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FIRM LEVEL JOB CREATION RATES OVER THE BUSINESS CYCLE

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ABSTRACT

We study the evolution and cyclical dependence of the cross sectional distribution of firm level job creation rates from 1975 to 2004 for the Austrian private sector. The share of firms not adjusting has declined over time, but the share of entries, exits, growing and declining firms increased. The share of firms adjusting is higher in upswings than in downturns and the higher order moments of the job creation distribution follow distinct cyclical patterns. The smallest firms and firms at the extremes of the growth rate distribution are largely unaffected by the business cycle.

Keywords: Employment adjustment, Business cycle, Firm growth.

JEL Codes: E24, E32, D21.

1. INTRODUCTION

The interaction between firm level and macro-economic dynamics has received considerable attention in recent empirical business cycle research. A large number of papers use micro-level employment data to make inferences about the structure and nature of firm level adjustment over the business cycle. The main lessons from this literature are that employment adjustment at the plant level is lumpy and occasional and that heterogeneity at the firm level is a preponderating characteristic of employment growth (Davis *et al.*, 1996; Davis and Haltiwanger, 1999; King and Thomas, 2006). Less is, however, known about the firm level factors underlying this heterogeneity. Few papers address this topic, with the main body of work (Higson *et al.*, 2002; Nilsen and Schiantarelli, 2003) looking at firm size and long run growth performance as possible explanations.

In this paper our aims are to first, establish a set of stylized facts concerning the evolution of the higher order moments of the cross sectional distribution of job creation rates over the business cycle. This is interesting because the standard deviation of this distribution provides information on the systematic variations in firm level heterogeneity over the business cycle. Changes in skewness of this distribution indicate cyclicality in the shares of firms growing faster or slower than the mean, and changes in the kurtosis indicate whether cyclical fluctuations in employment growth are primarily associated with changes in the growth performance of firms in the medium ranges of this distribution. Second, we are interested in regularities in responses of firms of differing size and growth rates to business cycle fluctuations. Previous literature has found these variables to be important predictors of other aspects of firm behaviour. Aside from providing descriptive evidence, we estimate a two stage Heckman type ordered logit model of firm level employment adjustments, in which firms of different sizes may react differently to aggregate employment changes. Our paper is thus closely related to the literature studying the interaction between firm level growth and aggregate dynamics over the business cycle (Davis *et al.*, 1996; Varejao and Portugal, 2007), while methodologically we draw on a set of recent contributions by Nilsen and Schiantarelli (2003) and by Higson *et al.* (2002; 2004) and Döpke *et al.* (2005).

We, however, differ from these contributions by focusing on the impact of aggregate employment growth on firm level job creation rates rather than on adjustment costs as Nilsen and Schiantarelli (2003) and by considering job creation rates rather than sales growth as Higson *et al.* (2002; 2004) and Döpke *et al.* (2005). In addition we use a large unbalanced dataset that covers the universe of private sector firms which registered at least one dependent employee in the years from 1975 to 2004 with the Austrian Social Security System. This makes a significant difference to previous studies since the broad coverage of firms makes our evidence quite general: We can explicitly consider firm entry and exit and in contrast to Higson *et al.* (2002; 2004) and Döpke *et al.* (2005) our findings are not limited to (larger) publicly traded firms. This is important in the light of the results obtained by Davis *et al.* (2007), which suggest that a substantial difference in the volatility and dispersion of firm growth rates for privately held and publicly traded firms.

2. SHOCKS AND AGGREGATE AND FIRM-LEVEL EMPLOYMENT GROWTH

The starting point of our analysis is the simple analytic framework provided by Higson *et al.* (2002). Firms are assumed to produce output according to a standard constant elasticity of scale production function in a stochastic environment, where firms are subject to a firm-specific and and an aggregate shock. The overall shock experienced by firm i in period t is thus:

$$\xi_{it} = \beta_i \eta_t + \varepsilon_{it}, \qquad (1)$$

where ε_{it} is the firm-specific shock, η_t the aggregate shock and β_i is the individual response of firm i to the aggregate shock.[1] From equation (1) aggregate shocks may have different impacts on different firms as captured by β_i. One possibility explored below is that there are systematic differences in the response to the aggregate shock by small and large firms. For example, large firms may decline faster in downturns. A second possibility we consider is that growth responses of firms to an aggregate shocks depend on their position in the growth rates distribution. For example, fast growing firms may be less affected by a recession than firms with average growth rates.

[1] Identification of the aggregate shock requires orthogonality of shocks. This would contradict theoretical models which propose mechanisms generating macroeconomic shocks from purely microeconomic causes Jovanovic (1987), Bak *et al.* (1993), Nirei (2006),Gabaix (2008). we refrain from explicitly identifying different types of shock.

