African Journal of Inter/Multidisciplinary Studies
Volume 3 (2021), 144-160

The Role of Size and Age on Firm Growth: Evidence from Manufacturing SMMEs in KwaZulu-Natal Province, South Africa

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DOI: https://doi.org/10.51415/ajims.v3i1.903

Abstract

Previous studies in both developed and developing economies have reported that firm growth declines with firm age and size. However, review of literature showed that there are limited studies to empirically assess the validity of this fact on firm growth in developing countries. As such, this paper assesses the role of firm size and age on firm growth in KwaZulu Natal, South Africa. The study employed a unique balanced three-year panel dataset of 191 manufacturing Small Medium and Micro Enterprises (SMMEs) in the province. As expected, the results showed a negative relationship between firm growth and size especially in the short term. However, contrary to the wider body of literature, the study established a positive relationship between firm age and growth. The study also established that older firms grow faster than their younger counterparts despite their size. On the other hand, small sized firms despite their age grow faster than large firms when employment and total assets were used as measures of firm size. It was recommended that the government should be cognisant of the complexity of SMMEs when crafting various sector policies.

Keywords: *Gibrat's Law; firm growth; Jovanovic Passive Learning Model; firm size; SMMEs*

Introduction

Small Medium and Micro Enterprises (SMMEs)[1], especially those in the manufacturing, sector play a critical role in driving socio-economic development across the globe (Özar *et al.,* 2008; Klapper and Richmond, 2011). In South Africa, small enterprises, are regarded as critical to addressing the tripartite challenge of unemployment, poverty, and inequality, hence, their growth is crucial to effectively addressing these issues (National Planning Commission, 2011; International Finance Corporation, 2019; Zhou and Gumbo, 2021). The report by the Small Enterprise Development Agency (2019) showed that SMMEs account for 66 per cent of the national employment, which is indicative of the important role played by the sector. According to Trade and Investment KwaZulu-Natal (TIKZN 2016), compared to their peers in the mining and agricultural sectors, manufacturing small and medium firms are responsible for 91 per cent and 84 per cent of the exports, implying that their sustainable growth presents strategic dividends for the province (Ngibe and Lekhanya, 2019). This underscores the need for both the national and provincial governments to promote the growth of these enterprises to achieve economic growth and address currently high poverty, unemployment, and inequality levels (OECD, 2017; Statistics South Africa, 2017).

These enterprises have been regarded as the main drivers of economic development and various countries across the globe continue to seek means to promote their sustainable growth (Machado,

[1]Small Medium and Micro Enterprises (SMMEs) is the official definition of small enterprises according to the Department of Small Business Department (DSBD 2019). As such, this study adopted this standard definition in line with the DSBD.

2016; Megaravalli, 2017). Given the importance of SMME growth, not only for practitioners but a wide range of other stakeholders like policy makers, various theoretical models have been postulated to explain this phenomenon (O'Farrell and Hitchens, 1988; Wiklund *et al.,* 2009). Gibrat's Law of Proportionate Effect (LPE) is one of the dominant theoretical models that has been embraced in firm growth research over the years. The theory claims a stochastic firm growth process, implying that firm growth is independent of its size at the beginning of the period (Megaravalli 2017). Later, Jovanovic (1982) extended Gibrat's Law with the Passive Learning Model (PLM), also known as the theory of noisy selection, which places emphasis on firm age (Jovanovic, 1982; McPherson, 1996; Teruel-Carrizosa, 2006; Nunes *et al.,* 2012).

However, despite their important implications, most studies to empirically test the validity of Gibrat's LPE and Jovanovic's PLM firm growth theories have predominantly been carried out in developed countries (McPherson, 1996; Nassar *et al.,* 2014). Notably, there are limited studies in developing countries like South Africa mainly due to data limitations (Gumede, 2000; Malepe, 2014; Masenyetse, 2017; International Finance Corporation, 2019). Considering the above background, the purpose of this study is to investigate the validity of Gibrat's LPE and Jovanovic's LPM on manufacturing SMMEs in South Africa's second largest province, KwaZulu-Natal. The results will provide an indication of the manufacturing SMMEs' growth dynamics, at least in the short term (Lotti *et al.,* 2009) and, thus, provide an informed basis for understanding the evolution of the province's industrial structure. To the best of the researchers' knowledge, this is the first study to empirically test these two theoretical models in the KwaZulu-Natal province. The rest of the paper is structured as follows; Section 2, a literature review which provides the theoretical context which informs the derivation of the hypotheses; Section 3, data structure and empirical model specification; Section 4, empirical results; Section 5, discussion of results; Section 6, recommendations; and Section 7, conclusion, and study limitations.

