

Association for Information Systems AIS Electronic Library (AISeL)

PACIS 2014 Proceedings

Pacific Asia Conference on Information Systems
(PACIS)

2014

“GROWTH OF THE FITTER”: EVOLUTIONARY GROWTH PATHS AND FIRM SIZE OF START-UPS IN E-MARKETS

Yumei He

Tsinghua University, heym.12@sem.tsinghua.edu.cn

Xunhua Guo

Tsinghua University, guoxh@sem.tsinghua.edu.cn

Guoqing Chen

Tsinghua University, chengq@sem.tsinghua.edu.cn

Qiang Wei

Tsinghua University, weiq@sem.tsinghua.edu.cn

Follow this and additional works at: <http://aisel.aisnet.org/pacis2014>

Recommended Citation

He, Yumei; Guo, Xunhua; Chen, Guoqing; and Wei, Qiang, "“GROWTH OF THE FITTER”: EVOLUTIONARY GROWTH PATHS AND FIRM SIZE OF START-UPS IN E-MARKETS" (2014). *PACIS 2014 Proceedings*. 326.

<http://aisel.aisnet.org/pacis2014/326>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2014 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

“GROWTH OF THE FITTER”: EVOLUTIONARY GROWTH PATHS AND FIRM SIZE OF START-UPS IN E-MARKETS

Yumei He, School of Economics and Management, Tsinghua University, Beijing, China,
heym.12@sem.tsinghua.edu.cn

Xunhua Guo, School of Economics and Management, Tsinghua University, Beijing,
China, guoxh@sem.tsinghua.edu.cn

Guoqing Chen, School of Economics and Management, Tsinghua University, Beijing,
China, chengq@sem.tsinghua.edu.cn

Qiang Wei, School of Economics and Management, Tsinghua University, Beijing, China,
weiq@sem.tsinghua.edu.cn

Abstract

Existing research related to firm growth has not paid sufficient attention to the growth paths of online stores in e-markets. The linkage between growth path and firm size has not been built up. This paper aims to investigate evolutionary trajectories and their effects on firm size. Theoretically, conceptually define three types of distinguishable paths, namely the convergent, tepid, and sustained paths. We then propose related theoretical hypotheses that reflect the impacts of different types of growth paths on the resulting firm size. To empirically validate the proposed hypotheses, we applied the trajectory analysis method with a novel indicator, the relative expansion rate, based on a data set that consists of 5,582 online stores on Taobao.com, the largest e-commerce platform in the world. Testing results largely support our hypotheses and suggest that the sustained growth path is the ideal mode nascent online sellers should struggle for, since it is significantly positively related to the firm size that the sellers can achieve. To achieve their goal of firm expansion, new online sellers should aggressively pursue opportunities in the short term, which is a reflection of the “the growth of the fitter” principle. Our findings also suggest that E-commerce platforms may attempt to facilitate the sustained growth path of sellers through including growth path analysis in the evaluation system of online stores.

Key words: young and small online sellers, growth path, firm size, evolutionary theory of firm growth, trajectory analysis.

1 INTRODUCTION

Growth is pivotal to start-up firms (Gilbert et al., 2006). Despite the substantial interest in new firm growth, meta-reviews on the findings of related research show that the progress has been modest (Coad et al., 2012). To achieve knowledge increment, researchers have attempted to shift the focus from identifying the determinants of growth rates to studying the modes of growth, that is, from ‘how much’ to ‘how’ (McKelvie & Wiklund, 2010). Further analyses have shown that there are recurring paths in the growth of new firms associated with typical developmental experience (Coad et al., 2012), such as “low growth”, “moderate growth”, and “high growth” (McMahon, 2001). Although some progress in growth path research has been achieved, there still lacks consolidated theoretical and empirical analysis that clearly explains the question of how firms grow. Besides, since rapidly achieving a certain size might be considered as the best way to reduce the uncertainty involved in determining productivity, cost structures, or capacity (Delmar et al., 2013) and a large size of operation is believed to be necessary for the effective exploitation of opportunities (Penrose, 1995), small and young firms often “rush” to gain scales (Lotti et al., 2003). Although the relationship between growth and size have long been studied (Gilbert et al., 2006; Penrose, 1995; Bentzen et al., 2012; Haltiwanger et al., 2013; Ijiri & Simon, 1964; Reichstein & Dahl, 2004; Evans, 1987), most of the research has focused on the dependency of growth rate on firm size. Although a recent study has attempted to identify the effects of firm size on growth paths (Brenner & Schimke, 2014), the relationship between growth path and firm size still deserves more investigation.

On the other hand, e-markets provide an ideal scenario for studying the growth paths of firms, since they boost millions of new online stores or sellers. Confronted with dynamic environment and intense competition, only a fraction of online sellers evolve into high-growth merchants. Moreover, size expansion is a matter of life and death since those online new sellers aimed at market expansion generally succeed (Gary Maddena, 2013). Although researchers have recently begun to study their survival (Wang et al., 2012), exploration on their growth is still rare.

The objective of our research is thus to explore the impact of growth path on firm size among start-ups in e-markets. Specifically, we ask two questions: the first is “is there any stereotype of growths path or can it be generalized?” Considering the long explored relationship between growth and firm size, the second question is “how will the growth path impact the firm size of online stores?” By developing a new indicator, the relative expansion rate, we derive three evolutionary growth paths of 5,582 new online sellers on Taobao.com, i.e., the “vicious”, the “tepid”, and the “sustained”. To reveal the inherent relationship, we control the variables that might have effects on firm size. Our results statistically show the significant impacts of growth paths on firm size, and suggest that the “sustained” path is the ideal growth mode online start-ups should pursue.

