

## The Survival of Businesses Formed in Bristol 2003 to 2016.

### Headlines



Business survival rates suffered through the recession of 2008/9.



There was some recovery post-recession (2011) but not to pre-recession levels.



Even at their best, business survival rates in the UK compare badly with those of other large economies.



Survival rates for Bristol consistently outperform the UK average, but not those of other large economies.



Bristol is unique among the British Core Cities in outperforming UK average.

## The Survival of Businesses Formed in Bristol 2003 to 2016.

### Summary



In 2008 the half life of businesses formed in Great Britain was 3.44yrs, 13.4% below that<sup>1</sup> (3.97yrs) for 2003.



In 2011 the half life of businesses formed in Great Britain was 3.67yrs, 6.7% above that (3.44yrs) for 2008 but still 7.6% below the value for 2003.



Half-lives of businesses born in the UK compare poorly with those of other countries. The half-life of a business born in the UK in 2010 was 3.8yrs. This compares to 6.6yrs for the USA; 4.8yrs for France and 3.9yrs for Germany.



In 2008 the half life of businesses formed in Bristol was 3.62yrs, 11.1% below that (4.07yrs) for 2003.



In 2011 the half life of businesses formed in Bristol was 3.70yrs, 2.4% above that (3.62yrs) for 2008 but still 8.9% below the value for 2003.



The half life of businesses formed in Bristol has been consistently higher than that for businesses formed in Great Britain. This is not the case in any of the other nine British Core Cities.

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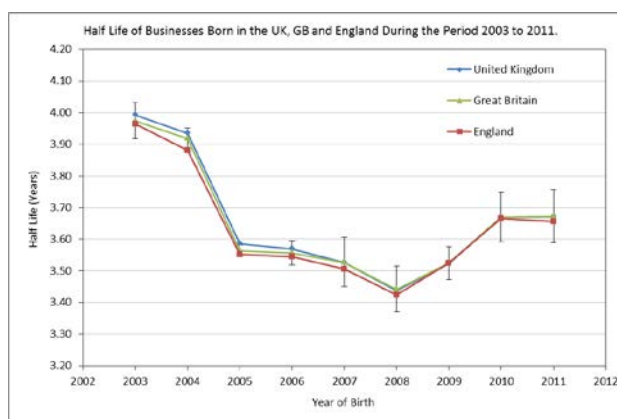
<sup>1</sup> The longer the half-life the better

## Business Survival in Bristol for the Period 2003 to 2016

### The National Picture

The data (from the Office for National Statistics<sup>2</sup>) supports a model<sup>3</sup> of behaviour that is analogous to that for the decay of radioactive material. The half-life of businesses born in the UK in 2010 was 3.7 years. This compares to 6.6 years for the USA<sup>4</sup>; 5.7 years for Luxembourg<sup>5</sup>; 5.1 years for France; 4.8 years for Austria; 4.2 years for Germany; 3.9 years for Hungary and 3.8 years for Finland. The chart below shows the half lives of businesses

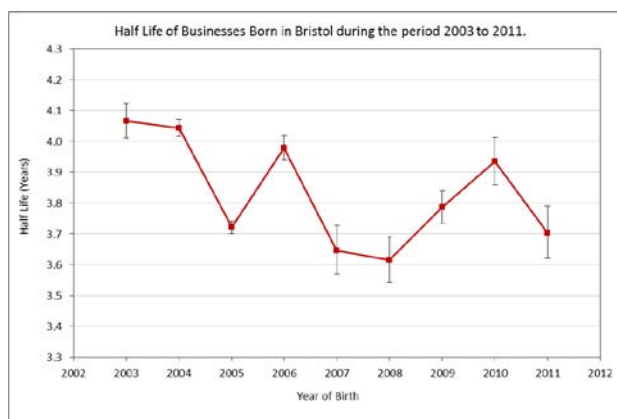
created in the years 2003 to 2011 for the UK, Great Britain and England. Not surprisingly the half lives are the same for all three areas. Further, it is clear that the half life fell sharply (GB 9.1%) between 2004 and 2005; fell further (GB 3.4%) between 2005 and 2008; increased (GB 6.7% from 3.4 to 3.67 years) between 2008 and 2010 and remained unchanged between 2010 and 2011. Further, half-lives calculated using 3 or 4 points<sup>6</sup> suggest that the metric is unlikely to change significantly over the next couple of years. Clearly businesses have found it more difficult to survive if they were created during the period 2005 to 2010 than they did if created in 2003 or 2004. It must be concluded that businesses which had survived for four years prior to the 2008 recession found it easier to remain active during and after said recession than those that survived only three years. Further, the adverse economic conditions that followed the recession (2010 to 2013) have meant that businesses created in the period 2005 to 2010 found it more difficult to survive than they would have if created in 2003 or 2004. As noted earlier, the half life did increase to 3.67 years in 2010 and was unchanged in 2011 but remains below the level of 2004 (3.9 years) by a significant margin.



