Al-Mahrouq (2014) in their article summarized all the studies about Gibrat's law in developed countries; they showed that in most countries and within different sectors the LPE did not hold and small firms tend to grow faster than their counterparty of large ones.

4. MODELS AND HYPOTHESIS UNDER EXAMINATION

Panel data were employed to determine the influence exerted by the size, age and liquidity constraints on firm growth. Panel data were employed because it elevates the degrees of freedom, deals with the collinearity issue among the independent variables (minimises it) and as a result allows for more efficient estimates. Issues such as heteroscedasticity and multicollinearity are also taken into account. "OLS specification presumes that all the explanatory variables are strictly exogenous. However, this is a naive presumption since the random events affecting the dependent variable are likely to influence the explanatory variables as well" (Antoniou et al., 2008). This implies that it is a must to take into consideration the heterogeneity in the data, because everything that is not explained in a pooled regression is transferred to the error terms. The cross section and period heterogeneity were tested further by running the GMM instead of OLS.

The univariate model of the growth of the firm was built on a model within which the transformed growth (the first difference of size) and the transformed firm size were the only considered variables. In this situation, it was assumed that:

$$(1) \quad \text{growth}_{it} = \alpha_i + \delta_t + (\beta - 1) \text{size}_{it-1} + \mu_{it},$$

where $\mu_{it} = \rho\mu_{it-1} + \varepsilon_{it}$, in which the first order autoregressive model for size_{it} is represented in (1), in other words, the log value of the firm size i at time t . The values of the parameters in (1) specify the conduct of the size throughout time. β represents the relationship between the size of the firm and the yearly growth, and δ_t and α_i permit for time and individual effects, respectively. The unseen time-invariant firm specific effects, concerning heterogeneity across companies, α_i allows that. ρ detects the persistence of chance or serial correlation in μ_{it-1} , the disturbance term of the growth equation. Lastly, ε_{it} represents a random disturbance, which is presumed to be normal, independent and identically distributed (IID) with $E(\varepsilon_{it}) = 0$ and $\text{var}(\varepsilon_{it}) = \sigma_\varepsilon^2 > 0$.

Tschoegl (1983) identified three assumptions that can be tested, which are obtained from the LPE (Gibrat's Law): first, growth rates are independent of the firm size; second, below or above average growth for any individual firm has a tendency to hold from one period to the next; and third, the variation in growth has nothing to do with the firm initial size.

Examination of the linkage between size and growth was based on the examination of the zero hypothesis ($H_0: \beta - 1 = 0$) implied in the LPE, which is concentrated on the idea that the likelihood of growth rates distribution is alike for all different firm classes. If $\beta \geq 1$ in (1), $\alpha_i = 0$ for all i . $\beta > 1$ indicates that all paths of the firm's growth are excitable: firms tend to have a tendency to grow in a quick way as they get larger. This style is possible for a limited duration, but possibly it will not carry on indefinitely. Both the level of concentration and cross-sectional firm size distribution variance increases with the passage of time. $\beta = 1$ implies that there is no explosive growth, which in turn has no link with the firm size. In this situation the LPE is invalid, which implies that both the variance of growth and mean have no relation with the firm size. However, the firm size distribution variance and the level of concentration increases with time. If $\beta < 1$, firm sizes are seen to be mean-reverting.⁵ In this case, there are various interpretations of α_i : $\alpha_i / (1 - \beta)$ is the average log size to which firm i has a tendency to revert to in the long run. Therefore, it is necessary to presume $\alpha_i > 0$. Cross-sectionally, α_i could be considered as being IID with $E(\alpha_i) = 0$ and $\text{Var}(\alpha_i) = \sigma_\varepsilon^2 \geq 0$. If $\sigma_\varepsilon^2 = 0$, the individual effects are homogeneous - all firms tend to revert toward the same mean size, and if $\sigma_\varepsilon^2 > 0$, they are heterogeneous, which means that the mean sizes are firm-specific. Consequently, deviation from the LPE occurs if $\beta \neq 1$, firm sizes regress into or move away from the mean size; if $\rho > 0$ then above-average growth in one period has a tendency to persist to the new period, if $\rho < 0$ then a period of above average growth has a tendency to be followed by below average growth or if $\sigma_\varepsilon^2 = \sigma_\varepsilon^2(i, t)$ the growth rates are heteroskedastic.