This research contributes to the emerging body of literature on the growth paths of online sellers by building the linkage between the endogenous growth paths and firm size of start-ups on e-markets, which extends the applicability of the evolutionary theory to e-markets

and helps provide a theoretical rationale to explain why a small group of firms grow rapidly to a size.

2 THEORY AND HYPOTHESIS DEVELOPMENT

2.1 Growth paths

The concepts of endogenous growth paths originates from the notion that growth is a process where history matters (Penrose, 1995), declaring that the evolutionary theory is appropriate for explaining the growth of small online firms. The growth of firms is history-dependent since every firm has its own history (Reichstein & Dahl, 2004). Firms that face and solve similar developmental problems in sequence will go through similar phases of entrepreneurial activities, pricing strategies, and the like (Garnsey et al., 2006). Therefore, we assume that there exists a taxonomy of growth paths, that a limited number of trajectories can be identified and are relatively stable over time (Diambeidou & Gailly, 2011). According to the evolutionary theory, the growth rates can be modelled as path-dependent processes, where firms that gain bigger in size can achieve more benefits of the time value in investment, or the “size effect” (Delmar et al., 2013).

The evolutionary growth principle can also be applied to new online stores. Like small bricks and mortars, stores on E-commerce platforms like Taobao.com or Ebay.com are also an allocation of resources. To operate in the e-market, online merchants must mobilize resources to form a resource base capable of generating economic returns on the platform, indicating that new firms online are, to some extent, bound to their history (Diambeidou & Gailly, 2011). Online sellers with different growth paths differ in their growth potency and speed, and even entrepreneurial activities. Their growth obeys the axiom that a firm will undergo growth, stability, or decline at any point in time. Therefore, the trend of change can be illustrated as a curve. For example, in the preorganization stage, there are several types of entrepreneurial sequence, i.e. “started up a business”, “still trying”, “gave up”(Carter et al., 1996), the “low growth”, “moderate growth” and “high growth”(McMahon, 2001), “high rate of start-up activities”, “activities spread out over time”, “activities concentrated later than earlier over time”(Lichtenstein et al., 2007). However, lacking in logical and accurate methods to present such taxonomy, the “path” discipline seems quite arbitrary and ambiguous. Considering that paths are more than trends of decline/stagnation/growth, we label these three types as the “vicious”, the “tepid”, and the “sustained” paths (Lee, 2010). The “sustained” path has higher growth probability and is a proxy of better fitness and adaption to the e-markets, which can be evolutionarily called “growth of the fitter” (Coad et al., 2013).

2.2 Consequences of Growth Paths

It is assumed that enterprising firms have a continuous incentive to expand and that there is no limit to the absolute size for start-ups (Penrose, 1995). However, our review shows that very few empirical studies have considered the role of path-dependent process within firm growth (Brenner & Schimke, 2014) and no linkage between growth paths and firm size is built, with only one exception that has demonstrated that the growth path has an effect on

survival (Coad et al., 2012).

2.2.1 *Growth path and survival chances*

The growth path has an effect on survival and then influences the firm size indirectly. Growth is a path dependent process and growth paths affect survival (Coad et al., 2012; Coad, 2010). The growth path is a record of the history of how the online sellers lived through and those who can survive would be more likely to gain resources and turn them into size. Growth is taken by both platform and consumers as a positive signal, for it not only provides confidence to the consumers that the firm is a trustful achiever, but also makes the platform more likely to supplement the resources like financial support and better services to the firm and makes subsequent exit less likely (Coad et al., 2012). Thus, firms with a vicious growth path are usually the entrepreneurs who gave up; the tepid path represents those sellers who are still trying; and the sustained path stands for the firms who indeed started up a new business (Carter et al., 1996). Sales and inputs are more likely to be threatened if the new firm is controlled by entrepreneurs who accept no growth. The activities for the “vicious” group of entrepreneurs who gave up seem to indicate that these entrepreneurs discovered that their initial idea for their businesses would not lead to success. As their business decline over time, they decreased and even ceased their start-up activities and the firm size would stop growing. Therefore, start-ups that do not grow are more likely to exit from the market (Garnsey et al., 2006) and the weaker firms are progressively eliminated and only the profitable firms will remain in existence. Therefore, the “growth of the fitter” principle makes sense and inspires us to propose the following hypothesis:

H1: Online sellers that have experienced a tepid growth path are able to reach bigger firm sizes than those that have experienced a vicious growth path.

H2: Online sellers that have experienced a sustained growth path are able to reach bigger firm sizes those than that have experienced a vicious growth path.

2.2.2 *Growth path and growth potency*

The evolutionary principle of “growth of the fitter” also applies to those who do survive. The growth trajectory gives birth to growth, which is conducive to further growth (Garnsey et al., 2006) and thus bigger size. Firms that went through fierce competition online would experience the positive feedback effects that the probability of a given firm being able to exploit new opportunities depends on the number of opportunities already captured (Bottazzi & Secchi, 2003). Since growth is a historical process where past success is a powerful aid to future progress (Penrose, 1995), the sellers who have been sustainable will gain the advantage to grow and the firms size they could expand to should be bigger than those who show low evidence of growth. Whilst, the sustained path firms are equipped with higher growth speed, which has beneficial effects on future profit rates. It would appear that firms learn over time how to produce more efficiently. In particular, periods of growth appear to be important opportunities for learning, whilst a firm that remains in the same size lacks such stimulus and would be characterized instead by increasing reutilization (Coad, 2007). Thus, increases in growth will increase size (Garnsey et al., 2006).

