Institut d'Economia de Barcelona

Document de treball de l'IEB 2012/8

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Postal Address:
Institut d'Economia de Barcelona
Facultat d'Economia i Empresa
Universitat de Barcelona
C/ Tinent Coronel Valenzuela, 1-11
(08034) Barcelona, Spain
Tel.: + 34 93 403 46 46
Fax: + 34 93 403 98 32
ieb@ub.edu
http://www.ieb.ub.edu

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GIBRAT'S LAW AND LEGACY FOR NON-PROFIT ORGANISATIONS: A NON-PARAMETRIC ANALYSIS *

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ABSTRACT: Gibrat's Law of proportional effect (i.e. growth is independent of initial size) has been tested for firms for several decades. In this paper I test Gibrat's Law for charities in England and Wales through time. Using a data set based on the population of registered charities from 1998 to 2009, I am able to test the 'ex ante' hypothesis that Gibrat's Law holds over the long run for a sample of charities as well as testing Gibrat's Legacy (that Gibrat's Law holds for large and mature organisations), the 'ex post' hypothesis. I use nonparametric local polynomial smoothing techniques which are more robust to the issues of autocorrelation, sample selection and truncation that make the conventional parametric approaches to testing Gibrat's Law difficult in practice. Results suggest that the dynamic processes driving growth in the charitable sectors may differ from those driving the growth of firms. Unlike for-profit firms Gibrat's Law is found to generally hold when controlling for selection both 'ex ante' and 'ex post'. Results may be driven by the absence of a minimum efficient scale which charities must achieve to survive and the different funding profiles of charities.

JEL Codes: L31, C14

Keywords: Gibrat's Law, charities, nonparametric estimation

Peter G. Backus
Third Sector Research Centre
University of Southampton & IEB
Department of Public Finance
University of Barcelona
Facultat d'Economia i Empresa
Tinent Coronel Valenzuela, 1-11
08034 Barcelona, Spain
E-mail: peterbackus@ub.edu

* The author is grateful for the helpful comments from Dr. Rafael Gonzalez-Val and Prof. John Mohan and seminar participants at the National Council of Voluntary Organisations. Thanks to Dr. David Clifford for helpful discussion.

1 Introduction

In 2010, British charities brought in £55 billion[1], about 2.4 percent of British GDP that year. Despite being a significant component of the economy, the 'industry' dynamics of the charitable sector are not well understood as there is no established theoretical model of charitable organisations though revenue and service maximisation are commonly used possibilities (Steinberg, 1986). Indeed, while it is acknowledged that the objective function of charities differs, by definition, from that of firms (i.e. profits), there is little consensus about what is, in fact, the objective function of charities. Many other questions remain as to the underlying processes by which charities are formed, grow and dissolve. The tools of empirical analysis generally applied to the study of charities and the charitable sector are taken largely from the literature on the study of firms (e.g. Tuckman and Chang (1991); Trussel (2002); Zhang (2010); Harrison and Laincz (2008b)). However, charities differ from firms in some fundamental ways, not least of all being the non-redistribution of profits constraint imposed on charities. As such, the formation, growth and dissolution of charities may follow distinct dynamic processes from those of firms rendering the application to charities of the analytic tools developed for the study of firms somewhat questionable.

One way to compare the for- and non-profit sectors is via observed empirical regularities that do not depend on an underlying theoretical foundation. One such regularity for firms is based on the law of proportional effect. The law of proportional effect holds if the proportional growth of x_t from time t to $t+s$ is independent of the value of x_t. Starting with Gibrat (1931) researchers sought to test the applicability of the law of proportional effect to firm growth and the independence of firm growth from the initial size of firms is known as Gibrat's Law.

Gibrat's Law, as applied to firms, has been tested empirically for decades. Early studies (e.g. Hart and Prais, 1958) confirmed Gibrat's Law for firms. Empirical support for Gibrat's Law proved popular with theorists as it is consistent with economic models of firm size distribution (Lucas 1978). These studies tended to use samples of large, well-established firms. As early as Mansfield (1962), evidence began to suggest that Gibrat's Law did not hold universally. Smaller firms were found to grow faster than larger ones, a result widely confirmed (Sutton (1997); Santarelli et al. (2006)).

Given this consistently observed deviation form Gibrat's Law, Lotti et al. (2007) regard it as a 'dynamic rule valid for large and mature firms' (Lotti et al. (2007), p 6) rather than a universal law. This weaker rule has found support elsewhere and has become known as Gibrat's Legacy (Sutton 1997). Gibrat's Legacy has been explained by the large fixed-costs incurred by new firms, necessitating that they 'hurry' to achieve a minimum efficient scale in order to survive. Audretsch et al. (2004) hypothesise that Gibrat's Law will hold for services, which tend to have lower fixed costs, and not hold for manufacturing where large fixed costs are normal. They find evidence that Gibrat's Law is indeed

[1] http://www.charitycommission.gov.uk/About_us/About_charities/factfigures.aspx

more likely to hold for small-scale services than for manufacturing.