Literature Review

Firms, like organisms, evolve and in the process adapt to changes in both their internal and external environments (Teruel-Carrizosa, 2006). Research on enterprise growth is mainly concerned with the increase or decrease in firm size over time. As such, firm growth is such an important concept in business research and over time various theoretical models have been postulated to explain this phenomenon (O'Farrell and Hitchens, 1988; Wiklund *et al.,* 2009). In 1931, Gibrat postulated the LPE which remains one of the dominant theoretical models that has been harnessed to understand firm growth process (Teruel-Carrizosa, 2006; Malepe, 2014). However, failure to find evidence for the LPE led to its modification through the addition of various ancillary assumptions (Sutton, 1997; Bigsten and Gebreeyesus, 2007). Resultantly, there was departure among firm growth studies away from viewing this phenomenon strictly as a random walk process but rather as a classical economic maximisation problem (Bigsten and Gebreeyesus, 2007). The latter implies that systematic forces like firm attributes, investment differences, and efficiency have important implications on firm growth (Sutton, 1997). These claims resulted in the development of new firm growth theoretical models incorporating additional elements in firm growth modelling. Introduced in the early 1980s, Jovanovic's PLM is one of the popular firm growth theoretical models which extended Gibrat's LPE by incorporating efficiency as one of the key features in the firm growth process (Sutton, 1997; Teruel-Carrizosa, 2006; Bigsten and Gebreeyesus, 2007).

The model places emphasis on firm efficiency and postulates that firms enter the market without knowing their efficiency and more efficient ones survive and grow whilst less efficient ones tend to stagnate and exit the market (Jovanovic, 1982; Pakes and Ericson, 1998). However, despite a growing body of literature on firm growth, some studies have noted that the available theoretical models were developed with a focus on large firms and have not been adapted to investigate the same

phenomenon in the context of SMMEs (O'Farrell and Hitchens, 1988; Machado, 2016). This aligns with assertions by McPherson (1996) that for years, to drive economic development, the focus was centred on large enterprises and SMMEs were largely discouraged, directly or otherwise. In recent years, the trend has however reversed, owing to increasing studies highlighting the potential of the SMME sector in driving inclusive economic growth (McPherson, 1996; Panda, 2015; Machado, 2016). This requires the empirical investigation of the relevant firm growth theoretical models in the SMME sector, which have become important for many countries, both developed and developing (National Planning Commission, 2011; MBEC 2017; International Finance Corporation, 2019)

Small Business Growth

Small enterprise growth research has attracted the interest of various stakeholders in recent years (O'Farrell and Hitchens, 1988; McPherson, 1996; Wiklund *et al.,* 2009; Achtenhagen *et al.,* 2010). This is because growth is such an important phenomenon, especially for SMMEs as their survival essentially depends on their sustainable growth (Machado, 2016). Small firm growth is often associated with an increase in sales, the number of employees, and total assets and all these measures are important in sustaining the operations of an SMME (McPherson, 1996; Teruel-Carrizosa, 2006; Panda, 2015). Santos and Brito (2012) posit that growth reflects a small firm's ability to increase its size, which leads to high profitability levels and consequently economies of scale. Importantly, growth does not only minimise the likelihood of small business failure, but results in socio-economic development (Özar *et al.,* 2008).

Extant literature indicates that small firm growth is important for governments as it is growing SMMEs that make significant contribution to economic growth (MBEC, 2017; Šarlija and Bilandžić, 2018). Despite its importance and increased interest, numerous studies converge in charging that growth is a complex process marked by uncertainty arising from both internal and external environments (Wiklund *et al.,* 2009; Achtenhagen *et al.,* 2010; Machado, 2016). The complexity of small firm growth is reflected in the use of various growth measures (Teruel-Carrizosa, 2006; Malepe, 2014; Masenyetse, 2017). Key to note is that despite little agreement on the ideal firm growth measure, Achtenhagen *et al.* (2010) have established that there is general agreement among researchers and practitioners on the usefulness of such measures. This is because commonly used growth measures, which mainly include sales, profit, employees, and total assets, provide insight on the small firm's continued learning and adaption to dynamic market changes (Megaravalli, 2017).

However, despite such an increased interest in this area, recent studies indicate that little is still known about the small firm growth phenomenon. This is in line with various studies (McPherson, 1996; Özar *et al.,* 2008; Machado, 2016) which note that despite the recognition of the importance of SMMEs in developing countries, the paucity of firm growth studies has become glaring. Inevitably, various stakeholders, which includes academics, business owners, and policy makers, are interested in understanding the economics of small firms' growth to inform effective interventions in the sector (Coad *et al.,* 2016; Machado, 2016; Megaravalli, 2017). Recent studies have adduced the importance of understanding the firm growth phenomenon, as it is growth-oriented firms which create more employment (MBEC, 2017; Megaravalli, 2017). This implies that by understanding small firm growth dynamics, countries like South Africa will be able to devise appropriate interventions to leverage the sector in addressing the tripartite challenges of unemployment, poverty, and inequality, especially in the context of the COVID-19 pandemic (National Planning Commission, 2011; International Finance Corporation, 2019; South African Government, 2021). As such, the researchers aim to harness Gibrat's Law and Jovanovic's passive learning model to shed light on the growth process of SMMEs in South Africa's second largest province of KwaZulu-Natal.