Earlier studies had the result that LPE was in operation, at least as a primary assessment, but the majority of these studies were built on samples of the largest companies, or quoted companies. On the other hand, more recent studies detected a negative relationship, and therefore found the LPE does not hold, for example, Dunne and Hughes (1994); Evans (1987a, 1987b); Goddard et al. (2002a, 2002b); Hall (1987); and Hart and Oulton (1996). By following Goddard et al.

(2002), and for the aims of the panel estimation, equation (1) can be written again as follows:

$$(2) \quad \text{growth}_{it} = \alpha_i (1 - \rho) + \delta_t + (\beta - 1) \text{size}_{it-1} + \rho \text{growth}_{it-1} + \eta_{it}$$

where $\eta_{it} = \varepsilon_{it} + \rho (1 - \beta) \text{size}_{it-2}$, so $\eta_{it} = \varepsilon_{it}$ under $H_0 = \beta = 1$. One remarkable fact regarding model (2) is lack of current models that can explain firm growth-size dynamics. Recent contributions to the illustration of firm growth consider the role played by liquidity constraints. Consequently, to examine the influence of liquidity constraints on firm growth, we take into account the multivariate model that is built upon the prolonged version (2), and that integrates more independent variables on the right side:

$$(3) \quad \text{growth}_{it} = \alpha_i (1 - \rho) + \delta_t + (\beta - 1) \text{size}_{it-1} + \rho \text{growth}_{it-1} + \gamma \text{age}_{it-1} + \varphi \text{cf}_{it-1} + \eta_{it}$$

where age_{it-1} is the log value of the firm age in the previous period, whilst cf_{it-1} is the transformed cash flow value at the start of the period where the firm net profit plus depreciation are taken as a proxy to represent them. The variable cash flow captures the sensitivity between growth and cash flow. As a result, within the context of equation (3) we test the null hypotheses of $H_0: \gamma = 0$ and $H_0: \varphi = 0$, with the alternate that they do not equal zero. If these null hypotheses are not rejected, this indicates that firm age and liquidity constraints have no influence on the growth of the firm. Equations (2) and (3) allow direct tests of the first two out of the three assumptions of Tschoegl's (1983): that growth rates are not impacted by the size of the firm ($\beta - 1 = 0$) and that growth does not persist ($\rho = 0$). The third proposition is that the variation in growth is independent of size, and it can be tested by carrying out a standard heteroscedasticity test on the residuals of each single estimated equation.

First, by inserting this measure we were able to examine whether the growth of the firm was affected by liquidity constraints. The second explanation is that by holding the liquidity constraints constant, we can concentrate on the linkage between the firm size and its growth; hence, by controlling for the liquidity constraints of the firm we were able to detach the size effects into two parts, those that stem from financial effects and those that stem from other size effects.

The estimation of these dynamic regression models uses panels including many firms and a considerable number of periods; we utilized a system GMM estimator developed by Arellano and

Bover (1995) and Blundell and Bond (1998). The instruments utilized count on the proposition formed as to whether the variables were predetermined or exogenous or endogenous; we used the lags of all the company level variables in the model. Instrument validity was examined by implementing a Sargan test of over-identifying restrictions. OLS levels do not control for the possibility bias of unobserved heterogeneity, and lagged endogenous variables (cash flow and size). Therefore OLS levels give rise to upward-biased estimates of the autoregressive coefficients if firm-specific effects are important. For these reasons, we focus our discussion on the GMM-system results. In general, the system GMM estimators reported give more acceptable estimates of the autoregressive dynamics than the basic first-differenced estimators, and this is consistent with the analysis of Blundell and Bond (1998) who showed that in autoregressive models with persistent series, the first-differenced estimator may be liable to serious finite sample biases as a result of fable instruments, and these biases could be minimized by involving the level equations in the system estimator. In this study, age is assumed as a pre-determined variable, whereas both cash flow and size are treated as endogenous. Since high growth rates procure to tremendous cash flow to changes, the same thing can be inferred concerning changes in size where alternations in growth lead to changes in size, which is in line with Oliveira and Fortunato's (2006) conjecture.