Taken together, Gibrat's Law and Gibrat's Legacy suggest that industries 'mature' through time towards compliance with the law of proportional effect. That is, a given population of firms will eventually adhere to Gibrat's Law as the less efficient firms fail over time. Lotti et al. (2007) test Gibrat's Legacy by observing the maturation of the media equipment manufacturing sector in Italy. As Gibrat's Law is often found to be violated, whereas Gibrat's Legacy is generally found to form two hypotheses. The 'ex ante' hypothesis is that Gibrat's Law will not hold over the entire observed period. The 'ex post' hypothesis is that the sector will mature toward Gibrat-like growth. That is when considering growth over a long period (1987-1994 in their paper), Gibrat's Law will not hold. However, when considering year on year growth, they find that the sector falls into line with Gibrat's Law as it matures over time. The less efficient firms fail and the sector moves towards less dependence of growth on initial size until independence, and thus Gibrat's Legacy, is realised. Their results confirm both the failure of Gibrat's Law ex ante and the maturation of the sector toward Girat'like growth.

This paper tests Gibrat's Law for charities in England and Wales using data on the population of registered charities from 1997 to 2009. The panel data set I use covers the population of registered charities for the years 1998 to 2009 allowing me to test the law of proportional effect over the whole period (Gibrat's Law) and for the convergence through time to size independent growth for a population of charities (Gibrat's Legacy). I test for adherence to the law over the entire period and also through time to see if the charitable sectors under examination mature towards compliance with Gibrat's Law (Gibrat's Legacy). Section 2 discusses Gibrat's Law and charities. The data are discussed in section 3 and the methodology is outlined in section 4. Results are presented in section 5 and conclusions drawn in section 6.

2 Gibrat's Law and Charities

Only recently have economists considered Gibrat's Law and charities. Harrison and Laincz (2008a) argue that Gibrat's Law may apply to charities given that charities tend to be involved in service provision rather than manufacturing and therefore face lower fixed costs. Alternatively, they note, the evolution of the charitable sector may violate Gibrat's Law due to the non-redistribution constraint that prohibits charities from distributing any of their value to shareholders. Even if a charity enters administration, liquidated assets must be directed towards charitable ends rather than to shareholders. Therefore, argue Harrison and Laincz, all fixed costs incurred by the charity are sunk.

However, this argument conflates the goals of a charity with those of a firm. The costs incurred by a firm are undertaken to generate shareholder value. Charities, however, do not generate shareholder value as they cannot redistribute profits to shareholders. Assume that charities are service maximisers (Steinberg 1986), they maximise their charitable expenditure in the service of some population (e.g. children, animals). That is, the charity's objective function (and that of its shareholders) is in effect the utility function of the population being served.[2] Should that charity enter administration and liquidate its assets, the subsequent income must be directed towards the welfare of the population the charity was established to serve. This is a different concept than that of sunk costs incurred by a firm.

Harrison and Laincz (2008a) find that smaller charities tend to grow faster than larger ones, violating Gibrat's Law. When they consider larger charities, those larger than the minimum efficient scale (MES) defined as the largest charities capturing 50% of total sector revenues, Gibrat's Law holds implying Gibrat's Legacy may hold for charities as well. However, this again is an application of methods developed for firms being applied to charities without consideration for the distinction between the two. The concept of MES is well understood for firms (see for example Carlton and Perloff (1994)). However, the concept is not as clear when considering charities and its application to charities will depend on their objective function, something that is itself not obvious.[3] Moreover, the above definition of MES, commonly used in studies of Gibrat's Law, is arbitrary. Moreover, charitable sectors tend to be highly concentrated. For example, in 2008, 50% of total charitable sector revenues was captured by fewer than 100 charities meaning less than 0.1 percent of charities achieve the defined MES.

Gibrat's Legacy holds if inefficient organisations fail, that failure is independent of size and surviving firms' growth converges to Gibrat consistent behavior. Ramanadham (1989) notes that 'private enterprise works for profit and closes if loses persist'. This is not necessarily the case for charities. The vast majority of charities are very small and tend to remain so over time, generating less than a few thousand pounds of income each year (Backus and Clifford, 2010). In fact, a charity may remain registered with the Charity Commission, the regulatory body in England and Wales, for years while reporting zero income and zero expenditure, only to begin raising funds again at a later date. Moreover, charities can rely on volunteer labor to a degree that firms cannot. As a result, the failure rate for charities is dramatically lower for charities than for firms (Harrison and Laincz, 2008b).

3 Data

The data I use come from the Charity Commission (CC) and represent the population of registered charities in England and Wales between 2002 and 2009. The data are collected from submissions of accounts by charities to the CC. The CC data are obtained from two sources. The 1998 to 2001 records were obtained from the National Council of Voluntary Organisations (NCVO) and the 2002 to 2009 data from the CC directly. Charities are

[2] Ignoring for now the public good nature of many services provided by charities.
[3] Consider for example, the literature (Steinberg (1986), Khanna et al (2000)) on gross versus net revenue (service) maximisation.

identified using a unique registration number.