The review of literature indicates that there are limited studies harnessing these two theoretical models, which have important, empirically testable implications to understanding small firm growth dynamics in South Africa, and particularly in the KwaZulu-Natal province. The closest related studies are by McPherson (1996), Malepe (2014), Masenyetse (2017), and Mamburu (2018). The first relied on survey data from two small townships in Gauteng and Eastern Cape provinces. Malepe (2014) assessed both theories using panel data from manufacturing SMMEs in the Gauteng and Western Cape provinces. The one by Masenyetse (2017) relied on data from listed firms on the Johannesburg Stock Exchange and recommended that future studies focus on SMMEs. The latter mainly focused on Gibrat's theory, utilising a database which covered both SMMEs and large firms across the country. This study aims to contribute to literature by being the first to focus on the KwaZulu-Natal province, in which SMMEs are confronted with different socio-economic dynamics compared to contexts in which these studies were conducted (Bureau for Economic Research, 2016; Small Enterprise Development Agency, 2019). The sections below provide a review of the two theoretical models that were harnessed in this study.

Gibrat's Law of Proportionate Effect

Conventional wisdom for years has dictated that firm growth is independent of firm size, as claimed by Gibrat's Law of Proportionate Effect (LPE) (Mamburu, 2018), also known as the stochastic theory (Geroski 2005). The LPE asserts that firm growth rate is independent of its size at the start of the period being examined (Lotti *et al.,* 2003). The theory connotes that all firms experience the same growth rate, which is proportionate to their sizes (McPherson, 1996; Geroski, 2005; Almsafir *et al.,* 2015). This implies that over time, size distribution in the market will be positively skewed, as characterised by many small and few large firms. The main assumption of the theory is that the firm's initial stock of resources expands or contracts because of stochastic shocks and firms exit the market when their stock drops below a minimum threshold (Levinthal, 1991; Bentzen *et al.,* 2012).

The theory assumes that these stochastic shocks are independent and identically distributed, thus, basically claiming that the log size of the measure follows a normal distribution (Bigsten and Gebreeyesus, 2007). In essence, the theory posits a random growth process independent of the firm's or the environment's characteristics (Stam, 2010). In giving credence to the stochastic theory, Geroski (2005) charges that there is an overwhelming impression from research revealing that firm growth is hardly predictable and, thus, a function of random process. Lotti *et al.* (2009) establish that Gibrat's Law is rejected when the complete population of firms is examined over the entire period but tends to be confirmed *ex post* when considering only surviving firms through time. This implies that LPE tends to hold once non efficient firms exit and a much more homogenous population of efficient firms that are past the minimum efficient scale remain. Coad *et al.* (2016) argue that the stochastic process closely matches the performance of various companies and investigating whether firm growth is purely random or not remains a necessary research question.

Despite its criticism for being atheoretical (Masenyetse, 2017), the stochastic theory, due to its tractability (Coad *et al.,* 2016), has been widely tested, mainly in developed countries, with also sporadic studies conducted in emerging economies (Nassar *et al.,* 2014). Whilst the theory was accepted in earlier studies, Gibrat's Law has been largely rejected in latter studies (Teruel-Carrizosa, 2006; Nassar *et al.,* 2014). Most of the studies which rejected the validity of Gibrat's Law established that small sized firms grew faster than large sized enterprises, with few claiming the opposite (Nassar *et al.,* 2014; Machado, 2016). Almsafir *et al.* (2015) assessed the validity of the theory in Jordan and established that small firms in the services sector grew faster than their large sized counterparts. This aligns with Malepe (2014), who also found a negative relationship between firm size and growth

for small manufacturing firms in South Africa. Similarly, Bigsten and Gebreeyesus (2007) established an inverse relationship between size and the growth rate of manufacturing small firms in Ethiopia.

McPherson (1996) established the negative relationship between firm size and growth for small firms across various sectors in Southern Africa. Recently, a study by Mamburu (2018) found a negative relationship between firm growth and size for South African firms registered with the South African Revenue Authority (SARS), thus, rejecting the validity of LPE. The preceding findings from the developing countries strongly align with many studies in the developed world. For instance, Farinas and Moreno (2000) note that compared to larger ones, smaller firms in the Spanish manufacturing sector registered a superior growth rate. This was also established by Teruel-Carrizosa (2006) in both manufacturing and services firms in Spain. Similar findings were established for manufacturing small firms in the United States (Hall, 1986; Evans, 1987). Dunne and Hughes (1994) established that small companies in the financial and non-financial sectors in the United Kingdom grew faster compared to their larger counterparts. This aligns with a recent study by Cowling *et al.* (2018) in which the validity of LPE could not be satisfied as small enterprises across commercial sectors in the United Kingdom grew faster than their larger counterparts.

