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Te Kōmihana Whai Hua o Aotearoa

Firm dynamics and job creation in New Zealand: A perpetual motion machine

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Abstract

This paper uses a cohort approach to examine firm dynamics and employment growth in New Zealand. Consistent with overseas evidence, we find a large degree of churn in the economy, with many new, mostly small, firms being created each year. Many of these firms disappear relatively quickly, but those that manage to survive experience reasonable employment growth on average. However, much of this "on average" growth is driven by a very small number of firms with high employment growth. Indeed, we find that while the smallest firms play a relatively large role in accounting for net job creation, this growth involves just a modest proportion of the smallest firms, while the majority of these firms do not grow much at all.

Contents

Tables

Figures

1 Introduction

This paper examines employment growth and dynamics at the firm level in New Zealand. It is an initial foray into this area and forms part of the Productivity Commission's ongoing firm-level research on firm dynamics, with future work focussing on reallocation and productivity.

We use a cohort approach to track the survival and growth patterns of new firms born in 2001. By following firms of the same age, this approach allows us to examine firm dynamics and employment growth without the confounding effect of firm age.

We find a high degree of turbulence in the New Zealand economy. While a large number of mostly small firms are born in any given year, a large proportion of these firms do not survive for very long. Firms that do manage to survive experience reasonable employment growth on average over the first decade of life. Small firms in particular, have high average rates of employment growth. However, these average growth rates do not tell the whole story. First, a substantial part of firm growth occurs in the first year of life and is likely to be an artefact of the business establishment phase. In addition, the average growth rates are due to a small number of firms with high employment growth combined with a large number of firms that do not grow much. Likewise, while the smallest firms account for a disproportionately large share of net job creation, this contribution involves just a fraction of the smallest firms.

While not the primary focus of this paper, this work is relevant to policy debates. Recent New Zealand policy-relevant research in this area focuses on firms experiencing rapid employment growth. However, policies focusing on high-employment-growth firms are controversial. The international literature not only questions whether increasing the number and size of high-employment-growth firms will result in increased employment, but also highlights that targeting employment-generating firms may not be conducive to the development of high-growth firms in terms of productivity. Overall, these policy debates are likely to benefit from a more holistic view of firm dynamics and reallocation in the economy rather than a relatively narrow focus on employment growth, and in particular, high-employment-growth firms. We aim to inform this area further through the Productivity Commission's reallocation research agenda (for details see Nolan, 2014).

The next section discusses the relevant literature and outlines the approach we use in this paper. Section 3 describes the data. Section 4 looks at the survival growth patterns of different cohorts of New Zealand firms. The following two sections look at the cohort of firms born in 2001: Section 5 examines survival and average growth rates by firm size and Section 6 examines job creation and destruction by firm size. Section 7 discusses policy issues and Section 8 concludes.

2 Literature and approach

In this section, we briefly summarise the more salient economics literature on firm growth.[1] Although there is a large amount of existing work on firm growth, few studies use the cohort approach adopted in this paper.

2.1 Literature: firm size, job creation and high-growth firms

Several inter-related strands of literature on firm growth are relevant to our analysis. These include literature on: the evolution of the firm-size distribution; the relationship between firm size and job creation; and high-growth firms.

[1] We focus on the economics literature. There is also a large body of relevant management literature, focussing on understanding growth from the firm's perspective, starting with Penrose's (1959) seminal work.

The firm-size distribution

The starting point for this strand of literature is Gibrat's Law (1931), which reasons that the observed lognormal distribution of firm size is an inevitable product of firm growth that was independent of initial firm size (Mata, 2008). However, more recent studies suggest that while chance is still an important driver, firm growth is not independent of firm size, and in particular, small firms tend to grow faster than larger ones (see for example Evans, 1987).

Of course, this relationship between firm size and growth may arise among surviving firms if the exit rate among smaller firms is higher. However, empirical evidence suggests that the observed change in the firm-size distribution is due to the evolution of the distribution of survivors in a given cohort, with very little due to a selection effect (Cabral & Mata, 2003).

Job creation and firm size

As mentioned, there is evidence that small firms grow faster than larger firms. Early studies (such as Birch, 1979) that showed the disproportionate contribution of small firms to job creation influenced the development of small-business-assistance policies in a number of countries. However, more recent evidence suggests that there is no systematic relationship between firm size and job creation once age is controlled for as small firms also tend to be young firms (Haltiwanger, Jarmin, & Miranda, 2013).

High-growth firms

The emergence of evidence that only a small number of firms account for a large proportion of job creation has led to a shift in focus from the role of small firms to the role of "high-growth" firms (for a survey of the literature see Henrekson & Johansson, 2010). In this context, "high-growth" usually refers to firms that have high employment growth, although sales growth is also commonly used (that is, it generally does not refer to high-productivity-growth firms). This literature has also been influential in the policy debate, with the focus in recent years moving from support for SMEs to the promotion of high-growth firms (Coad, Daunfeldt, Hölzl, Johansson, & Nightingale, 2014).

In New Zealand, the Ministry of Business, Innovation & Employment has published research seeking "to inform and stimulate discussion on high-growth business in New Zealand" (MBIE, 2013, p. 1). Although there are several definitions of high-growth firms, a commonly-used one is the Eurostat-OECD (2007) definition: firms with at least 10 employees in the start year and annualised employment growth exceeding 20% during a three-year period. According to this definition, 2.5% of New Zealand firms with at least 10 employees were high-growth in the three years to 2010 (MBIE, 2013).[2]

2.2 Our approach: cohort analysis

We track cohorts of firms over time, with a particular focus on the cohort of firms born in 2001. This approach provides insights into the growth and survival patterns of new firms. Focussing on new-born firms also allows us to examine job creation by firm size without the confounding effect of firm age.

Despite its suitability, the cohort approach is not widely used in studies of firm growth. More well-known exceptions in the economics literature include Cabral and Mata (2003), Lotti and Santarelli (2004) and Lotti, Santarelli, and Vivarelli (2001). These papers focus on Gibrat's Law and the evolution of the firm-size distribution, which although relevant, is somewhat different from our main focus of firm dynamics and employment growth trajectories of new firms.

There are, however, a small number of directly relevant firm cohort studies, including Anyadike-Danes et al. (2013), Anyadike-Danes and Hart (2014) and Carroll et al. (2002). Anyadike-Danes et al. (2013) is a cross-country comparison of firms born in 2001. While this analysis will ultimately include New Zealand, at the time of writing, only the results for the United Kingdom, Sweden, Germany, Austria, Finland and Norway were available. Anyadike-Danes and Hart (2014) follows firms born in the United Kingdom in 1998 for 15 years.

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[2] MBIE (2013) also examines several other definitions of high-growth firms in terms of both employment and sales.

Carroll et al. (2002) tracks the cohort of New Zealand firms born in 1995 for six years. The main difference between our analysis and Carroll et al. (2002) is that we examine more recent data over a longer (10 year) period. An important development since Carroll et al. (2002)'s work is that many of the data improvements foreshadowed in their paper have been undertaken by Statistics New Zealand. There is now a longitudinal business database for New Zealand, which includes linked employer-employee information allowing for better tracking of firms and employees over time. We describe this dataset in more detail in the next section.

3 Data

We use the Longitudinal Business Database (LBD) component of Statistics New Zealand's Integrated Data Infrastructure (IDI) (see Statistics New Zealand, 2013a). LBD is a rich firm-level database built around the Longitudinal Business Frame (LBF) with employment and financial information from the Inland Revenue Department (IRD), merchandise exports from Customs and various business surveys from Statistics New Zealand (Fabling, 2009). At the time of writing, data were available for 2000 to 2012. Our population of interest is economically active firms operating in the private sector, with a focus on the cohort of firms born in 2001 (the first year we can identify new-born firms).[3,4]

We measure firm employment using rolling-mean-employee (RME) counts from the Linked Employer-Employer dataset (LEED), which is derived from IRD's Employer's Monthly Schedule tax form. The RME count is a 12-month average of employee counts for the year ending March.[5] This employment measure simply uses employee head counts, with no distinction between full-time and part-time employment.[6] We include non-employing (ie, working proprietor) firms in our analysis, but working proprietors are not included in the employment counts.

In addition to the LEED employee count, LBD also has an LBF employee count. Data for both the LEED and LBF employee counts come from the Employer's Monthly Schedule tax form, but there are definitional differences between the two counts. The main difference is that the LBF counts employment at any time during the month, while LEED employment is measured on the 15th of each month. For example, a person employed for just the first week of a month is counted in the LBF employment total, but not in the LEED total. Consequently, LBF normally provides aggregate employment counts that are about 20% higher than the LEED figures.[7,8] The firm and employee counts presented here are rounded in accordance with Statistics New Zealand's confidentiality rules.[9]

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[3] 'Economically active' firms must have at least one operating plant and meet at least one of the following criteria: positive 12-month RME count; part of a group of enterprises; positive GST; or positive income recorded in the IR10 annual tax return. Note that this definition includes economically-active working-proprietor-only firms, which differs from some international studies that only include firms with employees. However, while we include working-proprietor-only firms in our analysis, working proprietors are not included in our employment counts. Therefore, this distinction probably does not make much difference to job creation and destruction numbers, but is likely to impact on firm survival rates. See Section 5.1 for more details.