I start with the population of registered charities with more than £1,000 of income (thus requiring them to submit an annual return to the Charity Commission) in 1998. Charities founded after 1998 or charities with less than £1,000 of total income in 1998 are excluded. I further restrict attention to general charities excluding NHS Trusts, schools, churches and parishes and parent teacher associations. I also exclude charities which move in an out of compliance with the requirement to file an annual report with the Charity Commission (i.e. reporting in some years and not others). Lastly, I exclude branched charities (e.g. the scouts) as it is not obvious whether it is the central governing body or the individual branches (e.g. scout troops) which should be included. Income and expenditure figures are deflated to 2009 prices using Consumer Price Index [4] so all reported monetary values and growth rates are in real terms.

Imposing these restrictions, I am left with 56,218 charities in 1998, of which 46,590 survive until 2009. This implies a annual failure rate of about 1.7 percent, comparable to the results (gross exit rate of 2.1 percent for US charities) in Harrison and Laincz (2008b). To help ensure exits in the final year are genuine (i.e. they do not return after not filing in 2008) I use 2008 as the last operational year.

Considering all charities together ignores important variation in the sector. Charities are a heterogeneous group of organisations, working for many different causes and funded in a variety of ways. I therefore test Gibrat's Law for two charitable sub-sectors (Social Services, International Development) in addition to consideration of the charitable sector as a whole. I identify charitable sub-sectors (or causes) using the International Classification of Nonprofit Organisations (ICNPO) (see Salamon and Anheier, 1992; 1996). The ICNPO classifies charities according to their primary economic activity. The National Council of Voluntary Organisations (NCVO) have classified charities on the CC register according to this ICNPO criteria (Kane, 2009). I assume the classifications remain constant over the observed period. In 1998 there were 10,918 social service charities and 1,021 development charities, with gross exit rates of 2.9 and 1.9 percent, respectively.

4 Methodology

Gibrat's Law can be tested in a number of ways. For example, if Gibrat's Law holds, the resulting distribution of charity sizes will be log-normal. Therefore a formal test of the log-normality of the charity size distribution amounts to a simple test of Gibrat's Law. More commonly linear regression techniques are used to test Gibrat's Law. The base specification used is

$$g_{it} = \theta_0 + \theta_1 y_{is} + \varepsilon_{it} \tag{1}$$

where y_{is} is the log of some measure of charity $i's$ ($i = 1, 2, \ldots, n$) size at time s and

[4] Obtained from the Office of National Statistics (http://www.statistics.gov.uk/statbase/)

g_{it} is the proportional growth of y between time s and t ($s < t$) defined as

$$g_{it} = \frac{y_{it} - y_{is}}{y_{is}} \tag{2}$$

The central concern of Gibrat's Law is then whether or not g_{it} is a function of y_{is}. The model can be estimated via OLS and Gibrat's Law is said to hold if $\theta_1 = 0$. Researchers have amended this basic specification, allowing for additional control variables such as age and industry/sector (Audretsch et al. 2004), sample selection and autocorrelation (Chesher 1979). The model is often estimated using three distinctly defined samples: surviving firms, all firms, and 'large' firms often defined as those operating above the minimum efficient scale (sample 3). Each sample presents its own complications for consistent estimation of equation 1.

If estimating the model for surviving firms only, selection bias will be a problem if the probability of failure is correlated with size. Such a selection bias can be mitigated using techniques such as that developed in Heckman (1979). However, it is generally acknowledged that this approach requires the inclusion of an 'idenitfying variable'; a variable that determines the survival of the firm or charity but not growth of the firm or charity. In the absence of good 'identifying' variables, the Heckman selection model is inefficient and not robust (Puhani, 2000).

Estimating the model for all firms is complicated by the fact that growth for exiting firms is unobserved. This has been addressed in the literature by setting the growth rate of exiting firms equal to -1 (Dunne et al., 1989; Fariñas and Moreno, 2000). However, simply estimating equation 1 by OLS using this approach can produce biased estimates as the employed data will be censored at -1 (Hayashi, 2000).

Testing of Gibrat's Legacy for firms is generally done by estimating equation 1 for large and mature firms. However, 'large' and 'mature' are difficult to define in any rigorous way. Generally, these firms are identified as those operating at above the minimum efficient scale, defined as the largest firms capturing 50% of total income/employment. Truncating the data used for estimation in this way can, however, result in biased estimates of θ (Lai and Ying, 1992).

In addition to these complications there are further difficulties in obtaining a consistent estimator of θ_1 arising from possible autocorrelation (Chesher 1979) and omitted variable bias. While all of these issues are theoretically surmountable, in practice they mean that the consistent estimation of θ_1, and thus a valid parametric test of Gibrat's Law, can be very difficult to achieve. I therefore appeal to a more robust non-parametric approach following Ionnides and Overman (2003) and González-Val (2011) which consider Gibrat's Law for the growth of national and municipal populations.