A study by Bentzen *et al.* (2012), contrary to other studies, ascertained that large sized enterprises across all industries in Denmark grew faster than small sized enterprises. On the other hand, a study by Aslan (2008) on Turkish firms established mixed results, with Gibrat's Law being rejected in seven and accepted in four sectors. Lotti *et al.* (2003) found that the law was rejected immediately post establishment as small Italian firms grew faster, presumably to reach minimum efficient size, but could not be rejected in subsequent years. Interestingly, a study by Hermelo and Vassolo (2007) established the validity of the Gibrat's Law on Argentinian firms. The review of literature shows that the LPE has been tested in various countries, mainly developed countries, with fragmented studies in South Africa. To contribute to literature in South Africa as a developing country, the following hypothesis is, thus, investigated:

H1: Small sized firms grow faster than larger sized firms in the KwaZulu-Natal province. Hence, contrary to Gibrat's LPE, in the KwaZulu-Natal province, enterprise size at the beginning of the period is inversely related to the firm's growth rate.

Passive Learning Model

Whilst early studies on firm growth mainly considered firm size as the only explanatory variable (Farinas, 2000), in recent times firm age has generated huge interest among researchers as they seek to establish how the latter, like the former, relates to growth (Evans, 1987; Farinas and Moreno, 2000; Coad *et al.,* 2018). Cowling *et al.* (2018) note that whilst both age and size are key drivers behind firm growth, it is rather the former that plays a critical role in firms' growth dynamic. Haltiwanger *et al.* (2013) argue that the inverse relationship between firm growth and size disappears once firm age is considered. The authors further argue that due to the limited or lack of inclusion of firm age in previous datasets, the results were misleading, establishing that small firms grew faster than large sized ones. They further mentioned that policies which consider firm size alone and exclude the age effect are less likely to achieve the desired results of promoting sustainable SMMEs growth. Evans (1987) states that theoretical models that consider firm age hold some promise and empirical studies that incorporate this variable provide critical insight on how firms behave over time. Jovanovic (1982) postulates a learning model which Pakes and Ericson (1998) call the Passive Learning Model (PLM). The model places importance on experience, as proxied by firm age, in explaining firm growth (McPherson, 1995; Farinas and Moreno, 2000). Jovanovic posits that firms enter the market without a complete appreciation of their own productivity but learn and

improve their performance through operational experience in the market (Farinas and Moreno, 2000; Malepe, 2014).

The PLM asserts that information gained through experience is used in key strategic decisions, like whether to expand or not (Renski, 2011). The theoretical model charges that each entity's cost curve is subject to random shocks, and over time firms learn about the impact of these shocks on their efficiency (Hart, 2000). The PLM concludes that firms which experience positive shocks survive and increase in size whilst those adversely affected by shocks stagnate before exiting from the market (Jovanovic, 1982). Essentially, the PLM implies that firm growth is inversely related to initial size and firm age (Evans, 1987; Majumdar, 2004; Özar *et al.,* 2008). Whilst Jovanovic (1982) claims a passive learning process for firms in the market, Pakes and Ericson (1998) propose a model of active learning process which in turn directly influences firm growth rate (Teruel-Carrizosa, 2006). In the active learning framework, increased investment levels in learning results in favourable efficiency distribution in the future. The model asserts that such investments will cease when firms reach a certain level of efficiency, and just as postulated by the PLM, younger firms will experience higher growth rates compared to their larger counterparts in the industry (Navaretti *et al.,* 2012).

As with Gibrat's Law, Jovanovic's PLM has been investigated in both developed and developing countries with mixed results. One of the early studies to empirically test PLM was by Evans (1987), which found that, in line with Jovanovic's theory, both firm age and size were inversely related with growth for manufacturing firms in the United States. Pakes and Ericson (1998) established that Jovanovic's model holds for firms in the retail sector in Wisconsin, the United States. A study by Dunne and Hughes (1994) on UK firms found that, in line with the PLM, there is a negative relationship between growth rate and the duo of firm age and size. Teruel-Carrizosa (2006) found the validity of the learning effects, as hypothesised by Jovanovic, on Spanish manufacturing and services enterprises. In line with the wide body of literature, Cowling *et al.* (2018) established that, on average, older firms in the United Kingdom have lower growth rates than younger firms.

A study by Özar *et al.* (2008) provides support for the Passive Learning Model on Turkish micro and small enterprises. Consistent with extant literature, Coad and Tamvada (2012) established that firm age had a negative relationship with growth rate among Indian small firms. Utilising data from 104 developing countries, Ayyagari *et al.* (2014), in line with the PLM, established the negative relationship between firm age and growth rate. These findings align with a few studies that have been carried out in the African region, which also established an inverse relationship between growth rate and the firm's age and size (McPherson, 1995; 1996; Mengistae, 1998; Bigsten and Gebreeyesus, 2007). Some recent studies have established mixed results either depending on age group (Majumdar 2004) or type of dependant variable used (Malepe, 2014). Armed with this empirical evidence, the following hypothesis is investigated:

H2: There is evidence of passive learning in the growth performance of SMMEs in the KwaZulu-Natal province. As such, growth rate is inversely related to both firm age and size in the province.

