Sherrill Shaffer – Iftekhar Hasan – Mingming Zhou

New small firms and dimensions of economic performance

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The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Bank of Finland.

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New small firms and dimensions of economic performance

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Abstract

Using data from US labour market areas, we quantify empirical associations between entry by small firms and a vector of economic performance measures encompassing levels, volatilities and growth rates of several income and employment variables. Distinct and robust associations are found for net and gross rates of entry. These results suggest a richer variety of effects of entry than previously documented, and point to several potential tradeoffs associated with entry by small firms.

Keywords: growth, stability, employment, entry

JEL classification numbers: O1, J23, M13

Miten talouden kuntomittarit reagoivat uuteen pienyritystoimintaan?

Suomen Pankin keskustelualoitteita 4/2009

Sherrill Shaffer – Iftekhar Hasan – Mingming Zhou
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Tässä työssä käytetään Yhdysvaltain alueellisia työmarkkinatilastoja arvioitaessa, miten uusi pienyritystoiminta vaikuttaa talouden suoriutumiseen. Talouden suoriutumista arvioidaan vaihtoehtoisilla mittareilla, kuten tulo- ja työllisyysmuuttujien tasoa, vaihtelua ja kasvua kuvaavilla suureilla. Tulosten mukaan uusien yritysten brutto- ja nettomääräisen syntymisen ja useiden talouden suoriutumista kuvaavien mittarien välillä on selkeä yhteys. Nämä tulokset viittaavat yhtäältä siihen, että uuden yritystoiminnan vaikutukset ovat dokumentoitua näyttöä moninaisemmat. Toisaalta ne viittaavat siihen, että uuden pienyritystoiminnan synnyttäminen mahdollisesti pakottaa yrittäjät ja yhteiskunnan useisiin taloudellisiin ja yhteiskunnallisiin kompromisseihin.

Avainsanat: kasvu, vakaus, työllisyys, markkinoilletulo

JEL-luokittelu: O1, J23, M13

Contents

1 Introduction

Understanding the role of new firms in the economy has long been recognized as a critical issue, both because new firms continue to enter and utilize significant resources, and because policymakers have consistently expressed interest in attempting to stimulate growth through entry. Many previous studies have reported evidence that new firms generate significant growth of employment and productivity, while offering lower and more variable remuneration.[1] This consensus suggests that, for those individuals willing to start or work in new firms despite the pecuniary uncertainty, net social benefits result. However, prior studies have not explored the impact of firm entry on the levels and volatility of regional income and employment, which also affects social welfare.

This paper undertakes the first exploration of these broader associations. We also introduce a new measure of volatility, the component of the standard deviation not explained by trend growth, that improves on the standard deviation as a welfare-relevant measure of volatility. Data from US Labor Market Areas (LMAs) indicate that rates of net and gross entry by small firms are significantly associated with several categories of performance measures. For gross entry, four associations are economically beneficial, while six are detrimental. For net entry, six associations are beneficial, while two are detrimental but of marginal significance. These findings are largely robust to alternate time periods, additional performance measures, and – most importantly – to replacing entry with the component of entry not explained by earlier performance outcomes, thus addressing the question of causality more directly than through lags alone. Together, these findings point to previously unrecognized tradeoffs among the dimensions of economic performance associated with firm entry.

The remainder of the paper is organized as follows. Section 2 reviews related literature, section 3 presents our basic model and testable hypotheses, and section 4 discusses the data. Section 5 presents the main empirical results, section 6 introduces variations on the benchmark model to explore additional properties of the empirical associations, and section 7 concludes.

2 Previous studies

Many previous studies have explored the relationship between firm entry and employment growth (eg Callejón and Segarra, 1999; Acs and Armington, 2004; Fritsch and Mueller, 2004; van Stel and Storey, 2004). A broader literature has quantified empirical associations between income growth rates and various other

[1] See van Praag and Versloot (2007) for an excellent review.

factors (eg Sala-i-Martin, 1997; Wurgler, 2000; Collender and Shaffer, 2003; Craig et al, 2005), while additional measures of performance – including of per capita income, stability of growth rates, and productivity – have also been proposed.

Klenow and Rodríguez-Clare (1997), Hall and Jones (1999), and Bils and Klenow (2000) emphasize the importance of studying levels of economic aggregates as measures of performance. Earnings volatility has likewise been intensively scrutinized (Cameron and Tracy, 1998; Haider, 2001; Moffitt and Gottschalk, 2002; Hacker, 2006; Shin and Solon, 2008), though without exploring factors that might explain such volatility. The importance of studying volatility in growth rates is supported by Cole and Obstfeld (1991), Obstfeld (1994), Ramey and Ramey (1995), Agénor (2003), Kurz (2004), and Martin (2008). Empirical evidence on factors associated with volatility of growth is provided by Bekaert et al (2006) and surveyed for earlier studies by Agénor (2003). Volatility of employment growth has been found to vary systematically by firm size (Lever, 1996; Burgess et al, 2000), further motivating the study of such volatility as a function of firm entry because new firms are typically smaller.

Heterogeneous linkages between firm entry and job creation have been found across time and regions by Audretsch and Fritsch (2002) and van Stel and Storey (2004). Using German data, Fritsch and Mueller (2004) find that the link between firm entry and total employment exhibits a complex lag structure that reflects both direct and indirect effects; van Stel and Suddle (2008) find a similar pattern for the Netherlands, and Fritsch (2008) surveys other recent studies with similar findings. Using US data, Acs and Armington (2004) find that employment growth rates in Labor Market Areas (LMAs) are positively associated with firm entry except in manufacturing. Other studies (such as Callejón and Segarra, 1999; Disney et al, 2003) focus on entry and productivity, though our LMA dataset precludes any measure of productivity here.