5. DATA AND SAMPLE

The data in this study consists of balanced panel data of all the manufacturing firms listed on the Bursa Malaysia in both the ACE market and main board. Bottazzi et al. (2011) stated that for the purpose of statistical consistency, it is recommended to employ surviving firms only, which means that firms that entered the market after the beginning of the sample period or exited during it were excluded from the sample. Fagiolo and Luzzi (2006) stated that for the sake of statistical consistency, unconsolidated budgets should be considered so that acquisition and merger effects in terms of size and growth influence can be avoided. If consolidated budgets were used, the acquisitions and mergers of business lines of the parent company would show up within the consolidated budget of the parent firm. The time frame covered is from 2005 to 2014; this was selected to allow many years for the analysis. A consideration of ethics is a must when it comes to both data collection and sample selection. Accordingly, the

data does not trigger any ethical problems since the data for all variables were collected from the firm annual reports. It should be mentioned that firms not part of the market before or in 2005 were excluded from the sample to avoid exit and entry influences. The study employs unconsolidated budgets, meaning that we examined firms and not groups because we concentrated on the test of internal growth rates.

The targeted population for this study consisted of all the firms operating in the Malaysian industrial sector as listed on both the ACE market and the main board that managed to survive during the sample period. After filtering the companies, 47 companies were excluded from the sample as they did not fall within the examined period (Hölzl, 2014). The number of industrial firms listed in Bursa Malaysia in 2014 was 257, and after ruling out firms that did not fulfil the criteria for the reasons mentioned, the final number of firms involved in the study after taking into account firm exit and entry was 210. All firms were older than 10 years.

In the first, second and third models our dependent variable was growth of the firm, measured in terms of the growth rate in total assets of the company between two successive years. This proxy for growth has been used by other studies (Fujiwara et al., 2008; Aslan, 2008; Serrasqueiro et al., 2009; Leitao et al., 2010). A wide variety of measures have been adopted as proxies for firm size, and among them are total assets, sales, value added and number of employees, to name a few. It has been claimed that, “no one theoretical reason exists for a particular size proxy in disclosure studies” (Hackston and Milne, 1996). However, total assets are a common measure for size, and many studies, including this study, adopted assets as a representative of firm size (Edmunds, 1981; Brock, 1987; Evans, 1987; Dhawan, 2001; Abu-Tapanjeh, 2006; Haniffa and Cooke, 2005; Ho and Wong, 2001; Tschoegl, 1983). As a proxy for liquidity constraints and based on Audretsch and Elston (2002), Oliveira and Fortunato (2006) and Fagiolo and Luzzi (2006), we employed cash flow (profit after interest and taxes plus depreciation)⁶ of the firm as a representative of liquidity constraints. It is common for liquidity constraints to be set at the right-hand-part of the equations of the empirical models pertaining to investment.⁷ The logic behind this is that as we get away from a perfect capital market, we usually find that a firm cannot always break financial as well as actual decisions. Liquidity issues usually worsen because of information asymmetry between finance providers and companies. Firm age refers to the number of years a firm has been active in the industry. The age for firm i at the end of period t (age_{it})

was measured by the difference between the end of period t (31/12/year t), which was the end of the year t , and the date of foundation (Oliveira and Fortunato, 2006). To assess the impact of liquidity constraints exerted on firm growth, both firm size and age will be controlled. In the present study, a two-step approach was adopted for transforming non-normally distributed continuous variables (Templeton, 2011), and in our case, both cash flow and growth were not normally distributed and most observations were negative. Hence, we could not subject them to the logarithm. Firstly, the variable was transformed into a percentile rank, resulting in uniformly distributed probabilities. The second step implemented the inverse-normal transformation to the outcomes of the first step to shape a variable consisting of normally distributed z -scores. The essence of this technique was the transformation of the original data and to maintain its series mean and standard deviation; whereas, age and size were subject to the logarithm and resulted in a normal distribution pattern.⁸