[4] In LBD, employee count is recorded at both the enterprise (ie, firm) and geographic unit (ie, plant) level. In this study, we use the term 'firm' to refer to an 'enterprise'. A firm is a business or service entity operating in New Zealand. It can be a company, partnership, trust, local or central government organisation or self-employed individual. We include firms in private sector industries, and therefore exclude firms that are in public administration & safety, education & training or health care & social assistance ANZSIC06 industries, as well as non-profit organisations and employing households.

[5] RME count is the widely used in the New Zealand firm analysis literature, however, an alternative measure which is often adopted in the international literature is the stock of employee numbers at a point in time. An advantage of RME count is that the effect of seasonal employment factors are mitigated, which is particularly relevant in industries such as agriculture and accommodation. However, it means that despite the lack of distinction between full- and part-time employees, fractional employee counts are possible. For example, a firm with no employees for half of the year and one employee for the other half has an employee count of 0.5. The possibility of fractional employee counts complicates the analysis and interpretation somewhat, particularly for small firms, with many firms having more than zero but less than one employee by this definition (see Section 5.1).

[6] If an individual had multiple jobs with different employers, all jobs are counted. Since an employee can hold more than one job, aggregating over firms gives the number of jobs rather than employment. We ignore this distinction here and use the terms employees and jobs interchangeably.

[7] There are also some other differences, such as the LBF includes employees under the age of 15 while LEED does not.

[8] Also note that several source and measurement differences mean that our results are not consistent with Statistics New Zealand's published Business Demography Statistics.

[9] Because totals are calculated by aggregating individually rounded numbers, totals based on different aggregations may not be identical across tables and figures. For example, according to Table 1, there are 13,626 surviving cohort-2001 firms in 2011 (sum of columns (1), (3) and (4)), but according to Table 2 there are 13,629 surviving firms in 2011.

3.1 Defining entry and exit

To analyse firm dynamics over time, we use longitudinal administrative information to identify firm status:

- An entering firm, or firm birth, is a firm that has administrative data in year *t* but not in year *t-1*. It is possible that some entering firms identified in this way are short-lived firms that enter at time *t* and exit again in the same year.
- An exiting firm, or firm death, is a firm that has administrative data in year *t* but not in year *t+1*. There are two kinds of exits: permanent exits where the firm is no longer active in any future years; and a temporary exit where a firm becomes economically inactive for some period of time but becomes active again in a later year.
- A continuing firm exists at time *t-1*, *t* and *t+1*.

The identification of actual firm births and deaths versus administration births and deaths due to firm mergers/acquisitions, splits or changes in legal status have been improved since the earlier New Zealand cohort analysis by Carroll et al. (2002). Statistics New Zealand now uses plant-level information such as business address and employee tenure to distinguish between actual plant entries and exits and events such as a change in legal status. We use this plant-level information to correct broken longitudinal firm identifiers using the approach developed by Fabling (2011). Although this approach goes a long way to fixing some of the issues, it does not address complex plant transfers such as partial sales of firms and group mergers or buyouts.[10]

4 Firm and employment dynamics by cohort

Before taking a closer look at the 2001 cohort, we look at the overall patterns of firm growth and survival for different cohorts. This information not only provides a general sense of the patterns involved, it also highlights that the differences between cohorts born in different years are not substantial, suggesting that the results for the 2001 cohort are likely to be reasonably representative for firm cohorts born in other years.[11]

It is well known that firm and worker churn is occurring constantly, leading some to describe the process as a "perpetual-motion machine" (Bassanini & Marianna, 2009). The dynamic nature of firm and employee counts is evident in New Zealand. Figure 1a shows the total number of firms in each year by birth cohort. In 2001, the total population of firms consists of firms that were born prior to 2001 and still survive in 2001 (the solid green bar in Figure 1) and the new cohort of firms born in 2001 (the solid orange bar). In 2002, the total population of firms consists of surviving firms that were born prior to 2001, surviving firms that were born in 2001 and the new cohort of firms born in 2002. Likewise, Figure 1b shows the total number of employees in each year by birth cohort.

Figure 1a shows that each year, the cohort of new-born firms accounts for about 11% of the total firm population on average (between 2001 and 2011, this ranged from 7% in 2011 to 13% in 2004). Firms also die over time, with about two-thirds of firms born in 2001 not surviving to 2011 (Figure 1a). Overall, the patterns of firm births and deaths over time appear broadly similar over different cohorts.

Looking at employment, new firms account for about 2% of total employment each year (ranging from 1.5% in 2011 to 2.8% in 2005) (Figure 1b). This number is lower than the share of new firms as entering

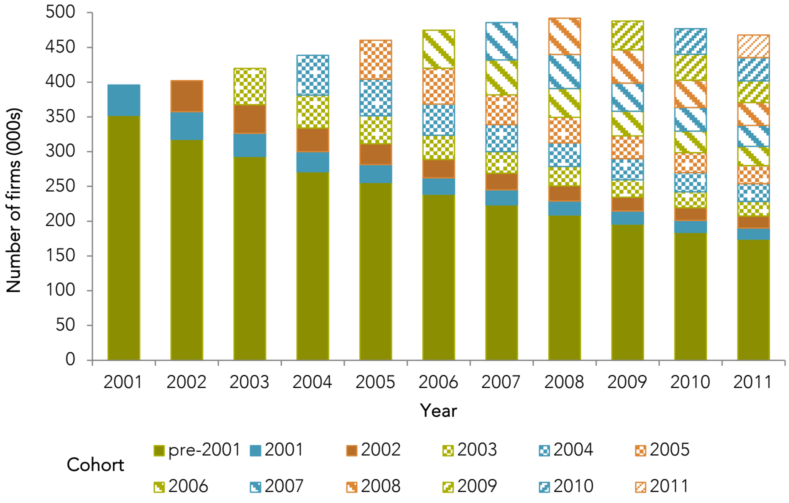
[10] In partnership with researchers from AUT University, the Productivity Commission is considering these issues in the context of employment growth by using plant-level information in a similar way to Haltiwanger et al. (2013).

[11] Although not presented here, we also took a more detailed look at other cohorts, particularly the 2002 cohort and found similar results to the 2001 cohort.

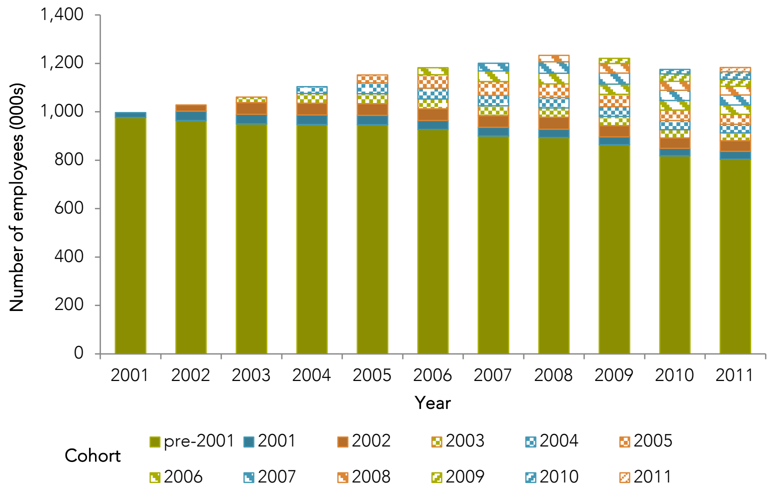
firms tend to be smaller than incumbent firms. As in the case of firm counts, different cohorts exhibit broadly similar employee count patterns over time.

Figure 1 Firm and employee counts by cohort

a. Firm count



b. Employee count



Overall business cycle patterns are also evident in Figure 1. The total number of firms increases until 2008, then falls following the onset of the Great Recession. Employee counts follow a similar pattern, but with increases in the total number of employees in 2011. The lack of a corresponding recovery in the number of firms suggests that employment has grown via within-firm growth rather than through new firms. It is difficult, however, to interpret these patterns without further information. For instance, it could indicate a decrease in dynamism following the Great Recession, with fewer new firms entering due to, for example, greater credit constraints. On the other hand, it could indicate that the Great Recession had a cleansing effect, with lower survival rates among low-productivity firms, for example. For the United States, Foster, Grim, and Haltiwanger (2014) find that while past downturns accelerated productivity-enhancing reallocation, the intensity of reallocation actually fell in the Great Recession and the reallocation that did occur was less productivity enhancing than in prior recessions. Whether New Zealand experienced a productivity-enhancing cleansing effect during the Great Recession or not is still an open question.