Given the difficulties in obtaining a consistent parametric estimator for θ_1, researchers have employed more robust, and informative, non-parametric methods. Given the model

$$g_{it} = m(y_{is}) + u_i \tag{3}$$

where $m(.)$ is an unknown mean function, u is a symmetrically distributed error term and $s < t$. Interest is in estimating $m(y_s) = E[g_t|y_s]$ without imposing any restrictions on the functional form of $m(.)$. To examine therelationship between growth and size, Fariñas and Moreno (2000) estimate $m(y_s)$ using the Nadaraya-Watson estimator given of $E[g_t|y_s = y_{0s}]$ by

$$\hat{m}_0(y_s) = \frac{\sum_{i=1}^{n} K_h(y_{0s} - y_{is})g_{it}}{\sum_{i=1}^{n} K_h(y_{0s} - y_{is})} \tag{4}$$

where K_h is a Gaussian Kernel with bandwidth h. Implementation of this estimator is simple, however, it suffers from bias at the boundaries (Fan and Gijbels, 1996; Cleveland, 1979). I therefore use an alternative smoothing technique, local polynomial smoothing , which resolves the boundary problem.

The local polynomial smoother fits g_{it} to a polynomial form of y_{it-1} via locally weighted least squares. Formally,

$$\sum_{i=1}^{n} \left\{ g_{it} - \sum_{j=0}^{p} \beta_j (y_{0s} - y_{is})^j \right\}^2 K_h (y_{0s} - y_{is}) \tag{5}$$

where $\beta_j = m^j(y_{0s})/j!$ and $j = 0, \ldots, p$ gives the degree of the polynomial used. This smoother amounts to estimating equation 5 for each each y_{is}, or some subset of grid points, with j polynomial terms $((y_{is} - y_{0s})^j)$, predicting the $\hat{\beta}_0$'s and then plotting them against the corresponding y_{0s}. Note that the Nadaraya–Watson estimator is a speacial case of this where $p = 0$. Local polynomials of higher orders have, however, been shown to have better bias properties at the boundary of the regression space (Fan and Gijbels, 1996). This approach to measuring the relationship between size and growth is also used in studies of economic inequality (Jenkins and Van Kerm 2006)

The values of p, h and the subset of y_{is}'s to use are determined by the researcher. Higher values of p have better bias properties, but are computationally more intensive. I use a cubic specification. The bandwidth, h, is determined using Silverman's (1986) 'rule-of-thumb'. The bandwidth used is given as 0.9 times the minimum of the standard deviation and the interquartile range divided by 1.34 times the sample size to the negative one-fifth power (Silverman (1986), page 48). Rather than estimate equation 5 for each value of y_{is}, I use 300 evenly spaced points to reduce the computational burden.

Testing Gibrat's Law using nonparametric smoothers

In practice I normalise the growth rate (differencing g_{it} from the mean and then dividing by the standard deviation) to facilitate interpretation. Therefore, if $E[g_{it}|y_{is}] = E[g_{it}] = 0$, $\forall i$ then Gibrat's Law holds. I test Gibrat's Law for charities by visually inspecting the local polynomial smoother to see if the unconditional mean deviates from the conditional mean (0) at any point in the distribution. I do this for charities surviving from s to t and for all charities by setting the $g_t = -1$ for those charities exiting between s and t. This is equivalent to weighting the local mean growth rate conditional on survival by the local probability of survival (Farinas and Moreno 2000).

To test Gibrat's Legacy, I produce the nonparametric smoother for two distinct time periods. First, I produce the nonparametric smoother for growth over the entire period, 1998 to 2008, to test the ex ante hypothesis that Gibrat's Law will not hold for this population of charities. I then use the sample of charities from the 1998 cohort that survived until at least 2007 to test Gibrat's Legacy by re-estimating the smoother for 2007-2008.

5 Results

I first consider the validity of Gibrat's Law over the entire observed period. As noted in Lotti et al. (2007) Gibrat's Law is generally rejected 'ex ante'; it does not hold over the entire size distribution when growth over the medium to long run is considered. They find evidence that Gibrat's Law holds 'ex post'; at the end of the observed period for surviving organisations. I test Gibrat's Law using both the 'ex ante' and the 'ex post' approaches for all charities, social service charities and international development charities.

Before looking at the relationship between size and growth, I present the kernel density estimation of the distribution of log income in 1998 for all charities, social services and development charities in Figure 1.

[Figure 1 about here]

There is a positive skew to all three of the distributions indicative of the small number of very large charities. Development charities tend to be larger wit ha median income in 1998 of £36,706 versus medians of £21,768 for social services and £19,813 for all charities taken together.

Below I present pairs of smoothers for each sector-period. In each case the left-hand smoother is for surviving charities only (i.e. those present in 1998 and 2008). However, using only surviving charities may produce a selection bias in the results if survival is not independent of initial size. Figure 2 is a local polynomial smoother for the probability of survival to 2008 by income in 1998 for all charities, social services and development.