The findings from this study will be key in providing a basis for informed policy development on SMMEs in the province. The validity of Gibrat's Law implies that size does not matter when it comes to growth, and most importantly, connotes that firm growth is a random process and not a function of any internal or environmental factors (Stam, 2010). Planning by entrepreneurs would simply be a fruitless process as key drivers of growth cannot be predicted in advance. On the other hand, the validity of Jovanovic's PLM would mean that learning plays an important role in firm growth and, thus, industrial dynamics in the province. This would mean that firms learn about their efficiency over time, post entry, with growth being highest during these early years of learning (Jovanovic, 1982; Bigsten and Gebreeyesus, 2007). As also argued by Haltiwanger *et al.* (2013) and Coad *et al.*

(2018), the inclusion of firm age in this study, which has been less studied, provides enhanced insight on the growth process of small manufacturing firms in KwaZulu Natal province.

Data and Analysis

In this study, the researchers used longitudinal data, which was supplied by McFah Consultancy, a company based in Durban that provides business and tax consulting services for SMMEs. The balanced panel data was from 191 small enterprises operating in the manufacturing sector across ten district municipalities and the eThekwini metro in the KwaZulu-Natal province, covering three years between 2015 and 2017. This is in line with a recommendation by McPherson (1996) that future studies should use panel data that is more accurate than survey data. The three-year period also aligns with previous related studies (Hermelo and Vassolo, 2007; Almsafir *et al.,* 2015). The sample size was deemed adequate, following previous studies and related studies in KwaZulu-Natal and other developing countries (Hermelo and Vassolo, 2007; Yusuf and Dansu, 2013; Zondo, 2016; Ayandibu and Houghton, 2017). Firm age was computed as the difference between the panel period (2015 to 2017) and the registration year. Following previous related studies, annual sales were used as a measure of firm size (Almsafir *et al.,* 2015; Coad *et al.,* 2016; Masenyetse, 2017; Cowling *et al.,* 2018). Firm growth rate was measured as the difference between sales from year t and t-1 and all variables were log transformed. The log transformation was done in line with previous related studies in developed countries (Evans, 1987; Teruel-Carrizosa, 2006) and developing countries (Bigsten and Gebreeyesus, 2007; Özar *et al.,* 2008), particularly South Africa (McPherson, 1996; Masenyetse, 2017).

Using sales as a size measure, SMMEs are categorised into four groups according to the Department of Small Business Department (DSBD 2019). Medium firms (>R13 million up to R51 million), Small firms (>R5 million to R13 million), Very Small (>R0.2 million to R5 million), and Micro (0 to R0.2 million). The dataset also has other variables, namely the number of permanent workers, number of temporary workers, and total assets measured in South African Rands, and these were utilised as alternative size measures to assess the robustness of the results. An open-source software, R project for statistical computing version 3.6.3, was utilised to compute both descriptive statistics and for econometric modelling (R Development Core Team, 2019).

Descriptive Statistics

Table 1 below shows the descriptive statistics of the main variables from the panel dataset as well as the growth rate over the three years. The small sized category registered a high mean growth rate, followed by the very small, medium, and micro sized categories, respectively. The findings relate with previous findings, which found high growth rates among smaller sized firms (Teruel-Carrizosa, 2006; Bigsten and Gebreeyesus, 2007). To assess if the means across different categories of the SMMEs were significantly different, in line with Coad *et al.* (2016), Wilk's lambda was computed. The results show that the means are significantly different across the four categories across the quartet of growth, employees, total assets, and firm age.

Table 1: Descriptive Statistics

Mean Values						
	Obs.	Size	Growth	Employees	Total Assets	Firm Age
Medium	159	17.76	0.28	4.40	16.72	2.78
Small	191	16.14	0.51	3.33	15.37	2.34
Very Small	172	14.69	0.30	2.99	14.42	1.99
Micro	51	11.41	0.23	2.30	11.67	1.51
Diff. means: Wilks' lambda (p-value)			0.313 (0.000)			

Notes: all variables are log transformed
Source: Authors' calculations in R

Model Specification

To empirically test both Gibrat's LPE and Jovanovic's PLM theories the researchers followed previous studies (Evans, 1987; Teruel-Carrizosa, 2006; Malepe, 2014). Letting S_{it} be the firm size and A_{it} the company age at time t of firm i, where ε_{it} is the error term, then firm growth can be formulated as:

$$\Delta logS_{it} = \alpha_i + \beta_1 logS_{it-1} + \beta_2 logA_{it} + \varepsilon_{it} \quad (1)$$

As outlined by previous related studies (Evans, 1987; McPherson, 1996; Teruel-Carrizosa, 2006) $\Delta logS_{it}$, which Bigsten and Gebreeyesus (2007) and Masenyetse (2017) show can be presented as $logS_{it} - logS_{it-1}$, is the annual logarithmic change in firm sales for three years between 2015 and 2017. For Gibrat's Law to hold $\beta_1 = 0$, such that if $\beta_1 < 0$ the Law is violated as small firms are growing faster than their larger counterparts and conversely if $\beta_1 > 0$, the Law does not hold, and in this case larger firms grow faster than small sized ones. For Jovanovic's PLM to be satisfied, both β_1 and β_2 should be negative, highlighting the inverse relationship between firm age and growth rate (Navaretti *et al.,* 2012).