Different cohorts exhibit similar patterns of survival, with survival rates declining in a concave pattern (Figure 2). That is, the likelihood of exiting, or the hazard rate, declines with years since birth (Figure 3). While 25% of firms born in 2001 exit in the first year, a firm born in 2001 that survives until 2010 has only a 7% chance of exiting in 2011. While the survival rates for different cohorts are reasonably similar, there are some differences, with slightly lower survival rates for firms born in later cohorts (Figure 2).

There is some evidence in the international literature of cohort effects on the probability of survival. Adverse environmental (eg, macroeconomic or institutional) conditions not only increase the chances of firm death overall, firms born during these periods seem to exhibit structurally lower survival rates, even over longer periods of time compared with firms born under more favourable conditions. That is, adverse founding conditions may imprint firms with a permanent liability (see for example Box, 2008). However, these cohort effects tend to be found in "generational" studies of long-term effects, whereas the effects are less pronounced in datasets over relatively short time periods using annual cohorts. That is, while firms born in 1980 may be different to firms born in 2000, there is generally little difference between firms born in 2000 and 2001 (see for example Fukuda, 2011).

Unfortunately, our dataset is too short to allow analysis of generational cohort effects as it covers only one full cycle, so our firms are mostly members of the same generation. Nevertheless, there may still be some cohort effects, particularly for firms born during the expansionary phase of the early 2000s versus firms born around the time of the Great Recession.

Figure 2 Firm survival rates by cohort

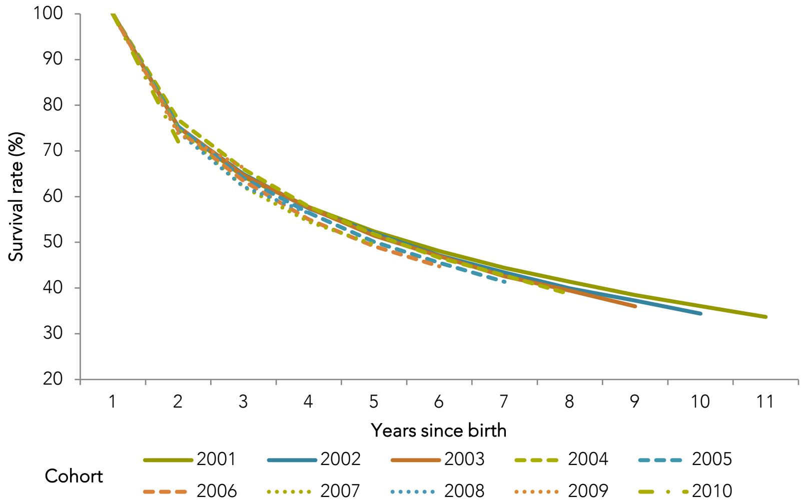
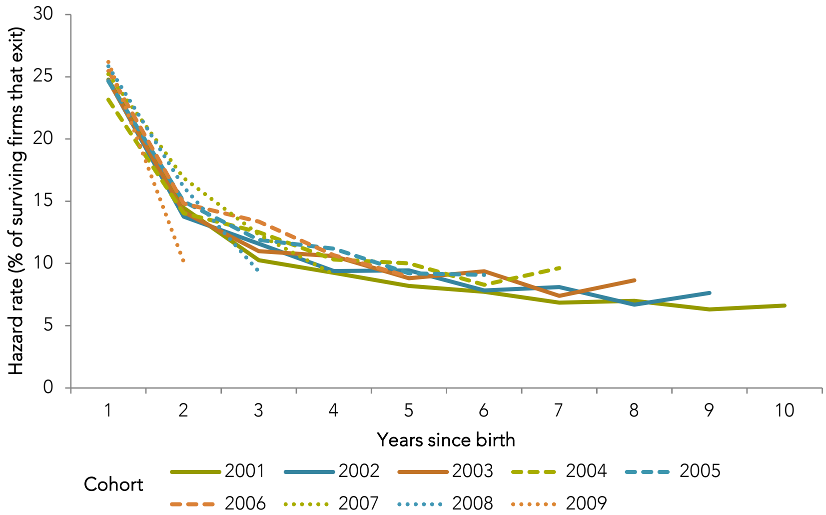


Figure 3 Firm hazard rates by cohort



It is also beyond the scope of this paper to examine possible reasons behind the small birth year effects that we observe. Carroll et al. (2002) also find differences in survival rates among firms born in different years. In particular they find that firms born in the 1998-99 year have lower survival rates than firms born in earlier cohorts and suggest that these lower survival rates are linked to the weak economic growth in this period. For the time period we examine, this explanation is consistent with the lower survival rates for the firms born during, and in the aftermath of, the Great Recession (ie, 2008 and later). However, it does not seem to explain the lower survival rates among firms born in 2005 compared with firms born in 2001 for example.

5 The 2001 cohort: firm size and growth

We now examine the cohort of firms born in 2001 in more detail. First, we look at some basic facts about cohort-2001 firms and at the firm-size distribution. We then look at differences by firm size in the propensity of firms to survive over time and the propensity of surviving firms to grow.

5.1 Some basic facts about cohort-2001 firms

In 2001, just under 43,600 firms were born in New Zealand.[12] This figure is broadly comparable to Carroll et al. (2002) who report that about 48,000 plants were born in 2000 (the latest cohort in their study). Notwithstanding the timing differences, it is not surprising that we find a lower number of births than Carroll et al. (2002). First, we examine firms while Carroll et al. (2002) focuses on plants, and even though the large majority of firms are single-plant firms, we would still expect a somewhat lower number of firm births than plant births. Second, the data improvements described above would have reduced the number of false firm births, for example, by distinguishing between a continuing firm that changed legal status and a true firm birth.

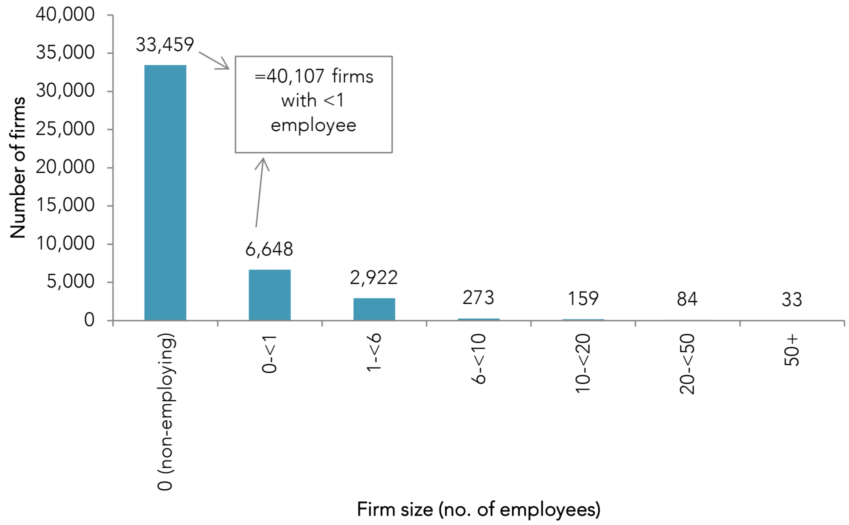
The smallest firm-size category we use in our analysis is zero to less than one employee. In Figure 4, we separate this category into "non-employing" firms and firms with less than one employee.[13] "Non-employing" firms never have any employees – that is, they are working-proprietor-only firms in all years. Firms with less than one employee either have zero employees in 2001 but subsequently employ workers, or have less than one employee in 2001. This distinction illustrates the large number of working-proprietor-only firms that do not grow. In subsequent analysis, we combine these two categories into one category for "zero to less than one employee".

Almost all of the cohort-2001 firms are born small. The majority of firms are non-employing (77%), followed by firms with less than one employee (15%). Together, these smallest firm-size categories account for 92% of new-born firms. Firms with between one and fewer than six employees account for about another 7%, while firms with six or more employees account for just 1% of firms born in 2001 (Figure 4).

[12] A firm may be born any time during the 2001 year, so the first year of data for a particular firm may include anything from one month to a full year of operation. When a firm is not present for the whole year, the part-year RME count is used.

[13] As noted, our employment measure is simply employee count, with no differentiation between part-time and full-time employees. However, firms can have less than one employee in 2001 due to the use of RME counts.

Figure 4 Number of new-born firms by size at birth for the 2001 cohort



Notes:

1. Non-employing firms are working-proprietor firms over their entire recorded lives. Firms with 0-<1 employee includes: 1. firms with zero employees in 2001 but which subsequently employ workers and 2. firms with less than one employee in 2001 (on average).

By including firms with between zero and one employee, our analysis differs from Anyadike-Danes and Hart (2014) and Anyadike-Danes et al. (2013), which only includes firms with at least one employee. Anyadike-Danes and Hart (2014) and Anyadike-Danes et al. (2013) also define births and deaths differently, with a firm birth being recorded in the year that the firm first employs, and death occurring in the year the firm no longer has any employees. While a working-proprietor-only firm that exists prior to 2001 but takes on employees in 2001 would be part of the 2001 cohort by Anyadike-Danes and Hart (2014)'s definition, it is not considered to be part of the 2001 cohort by our definition. However, while we include working-proprietor firms in our analysis, working proprietors are not included in our employment counts. Therefore, this distinction probably does not make much difference to job creation and destruction numbers, but is likely to impact on firm survival rates.