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### The Picture for Bristol

The chart opposite shows the half lives of businesses created during the years 2003 to 2011 in Bristol. Apart from what looks like an anomalous peak in 2006 the time series of half lives for Bristol more or less mirrors the national picture. The half life fell (by 7.2%) between 2004 and 2005; then fell further (by 2.9%) between 2005 and 2008; then increased 8.8% between 2008 and 2010 and



<sup>2</sup> <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/businessdemographyreferencetable>

<sup>3</sup> See Appendix 1 for a detailed discussion

<sup>4</sup> Source: - US Bureau of Labour Statistics: [Establishment Age and Survival Data](#)- Table 7.

<sup>5</sup> Source: All others - OECD - [http://stats.oecd.org/viewhtml.aspx?datasetcode=SDBS\\_BDI\\_ISIC4&lang=en](http://stats.oecd.org/viewhtml.aspx?datasetcode=SDBS_BDI_ISIC4&lang=en)

<sup>6</sup> The trend analysis that gives the Half-lives can be completed using as few as 3 points.

decreased 5.9% between 2010 and 2011. In 2011 the half life of businesses created in Bristol was 3.70 years not significantly different to that (3.67 years) for Great Britain. For the most part the half lives of businesses formed in Bristol have been longer than the national average<sup>7</sup>.

## Comparison with the British Core Cities

The table below lists the half lives for businesses created in the British Core Cities during the period 2003 to 2011.

Area name	Half Life (in years) for the Year in Which Businesses Were Created									% Change Between Years		
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2003-08	2008-11	2003-11
Bristol	4.07	4.04	3.72	3.98	3.65	3.62	3.79	3.93	3.70	-11.09	2.44	-8.93
Birmingham	3.76	3.68	3.15	3.13	3.00	3.05	3.17	3.25	3.26	-18.73	6.71	-13.28
Cardiff	3.77	3.75	3.50	3.60	3.32	3.48	3.37	3.57	3.40	-7.65	-2.32	-9.79
Glasgow	3.31	3.36	3.12	3.13	3.16	3.02	3.36	2.90	3.12	-8.75	3.03	-5.99
Leeds	3.76	3.81	3.63	3.41	3.27	3.29	3.54	3.78	3.67	-12.42	11.31	-2.51
Liverpool	3.75	3.76	3.12	3.02	2.86	2.86	3.15	3.08	3.14	-23.66	9.62	-16.32
Manchester	3.34	3.22	3.23	3.10	3.23	2.81	3.05	3.32	3.21	-15.89	14.20	-3.95
Newcastle	3.65	3.75	3.63	3.47	3.25	3.67	3.21	3.64	3.54	0.38	-3.53	-3.16
Nottingham	3.87	3.79	3.48	3.28	3.08	2.98	3.27	3.34	3.46	-22.90	16.22	-10.40
Sheffield	3.99	3.88	3.15	3.04	3.08	3.53	3.49	3.89	3.54	-11.71	0.38	-11.38
Great Britain	3.97	3.92	3.56	3.56	3.53	3.44	3.52	3.67	3.67	-13.41	6.68	-7.62

For the most part<sup>8</sup> the half lives of businesses formed in Bristol are longer than those for businesses formed in the other British Core Cities, and Bristol is the only Core City with half lives that are consistently longer than the national (GB) average. Businesses in all of the Core Cities had half lives that were shorter in 2008 than in 2004<sup>9</sup> and all but two (Glasgow and Nottingham) had longer half lives in 2011 than in 2008. All of the Core Cities had shorter half lives in 2010 than in 2004. In 2011 the half life of businesses formed in Bristol was 7.7% below that for 2004, over a percentage point worse than GB and 4<sup>th</sup> amongst the Core Cities. Further, it should be noted that business half lives for 2011 in excess of 4.25 years occur in areas such as Aberdeen (4.88 years); Carlisle (4.69 years); Reading (4.29 years); Rugby (4.58 years); Winchester (4.77 years) and Wokingham (4.44 years).