To estimate Equation (1) on KwaZulu-Natal's manufacturing SMMEs, the researchers utilised the two most used panel data modelling approaches, fixed effects and random effects (Bigsten and Gebreeyesus, 2007; Wooldridge, 2012; Dieleman and Templin, 2014). The main difference between fixed and random effects panel data modelling techniques lies in the information used to estimate the coefficients. The coefficients for the fixed effect approach are calculated from the differences within each firm over time (Wooldridge, 2012). In fixed effects models, the error component, though it varies across individuals, is assumed to be fixed or non-stochastic. On the other hand, the random effects approach assumes the random error term. Essentially, the random effects model expects unobservable individual effects to be random variables that are distributed independently of the explanatory variables (Teruel-Carrizosa, 2006; Wooldridge, 2012).

However, as also noted by Teruel-Carrizosa (2006), random effects tend to be inconsistent if individual effects are fixed and, in that case, fixed effects estimator will be consistent. On the flipside, fixed effects tend to create bias if firms are heterogeneous, which in that case random effects estimates will be more efficient (Masenyetse, 2017). Consequently, post fitting both models, the Hausman test was applied to formally test and select the most appropriate model (Teruel-Carrizosa, 2006; Wooldridge, 2012). The Hausman test evaluated the correlation between the regressors and unique errors (u_i) (Wooldridge, 2012; Kleynhans and Coetzee, 2019). Both fixed and random effects models were computed using the PLM package in R.

Empirical Results

The empirical results in Table 2, below, indicate that firm growth is negatively related with size for the manufacturing SMMEs in the KwaZulu-Natal province. This relationship is sustained across all the firm size categories at one per cent, except for the Micro sized group which was at five per cent significance level. The Hausman test indicated that fixed effects is the most suitable model and, thus, the analysis focused on the results of the fixed effects results, as shown in Table 2. Also, since the models were fit using panel data, there was a possibility of serial correlation and heteroskedasticity which can lead to upward bias of the beta coefficients and, thus, potentially invalidate the results (Dunne and Hughes, 1994; Wooldridge, 2012). As such, following Torres-Reyna (2010), the researchers used the Breusch-Godfrey/Wooldridge and Breusch-Pagan techniques to test for serial correlation and heteroskedasticity respectively, these techniques are in the latest package available in R. The tests showed the presence of serial correlation and homoscedasticity in the fixed effects model. As suggested by previous studies (McPherson, 1996; Bigsten and Gebreeyesus, 2007), the robust covariance matrix was used, specifically the Arellano method, within the sandwich estimator

in R was utilised to control for both heteroscedasticity and serial correlation in the dynamic model (Zeileis, 2006; Torres-Reyna, 2010).

Overall, the findings provide evidence for the first hypothesis (H1), and *ipso facto* reject Gibrat's LPE which claims that firm growth follows a random walk and, thus, size has no significant effect on growth. Essentially this indicates that size significantly influences the growth performance of manufacturing SMMEs in the province.

Table 2: Regression results

	All	Medium	Small	Very Small	Micro
$LogS_{it-1}$	-0.729***	-0.955***	-0.672***	-1.182***	-2.165**
	(0.225)	(0.178)	(0.197)	(0.262)	(0.640)
LogAge	1.835**	0.576	0.488*	0.981***	5.333
	(0.897)	(0.426)	(0.255)	(0.264)	(2.737)
R-Squared	0.500	0.379	0.237	0.628	0.604
Hausman test	0.000	0.000	0.021	0.000	0.018
Obs.	573	159	191	172	51

*Heteroskedasticity-robust standard errors in parentheses, *** p-value<0.01, ** p-value<0.05, * p-value<0.1*
Source: Authors' own calculations computed in R

Overall, *ceteris paribus*, the effect of age on growth does not align with the learning process hypothesis, as stated in the researchers' second hypothesis (H2). The combined analysis age was positively related with growth at five per cent significance level and in two out of four categories, which are small sized (10 per cent significance level) and the micro sized (at 1 per cent significance level). Firm age was, however, not significant for the medium and micro sized enterprises, thus, by considering size in these two categories, the passive learning hypothesis is satisfied. The effect of age is quantitatively higher than the negative effect of size for the combined analysis, which is different for the two categories (Small and Very Small) as the negative effect of size is higher than the magnitude of firm age. This shows that, generally, despite their size, older firms grow faster than young ones. However, in the case of the small and very small categories, despite their age, smaller sized firms grow faster than larger sized enterprises, as the magnitude of firm age is less than that of the size effects. These results provide partial evidence of the passive learning process, which is the case when firm size alone is considered and H2 is rejected when firm age is considered.

Robustness Tests

Given the complexity, and the importance of firm growth, it is important that the researchers test the consistency of the findings under different assumptions (Weisberg, 2006). Previous related studies utilised different measures of firm size, with some using employees (Teruel-Carrizosa, 2006; Bigsten and Gebreeyesus, 2007; Mamburu, 2018) and others using assets (Dunne and Hughes, 1994; Aslan, 2008; Ayyagari *et al.,* 2014). As such, to establish the robustness of our results, the researchers used employees and total assets as alternative size measures and the results are presented in Table 3, below. Just like above, for all the models, the Hausman test shows that Fixed Effects were more efficient than Random Effects estimators.