6. FINDINGS, ANALYSIS AND DISCUSSION

Prior to starting the empirical analysis we discuss the summary statistics. Table 1 shows the summary statistics of the raw data used in our study prior to subjecting the size and age to the log technique and the cash flow and growth to the two-step approach.

TABLE 1
Summary of Sample Statistics

Variables	Mean	Median	Std. Dev.	Min	Max	<i>N</i>
Growth	0.0953	0.0045	1.193	-0.989	45.560	1890
Size	377.167	111.620	982.407	0.4473	11690.18	1890
Cf	18.609	2.627	107.137	-1037.333	1694.369	1890
Age	26.246	23.014	15.385	2.674	90.685	1890

Note: Cf is cashflow, a combination of net income plus depreciation.

From the table, it is clear that the size distribution is extremely skewed with a mean of 377.176, which is greater than the median (111.62) by almost three times; since the size distribution was anticipated to be skewed, this is not strange as long as the existence of capital barriers renders the size distribution to be skewed. With regard to the growth rates, the mean was 9.53 %. The age of the firm was on average 26.6 years, as compared to the median of 23.014, and this confirms that our sample consisted of old companies (all companies

were older than 10 years). The mean for the cash flow was 18.607, as compared to the median of 2.627. Thus we could conclude that the firms on average exhibited positive cash flows.

7. EMPIRICAL MODEL AND RESULTS

This section presents and interprets the estimation results for the univariate and multivariate firm growth equations with serial correlation estimated by the GMM-system.

TABLE 2
GMM Results using a One-step GMM Estimator

	Model 1	Model 2	Model 3	Model 4
Growth _{it-1}	0.0730* (1.94)	0.0728* (1.95)	0.06980* (1.92)	0.0705* (1.93)
Size _{it-1}	-0.3966*** (-4.68)	-0.462*** (-4.70)	-0.546** (-2.29)	-0.630*** (-2.61)
Cf _{it-1}			0.0020 (0.64)	0.0023 (0.72)
Age _{it-1}		0.359** (2.34)		0.351** (2.51)
Constant	0.939*** (5.16)	0.594*** (2.93)	1.22*** (2.70)	0.921** (2.00)
Wjs	22.19 [0.000]	22.30 [0.000]	55.01 [0.000]	28.26 [0.000]
m1	-9.87 [0.000]	-9.90 [0.000]	-9.31 [0.000]	-9.42 [0.000]
m2	-0.32 [0.750]	-0.32 [0.749]	-0.42 [0.677]	-0.42 [0.674]
Sargan	3.28 [0.997]	3.81 [0.993]	3.24 [0.997]	3.75 [0.994]
N	1677	1679	1678	1678
Instrument Matrix	Size (2,2)	Size (2,2)	Size (2,2)	Size (2,2)
	ΔSize (1,1)	Age (1,1)	Cf (2,2)	Age (1,1)
		Δ Size (1,1)	Δ Size (1,1)	Cf (2,2)
		Δ Age (0,0)	Δ Cf (1,1)	Δ Size (1,1)
				Δ Age (1,1)
			Δ Cf (1,1)	

Notes: *p*-value for Wjs, m1, m2, Sargan in square brackets. *t* statistics in parentheses. *** *p*<0.01, ** *p*<0.05, **p*<0.10. Cf = net income plus depreciation. *N* is number of observations.