These last two studies, as well as some by Frisch and others, note that entering firms can either add to, or displace, existing firms, with potentially distinct effects on economic performance. Entry unaccompanied by exit increases the number of firms, though incumbents may subsequently lose market share and/or employees to the entrants. Entry followed by the exit of some less efficient incumbent firms can also contribute to enhanced economic performance by providing a mechanism for improved corporate efficiency and competitiveness. Motivated by these considerations, we measure gross entry and net entry separately in the empirical section below.[2]

Shaffer (2002) presents a theoretical model in which the size of a firm might plausibly affect economic growth rates. Because of the high correlation between

[2] We do not model gross exit because its high correlation with gross entry (0.97 in our sample, when entry and exit rates are measured relative to population) makes any independent interpretation of exit problematic.

small firms and young firms, the same model suggests an association between entry and growth. Further, because other empirical literature has noted that most new jobs are created by small firms (Hart and Oulton, 1996; Robbins et al, 2000), we might expect to find faster employment growth in regions where new firms have entered. Indeed, as reviewed by van Praag and Versloot (2007), many previous studies have found such a pattern, both in the short run and in the longer run, though some studies have uncovered a contrary medium-term effect. Other measures of firm size also reveal a consistent pattern that small and/or young firms tend to grow faster, both empirically (eg Evans, 1987) and theoretically (Cooley and Quadrini, 2001; Albuquerque and Hopenhayn, 2004; Rossi-Hansberg and Wright, 2005; Clementi and Hopenhayn, 2006; Pinto, 2008), and these firm-specific patterns may be strong enough to affect regional aggregates as well.

While traditional considerations apply most obviously to average levels or growth rates of economic performance, more indirect considerations apply to its variability. For instance, centralized decision processes have been shown to generate more variable economic performance (Sah, 1991; Sah and Stiglitz, 1991; Rodrik, 1999; Almeida and Ferreira, 2002). If larger and older firms tend to utilize more centralized decision-making than smaller firms, those findings suggest that economic performance could be less variable where more firms have recently entered. Similarly, Lambson and Jensen (1998) find both theoretically and empirically that the intertemporal variability of firm value is positively related to firm size, another pattern that might aggregate up to the regional level. By contrast, Clementi and Hopenhayn (2006) discuss a mechanism that could account for the finding of Evans (1987) and others that smaller, younger firms exhibit more variable growth rates. The next section discusses additional mechanisms by which new firms might affect economic volatility.

Previous literature has interpreted higher volatility as harmful, an interpretation that we maintain here. Standard consumer theory posits concave utility functions, which generate indirect utility functions that are concave (risk averse) in income; hence, higher volatility of per capita income yields lower expected utility for a given mean income. Dynamic models also indicate that volatility of consumption growth is welfare-reducing, by potentially large amounts (Martin, 2008). Because income tends to vary with employment status, and because adjustment costs may exist, volatility of employment should also be welfare-reducing. Volatility of levels and growth in both the real sector and financial markets is typically perceived as harmful (Stiglitz, 2000; Agénor, 2003; Bekaert et al, 2006), while Francois and Lloyd-Ellis (2003) have shown how volatility and growth can be negatively linked in a model of entrepreneurial innovation.

3 Model and hypotheses

We employ a vector of economic performance measures, to reflect multiple aspects of performance as previously identified or suggested in the literature. This step expands on the methods used in previous research on the economic impact of entry. Our measures span two categories of performance (income and employment) and three dimensions of each category (levels, growth rates, and stability). We measure economic performance initially as a vector of 16 variables, listed in Table 1.[3] Coefficients of variation are included for performance variables that are trended (such as per capita income) or truncated (such as unemployment rates, bounded between 0 and 1) so as to scale the variability by the average level for each LMA. A subsequent section introduces a new measure of volatility, the component of the standard deviation not explained by trend growth, which we term 'excess volatility' and consider to be more strongly associated with welfare than the simple standard deviation or coefficient of variation. While prior theoretical and empirical studies suggest that these variables may be associated with rates of firm entry, the signs and magnitudes of those associations are intrinsically an empirical question, which we address below.

We allow for intertemporal integration of both the pattern of entry and the subsequent economic performance by comparing firm entry averaged over a five-year period (1990–1994) with economic performance over a subsequent five-year period (1995–1999).[4] Some prior empirical studies of endogenous growth have employed a similar intertemporal aggregation of data (eg, King and Levine, 1993; Levine, 1998; Levine and Zervos, 1998; Collender and Shaffer, 2003). This procedure recognizes that firm entry occurs not only in a single year, but at varying rates from one year to another, and that the economic impact of entry will tend to be distributed over multiple years following entry.

A limitation of this approach is that it cannot test for a distinction between short-run and long-run effects, which can be significant (Fritsch and Mueller, 2004; Fritsch, 2008). Another limitation is that this approach may tend to understate both short-run and long-run effects. For example, if 1990 entry spawns short-run growth in 1992 and 1993, and long-run growth in 2000 and beyond, neither of these components is reflected in the 1995–1999 growth figures. Any short-run growth effects will show up at least partially in the medium-term income and employment levels, however, which is another reason to include levels in our vector of performance measures. A subsequent section presents

[3] Because we measure employment as a fraction of LMA population, rather than relative to the labor force, our employment rate is not the same as one minus the unemployment rate and, in particular, will reflect both job opportunities and endogenous labor force participation rates. As such, it forms a complementary measure to the unemployment rate.

[4] As a check for robustness, we also use the 1999 value of the outcome levels (per capita income, per capita employment, and unemployment rate) in separate regressions.

estimates from alternate time decompositions, to check for robustness in this dimension.

An additional benefit of our lag structure is to mitigate the potential for spurious (reverse) causality. Although, as in previous empirical growth studies, our data and techniques cannot prove causality, measuring the statistical associations with a multi-year lag greatly reduces the likelihood that changes in economic outcomes are driving changes in entry (for example, that entry responds positively to faster local growth or higher income levels). Our lag structure permits a generic interpretation of the estimates in terms of Granger causality. A technique introduced below, replacing actual entry with the component of entry not explained by prior performance outcomes, further reduces the possibility of reverse causality.