Table 3: Robustness test regression results

	Sales	Employees	Total Assets
$LogS_{it-1}$	-0.729***	-1.018***	-1.015***
	(0.225)	(0.074)	(0.078)
LogAge	1.835**	0.559***	0.533
	(0.897)	(0.216)	(0.727)
R-Squared	0.500	0.500	0.479
Hausman test	0.000	0.005	0.000
Obs.	573	573	573

*Heteroskedasticity-robust standard errors in parentheses, *** p-value<0.01, ** p-value<0.05, * p-value<0.1*
Source: Authors' calculations computed in R

The results in Table 3 are in line with the wider body of literature that shows that despite the measure of size, H1 is satisfied as Gibrat's Law does not hold for SMMEs in the KwaZulu-Natal province, and *ceteris paribus* smaller sized firms grow faster than their larger counterparts (Farinas and Moreno, 2000; Ayyagari *et al.,* 2014; Almsafir *et al.,* 2015; Mamburu, 2018). This is consistent with findings by Achtenhagen *et al.* (2010), indicating that despite different types of size measure used in firm growth studies, the findings are generally consistent and provide insight on the growth dynamics of small firms. This study's results align with findings by Masenyetse (2017), which also established that despite firm size measure used, Gibrat's LPE is rejected. Also, noteworthy is that compared to sales, the departure from Gibrat's LPE is more pronounced when employees and total assets proxy SMME size. However, this is contrary to related findings by Malepe (2014), with the results showing that large enterprises grow faster compared to their smaller sized counterparts when employees were used as a measure of size. On the other hand, larger sized enterprises grew faster compared to small sized firms when turnover was used as a proxy of firm size. The main implication regarding the rejection of H1 is that small firms in KwaZulu-Natal's manufacturing sector grow faster than larger sized enterprises. Based on this analysis, stakeholders should be aware that, opposed to Gibrat's LPE, small firm growth rates are not independent of the current size.

In relation to the second hypothesis, the findings are contrary to previous studies (Evans, 1987; McPherson, 1996; Mengistae, 1998; Cowling *et al.,* 2018) which found evidence for Jovanovic's PLM in relation to firm age. This study's findings relating total assets as proxy for firm size align with a related study by Masenyetse (2017) which establishes that firm age has no significant effect on growth. In this study, a strong positive relationship between growth and age is established when firm size is proxied by sales and employees, implying that older sized firms, despite their size, are at an advantage compared to younger firms. Key to note is the change in age effects, which varies by size measure. Clearly, when turnover is taken as a measure of firm size, older firms experience higher growth rates despite their size. However, when employees and total assets proxy firm size, small sized firms grow faster than their larger sized counterparts regardless of age effects. The rejection of H2 implies that age matters in achieving a higher level of sales growth whilst size plays a crucial role in achieving employment and total assets growth for small firms in the KwaZulu-Natal manufacturing sector.

Discussion

This study aimed to assess the relationship between firm growth and the duo of size and age using a balanced panel data of manufacturing SMMEs in KwaZulu Natal province. This area has been of interest over the years, as attested by numerous studies, mainly in developed countries (Almsafir *et al.,* 2015; Masenyetse, 2017; Coad *et al.,* 2018). To contribute to the body of knowledge, this study embraced the duo of Gibrat's LPE and Jovanovic's PLM to assess the relationship between firm growth and firm age/size in the KwaZulu-Natal province. Overall, the results show that smaller sized

firms in the KwaZulu-Natal province manufacturing sector grow faster than their larger counterparts, which aligns with the wider body of literature (Hall, 1986; McPherson, 1996; Teruel-Carrizosa, 2006; Almsafir *et al.,* 2015; Masenyetse, 2017; Cowling *et al.,* 2018). As with previous findings (Evans, 1987; Mamburu, 2018), the departure from Gibrat's law is more pronounced for firms in smaller size categories and less severe for those in large size categories. The firm age effects on growth are contrary to majority of previous studies in both developed and developing economies which established a statistically significant negative relationship with growth (Evans, 1987; Dunne and Hughes, 1994; McPherson, 1996; Mengistae, 1998; Bigsten and Gebreeyesus, 2007; Coad and Tamvada, 2012; Cowling *et al.,* 2018). Noteworthy is that contrary to expectations by Haltiwanger *et al.* (2013), the inclusion of age did not render firm size insignificant.

The study findings are robust, with Gibrat's LPE being rejected despite size measure. The results show that old firms have relatively higher sales growth rates than younger firms. On the other hand, it is small sized enterprises which grow faster in terms of total assets and employment, respectively. This finding holds some promise for both the national and provincial government as they aim to create employment opportunities through SMMEs (National Planning Commission, 2011; KwaZulu-Natal PPC, 2019). The findings on employment growth align with the findings of Umjwali (2012) and Ayyagari *et al.* (2014) that small sized manufacturing enterprises have a higher employment creation propensity than larger enterprises. Besides indicating that smaller sized firms experience higher growth rate, the rejection of the stochastic theory also implies that firm growth in the province is a function of some set of drivers from its operating environment (Stam, 2010). Therefore, in this light there is a need for pertinent stakeholders to identify these drivers that can in turn be harnessed by SMMEs in developing bespoke strategies to drive sustainable growth.