We report the results for a one-step GMM estimator with standard errors that are asymptotically robust to general

heteroskedasticity (Schiantarelli, 1996), and only the Sargan test comes from the second-step. The estimation results with models (2) and (3) for the samples are reported in Table 2. Despite the fact that a more efficient two-step GMM estimator was in hand, the asymptotic standard errors for the two-step estimator could be an uncertain guide for the outcome in finite samples. Hence, the conclusion based on the one-step estimator was found to be more reliable (Arellano and Bond 1991).

The null hypothesis that each coefficient was equal to zero was tested using one-step robust standard errors. The *t*-tests after applying the asymptotic standard errors were robust to the general cross-section and time-series heteroskedasticity, and are reported in parentheses. *W*_{js} is the Wald statistic of the joint significance of the independent variables. Sargan is a test of the validity of the over-identifying restrictions based on the efficient two-step GMM estimator, while *m*₁ (*m*₂) is a test of the null hypothesis of no first- (second-) order serial correlation. The *p*-values are in square brackets. The underlying sample of 210 firms contained a total of 1678 observations, from the 210 industrial companies that survived during the period 2005-2014, out of the 257 companies listed in the Bursa Malaysia (main board and ACE market).

Column (1), in Table 2, gives Gibrat's original specification estimating the impact of the initial firm size or past growth on growth (Gibrat, 1931), i.e., model (1). In this column, we have ignored any other non-stochastic determinants of firm growth and concentrated on the relationship between size and growth. The GMM results for the sample show that the estimated coefficient of the size is negative and significant at the 1% significance level. In the first column the size coefficient is (- 0.3966), and the coefficient is significant at the 1% level, indicating that small firms were growing quicker than larger ones during the period, and this outcome is supported by the findings of Oliveira and Fortunato (2006) for the Portuguese manufacturing sector, Oliveira and Fortunato (2008) for the service sector, Elston (2002) for German technology-based companies listed on the Neuer Markt, Heshmati (2001) for Swedish firms and Das (1995) for the Indian computer hardware industry. Hence, we found that firm growth always declined as the firm size became large, which was not in line with the theories that consider or imply Gibrat's Law. One possible explanation in economic terms is that there is a minimum efficient scale for the firm and until this size is reached, the firm experiences falling average costs and can enjoy speedy growth. After this threshold, its average cost curve flattens and it enters the world of

constant average and marginal costs experienced by firms operating above the minimum efficient scale. This finding is consistent with Sutton's (1997) statistical regularities and Geroski's (1995) stylized result for the validity of Gibrat's Law based on the proof from manufacturing holding for the services sector.

Regarding the serial correlation in the proportionate growth rates (Growth_{it-1} coefficient), factors which make a company grow abnormally slowly or quickly can be due to the persistence of luck. The serial correlation estimated coefficient was positive (0.0730) and significant at the 10 % significance level. This indicates that growth encourages growth. Firms that grew rapidly in the past will grow rapidly in the present; moreover, above-average growth tends to persist to the next period, and this is supported by the value of ρ since $\rho > 0$.

Based on the Wald joint test (Wjs), which examined the mutual significance of the estimated coefficients, we do not accept the null hypothesis at the 1% significance level that the coefficients of lagged growth and size were equal to zero. Therefore, we reject the LPE for this sample of the Malaysian industrial firms. This is further supported by the GMM results where β is less than unity.

According to Evans' (1987a, 1987b) specification, age is a firm-specific characteristic of the growth of the firm, as indicated in column 2. It is not expected that the coefficient of firm age will be positive as was found in most prior studies, and in our case it was positive (0.359) and significant at the 5% level. Hence, we can conclude that firms that tend to be younger do not grow as fast as the mature firms; consequently we infer that old firms grow faster than young ones, and this is an exceptional situation when compared to many previous studies. However, our findings were supported by some previous studies, namely Das (1995) and Elston (2002) who examined firm growth in the computer hardware industry in India. Both found a positive effect of firm age over firm growth. Heshmati (2001) stated that the negative relationship between growth and age regarding Swedish companies holds for growth when represented in terms of employment, whereas it shows a positive sign for sales and firm asset growth models. This may be attributed to the nature of the industry where young firms do not have the strong potential to grow faster and reach the minimum efficient scale to stay in the industry. In our case, this is very clear since all firms in the sample are old than 10 years. Besides this, the positive relationship may be ascribing to the relatively old age of the firms, and the fact that large and older firms have the advantage of possessing well established finance, goods and