For the 2001 cohort, Table 1 presents the number of firms by status from 2001 to 2011. The cohort consists of 43,578 firms born in 2001 ("Total" in column 5), of which, about 9% (3,736) had exited by the end of the year ("Short-lived entries" in column 4). In 2002, 7,071 of the remaining 39,852 firms exited ("Exits" in column 2), while 32,781 survived the year ("Continuing" in column 3). In 2003, 402 of the firms that had previous exited re-entered, although 165 of these firms had exited again before the end of the year.[14] Overall, by the end of 2011, less than a third of firms that were born in 2001 are still active.

It is also evident from Table 1 that the definition of entry and exit we use has some remaining issues (see Section 3.1). In particular, there is a reasonably high rate of short-lived entries and temporary exits. As suggested, these issues will impact on measures such as firm survival rates. However, these issues are not particularly concerning for job creation and destruction measures, which is our main interest area.

[14] This can occur when, for example, a firm is active (ie, has administrative information such as tax filings) in 2001, is inactive in 2002, but "reactivates" in 2003.

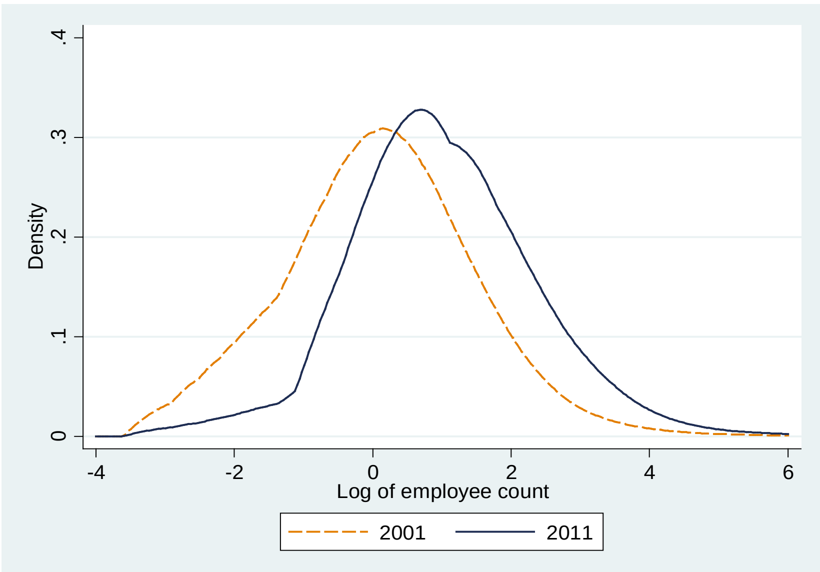
Table 1 Firm status over time for the 2001 cohort

Year	(1) Entries (including re-entry)	(2) Exits (including permanent and temporary exits)	(3) Continuing	(4) Short-lived entries	(5) Total Sum of (1) to (4)
2001	39,852			3,726	43,578
2002		7,071	32,781		39,852
2003	402	5,313	27,471	165	33,351
2004	729	3,615	24,258	174	28,776
2005	792	3,138	21,846	195	25,971
2006	780	2,637	19,998	186	23,601
2007	684	2,307	18,477	183	21,651
2008	675	1,983	17,172	171	20,001
2009	591	1,812	16,038	129	18,570
2010	507	1,539	15,090	105	17,241
2011	378	2,520	13,077	171	16,146

5.2 The firm-size distribution

The international evidence suggests that the distribution of log employee counts for new-born firms is right-skewed and converges towards a lognormal distribution over time (see Section 2.1). For New Zealand, the size distribution for new-born firms in 2001, as measured by the log of employee counts, is slightly right-skewed, with a very large number of small firms. By 2011, the distribution of surviving firms has become more symmetric (Figure 5). Firms born in 2001 also grow over time, with the distribution moving to the right by 2011 (Figure 5). The average firm size for surviving firms increases from about 0.5 employees in 2001 to 2 employees in 2011, with average firm size approximately doubling in the first year from about 0.5 employees to 1 employee (Figure 6).

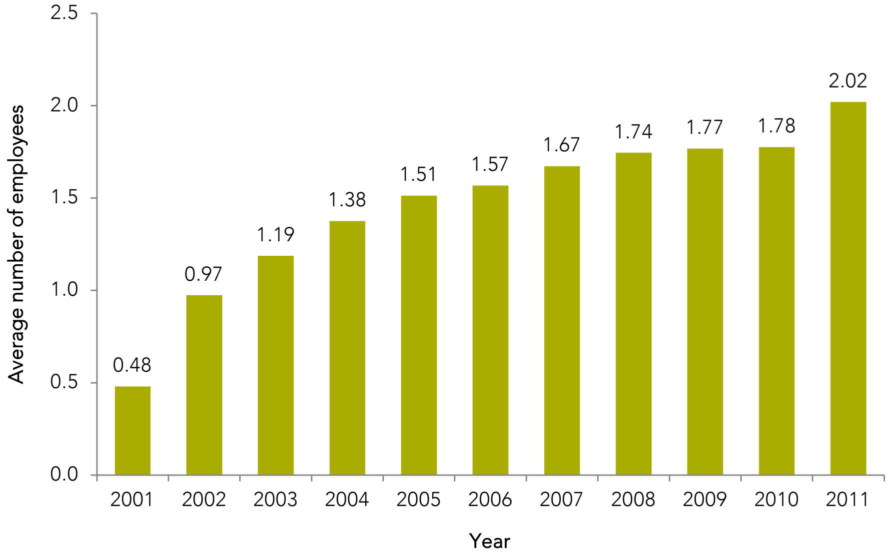
Figure 5 Firm size distribution for the 2001 cohort in 2001 and 2011



Notes:

1. Excludes non-employing firms (ie, zero-employee firms) due to the use of logs.

Figure 6 Average firm size for the 2001 cohort, 2001-2011



There was a noticeable increase in the average number of employees per firm in 2011, from about 1.8 employees to 2 employees (Figure 6). This trend does not seem to be peculiar to the 2001 cohort. In aggregate (not just for the 2001 cohort), the average number of employees increased in 2011, as evidenced by the continued decrease in firm count between 2010 and 2011 coupled with a slight rise in employee counts between 2010 and 2011 (Figure 1). We have not investigated why this increase occurred, but further years of data may shed more light on this trend.

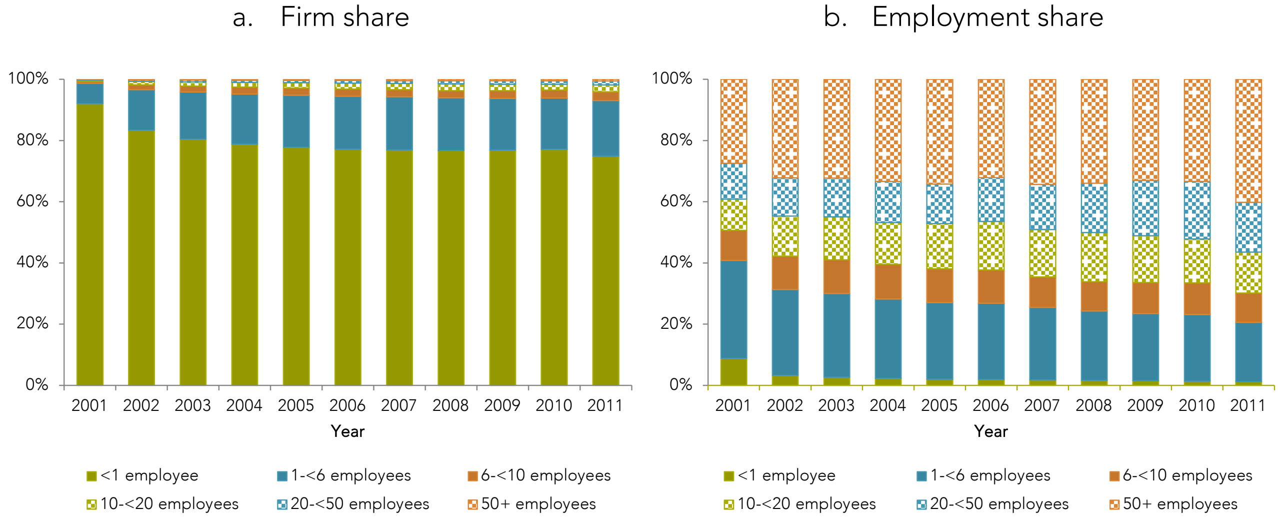
5.3 Survival rates and growth dynamics by firm size

We now look at survival rates and average employment growth by firm size for the 2001 cohort.