Therefore, the “sustained” group would be more prone to gain resources and enhance future

growth, survival chances, homochromous small change in size, hence, to gain bigger size in the long run. Therefore, we propose:

H3: Online sellers that have experienced a sustained growth path are able to reach bigger firm sizes than those that have experienced a tepid growth path.

3 RESEARCH METHOD

3.1 Dataset

We collected the data from Taobao.com, the world largest e-commerce platform and an ideal e-markets (Fan et al., 2013). It is on Taobao.com that most of new and small online firms grow, where more than 500 million online stores have been breed and more than 800 million products listings per day. So we believe this E-commerce platform is a typical online trade place to provide us a full sample of start-ups to avoid the sample selection bias.

Our sample is 5582 growing online stores who started up business at the same time (March, 2010). Their monthly record of the whole year from April 2010 to March 2011 were crawled. We claim that those firms had three salient features: (1) same firm age; (2) all are start-up stores and (3) all have survived the baby mortality and deserve the name of “growing firms”. First, we controlled the firm age to eliminate the effects of firm age and seasonality (Coad et al., 2013; Barnett et al., 2006; Davidsson et al., 2007) and firms founded up at the same time would experience similar seasonal effects that may cause fluctuations. Secondly, in order to select the firms which had experienced some growth, we extracted yearly data about all those firms that were more likely to grow with continuous growth history (Kirkpatrick et al., 1990) in the first half year since half year is enough for survival reason (Coad et al., 2012; Ba & Pavlou, 2002; Cabral & Hortacsu, 2010).

3.2 Measurements

3.2.1 Firm size

Firm size denotes the scale of online stores (Frankish et al., 2013). We choose trade volume size to represent conception for two reasons. Theoretically, the notion evaluated by volume improves the comparability and eliminate the pricing effects in cross industry analysis. As e-markets are quite different from the traditional market, other traditional measurements may not be suitable for they are either incomparable across industries or static. Empirically, online sellers are most concerned about the trade volume at their initial business stage since trade volume is an indicator in the e-commerce platform’s ranking system for consumers to search products. The higher volume they gain, the more likely are to be searched by consumers. We calculate the natural logarithm of increment size between the half and the first year to smooth the data (Coad et al., 2012), and also add one cent to avoid taking logarithm of zero to show change in size, that is, $\ln(\Delta Size_{n,n+m} + 1)$. It is processed as equation (1) and (2):

$$Size_n = \sum_{t=1}^n Trade Volume_t \quad (1)$$

$$\Delta Size_{n,n+m} = \sum_{t=1}^{n+m} Trade Volume_t - \sum_{t=1}^n Trade Volume_t \quad (2)$$

3.2.2 Growth path

Growth paths are models or prototypes characterizing the growth sequences of a groups of online retailers. Conceptually, we regard relative sales growth as the most appropriate growth variable for three reasons. First, we investigated growth process with sales in line with previous research (Bottazzi et al., 2010; Coad, 2007) and unlike for employment, almost no firms are “static” over time in such term (Coad et al., 2012). Secondly, sales growth is the most widely used indicator of new venture growth (Weinzimmer et al., 1998). Thirdly, sales growth reflects the firm’s capacity to sell its products or services, and thus strongly indicates market presence and activeness. Finally, a relative sales growth is an ideal indicator for cross-industry comparison (Diambeidou & Gailly, 2011).

$$Relative\ expansion\ Rate_n = \sum_{t=1}^n Sales_t / \sum_{t=1}^N Sales_t \quad (n = 1, 2, \dots, N) \quad (3)$$

Here, we propose a new indicator, *Relative expansion Rate_n* to stand for the relative expansion rate in nth month and $\sum_{t=1}^n Sales_t$ is the total sales in n months. We suggest for this novel indicator since it has several advantages over traditional growth rates of “ $(Sales_t - Sales_{t-1})/Sales_{t-1}$ ” or “ $(Sales_t - Sales_{t-1})/[(Sales_t + Sales_{t-1})/2]$ ” (Davidsson et al., 2006). First, this path of indicator corresponds to the historical and accumulative nature of firm growth, and contains both holistic and detailed information than cross sectional growth rates (Brenner & Schimke, 2014). Secondly, due to more intense competition, growth is rather volatile and discontinuous in e-markets, the online sellers are confronted with embarrassment of no sales for several months, which causes zero-denominator in the traditional formula of growth rate. Thirdly, the sequence of the relative expansion rate is more appropriate to lateral heterogeneous comparison since every start-up seller begins with a growth of “0” and ends with “1”. For instance, an increase in size of \$1,000 is different to stores with size of \$10,000 and that of \$100,000. Thus the relative expansion rate can describe a relative, comparable and historical growth.

3.2.3 Control Variables

(1). Startup size

Startup size is the initial size of online sellers. Initial resources have a positive effect on firm performance, especially the start-up size (Coad et al., 2012; Ba & Pavlou, 2002; Cooper et al., 1994). Firms with a larger start-up size have amassed a stock of resources, capabilities, assets, and network connections that they can mobilize once they enter the market to safeguard them from a premature exit (Coad et al., 2012; Cooper et al., 1994).