We measure volatility using the intertemporal standard deviation of the respective outcomes over a five-year period, as in Bekaert et al (2006) and other studies. As noted by Agénor (2003), volatility itself is endogenous, and modeling the sources of volatility is important. The empirically observed variation among short, medium, and long-run effects of firm entry on economic outcomes suggests that increased entry will generate increased intertemporal volatility of income, employment, and similar outcomes (Fritsch and Mueller, 2004; Fritsch, 2008). One mechanism generating a nonmonotonic time path of outcomes is the lagged displacement of some incumbent firms by new entrants. In addition, not all new firms survive in the long run, and the subsequent failure of some entrants further increases the volatility of employment and income. A separate mechanism may operate to the extent that small new firms tend to be less diversified than older or larger firms; such entrants would tend to transmit sectoral shocks more strongly to the local economy, again generating higher volatility of outcomes. Combined with the discussion in the previous section, these factors provide mixed predictions, leaving the direction of association between volatility and firm entry an open empirical question.

Our unit of observation is a Labor Market Area (LMA) as defined by the Bureau of Labor Statistics of the US Department of Labor and discussed further in the Data section below. Following prior literature, we estimate separate effects of gross entry and net entry (entry minus exit), each measured relative to the number of incumbent firms and, alternatively, relative to the LMA population.[5] These distinctions reflect the fact that new entry can either add to the total number of firms or correspond to turnover in which new firms crowd out some incumbents.

[5] van Stel and Suddle (2008) note that the two ways of scaling entry can yield different results. They (and Garofoli, 1994) favor scaling by the labor force to avoid a bias due to variations in average firm size across regions. We scale by population rather than labor force, since the labor force participation rate is endogenous and can vary across regions in response to job opportunities, working conditions, pay scales, and other factors that can be influenced by new firm entry. Hence, scaling by population may avoid some endogeneity bias suffered when scaling by labor force.

While either form of entry can potentially generate both costs and benefits, the mechanisms and nature of their effects may differ.

Also following previous studies, we incorporate a vector of control variables including a measure of population, population density, and education within each region, along with the initial level of per capita income, incumbent firms per capita, and the rate of R&D expenditure. The logarithm of population is a measure of market size as in Glaeser et al (1995) and Cetorelli and Gambera (2001). Previous theory and empirical findings suggest that this variable is positively associated with economic performance, implying positive coefficients with respect to average levels or growth rates of income or employment, but negative coefficients with respect to the intertemporal standard deviation of income or employment.

Population density has been found significantly related to several measures of economic performance, possibly due to scale effects or to superior matching between firms and workers. Andersson et al (2007) find a higher correlation between workers' skills and productivity in counties with denser populations. Ciccone and Hall (1996) find that population densities at the county level help explain differences in productivity levels across states, while Audretsch and Fritsch (2002) note that population density may reflect an array of regional factors that could influence employment growth rates but individually would suffer from multicollinearity. Carlino et al (2007) find more patents per capita in higher-density areas. These findings suggest that density may be positively associated with economic performance.

Education reflects the accumulated level of human capital and is expected to be positively associated with economic performance. Our measure is the fraction of population graduated from college. The initial level of per capita income is intended to capture the convergence effect noted by Barro and Sala-i-Martin (1992), and would thus exhibit a negative association with subsequent growth rates of per capita income.[6] Both variables are similar to those used in recent studies of economic growth such as Glaeser et al (1995), Cetorelli and Gambera (2001), and Collender and Shaffer (2003). Finally, incumbent firms per capita is intended as a rough proxy for the average size of firm, found to be significantly associated with growth rates of both income and employment (Shaffer, 2002; 2006a, b).

As noted above, most studies have focused on average growth rates as the indicator of economic performance. However, equilibrium models of economic dynamics often predict a convergence of economic growth rates across countries

[6] Associations with other measures of performance are much less well established in the literature, either theoretically or empirically. One might hypothesize a positive association with subsequent levels of per capita income, and perhaps a negative association with subsequent growth rates of employment (to the extent that income convergence in driven by an employment channel), but we regard the other linkages as an open empirical question.

or regions to a uniform long-run rate (Barro and Sala-i-Martin, 1992; Mankiw et al, 1992). These considerations suggest that long-run differences in economic performance are best studied in terms of *levels* rather than growth rates of income or other indicators (Hall and Jones, 1999). Hence, we also estimate models of that sort below.

The basic model to be estimated takes the form

$$Y_i = f(N_i; Z_i) + \varepsilon_i \tag{3.1}$$

where the subscript i denotes the ith LMA, Y denotes one of the nine measures of economic performance described above, N denotes a measure of entry by small firms, Z is a vector of control variables as discussed above, and ε is a stochastic error term. We estimate the model by OLS with robust (White heteroscedastic-consistent) standard errors. The next section describes our data, sources, and unit of analysis in more detail.

4 Data

As noted earlier, we use data from a nationwide set of Labor Market Areas (LMAs), as defined by the Bureau of Labor Statistics (BLS) of the US Department of Labor, as our unit of analysis. The BLS identifies three types of LMAs based on total population, each comprising one or more counties: metropolitan, micropolitan, and small areas. Our sample comprises the 394 metropolitan LMAs, none of which are contiguous; hence, spatial correlation is not an issue in our sample. LMAs are identified according to commuting patterns and thus capture economic and social integration in local regions.

We obtain LMA Firm births 1990 through 1996 from a file prepared by Armington and Acs (2002) using the Longitudinal Establishment and Enterprise Microdata (LEEM) file at the Center for Economic Studies of the Bureau of the Census.[7] Using the same procedure, the Company Statistics Division at the Census Bureau collected data on firm births during 1997–1999 from a more recent LEEM file. We define small firm entry as either new single-establishment firms with less than 500 employees or the primary locations of new multi-establishment firms with less than 500 employees firm-wide. Non-affiliated single-unit firm births were identified by LEEM data file if they had no employment in March of year t-1, but had positive employment below 500 in their starting year t. For new multi-establishment firms, the employment in their new primary location should constitute at least one third of their total employment in the first year. We obtain

[7] See Armington and Acs (2002) and Kirchhoff, Newbert, Hasan, and Armington (2007) for a full description of the data collection procedure.

labor force information, population, employment, and unemployment from local area employment statistics provided by the US Department of Labor, aggregated at the LMA level based on the 1990 LMA definitions.