Firm and employment shares by firm size

As mentioned in Section 5.1, the vast majority of the cohort-2001 firms are born with less than one employee. But these micro firms account for only 8% of total employment in 2001 (Figure 7). Over time, the share of firms with less than one employee in the 2001 cohort falls: from about 92% in 2001 to 75% in 2011. Their share of employment drops even more substantially, from about 8% in 2001 to just 1.2% in 2011 (Figure 7). We will show that this decrease in small firms' share of employment is due to a combination of lower survival rates among small firms and faster growth rates for surviving small firms.

Figure 7 Firm and employment share by firm size for the 2001 cohort, 2001-2011

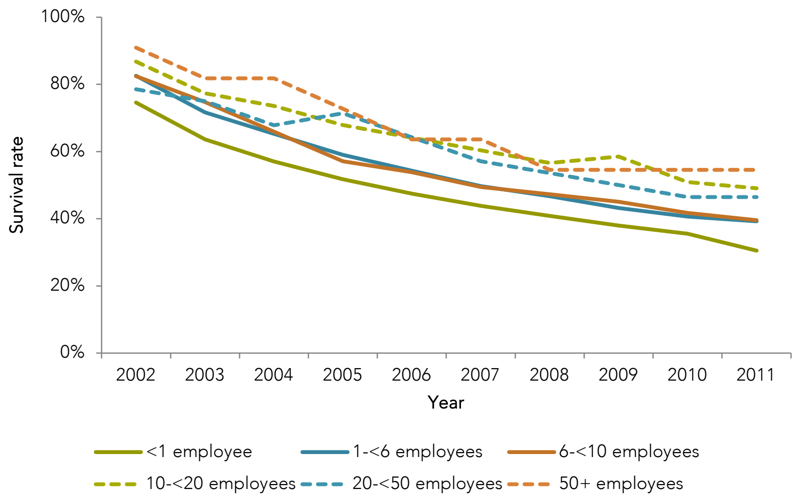


Survival rates by firm size

On average, firms in all size categories exhibit similar decreasing trends over time in their survival rates, with small firms displaying systematically lower survival rates (Figure 8). The gap between the survival rate of small and large firms also increases over time. For example, in 2002 there is a four percentage point gap between the survival rate of firms with less than one employee and between 20 and 50 employees (75% versus 79%). By 2011, this gap has grown about 16 percentage points (31% versus 46%).

The lower survival rates among smaller firms is consistent with existing evidence. For the United Kingdom cohort of firms born in 1998, the hazard rates are inversely related to size at birth (that is, the smallest firms have the smallest probability of survival) (Anyadike-Danes & Hart, 2014). For New Zealand, Carroll et al. (2002) also finds this relationship between survival and firm size. The lower survival rate among small firms may reflect that these firms are more credit constrained and therefore more vulnerable to downturns that make it difficult for them to obtain financing at the same time that reduced cash flows make them less able to finance their activities from internal funds (Fort, Haltiwanger, Jarmin, & Miranda, 2013).

Figure 8 Survival rates by firm size at birth, 2002-2011



Average growth by firm size

The second reason for small firms' decreasing share of employment is that small firms experience greater growth.

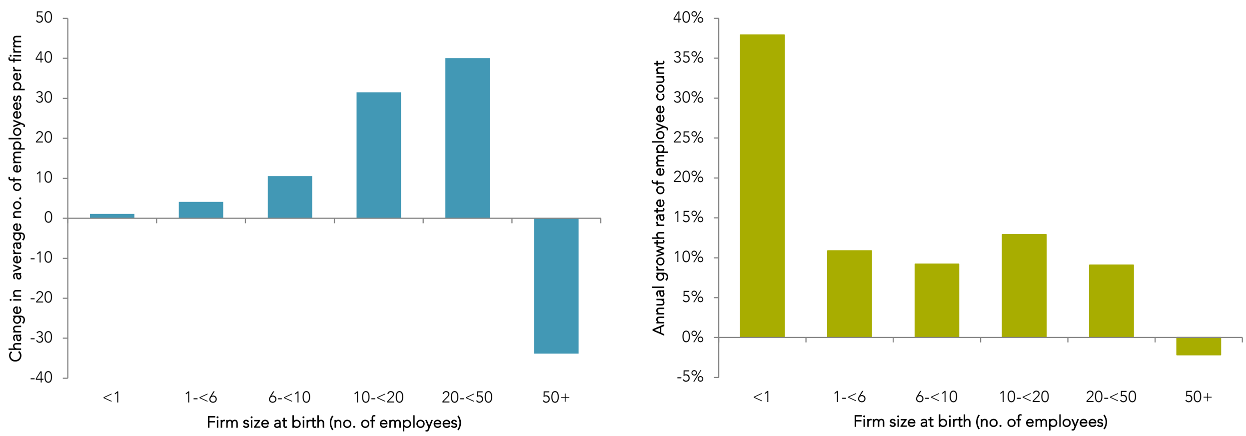
One of the issues in measuring firm growth by size category is whether absolute or relative measures should be used. That is, should the growth in the average number of employees per firm or the growth *rate* of average employee count per firm be used? Different growth measures make a difference to which firm size category has the largest growth and, for example, to which firms are defined as "high-growth" (Daunfeldt, Elert, & Johansson, 2014). Since measures of absolute (relative) growth tend to be biased towards larger (smaller) firms (Coad et al., 2014), we examine each in turn.

Absolute growth, ie, growth in the average number of employees per firm, generally increases with firm size at birth. The exception is the largest firm size category (50+ employees) where the average number of employees actually decreases between 2001 and 2011 (Figure 9a). This decrease however, is likely to be influenced by the performance of just a few firms given that the total number of firms in this category is small.[15] Firms with 20 but less than 50 employees at birth have the highest growth in the number of employees, with an average increase of 40 employees (from 29 employees in 2001 to 69 in 2011).

As expected, using a relative measure of growth gives a very different relationship between firm size at birth and subsequent growth than the absolute measure, with the smallest firms having the highest relative growth rates (Figure 9b). Firms with less than one employee have an average growth rate of 38% a year between 2001 and 2011. The 1-<6, 6<10, 10-<20 and 20-<50 employee size categories all have similar relative growth rates to each other, ranging from 9.1% a year for the 20-<50 employees size band to 12.9% for the 10-<20 employee size band. The largest size category of 50 or more employees has a negative annual growth rate of -2.2%.

Figure 9 Absolute and relative growth in firm size by firm size at birth, 2001 versus 2011

a. Absolute growth b. Relative growth



Time dimensions of firm growth by firm size

A large part of the total employment growth of firms, particularly small firms, occurs in the first year after entry (Figure 10a). These initial growth rates are so high compared with other years that we have excluded the first year of growth in Figure 10b to ensure that the growth rates for subsequent years are visible. The high growth in the first year is a specific example of the more general issue that often a firm experiences a high-growth period over a single year, and smoothing growth over a number of years does not eliminate this issue (Daunfeldt & Halvarsson, 2012; Hölzl, 2014).

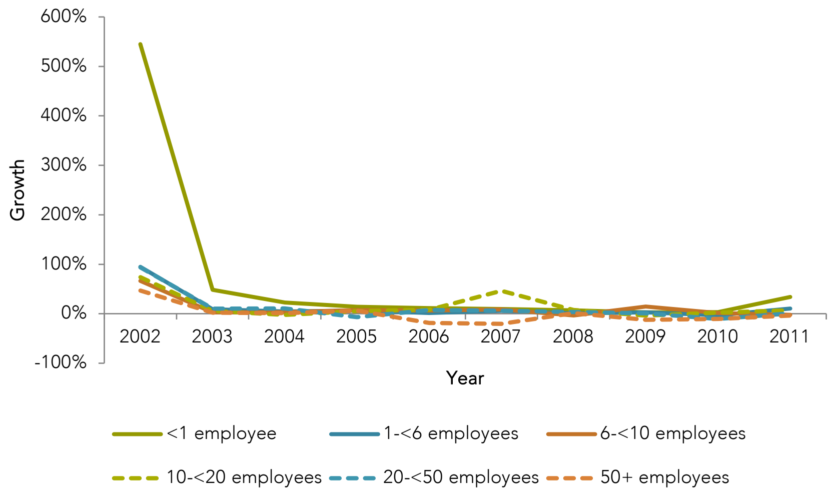
This issue also has important implications for defining and identifying "high-growth" firms (Coad et al., 2014). Indeed, the Eurostat-OECD (2007) manual recommends that growth rate calculations do not include the first year of operation. In our data, a firm born in 2001 may be born at any time during the year ending March so this may impact on the estimates of first-year growth. For example, assume Firm A is born in April 2000 (ie, the beginning of the March 2001 year) and Firm B is born in March 2001 (ie, the end of the year). Assume these two firms are each born with one employee and grow by one

[15] Indeed, firms with 50 or more employees in the 2002 cohort exhibit an increase in the average number of employees per firm between 2002 and 2011.