[Figure 2 about here]

It is evident that the probability of survival is a positive function of initial size for each of the sectors. I therefore allow for selection by setting the growth of charities exiting to -1 (Dunne et al., 1989) and re-estimate the local polynomial smoothers (the right-hand side smoother). In each figure, the solid line is the smoother and the bootstrapped 95 percent confidence interval is given by the two dashed lines.

Figures 3, 4 and 5 show the local polynomial smoothers of normalised growth between 1998 and 2008 by income in 1998 for all charities, social service charities and development charities, respectively. The figures are truncated at £10 million as data are too sparse above that level for a useful degree of precision.

[Figure 3 **about here]**

[Figure 4**about here]**

[Figure 5 **about here]**

For surviving charities (left-hand side), Gibrat's Law is violated for all charities and for social service charities, albeit in different ways. Figure 3a indicates that when considering all charities together, smaller charities grow faster than larger charities though above about £100,000 the smoother is very flat suggesting that Gibrat's Law may be holding for these larger, surviving organisations. This result is broadly consistent with what is generally found for firms; Gibrat's Law is rejected 'ex ante' and that smaller organisations grow faster on average, than larger ones. Conversely, Figure 4a indicates that larger surviving social service charities grow faster than smaller ones. However, the smoother again appears very flat above about £100,000. For surviving development charities, Figure 5a, I cannot reject Gibrat's Law over the entire size distribution at the 5 percent level.

When allowing for selection (Figures 3b, 4b and 5b) Gibrat's Law cannot be rejected 'ex ante' at the 5 percent level for all charities nor for development charities. For social service charities, the positive relationship between growth and initial size seems to be strengthened relative to Figure 2a.

Note that for both all charities and for development the largest deviations from the unconditional mean growth (of 0) are observed for the very smallest charities (though for development these deviations are not statistically significant). For these small charities, relatively small changes in absolute income (less than, say, £5,000) result in large proportional changes. This, and the selection bias which is reinforced for smaller charities, produces the observed deviations for the smallest charities.

The results suggest that when selection is accounted for, Gibrat's Law holds 'ex ante' for all charities and for development charities. This differs from the results generally found for firms, where smaller firms grow more quickly in an effort to 'catch up' (Lotti et al., 2007) to the minimum efficient scale. That the results presented here that the growth of charities are not subject to the same requirements. While firms must achieve a minimum efficient scale to survive, charities can, and in fact may intend to, remain very small. More than half of the charities in the bottom decile of income in 1998 remain in the bottom decile of income in 2008 (66 percent for social services and 43 percent for development).

Gibrat's Law does not, however, hold for social services, where it is the larger charities that grow faster than the smaller ones. One explanation for social services' violation of Gibrat's Law may lie in the funding profile of social service charities. The development sector relies most heavily on on 'donations and fundraising activities' (author's calculation of 2008 National Survey of Third Sector Organisations). Social services, however, are predominantly dependent on contract funding. During the observed period, there was a transitioning from grant-based to contract-based public funding of social service charities, the later thought to favor larger charities (Waine, 1992). This favoritism is consistent with the observed positive relationship between initial size and growth of social service charities (see Clifford and Backus 2010 for a fuller discussion).

To test Gibrat's Legacy, I re-estimate the smoothers for growth at the end of the period (2007-2008) for the surviving charities. Results are presented below in Figure 6, 7 and 8 in a manner analogous to Figures 3, 4 and 5. Results for all charities (Figure 6) suggest a departure from Gibrat's Law with the smaller charities growing more quickly than the large charities, even when selection is accounted for. (Figure 6b. For social services, the 'ex ante' pattern is reversed, with smaller charities growing fast than larger ones at the end of the period (Figure 7a). Allowing for selection, however, indicates that all but the very smallest social service charities adhere to Gibrat's Law. This result suggest a 'maturation' over time of the social services sector towards Gibrat consistent growth, similar to the dynamic process observed for firms in Lotti et al (2007). Development charities adhere to Gibrat's Law at the end of the period once selection is allowed for (Figure 8b).

[Figure 6 **about here]**

[Figure 7**about here]**

[Figure 8 **about here]**

6 Conclusions

This paper sets out to test Gibrat's Law of proportional effect using a unique data set on the population of registered charities in England an Wales between 1998 and 2009. A non-parametric approach to the analysis is preferred to the standard parametric methods to testing Gibrat's Law as consistent parametric estimation of the key parameters is difficult to achieve given the nature of the data. The results suggest that, in contrast to for-profit firms, all charities taken together adhere to Gibrat's Law 'ex ante' (i.e. over the long-run), once sample selection is accounted for. Development charities, which rely predominantly on charitable contributions, also adhere to Gibrat's Law 'ex ante'. Social service charities, violate Gibrat's law 'ex ante'. In contrast to what is generally found for firms, however, it is the larger charities which grow faster than the smaller ones. This results is consistent with social service charities' greater dependence on contract funding which thought to favor larger charities. Testing for Gibrat's Legacy suggest that the social service sector may 'mature' towards Gibrat consistent growth over time.