Table 1 reports summary statistics on the variables. Table 2 reports correlation coefficients between each performance variable and each measure of entry, as a preliminary view of the key empirical associations. The highest correlations, 0.81, are between gross entry per capita in 1990–1994 and the average per capita employment rate in 1995–1999; and between gross entry per capita in 1990–1994 and the 1999 per capita employment rate. Given the lags, these correlations reflect both direct employment effects of entry and some indirect effects and persistence. Other notable correlations involve the 1995-99 employment growth rates: 0.611 with gross entry per incumbent firm and above 0.4 for both measures of net entry. These preliminary figures suggest that some significant linkages may be expected even after controlling for other factors, as analyzed in section 5 below.

The following section presents the results of the benchmark model. In a subsequent section, we present and discuss results of several extensions and variations of the empirical model, aimed both at assessing robustness and at identifying additional characteristics of the empirical associations.

5 Benchmark results

Table 3 reports empirical estimates of coefficients on the entry variables in the various versions of equation (3.1); coefficients on control variables are omitted from the table for brevity, but will be discussed below and are available from the corresponding author. As shown in the table, each measure of structural change (gross entry and net entry) exhibits a statistically significant association with several dimensions of economic performance, whether measured relative to the number of incumbent firms or relative to population. Conversely, each measure of economic performance – except the coefficient of variation of the unemployment rate – exhibits significant association with more than one measure of structural change.[8] In particular, gross entry is significantly associated with nine of the 16 measures of economic performance, while net entry is associated with eight measures of economic performance.[9]

[8] The standard deviation of per capita income growth is only marginally associated (at the 0.10 level) with gross entry and gross exit, measured relative to the number of incumbent firms.

[9] An alternate set of estimates, in which 1994 measures of entry and exit replaced the 1990–1994 averages, yielded broadly similar results except net and gross entry were both significantly associated with 15 measures of economic performance; coefficient signs were unaltered. The differences in significance suggest that longer-term effects (beyond two to three years) may be weaker in our sample than short-term effects.

According to these estimates, beneficial correlates of net entry include faster subsequent growth of per capita income and per capita employment, higher average levels of subsequent per capita income and employment, lower subsequent rates of unemployment, and more stable subsequent unemployment rates. Beneficial correlates of gross entry include faster subsequent growth of employment, and less volatile subsequent per capita income. These results are robust whether the employment figures are measured as of 1999 or averaged over 1995–1999.

At the same time, higher rates of net entry are marginally associated with more volatile levels of subsequent per capita income. Higher rates of gross entry are also associated with some detrimental aspects of labor market performance, controlling for net entry: subsequent growth of per capita income is slower, employment rates are lower and more variable, and unemployment rates are higher and more variable. Thus, we find that net entry is associated with subsequent benefits in several dimensions – including many not previously explored – while gross entry is associated with several additional benefits but also some tradeoffs or costs. The income effects appear statistically weaker when measured in 1999 as compared with the 1995–1999 average, although the point estimates of the net entry coefficients are larger for 1999 than for the 1995–1999 net entry rates.

The combined associations involving employment levels versus employment growth rates suggest the possibility that, in some areas at least, lower employment rates (and higher unemployment rates) may stimulate the entry of new firms to create expanded job opportunities and take advantage of an underutilized labor force.[10] What is noteworthy here is not so much that such entry is attracted, but rather that such entry is successful on average in promoting faster employment growth.

Simple regressions between the entry measures and economic performance, not reported in the table, indicated that net entry alone – measured relative to the number of incumbent firms – explains 37 per cent of the subsequent growth in per capita employment. Measured relative to the population, gross entry in 1990–1994 explains 66 per cent of the variation in the 1999 employment rate and in the 1995–1999 average employment rates. With quadratic terms added, gross entry explains 81 per cent of the variation in subsequent employment rates, in both 1999 and 1995–1999. These patterns support previous findings that new small firms can contribute strongly to regional employment.

[10] This conjecture is consistent with the finding of Evans and Leighton (1989) that unemployed or underemployed workers are more likely to enter self-employment.

Magnitudes of estimated effects

Of particular economic relevance is not just the statistical significance, but also the relative magnitudes, of the estimated effects. Because previous literature has presented arguments favoring population-based measures of entry rates over per-incumbent measures, we focus on the population-based measures hereafter. Table 4 reports estimated magnitudes of the statistically significant associations. The numbers in this table indicate the change in each performance measure, expressed as a percentage of the sample mean value of that variable, associated with an increase in the respective entry variable equal to one sample standard deviation of that variable. Thus, for instance, the top row in the net entry column (0.4224%) indicates that a one-standard-deviation increase in the net entry rate per capita is associated with a subsequent growth rate of per capita income that is higher by 0.4224 per cent of its sample mean.

A majority of the significant gross entry effects exhibit large magnitudes. A one-standard-deviation increase in the per capita gross entry rate is associated with a 30 per cent reduction in the subsequent average employment rate and in the standard deviation of the subsequent per capita income growth rate, a 35 per cent increase in the subsequent average unemployment rate and its standard deviation, and more than double the subsequent standard deviation and coefficient of variation of per capita employment. A one-standard-deviation increase in the per capita net entry rate is associated with more than a 10 per cent reduction in the subsequent average unemployment rate and its standard deviation. Thus, these empirical linkages are not only statistically significant but economically large. The estimated magnitudes for entry rates per incumbent firm, not reported in the table, were very similar for net entry and generally similar (though somewhat smaller) for gross entry.

Control Variables

The control variables, not reported in Table 3, indicate patterns generally consistent with prior literature where applicable. Higher initial (1994) per capita income is significantly associated with lower but faster-growing subsequent employment, higher but more volatile subsequent levels of per capita income, more volatile subsequent growth rates of per capita income, and lower subsequent unemployment rates with lower absolute variability (measured by standard deviation) but marginally higher relative variability (measured by coefficient of variation). However, the positive association between initial and subsequent per capita income contrasts with the convergence hypothesis of Barro and Sala-i-Martin (1992) and suggests instead the possibility of path dependence, multiple equilibria, or related patterns, as previously noted by Parker (2005), Fritsch and

Mueller (2006), Martin and Sunley (2006), and Audretsch et al (2008). If multiple equilibria exist, then time-series effects might differ from cross-sectional effects in our sample, a possibility that future research could explore in more detail.[11]

More populous LMAs exhibit significantly faster but more volatile growth rates of employment, more volatile levels of employment, higher unemployment rates, more stable growth of per capita income, and marginally higher levels of per capita income. Population density is associated with significantly higher unemployment rates and significantly more volatile employment levels.