(2). Volatility

Growth volatility is the instability in the growth process. In our study, we followed previous

work (Frankish et al., 2013) and measure volatility by the relative standard variance of monthly sales over six months. This an increment of sales variance excludes the zero-growth rates and the relative form of variance eliminates the effects of size.

$$\text{Volatility}_n = \frac{\left(\frac{\sum_{t=1}^n (\text{Sales}_t - \overline{\text{Sales}})^2}{n-1} \right)^{1/2}}{\overline{\text{Sales}} + 1} \quad (4)$$

In equation (4), $\overline{\text{Sales}}$ is the average sales of the first half year of the n^{th} online start-up.

(3). Industrial structure

The new online stores not only face fierce competition from long-established and large sellers, and demanding customers that expect lower prices online, but also suffer from the insufficient financial, human, and other resources, and lack of experience and formal management training (Wang et al., 2012). And this condition may varies cross industries since the industry structure would influence the firm size. We used the categories of business (Fan et al., 2013) to represent the industries that a firm based in, and the rivals or the competitors to represent the industrial structure since this indicators are rather important in the Information Age(Sampler, 1998). Meanwhile, industry transference is common on the e-commerce platform. Therefore, we use the following two indicators to measure industry structure in equation (5) and (6) respectively.

$$\text{Competitors} = \text{number of the sellers operating in the same industry} \quad (5)$$

$$\text{Changed_indsutry} = \begin{cases} 0 & (\text{no industry transference during observation}) \\ 1 & (\text{otherwise}) \end{cases} \quad (6)$$

Based on the number competitors, we divide the industry into two categories: high competition and low competition (Hou and Blodgett, 2010).

(4). Reputation

Reputation is an invisible asset to a firm especially on electronic markets, where information asymmetry and uncertainty blocks trust between buyers and sellers (Ba & Pavlou, 2002). This construct has long been related to firm performance (Standifird, 2001) and the reputation type matters (Standifird, 2002).To relieve trust problem, many E-commerce sites feature public online reputation systems (Fan et al., 2013; Bolton et al., 2004; Grosskopf & Sarin, 2010; Rice, 2012). One common systems is the feedback system (Fan et al., 2013). To control potential effects of the feedback system, we control the positive rating and seller star (seller rating category or scores by the platform's reputation rank system) (Fan et al., 2013). Percentage of positive rating are most frequently used by consumers and thereby have the biggest impact on trade volume size. Besides, the rating category of a seller is a salient reputation symbol which plays a big role shaping buyers' purchase decisions (Fan et al., 2013).

$$\text{Positive rating} = \text{number}_{\text{positive feedback}} / \text{number}_{\text{whole feedback}} * 100\% \quad (7)$$

3.3 Analysis methods

3.3.1 Trajectory analysis

Empirical taxonomy can reduce the complexity of empirical phenomena to a few constructs (Diambeidou & Gailly, 2011) and solve the arbitrary and ambiguous classification problem in previous “growth” research. Based on the assumption of growth taxonomy, we presume that the number of trajectories adopted by a majority of firms is greater than one but is significantly lower than what a random distribution would generate (Diambeidou & Gailly, 2011). Thus we explore the heterogeneity of the initial growth trajectories adopted by young firms, understand and describe the underlying development growth path patterns. Graphical methods is an representative of sequential of growth behavior, which drives us to apply trajectory analysis with a novel indicator to uncover growth episodes and turning points during the early life course of new firms (Garnsey et al., 2006). For this purpose, the data points making up the growth paths are compressed and coded for our relative expansion rate in a growth indicator (Garnsey et al., 2006).

We used the kml algorithm to find the empirical paths. Kml is an implementation of k-means for longitudinal data (or trajectories). This algorithm is able to deal with missing value and provides an easy way to reroll the algorithm several times, varying the starting conditions or the number of clusters looked for (Genolini & Falissard, 2011). Identifying “typical” trajectories among a large sample of firm requires to define not only a measure of growth but also a notion of distance between two growth trajectories, in other words to choose what constitutes “similar” vs “distinct” growth trajectories. Here, we define the distance as equation (9) (Genolini & Falissard, 2011).

$$Dist_{NA}^E(y_i, y_j) = \sqrt{\frac{t}{\sum_{l=1}^t w_{ijl}} \sum_{l=1}^t (y_{il} - y_{jl})^2 \cdot w_{ijl}} \quad (8)$$

Here, y_i denotes the relative expansion rate of the i^{th} online seller and w_{ijl} will be 0 if y_{il} or y_{jl} or are both missing, and 1 otherwise. The relative measurement strengthens the accuracy of k-means time series clustering analysis which may be weakened by outliers with extreme sales history.

3.3.2 Multivariate Regressions

The statistical model to test our hypothesis is the multivariate regression. We apply multi method to overcome three problems of multivariate regression, i.e., endogeneity, heteroscedasticity, and multicollinearity. First, we applied multi time points to deal with the endogeneity problem. All the independent and control variables are observed at the first half year (Sep, 2010) and the firm size, our dependent variable, is obtained at the second half of the year (March, 2011). Second, in order to control heteroscedasticity, we undertake some multivariate regressions in STATA 11 and use the robust variance estimator. Third, to examine whether there is multicollinearity, we had the Variance Inflation Factor values of each explaining variable.