As established above, holding size constant, the PLM is not supported, with age being positively related to growth and not significant when total assets proxied size. The positive impact of age on growth aligns with recent indications by the Small Enterprise Development Agency's (2019) report indicating a net decrease of younger SMMEs and a net increase of older firms between 2018 and 2019 in South Africa. The findings show that younger firms struggle to compete with incumbents in the market as, *inter alia*, older firms compared to young ones leverage on their track record, networks, and efficient routinised operational models (Navaretti *et al.,* 2012). This, as argued by Lotti *et al.* (2009), could be an indication of market selection effects within the manufacturing sector in KwaZulu-Natal, such that should these SMMEs be tracked through time, the surviving firms may exhibit a Gibrat-like pattern of growth. Importantly, the use of the fixed effects model in this study implies that the differences within each SMME over the three-year period between 2015 and 2017 was used to calculate the coefficients.

Study Recommendations

The conditional rejection of the stochastic theory by Gibrat, *ex ante* provides important implications for various players in the SMME ecosystem in the KwaZulu-Natal province. Based on the findings, relevant stakeholders in the SMME sector should be aware that smaller sized firms attain higher rates of growth only in terms of employment and total assets. As argued by Malepe (2014), to address the problem of employment the provincial government should focus on assisting small sized firms in the province. The rejection of Gibrat's LPE indicates that small firm growth is not a function of unpredictable stochastic shocks but rather, as also noted by Stam (2010), is determined by structural enterprise internal or external attributes. Resultantly, establishing such factors might be key in enabling SMMEs to leverage identified factors to achieve higher growth rates. However, the rejection of Jovanovic's PLM shows that when it comes to sales it is the older firms that achieve stellar performance, thus, policies and interventions aimed at these enterprises should be cognisant of this fact. This finding implies that to address issues of unemployment, much focus should be given to

smaller sized firms but to boost economic activity through increased sales activity in the sector, older firms should rather be prioritised. This shows that these enterprises have adequate capacity to produce and market their products, thus, the provincial government should ensure sector specific support programmes to boost older firms' sales performance. Entities like Trade and Investment KwaZulu-Natal and the Small Enterprise Development Agency should develop support schemes which targets old SMMEs and provide them with support to further enhance their sales growth.

Conclusion and Study Limitations

This paper investigated the role of size and age on firm growth using secondary panel of manufacturing SMMEs in the KwaZulu-Natal province. Firms were grouped and analysed by their size category. The results showed that SMMEs in the manufacturing sector do not follow a random walk, as postulated by Gibrat's LPE, indicating no signs of industrial concentration in the KwaZulu-Natal manufacturing sector. The results regarding Jovanovic's PLM were mixed, with size indicating some learning process among manufacturing firms in KwaZulu-Natal. However, *ceteris paribus*, contrary to the passive learning process, the firm age and growth relationship is not inverse but generally positive. The positive relationship between firm age and growth shows that older firms have a significant advantage compared to their younger counterparts in the province.

The results reveal that whilst firm size has diminishing returns on growth, firm age does not, in fact the emerging picture from the analysis was, "the older the better". The faster growth rate by smaller sized enterprises is indicative of healthy industrial dynamics in the KwaZulu-Natal manufacturing sector. However, pertinent stakeholders should develop and deploy structured and targeted interventions to help sustain the growth momentum of small sized firms in the province. The rejection of Gibrat's Law also shows the need for SMMEs to identify key drivers to develop informed growth strategies. It is also important that in developing policies to help SMMEs, policy makers should appreciate the complexity of the sector, as shown by the differing net effect of firm size and age on growth depending on size measure adopted.

The main limitation of this study is that the panel data covered SMMEs in the manufacturing sector in the KwaZulu-Natal province and, hence, the results may not be generalised beyond this sector in the province. To address this limitation, future studies should consider other sectors of SMMEs across the country to shed some light on the SMME growth dynamics at a national level. The period of three years is relatively short compared to the majority of studies in developed countries (Dunne and Hughes, 1994; Almsafir *et al.,* 2015; Cowling *et al.,* 2018) and this requires future studies to consider longer periods to allow for enhanced comparison of results with those from the developed countries. Finally, due to the nature of the dataset, the LPE and PLM were tested *ex ante* and, thus, to get a complete picture it is recommended that future studies utilise data which accounts for the selection of the initial population to assess the validity of both theoretical models through time in KwaZulu-Natal. Notwithstanding some of these limitations, this study being the first of this type in KwaZulu-Natal has cast some light on the manufacturing sector's industrial dynamics in the province. Inevitably, the study provides an informed basis for the development and deployment of effective policies aimed at SMMEs, especially those in the manufacturing sector. The study also provides a starting point and, thus, a comparative basis for future research focusing on firm growth dynamics in developing countries like South Africa.

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