Education, measured as the percentage of the population graduated from college, is associated with faster and more stable growth of per capita income, marginally higher but more volatile levels of per capita income, lower rates of unemployment, and higher rates of employment. More establishments per capita as of 1994 are significantly associated with higher subsequent employment rates, more volatile subsequent growth of per capita income, and marginally more stable subsequent levels of per capita income. Rates of R&D expenditures are significantly associated with lower and marginally more stable subsequent unemployment rates, and marginally lower employment levels.

6 Robustness and extensions

This section introduces several extensions of the basic model shown above, including a new measure of volatility; an alternate procedure to mitigate reverse causality; interactive terms between entry and population, and between entry and density; quadratic entry terms to check for nonlinearity; alternate decompositions of the time periods; and alternate control vectors.[12] First, because growth itself generates a positive standard deviation of the growing variable, we introduce a new measure of volatility to correct for this dependency.[13] We regress each standard deviation of levels on the growth rate of the associated variable and use the residuals from this regression as a new dependent variable in our original model. That residual is the portion of volatility not explained by growth, and may be viewed as ‘excess volatility’ – the volatility beyond that resulting from smooth trend growth. This variable is the most relevant measure of volatility with respect to consumer welfare and, to the authors’ knowledge, has not been used in prior literature.

[11] Our available time series is too short to permit reliable decomposition of these effects here.

[12] We also re-estimated both the benchmark model and the model of Table 5 after removing outliers. The results were essentially unchanged.

[13] For example, a variable that grows from 100 to 110 has a variance of 5 measured by the endpoints.

Table 5, Panel A, reports the auxiliary regressions generating the excess volatility residuals for per capita income, per capita employment, and the unemployment rate. Growth is significantly associated with the standard deviation in each case, and explains 67 per cent of the variation in per capita income. Panel B reports regression coefficients in the model of equation (3.1) with excess volatility as the dependent variable. The gross entry rate of small firms is positively associated with subsequent excess volatility of per capita income at the 0.05 level, and with subsequent excess volatility of the unemployment rate at the 0.01 level. Net entry is associated with lower subsequent excess volatility of the unemployment rate at the 0.01 level, and is weakly associated with lower subsequent excess volatility of per capita income ($p = 0.108$) and of per capita employment ($p = 0.110$).

Initial per capita income is associated with significantly higher excess volatility of subsequent per capita income but lower excess volatility of the subsequent unemployment rate, both at the 0.01 level. Per capita employment rates exhibit lower excess volatility in more populous but less densely populated regions. The unemployment rate exhibits lower excess volatility in regions that spend more funds on research and development, and where the average education level is higher.

Although our lag structure mitigates the potential for reverse causality in a Granger sense, Bosma et al (2008) and van Stel and Suddle (2008) have attempted to reduce that possibility further by including a lagged dependent variable in their regressions. We next apply a refinement of that technique by re-estimating equation (3.1) replacing the gross and net entry variables with their respective residuals not explained by 1990–1994 values of the respective performance variables. Table 6 reports the results. In nearly every case, the signs, magnitudes, and significance levels are comparable to those in the benchmark model, suggesting that reverse causality is not driving the results.

Next, we include interactive terms between entry and population or density, to explore possible heterogeneity of the linkages across regions as in Fritsch and Schroeter (2007) and van Stel and Suddle (2008). Severe multicollinearity between the entry terms and their interactions with population undermines the precision of the results, as the correlation coefficient between gross entry rates and its cross-product with log (population) is 0.970, while that between net entry rates and its cross-product with log (population) is 0.995. At the 0.05 level, no interaction term with density is ever significant, the interaction term between net entry and population is significant in only two of 16 regressions (an outcome that could occur by chance alone), and the interaction term between gross entry and population is significant in only five of the 16 regressions. In the latter case – for the regressions involving employment growth and the 1999 and 1995–1999 employment and unemployment rates – the negative coefficient on the interaction term has the opposite sign as that on gross entry, an outcome encouraged by the high positive correlation (Johnston, 1972, p. 161). Because of the paucity and unreliability of these results, we do not report them in tables.

Further, we add quadratic entry terms to explore possible nonmonotonicity in the associations, as in Fritsch and Schroeter (2007) and Bosma et al (2008). At the 0.05 level, the squared net entry rate is significant in only two of the 16 regressions (an outcome that could occur by chance alone) and then always with the opposite sign as the coefficient on net entry (an outcome encouraged by the positive correlation of 0.717 between net entry and its square; *ibid.*). At the 0.05 level, the squared gross entry rate is significant in only four of the 16 regressions. However, despite a high correlation of 0.920 between gross entry and its square, the coefficients on both terms have the same positive sign in two cases – for the unemployment rate in 1999, and for the average unemployment rate over 1995–1999. Again, because of the paucity and unreliability of these results, we do not report them in tables.

Because Fritsch and Mueller (2004) and others have found lagged effects of entry on growth as far as 10 years out, we then re-estimate the model using 1990 entry data versus 1999 levels and 1991–1999 growth rates and volatility. Finally, we split the sample into early and later periods, to check for stability of the empirical associations over time. We focus on the population-based measures of entry in these extensions for brevity, because the previous section found broadly similar results for population-based measures as for firm-based measures, and because previous literature has argued that population-based measures of entry are superior to firm-based measures.

Table 7 reports the results of these last two modifications. Gross entry per capita in 1990 is significantly associated with lower subsequent per capita employment and higher unemployment rates during 1991–1994 and 1991–1999, while gross entry per capita in 1995 is significantly associated with lower per capita employment and higher unemployment rates during 1996–1999; these welfare-reducing results are consistent with the baseline model of Table 3. Gross entry rates are significantly associated with faster rates of employment growth over all time periods, again as in Table 3. Together, these contrasting labor market effects suggest that entry by small firms may tend to occur in regions that exhibit persistent underemployment and, over time, help to close the 'employment gap' compared with other regions; this question merits further research.