services. Young firms are still in a learning phase of their evolution and differ from old industries in their behavior and reactivity. In addition, within an infant industry, consumers' awareness and learning about the existence of a new product may augment over the age of a firm outputting the product and might have a positive influence over its growth. Moreover, reputation of a firm could be improved with the passage of time. However, the firm size coefficient remains negative and significant at the 1% significance level. Again, W_j s rejects the null hypothesis that the coefficients of size, past growth and age are equal to zero.

Regarding columns 3 and 4, through an expanded specification for growth, this study tried to provide the evidence that liquidity constraints impacted firm size and growth, even under the case where firm age is controlled. Of particular interest is cash flow, which gives the expected positive coefficient signal (0.0020), but it is not statistically significant, which means that there is no evidence in the industrial sector that liquidity constraints affect the firm's growth; in other words, the change in growth rate is ascribed to other variables and the nature of the Malaysian industry. However, in column 3, when we did not take into account the firm age variable, the estimated coefficient of cash flow was 0.0020, and again it was not significant, which was the same case as in column (4), where age remains significant at the 5% level with a very tiny decrease from 0.359 in column (3) to 0.51 in column (4). Furthermore, in the case where cash flow was introduced as a regressor, the lagged size (column 2) stayed significant and negative for both columns (3) and (4). This occurred because there was no correlation between firm age and size, which can cancel the illustrative power of the firm size; as cash flow is presented as an illustrative variable of the explicative power of the firm size that does not change and get stronger since the coefficient increases, which in turn confirms that it is not liquidity constraints but the firm size and age that explains the changes in growth.

Consequently, we can conclude that the outcomes in column 4 are more credible because all the variables are included, and both firm age and size and lagged growth exert an impact on growth differently. Finally, Arellano and Bond (1991) took into consideration the specification tests that can be applied after estimating a dynamic model from the panel data by using the GMM estimators. According to this, we tested the validity of the instruments involved by reporting the Sargan test of the over-identifying restrictions and direct tests of the serial correlation in the residuals. In this frame, the key to identifying the proposition is that there is no serial correlation in the

ε_{it} disturbances, which can be examined by testing for second-order serial correlation in the first-differenced residuals. The consistency of the GMM estimator depends on the presence of the second-order serial correlation in the residuals of the growth specifications. The m1 statistics, on the same line as m2, test for the absence of the first-order serial correlation in the differenced residuals. The Sargan test examines over-identifying restrictions, which has an asymptotic χ^2 -distribution in light of the null hypothesis that these moment conditions are valid. As a consequence, the validity of the dynamic models relies on the lack of the second-order serial correlation (m2 statistics). The Sargan test was accepted for all columns. This asserts the validity of the instruments employed in the columns. The two tests of the validity of the estimator indicated the absence of the serial correlation (m1 was significantly negative, while m2 was not significant). Based on this, we conclude that the results for all columns were constantly consistent.

8. CONCLUSION

By considering the balanced panel data for 210 Malaysian manufacturing surviving firms during the period 2005 to 2014 to assess a dynamic panel data model of firm growth that included serial correlation and financing constraints using the system GMM technique, this study analysed whether Gibrat's Law holds. The findings support most preceding studies that Gibrat's Law is invalid for the industrial sector. The study also examined whether liquidity constraints encountered by companies affect the growth of the firms. The overall outcomes confirmed that the growth of the Malaysian manufacturing firms was not explained by the financial constraints where the liquidity constraint proxy was insignificant in terms of illustrating the firm growth. This is an exceptional case perhaps due to the nature of this sector, since it almost exclusively consists of companies older than 10 years (well-established). In other words, they may have well established finance and conduct that is not influenced by liquidity constraints since they are the second main source of GDP growth in Malaysia with 22.9% (Department of Statistics, Malaysia 2016), after the trading services sector. Since Gibrat's Law is not valid, this means that the firm growth processes are not random and are affected by explanatory variables. Regarding age, it was another striking finding, but it is clear that with regard to old firms, it is not the cash flow but age and size of the firm that promotes growth.