4 RESULTS AND DISCUSSIONS

4.1 Trajectory analysis

We apply kml algorithm to illustrate the growth paths and examine whether the number of optimal types is three. Our results show the optimal number of clusters is three as Figure 1 illustrated. These paths show distinct variance in their graphical trajectory and echoes the theoretical paths. To examine the robustness of our analysis, we clustered the seventeen subsamples divided by industry and rerun the algorithm respectively. Almost all subgroups reached optimal clusters when $N=3$, indicating that our clustering is stable and persist

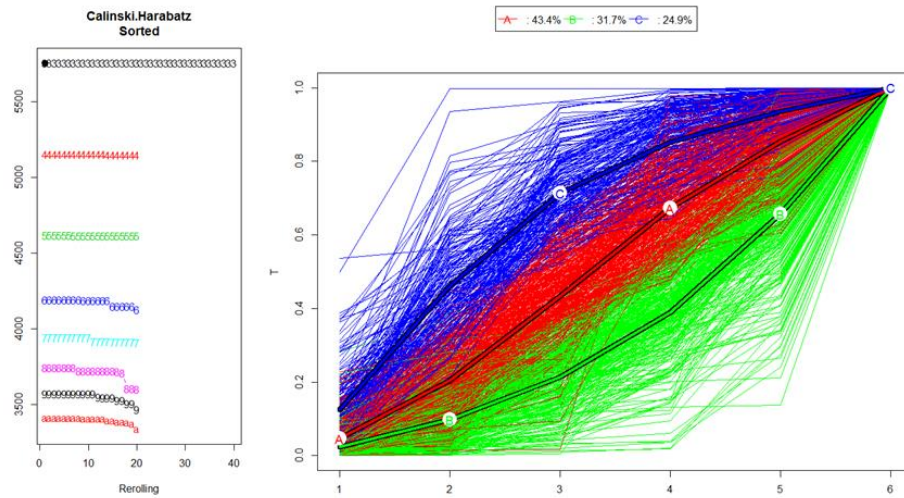


Figure 1. Growth paths for online sellers from April 2010 to March 2011, $N=5582$

Besides, we check the robustness of the results by calculation mainly on the Calinski & Harabatz criterion that combines the within and between matrices to evaluate the quality of the partition. Other two criteria, the Ray & Turi criterion, and the Davies & Bouldin criterion also confirm reliability of our results (Genolini & Falissard, 2011). As shown in Figure 2, the x-axis represents numbers of optimal clusters, and y-axis is the values of criterions. In order to plot them on the same graph, they are mapped into $[0, 1]$, and we found the results are concordant. Other two (Ray & Turi and Davies & Bouldin) criterions demonstrated consistency of our results.

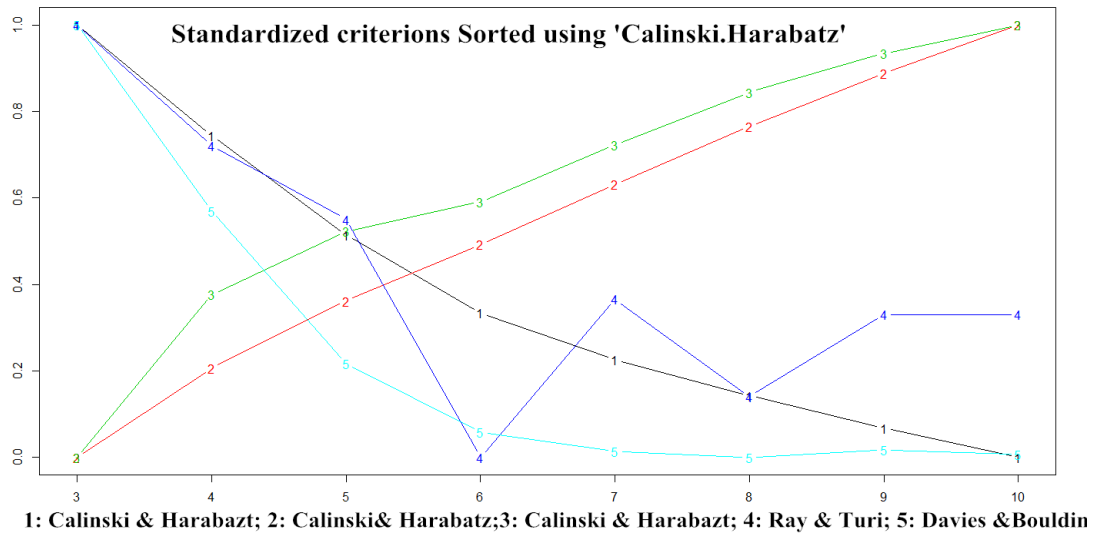


Figure 2. Concordant criteria of optimal cluster number

We propose that these paths are the stereotypes we summary in literature review, the “tepid”, the “tepid” and the “sustained” respectively. A brief interpretation in Table 1 displays their characteristics.

No	graphical type	growth rate	curve	proportion
A	The tepid	stable and symmetric	linear	43.4%
B	The sustained	slowly first and then faster	Convex	31.7%
C	The vicious	fast first and then slower	Concave	24.9%

Table 1. Characteristics of growth paths

4.2 Descriptive analysis

The description of our variables is shown in Table 2, and we carried on a logarithm analysis of firm size to smooth the model. To pretest our hypothesis, we also had Kruskal-Wallis Test (971.59, $p < 0.001$) and ANOVA test (R adjusted=0.140, $p < 0.001$) (McMahon, 2001) before the multivariate regressions and the result proved that the growth paths had significant relationship with the firm size.