The 1990 gross entry rate is significantly associated with lower volatility of per capita income and per capita employment in 1991–1994 and 1991–1999, whether measured as the standard deviation, the coefficient of variation, or the excess volatility as in Table 5. However, the later period (1995 entry versus 1996–1999 volatility) does not clearly show these benefits; the point estimates remain negative but not significantly so. It is possible, however, that the lack of significance is an artifact of the short window within which to calculate annual standard deviations over 1996–1999.

As in Table 3, gross entry is associated with a larger standard deviation of subsequent unemployment rates over all periods, but not with a significantly higher coefficient of variation of unemployment rates. Unlike Table 3, gross entry is significantly associated with lower per capita income in each half of the sample; but as in Table 3, gross entry in 1990 is associated with slower growth of per capita income over 1991–1994 and 1991–1999. We did not estimate the volatility of growth rates over the shorter subperiods because those calculations would have involved too few time periods.

Net entry rates are significantly associated with higher subsequent per capita employment and income in all periods, faster subsequent growth of per capita income in all periods, and faster subsequent employment growth in all but one case, as in Table 3. However, net entry is generally associated with higher volatility of per capita income in each subperiod, also as in Table 3. Net entry in 1995 is significantly associated with lower standard deviation of unemployment rates, as in Table 3.

Overall, the split sample analysis and alternate time periods show a pattern of associations generally consistent with the benchmark analysis of Table 3. The few contrasting instances may be an artifact of few time periods in the subsamples.

As a final check of robustness, we re-estimated the benchmark models using alternate subsets of the control variables listed in Table 1. With the following exceptions, all results remain unchanged under these variations. When 1994 establishments per capita are removed from the regressions, gross and net entry lose their explanatory power for the average subsequent employment rate, and gross entry loses its explanatory power for the standard deviation of subsequent income growth. When R&D is removed, net entry gains a significantly positive coefficient associated with the standard deviation of subsequent income growth.

7 Conclusion

The goal of this paper has been to quantify empirical associations between measures of entry by small firms versus an expanded vector of economic performance measures identified in other literature as relevant to economic welfare. These dimensions of performance encompassed levels, growth rates, and stability of per capita income, per capita employment, and unemployment rates. As part of the analysis, we introduced a new measure of volatility – the excess volatility not explained by trend growth – as an important dimension of economic performance. We applied a similar technique – replacing entry by the component of entry not explained by prior performance outcomes – to mitigate the potential for reverse causality.

Our findings for US data indicate significant tradeoffs between various benefits and costs associated with gross and net rates of entry by small firms. Such tradeoffs imply that the role of new firms in the economy is more complex than can be reduced to a simple scalar performance index, a finding that raises new opportunities and challenges for public policy and for future research. Even if public policy toward small business entry is geared toward a different objective, such as promoting business ownership per se rather than economic growth alone (similar to the social objective of US federal home ownership financing programs), recognizing a broader array of costs and benefits is socially relevant. Several of the estimated linkages are not only statistically significant but also economically large. The associations are also generally robust to alternate time periods and lags, as well as to other refinements discussed above.

On a technical level, future research could attempt to refine or extend the analysis here in several ways. Given appropriate data (not available in our sample), productivity could be added to the vector of performance variables, sector-specific effects could be explored, and the impact of regional variations in policy could be studied. Potential differences between time-series effects and cross-sectional variation, perhaps reflecting multiple equilibria or path dependence, could be explored. More broadly, further research may uncover specific mechanisms underlying each empirical linkage, raising the possibility of structuring entry in ways to maximize the dimensions of benefit while mitigating the costs. Conversely, to the extent that some tradeoffs may be inevitable, the public policy challenge is then to identify appropriate weights for each dimension of economic performance in assessing the overall impact of small new firms on the economy.

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Tables 1–7

Table 1. **Variables and summary statistics (394 US labor market areas)**

Variable	**Mean**	**Standard Deviation**
Regressors:		
Gross entry per incumbent, avg. 1990–1994	0.1022	0.01666
Gross entry per capita, avg. 1990–1994	0.001830	0.0008850
Net entry per incumbent, avg. 1990–1994	0.006814	0.01086
Net entry per capita, avg. 1990–1994	0.0001255	0.0002158
1994 per capita income	18.904	2.9934
Log of population, 1994	12.777	0.9534
Population density, 1994	144.00	322.47
% college graduates, 1994	0.009936	0.05144
1994 establishments per capita	0.02269	0.01067
Avg. R&D expenditure per capita, 1990–1994	0.05820	0.1613
Performance Variables		
Avg. unemployment rate, 1995–1999	0.05278	0.02299
Unemployment rate, 1999	0.04657	0.02171
Std. dev. of unemployment rate, 1995–1999	0.006196	0.003349
Coeff. of variation of employment rate, 1995–1999	19841	51722
Coeff. of variation of per capita income, 1995–1999	0.07068	0.01190
Coeff. of variation of unemployment rate, 1995–1999	0.1219	0.05518
Per capita income growth rate, 1995–1999[1]	1.1907	0.03687
Per capita employment growth rate, 1995–1999[1]	1.0499	0.04401
Std. dev. of per capita income, 1995–1999	1.5366	0.4582
Std. dev. of per capita employment, 1995–1999	9642.36	24379.24
Avg. per capita income, 1995–1999	21.4826	3.6061
Avg. per capita employment, 1995–1999	0.4876	0.2161
Per capita income, 1999	23.3078	4.1384
Per capita employment, 1999	0.4900	0.2173
Std. dev. of per capita income growth rate, 1995–1999	0.01733	0.01279
Std. dev. of per capita employment growth rate, 1995–1999	0.01054	0.006228

[1]Measured as the ratio of the 1999 level to the 1995 level.