9. POLICY AND IMPLICATION

The main policy implication that can be obtained from the abovementioned outcomes is that policy makers should focus on old manufacturing companies in the industrial sector since they are not financially driven. Their average positive growth (0.0953) indicates that they contribute to job creation. This does not mean we are ignoring small firms, but as a matter of priority, firms older than 10 years contribute around 22.9% to the entire GDP of Malaysia and 16.5% to the workforce in 2015. In addition, the focus should be maintained on old companies since 80% of the industrial sector firms are older than 10 years, and they exhibit a persistent growth that is in line with the anticipated industrial growth in both 2015 and 2016, which is expected to be a positive 4.5% (20% of the companies that were ruled out of the sample were less than 10 years old). In addition, since old companies exhibited a higher growth in comparison with young ones, it is recommended that the government should keep the focus on old companies as they are not affected by liquidity constraints. Companies then can focus more on important concerns, such as production and innovation to boost their growth.

10. RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the objectives of our study, we have employed three independent variables to examine the validity of Gibrat's Law as well as the possibility that liquidity constraints exist in the sector. It is recommended for other researchers to further develop an understanding of firm growth and growth-size dynamics to include extra independent variables, such as profitability and ownership along with some other variables that are believed to affect firm growth so as to further explain the drivers of the firm growth in Malaysia.

ENDNOTES

1. For more details, see for instance, Schiantarelli (1996) and Hubbard (1998).
2. For more details, see Evans and Jovanovic (1989) and Holtz-Eakin et al. (1994).
3. Nevertheless, the magnitude of the departure from the LPE is very small; it was found that there was a stable relationship between growth rates and size (Ross, 1990). On the other hand, studies like Evans (1987a, 1987b), Kumar (1985) and Hall (1987) detected a moderate relation between growth and size. Acs and Audretsch (1990) concluded that when a firm

fails, it is considered to be a tendency of young firms, and this enhances the growth of the surviving firms.

4. According to Elston (2002), the old economy is characterized by tangible assets whereas the new one involves a small amount of tangible assets.
5. There is a potential in the short-term for a cross-sectional distribution for 22 companies' sizes to go up or go down. However, in the long-term this variation becomes stable at its balanced point.
6. Currency used in this study is Malaysian Ringgit.
7. For further details of check investment models on liquidity constraints see, for instance, Elston (1993), Fazzari et al. (1988) and Hoshi et al. (1991).
8. For more details see Appendix A.