Questions about the contents of this briefing should be addressed to:

Stephen Usmar,  
 Economic Intelligence Officer,  
 Policy and Research Team,  
 Bristol City Council.  
 BS3 9FS  
 email: stephen.usmar@bristol.gov.uk  
 Phone: 0117 9222925

<sup>7</sup> See Appendix 3

<sup>8</sup> Newcastle had a longer half lives in 2008.

<sup>9</sup> See charts in Appendix 2

## Appendix 1

The mathematics of the model results in an equation which gives the number of businesses ( $N$ ) that remain active at a particular time,  $t$ , as:

$$N = N_0 \exp[-\lambda t] \quad (N = N_0 e^{-\lambda t}) \quad (1)$$

where  $N_0$  is the initial number of businesses;  $\lambda$  the death rate of businesses. For ease of manipulation and analysis equation (1) can be turned into a straight line by taking its log.

This gives:  $\ln(N) = \ln(N_0 \exp[-\lambda t]) \quad (2)$

and then:  $\ln(N) = -\lambda t + \ln(N_0) \quad (3)$

Thus, plotting the survival rate<sup>10</sup> against time results in a line with a slope that is the death rate of businesses for the year of formation.

The data, published by the Office for National Statistics (ONS) under the title Business Demographics<sup>11</sup>, was first published in 2008 and now comprises 8 data sets with 1 to 5 year survival rates for the years starting 2003 to 2010. The data sets are separated by country, region and local authority. Thus at the national and regional levels there are 32 and 72 independent data sets respectively. Analysis all of these data sets indicate that they fit the model very well. The table below shows the results of the analysis. The numbers in the table (matching parameters) provide a measure of how well the data and model are matched, with a perfect match indicated by 100. Clearly in some instances the match might as well be perfect. At the local authority geography there are over 3,000 independent data sets. The analysis shows that for over 78% of these the model and data are well matched with matching parameters over 99. Further, at these geographies numbers can be quite small and the rounding (to the nearest 5) applied to the data before publication can distort real changes and result in deviations from the model. For areas with more than 1,250 new businesses initially nearly 90% are in the 99% class.

Area Name	Percentage of behaviour accounted for by the model for start date								
	2003	2004	2005	2006	2007	2008	2009	2010	2011
England	99.73	99.90	99.96	99.83	99.32	99.36	99.70	99.38	99.27
Scotland	99.32	99.62	99.78	99.88	99.55	99.65	99.63	99.43	99.63
Wales	99.89	99.99	99.94	99.84	99.30	99.51	99.59	99.33	99.29
Northern Ireland	99.41	99.27	99.95	99.92	99.70	99.31	99.29	99.03	98.29
East Midlands	99.65	99.93	99.97	99.78	99.47	99.28	99.62	99.28	99.20
East	99.81	99.92	99.96	99.86	99.36	99.56	99.68	99.38	99.48
London	99.34	99.60	99.93	99.80	99.03	98.95	99.68	99.36	99.17
North East	99.70	99.88	99.89	99.89	99.45	99.76	99.73	99.32	99.27
North West	99.79	99.99	99.92	99.82	99.31	99.42	99.75	99.26	99.35
South East	99.80	99.90	99.95	99.86	99.38	99.59	99.81	99.52	99.39
South West	99.89	99.94	99.91	99.84	99.39	99.46	99.82	99.52	99.22
West Midlands	99.85	99.93	99.93	99.83	99.25	99.43	99.62	99.44	99.29
Yorkshire & The Humber	99.87	99.94	99.90	99.86	99.38	99.22	99.55	99.14	99.07

For most of the data the probability that the model is wrong is less than 1 in 100. For some data sets (1,690) this falls to less than 1 in 500 and for quite a few (318) to less than 1 in 1,000.