Table 2. **Correlation coefficients, entry vs performance**

	Gross Entry 1990–1994		**Net Entry 1990–1994**	
Performance Variable:	**Per Firm Incumbent**	**Per Capita**	**Per Firm Incumbent**	**Per Capita**
% change, per capita income	0.003	0.112	0.033	0.062
% change, employment	0.611	0.227	0.459	0.423
σ of per capita income	0.043	0.151	0.006	0.044
σ of employment	0.275	0.100	0.023	0.016
Mean per capita income	0.036	0.158	-0.024	0.021
Mean per capita employment	-0.078	0.813	0.033	0.237
Per capita income 1999	0.054	0.163	-0.014	0.029
Per capita employment 1999	-0.079	0.812	0.030	0.233
σ of annual per capita income growth rates	-0.260	-0.037	-0.088	-0.081
σ of annual employment growth rates	-0.038	0.094	-0.002	0.029
Unemployment rate, 1995–1999 average	0.108	-0.123	-0.103	-0.115
Unemployment rate, 1999	0.085	-0.148	-0.106	-0.122
σ of annual unemployment rates	0.125	0.060	-0.041	-0.041
C.O.V. of employment	0.263	0.087	0.005	-0.001
C.O.V. of per capita income	0.006	0.113	0.030	0.059
C.O.V. of unemployment rate	0.028	0.225	-0.001	0.031

Table 3. **Benchmark regression coefficients for entry variables**

	Gross entry 1990–1994		Net entry 1990–1994	
Dependent variable	**Per firm incumbent**	**Per capita**	**Per firm incumbent**	**Per capita**
% change, per capita income	-0.3277 (-2.01)**	-15.2146 (1.85)[1]	0.4822 (1.98)**	23.3070 (1.92)[1]
% change, employment	1.1822 (6.63)*	47.7711 (2.84)*	0.6487 (2.69)*	44.8249 (2.76)*
σ of per capita income	-1.9834 (-1.46)	-107.043 (-1.34)	3.5074 (1.73)[1]	182.957 (1.69)[1]
σ of employment	288863 (4.35)*	1.097×10^7 (2.02)**	-156454 (-0.94)	-4.27×10^6 (-0.46)
Mean per capita income, 1995–1999	-2.2572 (-1.05)	-132.046 (-1.18)	5.6070 (1.77)[1]	305.454 (1.86)[1]
Mean per capita employment, 1995–1999	-2.0044 (-3.98)*	-168.105 (-3.63)*	1.9734 (3.49)*	129.986 (3.33)*
Per capita income, 1999	-0.7103 (-0.20)	-96.293 (-0.41)	8.3391 (1.50)	497.824 (1.63)
Per capita employment, 1999	-2.0579 (-4.05)*	-170.086 (-3.63)*	1.9667 (3.45)*	127.921 (3.25)*
σ of annual per capital income growth rates	-0.1383 (-2.63)*	-5.8218 (-1.88)[1]	0.03353 (0.43)	-0.9325 (-0.23)
σ of annual employment growth rates	0.02580 (0.91)	1.2310 (0.99)	-0.03022 (-0.71)	-1.4187 (-0.70)
Unemployment mean rate, 1995–1999	0.4062 (4.05)*	20.7106 (4.58)*	-0.6319 (-4.47)*	-28.4446 (-4.44)*
Unemployment rate, 1999	0.3507 (3.73)*	17.3442 (4.45)*	-0.5743 (-4.56)*	-25.2390 (-4.53)*
σ of annual unemployment rates	0.05232 (3.58)*	2.4193 (2.81)*	-0.06354 (-2.27)**	-3.0901 (-2.28)**
C.O.V. of employment	632632 (4.79)*	2.51×10^7 (2.17)**	-422724 (-1.14)	-1.43×10^7 (-0.69)
C.O.V. of per capita income	-0.1045 (-2.01)**	-4.9413 (-1.84)[1]	0.1486 (1.88)[1]	7.2167 (1.81)[1]
C.O.V. of unemployment rate	0.1930 (0.81)	1.4990 (0.12)	-0.1736 (-0.44)	-9.3460 (-0.49)

Heteroscedastic-consistent (White) t-statistics are reported in parentheses, significant at the *0.01, **0.05, or [1]0.10 level. Dependent variables are measured using annual data 1995–1999, while entry is measured as the average rates over 1990–1994. C.O.V. = coefficient of variation over time; σ = standard deviation over time. See control vector in Table 1.

Table 4. **Estimated magnitudes of associations**
Percent change in performance variable associated with 1–σ increase in entry (statistically significant estimates only)

Dependent variable	**Gross entry per capita**	**Net entry per capita**
% change, per capita income	-1.13%	0.422%
% change, employment	4.03%	0.921%
σ of per capita income	–	2.57%
σ of employment	100.7%	–
Mean per capita income	–	0.307%
Mean per capita employment	-30.5%	5.75%
σ of annual per capita income growth rates	-29.7%	–
Unemployment mean rate	34.7%	-11.6%
σ of annual unemployment rates	34.6%	-10.8%
C.O.V. of employment	112.0%	–
C.O.V. of per capital income	-6.19%	2.20%

Percent change of each dependent variable is measured relative to the sample mean value of that variable; σ is the sample standard deviation of each respective entry variable.

Table 5. **Excess volatility**

PANEL A: Auxiliary regressions of retrieve excess volatility

Dependent variable	**Intercept**	**Growth rate, 1995–1999**	**Adjusted R^2**
Std. dev. of per capita income, 1995–1999	-10.5817 (-16.30)*	10.1773 (18.54)*	0.670
Std. dev. of per capita employment, 1995–1999	-230496 (-6.37)*	228717 (6.46)*	0.168
Std. dev. of unemployment rate, 1995–1999	0.01464 (11.10)*	-0.01047 (-6.26)*	0.198

PANEL B: Excess volatility and entry

Dependent variable / **Regressor**	**Excess volatility of per capita income, 1995–1999**	**Excess volatility of per capital employment, 1995–1999**	**Excess volatility of unemployment rate, 1995–1999**
Intercept	-1.5638 (-11.96)*	-132596 (-2.02)**	0.00202 (0.65)
Gross entry per capita, 1990–1994	47.7999 (2.37)**	43773 (0.01)	2.2688 (3.14)*
Net entry per capita, 1990–1994	-54.2445 (-1.61)	-1.452×10^{8} (-1.60)	-2.8577 (-2.60)*
Per capita income, 1994	0.0757 (22.91)*	-493.748 (-0.76)	-0.000394 (-4.05)*
Log (population), 1994	0.0116 (1.11)	10501 (1.78)[1]	0.000400 (1.46)
Population density, 1994	3.47×10^{-5} (0.80)	24.9146 (4.82)*	1.351×10^{-6} (1.18)
Education, 1994	-0.3339 (-1.01)	-49896 (-0.76)	-0.01804 (-2.27)**
Establishments per capita, 1994	-2.9667 (-1.03)	476066 (1.48)	-0.07847 (-1.34)
R&D expenditure per capita, 1994	-0.00642 (-0.19)	1287.20 (0.34)	-0.00180 (-2.77)*

Robust (White) t-statistics in parentheses, significant at the *0.01, **0.05, or [1]0.10 level.