The above results indicate that the growth and development of charitable sectors may not be governed by the same dynamic forces that apply to firms. This suggests that applying the tools and models developed for the study the growth of for-profit sectors to the growth of charities may not be appropriate. Further work is needed to more fully understand the underlying growth processes of the non-profit sector.

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Figures

Figure 1: Kernel densities of log income in 1998 for all, social services and development charities

Figure 2: Probability of survival to 2008 by income in 1998

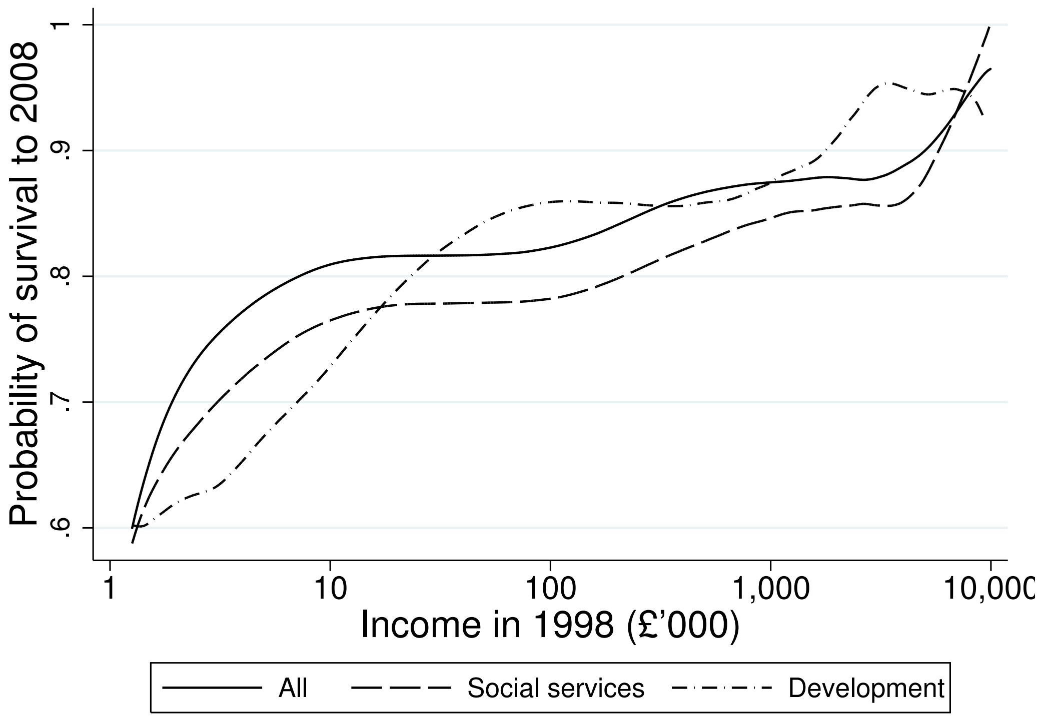


Figure 3: Growth by initial size for all charities, 1998-2008

3a: Surviving Only

3b: Surviving and Exiting

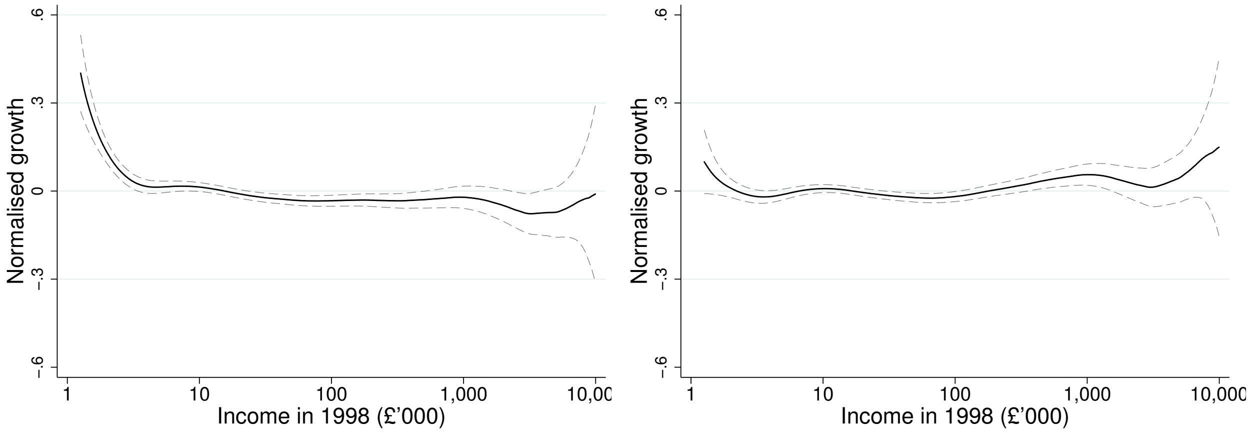


Figure 4: Growth by initial size for Social Service charities, 1998-2008

4a: Surviving Only

4b: Surviving and Exiting

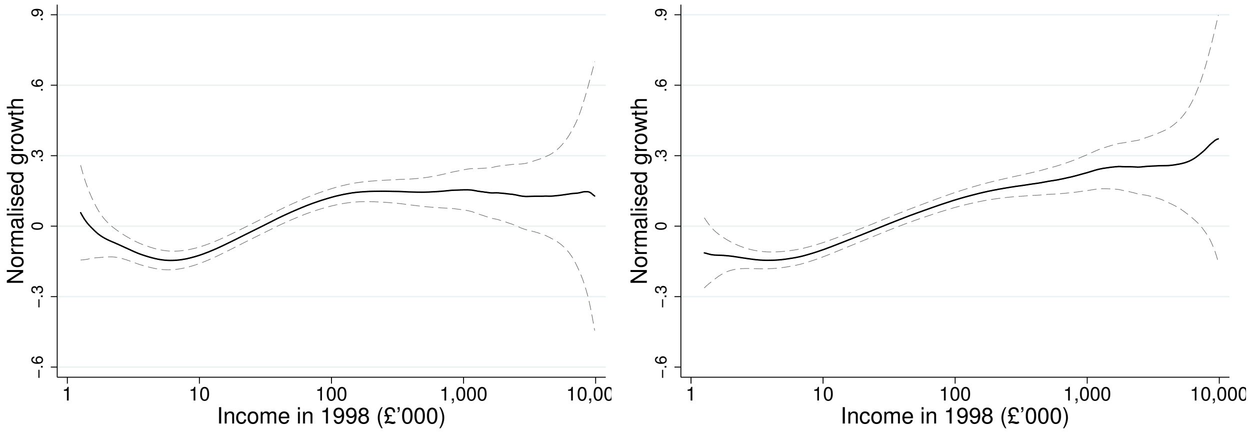


Figure 5: Growth by initial size for Development charities, 1998-2008

5a: Surviving Only

5b: Surviving and Exiting

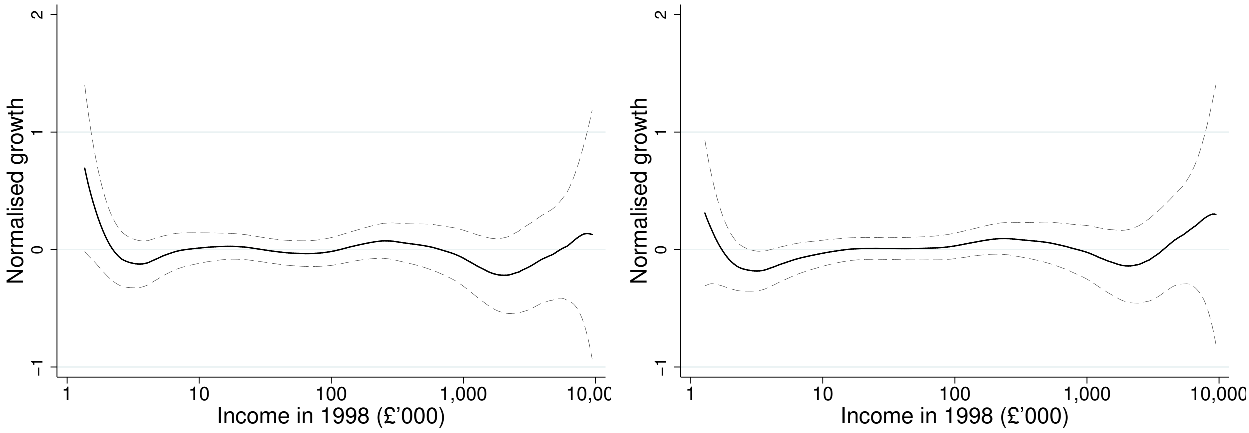