4.3 Findings of Multivariate Regression

This section investigates our hypotheses related to firm size-Hypotheses 1, 2, and 3. Our main interest lies in the difference of firm size between growth trajectories at the group level. However, in order to control influences of other factors and avoid omitted variable bias, we include a collection of control variables that have appeared in previous work, which had influence on firm size. We also investigated the possible presence of multicollinearity by examining the relevant Variance Inflation Factor (VIF) diagnostics; all the values are less than 2, which is far from the threshold of 10. Therefore, we conclude that multicollinearity is not a

pressing concern. Furthermore, tests for hypotheses of the linear regression validate our model empirically.

growth_path	The vicious		The tepid		The sustained		Full Sample	
	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev	Mean	Std.Dev
size	214	1026	641	2351	1846	10817	910	6296
size_initial	348	713	723	2333	1389	7522	837	4509
volatility	0.91	0.32	0.68	0.23	0.91	0.29	0.81	0.30
competition	0.5089	0.5001	0.4570	0.4982	0.4633	0.4988	0.4721	0.4993
changed_industry	0.1590	0.3658	0.1676	0.3736	0.1869	0.3900	0.1714	0.3769
positive_rating	0.9950	0.0125	0.9959	0.0113	0.9961	0.0100	0.9957	0.0112
seller_star	4.48	1.77	5.21	2.01	5.87	2.03	5.23	2.02

Table 2. Descriptive analysis of variables

Variable	Model1		Model2	
	Coef.	Std.Error	Coef.	Std.Error
intercept	-14.532 ***	4.170	14.330 ***	3.861
the tepid			0.932 ***	0.095
the sustained			1.758 ***	0.302
start-up size	1.129 ***	0.300	1.040 ***	0.128
volatility	-0.995 ***	0.133	-1.005 ***	0.064
competitors	-0.492 ***	0.656	-0.429 ***	0.091
changed_industry	-0.186 *	0.093	-0.106	3.873
positive_rating	12.810 ***	4.181	11.968 ***	0.022
sell_Star	0.135 ***	0.022	0.093 ***	3.861
Adjusted R_squared	0.388		0.427	
Root MSE	2.421		2.343	

Note: "the vicious" is the benchmark of growth path.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, . $p < 0.1$

Table 3. Results of Multivariate Regression

This section investigates our hypotheses related to firm size. Our main interest lies in the difference of firm size between growth trajectories at the group level. Penrose claimed that “the economies of growth may exist at all sizes, and some of them may have no relation either to size of the firm” (Penrose, 1995). However, we find that economies of growth leads to certain size. Controlling lag size, these results in column (2)-(3) demonstrate **significant and strong influence of growth path on firm size**. As is displayed in *Table 3*, we found that after adding growth paths into the model, the adjusted R squared shifted from 0.388 to 0.427, implicating a rather big power to explain group means. Compared with the “vicious”, the coefficients of the “tepid” and of the “sustained” increase with 93.2% ($p < 0.001$) and 178.5% ($p < 0.001$) respectively, and our joint hypothesis tests consolidate the statistical significant difference in the coefficients, which jointly indicates **the size the sellers could reach can be ranked as the “sustained” > the “tepid” > the “vicious”, implying that the “sustained” path is the ideal trajectory online sellers who desire for size expansion should struggle for**. Therefore, our hypotheses are supported.

Besides, the results of control variables keep consistency with previous works. Column (4)-(9) is represent for controlling. We find significant positive effects of start-up size (1.040, $p < 0.001$), volatility (-1.005, $p < 0.001$), competitors (-0.429), positive rating (11.968, $p < 0.001$) and seller star (0.093, $p < 0.001$) while the effect of industry transference behavior is not significant at all.

5 IMPLICATIONS

This study makes several contributions to the literature on new firm growth and dynamics. First, by developing a new indicator for analyzing growth paths, we derive the growth paths of online sellers, and find significant unobserved firm heterogeneity which implies that such heterogeneity cannot be avoided when we focus on firms and their growth. Empirical research to date has not been able to adequately mitigate the statistical problems arising from the heterogeneous and dynamic picture of growth (Coad, 2007). Our approach also brings insights on how to track growth trajectories in a systematic way to deal with the complex and dynamic nature of firm growth and therefore to contribute to theory development. Notably, our new measurement of growth, the relative expansion rate, is a path-dependent, accumulative, and relative indicator to conceal the evolutionary nature of growth.

Second, we build up a linkage between growth path and firm size in e-markets, which extends applicability of evolutionary theory of firm growth to e-markets and helps to provide a theoretical rationale as to why a certain group of firms grow rapidly to a size. We concluded that history of growth can be a predictor of future size (Coad et al., 2012). Since the “sustained” sellers who started up a business as a fitter in their initial stage can gain benefits to expand their firm size, the principle of “growth of the fitter” is confirmed. Furthermore, we find that the effect still holds even if the initial firm size is controlled, which is different from the hypothesis of previous work which inserted that the effect of path on size is no significant after initial size is controlled (Coad et al., 2012). Thus, this analysis also indicates that the relative growth path and absolute firm size are positively related, against conclusions that relative measures tend to “favor” small firm growth (Davidsson et al., 2007).