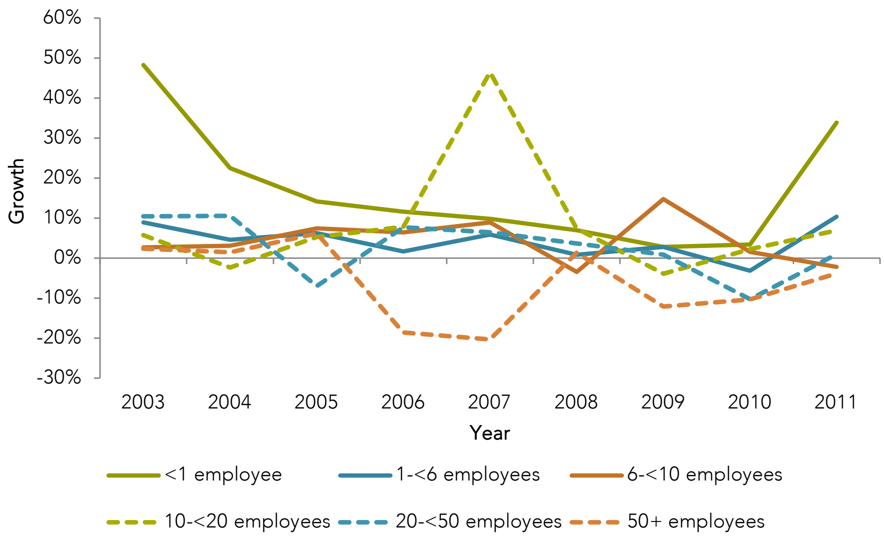
additional employee every six months for the first 24 months of their lives. Despite having exactly the same growth trajectories, the two firms have different absolute and relative employment growth because of their different birth months. Firm A's 2001 RME count is 1.5 and its 2002 RME is 3.5. Firm B's 2001 RME count is 1 and its 2002 RME is 1.67. This equates to an increase of 2 employees, or 133% for Firm A, and 0.67 employees or 67% for Firm B. This part-year issue is more acute if total sales growth rather than employment growth is examined, as a firm may have seemingly high sales in the second year of operation compared with the first year simply because the first year consists of sales for only part of a year, whereas the second year's sales are for a whole year.

Figure 10 Growth rates by firm size at birth

a. All years

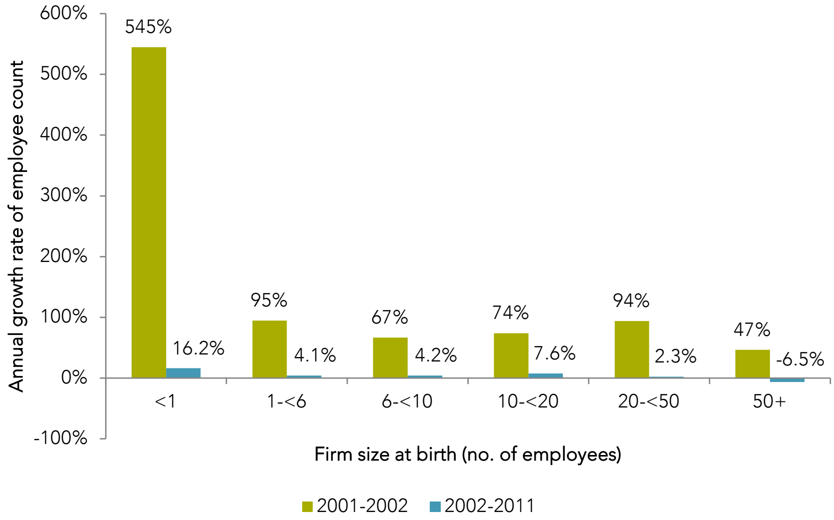


b. Excluding the first year of growth



Bearing this measurement limitation in mind, the overall average annual employment growth rate of 38% a year for the smallest firm-size category is due to a massive 545% increase in the first year and a more modest average annual growth of 16.2% in subsequent years (Figure 11). This difference is also evident for other firm-size categories, although the difference is starkest for the smallest size category. Note that this general pattern is also observed if absolute rather than relative growth is used, so is not entirely due to lower employee counts (ie, a smaller denominator) in the first year.

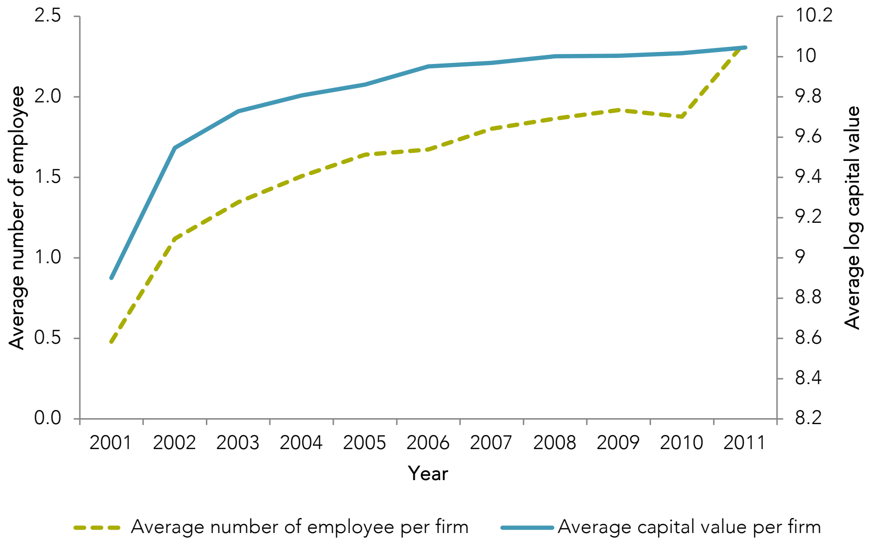
Figure 11 Average annual employment growth rates by firm size at birth, first year after birth versus subsequent years



Comparing our results for New Zealand with those of Anyadike-Danes and Hart (2014) for the United Kingdom shows some differences in the patterns of firm employment growth by size categories. For the United Kingdom, firms with 1-4 employees in 1998 experience a high average growth rate in the first year, with growth dropping over subsequent years before flattening out after about six years. While this general pattern of decreasing average growth rates over time is similar to the pattern for the two smallest firm-size categories in New Zealand, the first year's average growth rate for United Kingdom firms with 1-4 employees in 1998 was not nearly as extreme as the first year growth rate for New Zealand firms with less than one and 1-<6 employees. In addition, United Kingdom firms in the larger size categories exhibit quite different growth patterns to New Zealand firms. The average employment growth rate for United Kingdom firms born in 1998 with between 5-9 employees and 10-19 employees peaks in the second or third year, not the first year, and then falls over time. For United Kingdom firms with 20 or more employees, the patterns are very different. These large United Kingdom firms have negative average employment growth in the first year, with these growth rates increasing moderately over time, although they remain negative or modest.

As well as the part-year measurement issue discussed above, at least part of the employment growth in the first year for new-born firms is likely to simply be an artefact of the set-up phase. For example, a retail firm that is legally established in 2001 may only employ minimal staff at first and recruit the bulk of their core staff after a suitable location is found and fitted out, any necessary permits gained and so forth. The idea that the first year of growth reflects set-up activities is also consistent with the sharp increase in the median capital stock between the first and second years of operations (Figure 12).

Figure 12 Average firm size and median capital stock values for 2001 cohort



Notes:

1. Capital stocks are in 2007 dollars and are deflated by the capital goods price index.
2. Capital stocks information is derived from IR10 financial statements summary and covers: land, buildings, vehicles, plant and machinery, furniture and fittings and other fixed assets.
3. There are some issues with measuring capital stocks for small firms, particularly working-proprietor-only firms. However, if we exclude data for working-proprietor-only firms we get similar results.

In summary, our data suggests a highly turbulent economy, with a large number of mostly small firms being created, but a great proportion of new firms disappearing in the first years of their lives. Surviving firms experience reasonable employment growth *on average*, although a substantial part of this growth occurs in the first year of life, and may therefore reflect the business set-up phase. *Relative* growth rates tend to decrease with firm size, suggesting that small firms grow faster than larger one. However, small firms experience lower *absolute* growth in the average number of employees.

Average growth rates within each firm-size category may mask differences among individual firms, however. Existing literature suggests that average growth rates come about due to a large number of stagnant firms together with a small number of very high-growth firms. The next sub-section therefore looks at firm-size transitions.

5.4 Firm-size transitions

We now look at the movement of individual firms between different firm-size categories to get an idea of differences among firms within the same size category.

We use origin/destination matrices to measure firm and employee counts by size at birth in 2001 and a decade later in 2011. The origin rows are five broad firm-size categories in 2001 and the destination columns are the same firm-size categories in 2011, as well as a column indicating the survival rate for each category (Table 2). For the rest of the paper, we combine the two largest firm size categories into 20+ employees due to the small cell counts involved.