Figure 6: Growth by initial size for charities, 2007-2008

6a: Surviving Only

6b: Surviving and Exiting

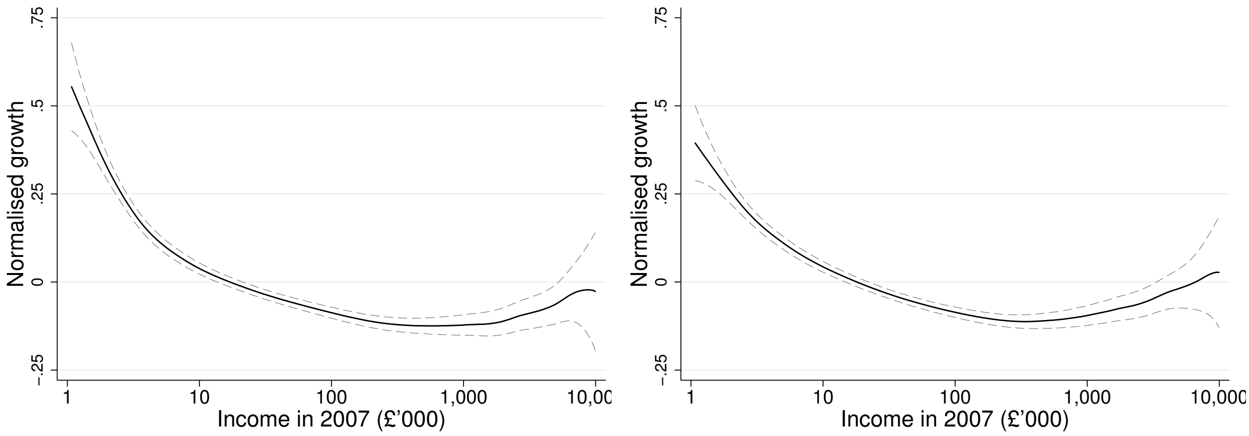
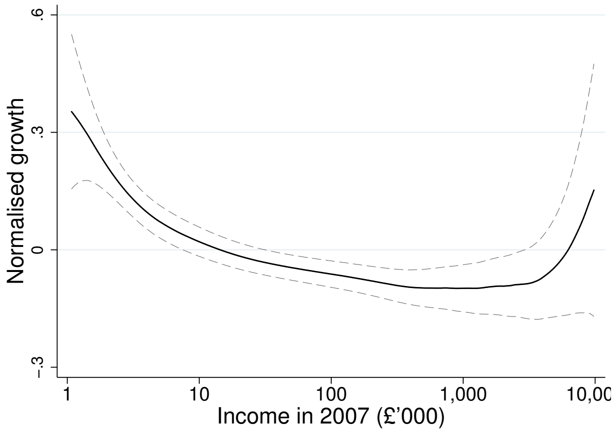


Figure 7: Growth by initial size for Social Service charities, 2007-2008

7a: Surviving Only



7b: Surviving and Exiting

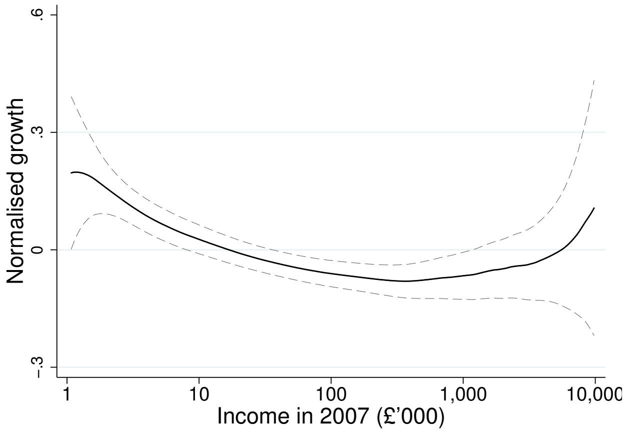
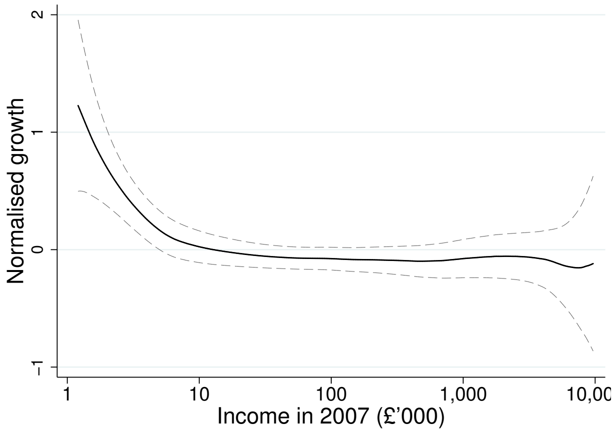
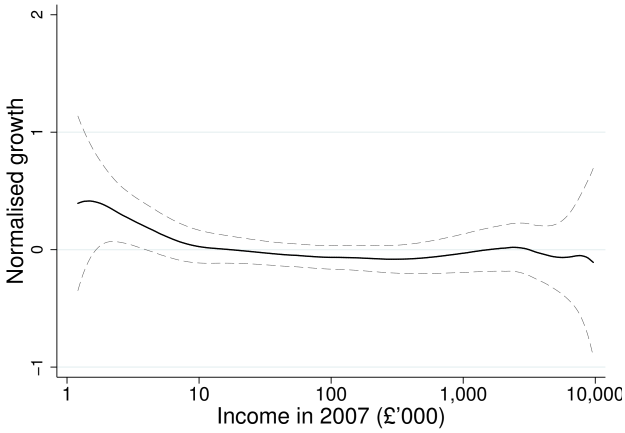


Figure 8: Growth by initial size for development charities, 2007-2008

8a: Surviving Only



8b: Surviving and Exiting



2010

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