These findings have direct implications for both E-commerce platforms and nascent online merchants. For the e-commerce platforms like E-bay.com and Taobao.com, who serve as the regulator and servicers in this business ecosystem, we recommend digging the types of growth paths and such pattern being included within the existing rating system. For instance, they can provide payment facilities for new enterprises, since the sales data derived from sellers can be monitored and used as a basis for future seller ratings and loan decision. Besides, the rating service can be embedded into the analytical service to make the store owners aware of their growth history and potential to grow. Specifically, since the “sustained” group can reach to bigger size than the other types, which is a hint of starting up a business, we suggest it is worthwhile to invest on the “sustained” sellers and individualized financial policies or services be developed to rocket their growth. Our analysis also has implications for entrepreneurs who start up their new business online. Since our process-based growth path can distinguish the type of seller’s growth and predict the firm size in long run, it might be helpful for the sellers to more accurately know “who I am” and adjust their operating strategy to pursue the fitter mode when the growth crisis occurs. More specifically, since the sustained type can usually start up a real business, and gain sustainable development, nascent online sellers should aggressively pursue opportunities in the short term, thus they can gain more chances of expansion.

6 CONCLUSIONS

In summary, our growth path analysis highlights the evolutionary nature of growth. To the best of our knowledge, existing research related to firm growth path has been insufficient. We defined the theoretical growth path with a novel measurement of relative expansion rate, which implying the potential and capability to expand in the e-markets. Our empirical trajectory results enhance the types of growth path, or the sustained path, the tepid path, and the vicious path. More specifically, we find the impact of growth trajectory varies, indicating that history of growth can be a predictor of future size, which echoes the conclusion that it is high time to build theories relating firm growth to business performance (Coad et al., 2012). Since the “sustained” sellers who started up a business and hold better growth potential can gain benefits to expand their firm size, the principle of “growth of the fitter” is confirmed. Besides, our new measurement of growth, the relative expansion rate, is a combination of relative and absolute growth since our results indicate that the relative growth path and absolute firm size are positively related, against conclusions that relative measures tend to “favor” small firm growth (Davidsson et al., 2007). Furthermore, according to researches about structure of growth rates, most firms have a growth rate that is close to zero, which forms a fat tails and closely follow the Laplace distribution (Coad, 2010). Our study echoes this conclusion since most of the firms are vicious pattern who gave up and show no evidence of growth in the e-commerce platform (about 43%) or tepid pattern (about 25%) that have low potential to grow.

But the research still has several limitations and needs improvement. Because of the evolutionary process essence of growth, in the historical context, dependent variables can turn into independent variables as time passes (Stam, 2010) and the causality is bidirectional,

which means that the roles of growth paths and firm size are mixed and unstable. Therefore, dynamic analysis could be a good approach for further discussion. Besides, our assumption is that nascent sellers are concerned about firm size expansion, and other motivations or business strategies maybe neglected. Although there are distinguishable differences between the concepts of sales and volume, these two constructs might be correlated. Therefore, the validity of empirical may rely on the pursuit of more suitable measurements of firm size.

Acknowledgements

This work was partly supported by the National Natural Science Foundation of China (grant number 71110107027) and the MOE Project of Key Research Institute of Humanities and Social Sciences at Universities of China (grant number 12JJD630001).

References

- Ba, S. and Pavlou, P. A. (2002). Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behaviour. *MIS quarterly*, 26(3), 243-268.
- Barnett, M. L., Jermier, J. M. and Lafferty, B. A. (2006). Corporate reputation: The definitional landscape. *Corporate Reputation Review*, 9(1), 26-38.
- Bentzen, J., Madsen, E. S. and Smith, V. (2012). Do firms' growth rates depend on firm size? *Small Business Economics*, 39(4), 937-947.
- Bolton, G. E., Katok, E. and Ockenfels, A. (2004). How effective are electronic reputation mechanisms? An experimental investigation. *Management science*, 50(11), 1587-1602.
- Bottazzi, G. and Secchi, A. (2003). Why are distributions of firm growth rates tent-shaped? *Economics Letters*, 80(3), 415-420.
- Brenner, T. and Schimke, A. (2014). Growth Development Paths of Firms-A Study of Smaller Businesses. *Journal of Small Business Management*.
- Cabral, L. and Hortacsu, A. (2010). The Dynamics of Seller Reputation: Evidence form eBay. *The Journal of Industrial Economics*, 58(1), 54-78.
- Carter, N. M., Gartner, W. B. and Reynolds, P. D. (1996). Exploring start-up event sequences. *Journal of business venturing*, 11(3), 151-166.
- Coad, A. (2007). Testing the principle of 'growth. of the fitter': the relationship between profits and firm growth. *Structural Change and Economic Dynamics*, 18(3), 370-386.
- Coad, A. (2010). Exploring the processes of firm growth: evidence from a vector auto-regression. *Industrial and Corporate Change*, 19(6), 1677-1703.
- Coad, A., Daunfeldt, S., Hözl W, Johansson, D. and Nightingale, P. (2014). High-growth firms: introduction to the special section. *Industrial and Corporate Change*, 23(1), 91-112.
- Coad, A., Frankish, J., Roberts, R. G. and Storey, D. J. (2012). Growth paths and survival chances: An application of Gambler's Ruin theory. *Journal of Business Venturing*. <http://dx.doi.org/10.1016/j.jbusvent.2012.06.002>
- Coad, A., Segarra, A., and Teruel, M. (2013). Like milk or wine: Does firm performance improve with age? *Structural Change and Economic Dynamics*, 24(0), 173-189.
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386-405.