As we have already seen, of the approximately 43,600 firms born in 2001, about 13,600 remain by 2011, that is, only about 31% of firms survive the decade. This "extraordinary force of mortality" (Anyadike-Danes & Hart, 2014, p. 3) is not unusual. For example, for the United Kingdom Anyadike-Danes and Hart (2014) finds that 90% of firms born in 1998 do not survive to age 15.

For surviving firms, there is high degree of inertia across all size categories, with the majority of firms remaining in the size category they were born into after a decade. For the smallest firms at birth, the vast majority (81%) of surviving firms still have less than one employee after ten years (Figure 13). About 16% move up one size category to 1<-6 employees, while less than 4% grow to have six or more employees. Consequently, not only are the vast majority of firms born into the smallest size category, surviving firms are still overwhelmingly small a decade after birth (Table 2). This inertia is observed across OECD countries, with few small start-ups with fewer than 10 employees growing to more than 10 employees (between about 2% and 9%) over a three-year period (Criscuolo, Gal, & Menon, 2014). For firms in the second smallest category of 1-<6 employees in 2001, about 48% are still in this size category in 2011, while almost a quarter have moved down a category to have fewer than one employee and just over a quarter grow to have six or more employees. The mid-size categories are a little different, with the number of firms born into the 6<-10 and 10-<20 categories that move up one size category outnumbering firms that stay in their birth-size category. Around 30% of firms in both these size categories move up one size category, while 16% in both categories remain in the same category. About 70% of firms with 20 or more employees remain there after 10 years.

Table 2 Firm size transition matrix between 2001 and 2011

		2011						
	Firm size (no. of employees)	**<1**	**1-<6**	**6-<10**	**10-<20**	**20+**	**Total**	**Survival rate**
2001	<1	9,897	1,902	225	132	81	12,237	30.5%
	1-<6	279	549	138	120	54	1,140	39.0%
	6-<10	21	9	18	33	33	114	41.8%
	10-<20	3	6	12	24	30	75	47.2%
	20+	6	3	3	6	45	63	53.8%
	Total	10,206	2,469	396	315	243	13,629	

Figure 13 Firm size transitions for surviving firms between 2001 and 2011

Overall, there are very few small firms that transition into large firms over the ten years, which is consistent with the literature on high-growth firms that finds that only a small number of firms experience large increases in employment. It is also similar to Anyadike-Danes and Hart (2014)'s findings for the United Kingdom and Carroll et al. (2002)'s earlier work on New Zealand firms.

6 The 2001 cohort: job creation and destruction

What is the propensity to grow among firms that survive for a decade, and does this vary by firm size? While early studies showed that small firms make a disproportionately large contribution to job creation, more recent evidence suggests that there is no systematic relationship between size and job creation once age is controlled for as young firms also tend to be small firms (Haltiwanger et al., 2013). With the cohort approach, we are removing the age dimension by examining firms of the same age, allowing us to look at whether small firms make a disproportionate contribution to job creation without the confounding effects of age.

6.1 Job creation and destruction: concepts and measurement

We are interested in how many jobs the 2001 cohort of firms creates and destroys in the first decade of their lives. Because we take a cohort approach, we examine only surviving firms over the 2001 to 2011 period so our definition of job creation (destruction) does not include employment created via firms entering (exiting). That is, job creation (destruction) is the number of jobs the 2001 cohort of firm creates (destroys) through firm expansion (contraction) between 2001 and 2011. Although we could include job destruction through firm exit in our analysis, we exclude both entry and exit to keep the analysis symmetric. That is, we examine job creation and destruction from surviving firms within the cohort only.

The job creation rate is the total number of jobs created divided by the average of number of jobs in 2001 and 2011. The job destruction rate is the total number of jobs destroyed divided by the average number of jobs in 2001 and 2011. The average number of jobs in 2001 and 2011 is used instead of the job count at 2001 to mitigate issues of regression to the mean (Haltiwanger et al., 2013). This definition is monotonically related to the conventional growth rate definition. The net job creation rate is a difference between job creation and destruction rates. That is:

$$\Delta E_{2011}^{c} = \frac{\sum\limits_{i \in E_{i2011} > E_{i2001}} E_{i2011} - E_{i2001}}{\frac{1}{2}\sum\limits_{i}(E_{i2001} + E_{i2011})}$$

$$\Delta E_{2011}^{d} = \frac{\sum\limits_{i \in E_{i2001} > E_{i2011}} E_{i2011} - E_{i2001}}{\frac{1}{2}\sum\limits_{i}(E_{i2001} + E_{i2011})}$$

$$\Delta E_{2011}^{net} = \Delta E_{2011}^{c} - \Delta E_{2011}^{d}$$

where E_{i2011} is the total employment of firm *i* in 2011.

Note that we are measuring the overall job creation and destruction of each firm rather than the job creation and destruction within firms. For example, a firm with two employees in both 2001 and 2011 has no job creation or destruction by our measure. This is the case even if the firm had 100% employment turnover, that is, if the two employees in 2001 were different people to the two employees in 2011. That is, we are measuring the difference between the number of new hires and the number of separations at a firm, not the dynamics of individual workers. This limitation is likely to underestimate the full extent of job creation and destruction in the economy.[16] On the other hand, we cannot separate the impact of changing vacancies from job creation and destruction, which will tend to overestimate the extent of changes in firms' desired employment levels (Carroll et al., 2002). There are also other issues, for example, since we do not include working proprietors in employment counts, if tax changes incentivise working proprietors to re-classify themselves as employees, job creation may be overestimated (and if the opposite incentives arise, job destruction may be overestimated).

6.2 Job creation and destruction: results

Firms in the smallest size category (<1 employee) made the largest contribution to job creation, accounting for over half of the total (16,990 out of 32,065) (Table 3). Over a third of the job creation by

[16] It is possible to observe the movements of individual workers with the linked employer-employee data in Statistics New Zealand's Integrated Data Infrastructure. However, this analysis is beyond the scope of this paper.

these smallest firms came from firms that grew to 20 or more employees over the decade (6,400 out of 16,990). This contribution involved just 81 firms, or 0.7% of the smallest firms (Table 2). A further 22% of job creation came from firms in the second smallest size category of 1-<6 employees (7,000 out of 32,065). Similarly, just under half of the jobs created by firms in this category came from the 54 firms that moved into the 20+ size category (Table 2).

Firms in the largest size category (20+ employees) made the largest contribution to job destruction, accounting for about 40% of the total (3,590 out of 8,870). Almost half of this contribution involved just six firms that moved from the largest to the smallest size category (1,710 out of 3,590) (Table 2 and Table 3). Another 39% of this contribution was due to firms that stayed in the largest firm size category but shrank (1,390 out of 3,590) (Table 3).

Overall, most job creation and destruction (as defined here) is concentrated in relatively few firms that experience sizable employment changes. These findings are consistent with Carroll et al. (2002)'s analysis of the cohort of New Zealand firms born in 1995, Anyadike-Danes and Hart (2014)'s results for the United Kingdom and Anyadike-Danes et al. (2013)'s cross-country findings.

Table 3 Job creation and destruction between 2001 and 2011

a. Job creation

		2011					
	Firm size (no. of employees)	**<1**	**1-<6**	**6-<10**	**10-<20**	**20+**	**Total**
2001	<1	690	5,700	2,000	2,200	6,400	16,990
	1-<6	.	1,000	1,000	1,600	3,400	7,000
	6-<10	.	.	35	300	1,320	1,655
	10-<20	.	.	.	90	2,980	3,070
	20+	.	.	.	.	3,350	3,350
	Total	690	6,700	3,035	4,190	17,450	32,065

b. Job destruction

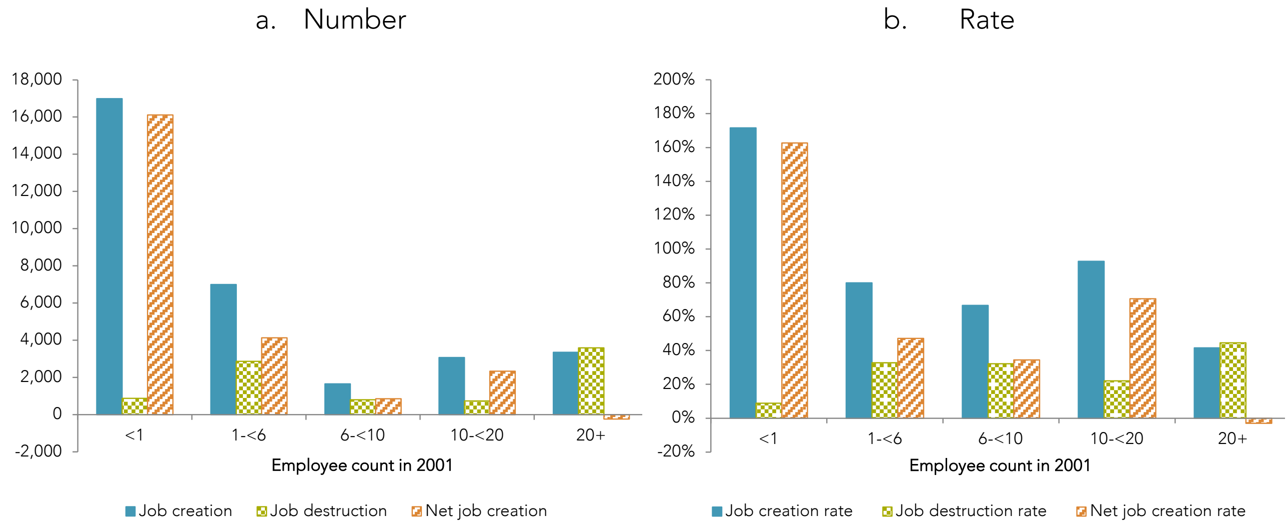
		2011					
	Firm size (no. of employees)	**<1**	**1-<6**	**6-<10**	**10-<20**	**20+**	**Total**
2001	<1	880	.	.	.	.	880
	1-<6	2,400	470	.	.	.	2,870
	6-<10	450	330	20	.	.	800
	10-<20	340	240	110	40	.	730
	20+	1,710	175	90	225	1,390	3,590
	Total	5,780	1,215	220	265	1,390	8,870