Using the terminology from physics the half life ( $T_{1/2}$ ) of businesses is the time at which half of the original businesses survive and is:

$$T_{1/2} = \ln(0.5)/\lambda \quad (4)$$

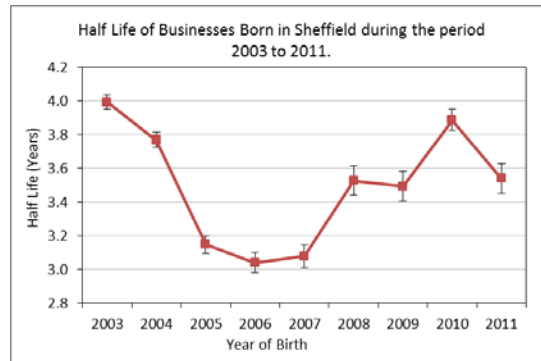
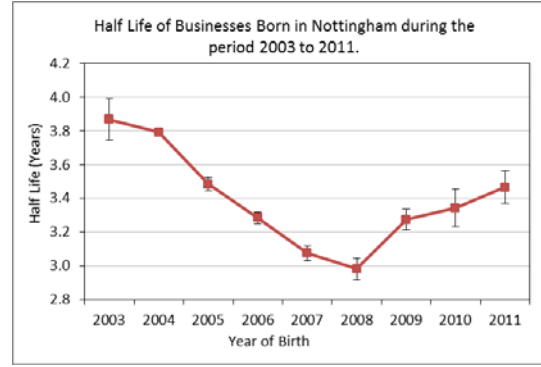
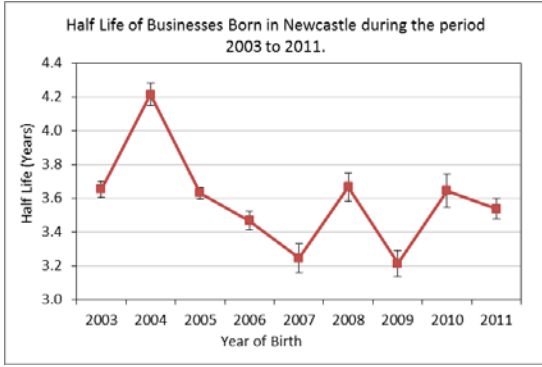
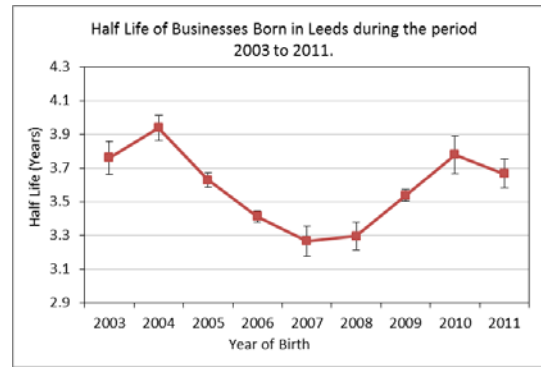
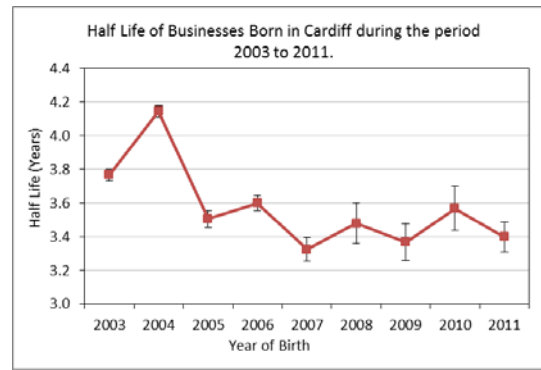
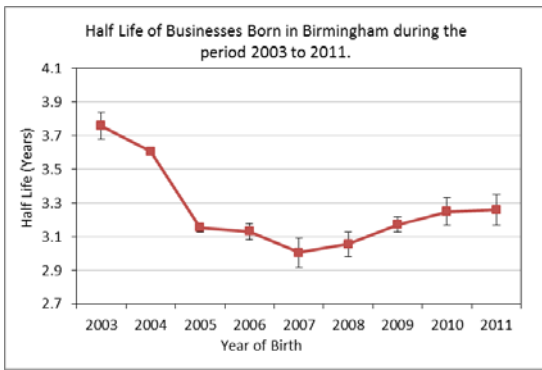
The linear regression analysis provides a value and 95% confidence limits for the half life.

<sup>10</sup> Whether one uses the numbers that have survived or the survival rates ( $R$ ) is irrelevant. For rates equation (1) is multiplied by 100 and becomes  $R = 100 \exp[-\lambda t]$ . The death rate is unaffected.

<sup>11</sup> <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/businessdemographyreferencetable>

## Appendix 2

Time Series for the half lives of businesses created in the British Core Cities.



### Appendix 3

Comparison of half lives of businesses started in Bristol with those started nationally (GB).