- Cooper, A. C., Gimeno-Gascon, F. J. and Woo, C. Y. (1994). Initial human and financial capital as predictors of new venture performance. *Journal of Business Venturing*, 9(5), 371-395.
- Davidsson, P., Delmar, F. and Wiklund, J. (2006). *Entrepreneurship and the Growth of Firms*: Edward Elgar Publishing, UK.
- Delmar, F., McKelvie, A. and Wennberg, K. (2013). Untangling the relationships among growth, profitability and survival in new firms. *Technovation*(0).
- Diambeidou, M. B. and Gailly, B. (2011). A taxonomy of the early growth of Belgian start-ups. *Journal of Small Business and Enterprise Development*, 18(2), 194-218.
- Evans, D. S. (1987). The relationship between firm growth, size, and age: Estimates for 100 manufacturing industries. *The Journal of Industrial Economics*, 42(2), 567-581.
- Fan, Y., Ju, J. and Xiao, M. (2013). *Losing to Win: Reputation Management of Online Sellers*, working paper.
- Frankish, J. S., Roberts, R.G., Coad, A., Spears, T. C. and Storey, D. J. (2013). Do entrepreneurs really learn? Or do they just tell us that they do? *Industrial and Corporate Change*, 22(1), 73-106.
- Freel, M. S. (2000). Towards an evolutionary theory of small firm growth. *Journal of Enterprising Culture*, 8(4), 321-342.
- Garnsey, E., Stam, E. and Heffernan, P. (2006). New firm growth: Exploring processes and paths. *Industry and Innovation*, 13(1), 1-20.
- Gary Maddena, Md. Shah Azam, and T. Randolph Beard. (2013). Small firm performance in online markets. *Economics of Innovation and New Technology*, 1(22), 99-111.
- Genolini, C. and Falissard, B. (2011). KmL: A package to cluster longitudinal data. *Computer Methods and Programs in Biomedicine*, 104(3), 112-121.
- Gilbert, B. A., McDougall, P.P. and Audretsch, D. B. (2006). New Venture Growth: A Review and Extension. *Journal of Management*, 32(6), 926-950.
- Grosskopf, B. and Sarin, R. (2010). Is reputation good or bad? An experiment. *The American Economic Review*, 100(5), 2187-2204.
- Haltiwanger, J., Jarmin, R. S. and Miranda, J. (2013). Who creates jobs? Small versus large versus young. *Review of Economics and Statistics*, 95(2), 347-361.
- Hou, J. and Blodgett, J. (2010). Market structure and quality uncertainty: A theoretical framework for online auction research. *Electronic Markets*, 20(1), 21-32.
- Ijiri, Y. and Simon, H. A. (1964). Business growth and firm size. *American Economic Review*, 54(2), 77-89.
- Kirkpatrick, M., Lofsvold, D. and Bulmer, M. (1990). Analysis of the inheritance, selection and evolution of growth trajectories. *Genetics*, 124(4), 979-993.
- Lee, C. (2010). A theory of firm growth: Learning capability, knowledge threshold, and patterns of growth. *Research Policy*, 39(2), 278-289.
- Lichtenstein, B. B., Carter, N. M., Dooley, K. J. and Gartner, W. B. (2007). Complexity dynamics of nascent entrepreneurship. *Journal of Business Venturing*, 22(2), 236-261.
- Lotti, F., Santarelli, E. and Vivarelli, M. (2003). Does Gibrat's Law hold among young, small firms? *Journal of Evolutionary Economics*, 13(3), 213-235.
- McKelvie, A. and Wiklund, J. (2010). Advancing Firm Growth Research: A Focus on Growth Mode Instead of Growth Rate. *Entrepreneurship Theory and Practice*, 34(2), 261-288.

- McMahon, R. G. (2001). Deriving an empirical development taxonomy for manufacturing SMEs using data from Australia's business longitudinal survey. *Small Business Economics*, 17(3), 197-212.
- Penrose E.T. (1995). *The Theory of the Growth of the Firm*. Oxford University Press, UK.
- Reichstein, T. and Dahl, M. S. (2004). Are firm growth rates random? Analysing patterns and dependencies. *International Review of Applied Economics*, 18(2), 225-246.
- Rice, S. C. (2012). Reputation and uncertainty in online markets: An experimental study. *Information Systems Research*, 23(2), 436-452.
- Sampler, J. L. (1998). Redefining industry structure for the information age. *Strategic Management Journal*, 19(4), 343-355.
- Stam, E. (2010). Growth beyond Gibrat: firm growth processes and strategies. *Small Business Economics*, 35(2), 129-135.
- Standifird, S. S. (2001). Reputation and e-commerce: eBay auctions and the asymmetrical impact of positive and negative ratings. *Journal of Management*, 27(3), 279-295.
- Standifird, S. S. (2002). Online auctions and the importance of reputation type. *Electronic Markets*, 12(1), 58-62.
- Wang Y., Wang S., Fang Y., and Chau P.Y. (2012). Store Survival in Online Marketplace: An Empirical Investigation. *Decision Support Systems*.
- Weinzimmer L.G., Nystrom P.C., and Freeman S.J. (1998). Measuring organizational growth: issues, consequences and guidelines. *Journal of Management*, 24(2), 235-262.