Putting the job creation and destruction numbers together, firms in the smallest size category made by far the largest contribution to net job creation (Figure 14a). This is perhaps unsurprising as their potential job creation has no upper bound while their potential job destruction is limited to at most one employee per firm. That is, even though there are a large number of small firms, each of these firms starts with no more than one employee and so can lose at most one employee. The second smallest category (1-<6 employees) made the next largest contribution. The 20+ size category was the only one that made a negative, albeit small, contribution to net job creation. These results differ from Carroll et al. (2002)'s finding for firms born in 1995 that employment decreased in all size categories after six years. We find it decreased in only the largest size category over the ten years from 2001 to 2011.

We also examine job creation and destruction rates since, for example, the large amount of job creation accounted for by small firms may be because of the large number of firms in this size category.

We find that the smallest size category also has the highest job creation rates. However, while firms in the 1-<6 category have the second highest job creation numbers, firms in the 10-<20 category have the second highest job creation rate. Firms in the 20+ category not only have the largest number of jobs destroyed, but also the highest job destruction rate. Net creation rates were highest for the smallest firms. In contrast to the number of net jobs created, the second highest net creation rates came from the 10-<20 employee category (Figure 14b).

Figure 14 Job creation, job destruction and net job creation by firm size at birth between 2001 and 2011



In summary, the smallest firms born in 2001 play a relatively large role in accounting for overall net job growth in the first decade of their lives. However, this growth involves just a modest proportion of the smallest firms, while the majority of surviving firms do not grow much. It is also not just the bulk of job creation that is concentrated in a small number of firms, the bulk of job destruction also comes from a very small number of firms.

7 Discussion

Much of the discussion on the contribution of different sized-firms to job creation and the role of high-growth firms is driven by the policy debate over the role and form of business assistance programmes. We have a more general motivation for looking at this area. We are interested in what it can tell us about firm dynamics and the role of reallocation. It is a first step in our wider research programme on reallocation, and interesting questions in this area may include: Has business dynamism decreased in recent years and why? Is resource reallocation productivity-enhancing, and are there barriers to efficient reallocation?

However, the policy aspects of research into employment growth, and in particular the role of high-growth firms, highlight some interesting issues and questions. The Ministry of Business, Innovation and Employment's report on high-growth firms states that there is an "…obvious rationale for policy interventions to try to increase high-growth business numbers and size…" (MBIE, 2013, p. 2). However, several concerns about policies directed at high-growth firms have been raised. First, focussing on high-growth firms does not take into consideration the overall dynamics of growth. Research shows that a larger number of high-growth firms is associated with a larger number of shrinking firms, which suggests that looking at the whole distribution of firm growth is important. For example, European economies not only have on average a lower share of high-growth firms than the United States, but fewer medium-growth firms, fewer shrinking firms, and a larger share of static firms that are neither expanding nor contracting (Bravo-Biosca, 2010). Bravo-Biosca (2010, p. 2) suggests that "[p]olicies targeted solely at high-growth businesses… are not on their own sufficient to address the lack of dynamism that hampers Europe's productivity performance". Indeed, we also find that it is not just that job creation in New Zealand is concentrated in a small number of firms, job destruction is also very concentrated in a few large-shrinkage firms. Available evidence also suggests that fast-declining firms are more likely to be high-growth firms in later periods (Daunfeldt & Halvarsson, 2012). Therefore, increasing the number of high-growth firms may not necessarily increase employment, but instead increase employment turnover and economically unproductive churn (Coad et al., 2014). Overall, the policy conclusion that countries should aim to have more high-growth firms is controversial, while the claim that countries should reduce general barriers to competition and reallocation is much less controversial.

As well as a lack of certainty over whether an increase in high-growth firms will actually increase employment, targeting employment generators may also be problematic if it creates incentives that disfavour high-growth firms in terms of productivity. Although there is limited literature on the link between employment growth and productivity growth, evidence to date suggests that high-growth firms in terms of employment are not the same firms as high-growth firms in terms of productivity, and that their economic contributions differ significantly.[17] Therefore, "… policy promoting fast growth in employment may… come at the cost of reduced productivity growth" (Daunfeldt et al., 2014, p. 337). Consideration of the economic problem is therefore important, and rapid growth in employment may be the target if the goal is to quickly reduce unemployment, while relative growth in productivity is more relevant if the target is long-run economic growth (Coad et al., 2014).

Even if there was a clear rationale for increasing the number and size of high-growth firms, it is not clear whether policy can achieve this aim by specifically targeting firms with growth potential, a point which the MBIE report acknowledges. Some of the stylised facts to emerge from the high-growth firm literature are that high-growth firms are rare and widely disbursed across the economy, their growth is unpredictable and seldom sustained, and there is no clear consensus on what causes high-growth (Autio & Hölzl, 2008). MBIE (2013) notes that the New Zealand evidence is consistent with these stylised facts, which "calls into question the rationale behind policies based on *directly* selecting and/or developing high-growth-potential businesses [emphasis in original]" (p. 2).

The MBIE report found that both the absolute number and proportion of high-growth firms in New Zealand has decreased over the 2000s, but says that the factors underlying these figures are unclear. Placing this finding within a broader context of patterns of firm dynamics in New Zealand is likely to be helpful. It could be that the numbers of both high-growth and fast-shrinking firms have decreased due to a reduction in unproductive churn. Or, it could be symptomatic of a general decline in business dynamism in New Zealand, as has been observed in the United States in recent years (for example, see Decker, Haltiwanger, Jarmin, & Miranda, 2014; Decker, Haltiwanger, Ron, & Miranda, 2014; Haltiwanger, Hathaway, & Miranda, 2014). In particular, Decker, Haltiwanger, Ron, et al. (2014) highlights that this decrease in business dynamism in the United States is reflected in the declining rates of start-ups, a trend that is observed in other OECD countries, including New Zealand (Criscuolo et al., 2014). Alternative, it could simply be a cyclical pattern. Indeed, more recent New Zealand data suggests cyclicality has been a driver, with the number of high-growth firms actually increasing in the last couple of years (Statistics New Zealand, 2014). This increase in recent years is observed across a number of industries in New Zealand, with noticeable upticks in manufacturing, professional, scientific & technical services and construction industries.[18] In summary, focussing on high-growth firms is likely to overlook many important aspects of firm dynamics and related policy issues.

Overall, it is likely that greater insights can be drawn from taking a more holistic view of firm dynamism and reallocation in the economy. As such, this current piece of work should be viewed as one part of a wider evidence base that is under development. Future Productivity Commission work will look at broader questions of dynamism and reallocation, with a particular focus on productivity growth.

[17] Du and Temouri (2015) does, however, find a positive link between *sales growth* and total-factor productivity for the United Kingdom.

[18] As well as cyclical factors, at least part of the uptick in the number of high-growth construction firms is likely to be due to the Canterbury earthquake rebuild.

8 Conclusion

We use a cohort approach to examine firm dynamics and employment growth in New Zealand. Consistent with overseas evidence, we find a large degree of churn in the economy, with many new, mostly small, firms being created each year. Many of these firms disappear relatively quickly, but those that manage to survive experience reasonable employment growth on average. However, much of this growth is driven by a small number of firms.

We find that the smallest firms play a relatively large role in accounting for net job creation. But here too we find that this growth involves just a modest proportion of the smallest firms, while the majority of these firms do not grow much.

While it is not the primary focus of this paper, this work is relevant to policy debates. Recent policy-relevant research in this area for New Zealand focuses on high-growth firms. We argue that greater insights can be drawn from taking a more holistic view of firm dynamism and reallocation in the economy, and in particular, that a greater focus on productivity growth is warranted. The ‘Reallocation’ work stream of the Productivity Commission’s research agenda aims to further inform this discussion.

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