Table 6. **Using residual entry not explained by 1990–1994 performance**

Dependent variable	**Gross entry per capita 1990–1994**	**Net entry per capita 1990–1994**
% change, per capita income	-20.0389 (-2.42)**	34.2101 (2.59)*
% change, employment	51.8908 (3.09)*	21.6188 (1.34)
σ of per capita income	-101.978 (-1.28)	204.219 (1.84)[1]
σ of employment	1.05x10^{7} (1.81)[1]	-1.64x10^{6} (-0.21)
Mean per capita income, 1995–1999	-136.279 (-1.18)	312.145 (1.86)[1]
Mean per capita employment, 1995–1999	-152.525 (-15.27)*	132.670 (10.16)*
Per capita income, 1999	-99.858 (-0.42)	503.330 (1.62)
Per capita employment, 1999	-151.804 (-13.49)*	127.956 (8.95)*
σ of annual per capita income growth rates	-3.6387 (-1.37)	-0.7619 (-0.19)
σ of annual employment growth rates	-1.2998 (1.06)	-1.7074 (-0.83)
Unemployment mean rate, 1995–1999	31.4533 (4.19)*	-30.4105 (-4.30)*
Unemployment rate, 1999	26.8767 (3.95)*	-27.0840 (-4.32)*
σ of annual unemployment rates	1.7073 (2.05)**	-1.1234 (-0.82)
C.O.V. of employment	1.63x10^{7} (1.79)[1]	4.43x10^{6} (0.43)
C.O.V. of per capita income	-4.8706 (-1.78)[1]	9.3399 (2.25)**
C.O.V. of unemployment rate	-14.4983 (-1.21)	16.7100 (0.85)

Heteroscedastic-consistent (White) t-statistics are reported in parentheses, significant at the *0.01, **0.05 or [1]0.10 level. Dependent variables are measured using annual data 1995–1999, while entry is measured as the average rates over 1990–1994. C.O.V. = coefficient of variation over time; σ = standard deviation over time. See control vector in Table 1.

Table 7. **Alternate time periods**

Dependent variable	1990 gross entry per capita vs 1991–1999 growth & std. dev., ’99 levels	1990 net entry per capita vs 1991–1999 growth & std. dev., ‘99 levels	1990 gross entry per capita vs 1991–1994 outcomes	1990 net entry per capita vs 1991–1994 outcomes	1995 gross entry per capita vs 1996–1999 outcomes	1995 net entry per capita vs 1996–1999 oucomes
Per capita income	-426.312 (-1.39)	590.509 (1.85)[1]	-151.337 (-1.77)[1]	279.624 (2.99)*	-346.134 (-3.68)*	387.794 (2.44)**
Per capita employment	-160.586 (-3.82)*	113.159 (3.13)*	-149.138 (-3.49)*	109.029 (2.99)*	-133.148 (-2.79)*	121.219 (1.98)**
Per capita income growth	-22.8459 (-1.72)[1]	26.9013 (1.81)[1]	-21.0442 (-4.00)*	22.1079 (3.40)*	1.2778 (0.19)	21.4751 (2.14)**
Employment growth	114.938 (6.48)*	50.920 (2.65)*	30.9567 (4.14)*	32.2897 (3.44)*	39.4942 (4.71)*	16.6540 (1.54)
Std. dev. of per capita income	-203.197 (-2.24)**	159.164 (1.62)	-176.397 (-4.45)	163.679 (3.51)*	-15.3965 (-0.24)	196.371 (2.03)**
C.O.V. of per capita income	-7.9416 (-2.51)**	5.3108 (1.43)	-7.8833 (-4.14)*	7.3974 (3.15)*	-0.4984 (-0.23)	8.3839 (2.47)**
Excess volatility of per capita income	-58.251 (-2.67)*	-11.193 (-0.38)	-62.324 (-4.02)*	43.841 (2.73)*	-29.561 (-1.44)	-41.679 (-1.26)
Std. dev. of employment	-6.4688 (-5.88)*	7.0525 (4.68)*	-3.4318 (-4.02)*	4.9030 (3.70)*	-0.5899 (-0.41)	-1.4899 (-0.74)
C.O.V. of employment	-7.3636 (-4.05)*	8.5557 (3.75)*	-3.9732 (-2.24)**	6.8005 (3.20)*	0.4063 (0.36)	-3.3361 (-2.06)**
Excess vol. of employment	-8.0446 (-7.53)*	6.3544 (4.38)*	-2.1628 (-2.74)*	3.5699 (2.84)*	-0.5968 (-0.43)	-1.6057 (-0.80)
Unemployment rate	13.4744 (4.61)*	-2.9294 (-0.93)	18.8616 (5.43)*	-1.7867 (-0.49)	17.6471 (4.04)*	-31.5291 (-4.61)*
Std. dev. of unemployment	2.6332 (3.12)*	0.9556 (0.81)	1.6520 (2.60)*	1.2130 (1.21)	1.8420 (2.43)**	-2.5572 (-2.41)**
C.O.V. of unemployment	$2.17\text{x}10^{-5}$ (0.14)	$2.08\text{x}10^{-4}$ (0.94)	$1.65\text{x}10^{-4}$ (1.62)	$1.38\text{x}10^{-4}$ (0.86)	$2.31\text{x}10^{-5}$ (0.24)	$2.02\text{x}10^{-6}$ (0.01)

Heteroscedastic-consistent (White) t-statistics in parentheses, significance at the *0.01 **0.05, or [1]0.10 level. C.O.V. is the coefficient of variation. See control vector in Table 1.

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