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APPENDIX A

Variable Distribution using Logarithm and a Two-step Transformation Approach

FIGURE 1

Size Distribution Before Log

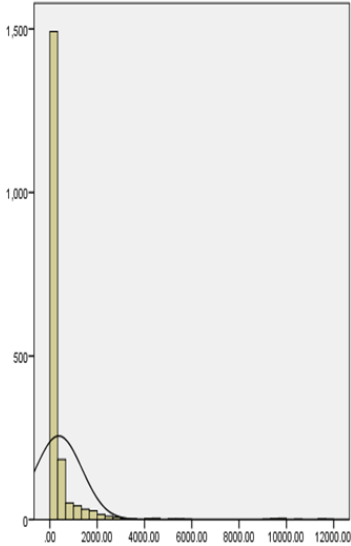


FIGURE 3

Age Distribution Before Log

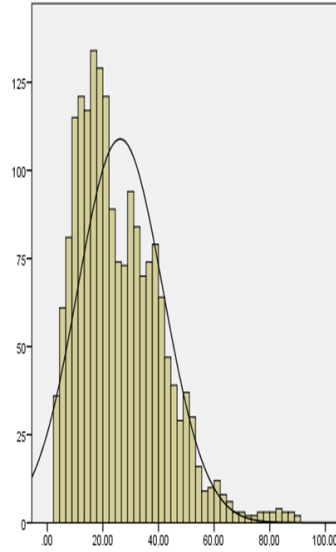


FIGURE 2

Log Size Distribution

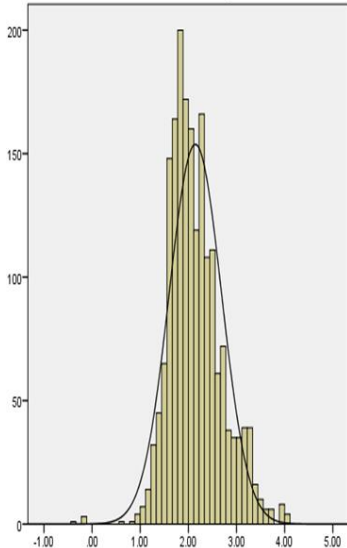


FIGURE 4

Log Age Distribution

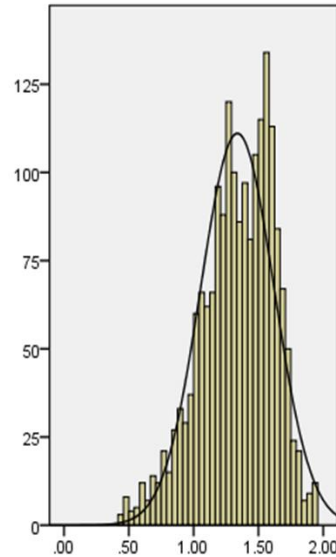


FIGURE 5
Cash Flows Before a Two-step Approach

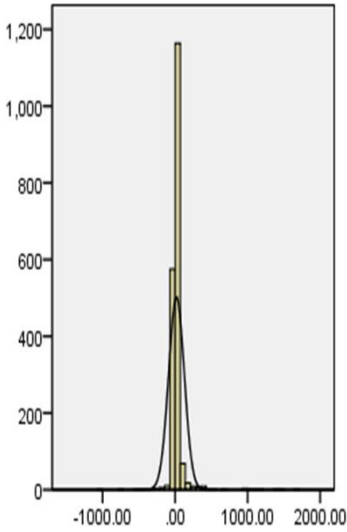


FIGURE 7
Growth Before a Two-step Approach

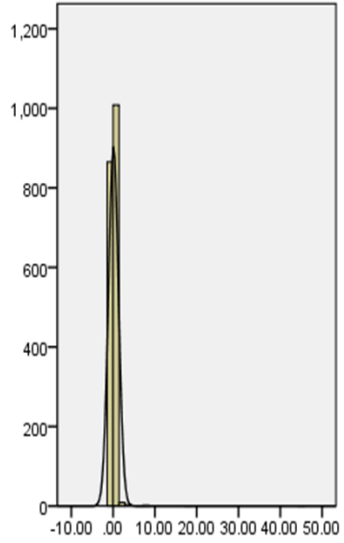


FIGURE 6
Cash Flows After a Two-step Approach

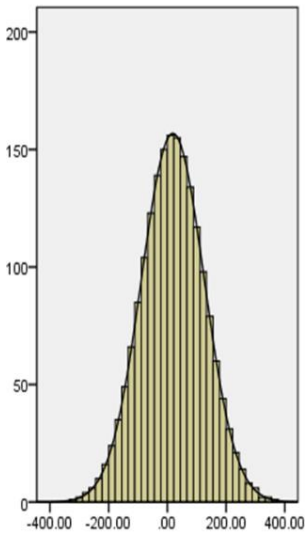


FIGURE 8
Growth After a Two-step Approach