Considering employment growth we, however, cannot translate these shocks directly into firm level employment growth, as a by now substantial literature (Hammermesh, 1989; Varejao and Portugal, 2007) shows that due to adjustment costs a large number of firms does not adjust employment at a given point in time. In line with Caballero *et al.* (1997) we thus assume that at each point in time each firm in our sample can be characterized by a measure of labor shortage z_{it}, which is defined as the difference between the desired number of workers in a frictionless economy ($e*_{it}$) and the actual employment stock (e_{it}) (i.e. $z_{it} = e*(\xi_{it}) - e(\xi_{it})$). As shown by Caballero and Engel (1993) in this case the optimal adjustment strategy of a firm consists of either adjusting employment completely (by z_{it}) if adjustment costs are smaller than the opportunity costs of not adjusting or not adjusting at all. Thus to present a complete description of firms' adjustment behavior over the business cycle we consider both the share of firms adjusting as well as the size of adjustment of those firm that do adjust.

3. DATA AND MEASUREMENT

We use data from the Austrian Social Security Database (ASSD). This is an administrative data set which includes records for all employees in Austria and has been widely used in labor market and industrial organization literature (see (Winter, 2003; Boheim, 2006; Kaniovski and Peneder, 2008)for applications and (Hofer and Winter, 2003)for a description). The data represent a daily calender of employment relationships between individuals and firms and, thus, allow for each point in time to calculate the (overall) number of employees in a firm for the time period from the 4th quarter of 1974 to the 4th quarter of 2004. This is an interesting period of time in Austrian economic history because of the unprecedented internationalization on account of opening of Central and Eastern Europe and European integration as well as the substantial institutional reforms Austria experienced in this time period. We focus on quarterly micro-data to avoid excess smoothing through temporal aggregation (Hammermesh, 1993; Varejao and Portugal, 2007).

However, we also report results for annual data as a robustness check. Compared to other data sets ours has the advantage of a wide coverage. We have available information on all business units for the Austrian private sector starting from the size of one employee. This comes at the price of limited information on firms. We lack all information on firms other than employment, industry affiliation and region of operation. It is also not entirely clear whether the business units reporting are enterprises or establishments, since the anonymous firm numbers in the social security files identify administrative accounts. It is left to discretion of the individual firm whether it chooses to report at the enterprise or establishment level (or a mixture of both). However, Stiglbauer (2003) argues that the majority of data will be on the enterprise level, since firms reduce their administrative burdens when reporting social security contributions at enterprise level.

We measure firm level employment growth by the job creation rate as proposed by Davis *et al.* (1996): $JCR_{it} = (E_{it} - E_{it-1})/AVE_{it}$, with JCR_{it} the job creation rate of firm i in period t, E_{it} the employment level and AVE_{it} average employment, which is also used as the definition of firm size, and is defined as $AVE_{it} = (E_{it} + E_{it-1})/2$. This measure has the advantage that growth rates of employment are defined even for firms which have no employees at the beginning or the end of a period Davis *et al.* (1996) Firms which had no employees at the beginning of a period (i.e. entries) have a job creation rate of 2 and firms that have no employees at the end of the period (i.e. exits) have a job creation rate of -2. Furthermore, in contrast to conventional growth rates that have a support in the interval $[-1,\infty)$ job creation rates have a support in the interval $[-2,2]$. The resulting distribution is symmetric and not distorted as the standard growth rate distribution by the asymmetry of the distribution due to a few fast growing firms. One disadvantage of this measurement of employment growth, however, is that firm start-ups and closures are associated with extremely high growth rates, which may affect inference and conclusions (Foote, 2007). Therefore we also consider a growth rate distribution which excludes entry and exit, and a weighted job creation rate distribution, where the job creation rate is weighted by firm size.

Table-1. Descriptive Statistics for job creation and destruction rates by year

	ShareofFirms(in%)					**Descriptive Statistics of unweighted Job Creation Rate**							
						Incl Excl. Entry & Exit				**Excl. Entry & Exit**			
	Entry	Exit	Groth	Decline	Inactive	Mean	S.D.	Skew	Kurt	Mean	S.D.	Skew	Kurt
1975	8.6	9.0	25.6	24.6	49.8	-0.00	0.88	-0.04	4.85	0.01	0.28	-0.24	9.85
1976	9.8	9.3	27.6	23.7	48.8	0.02	0.91	-0.02	4.55	0.02	0.28	-0.20	10.40
1977	9.0	8.5	27.8	22.5	49.7	0.02	0.87	-0.02	4.89	0.02	0.28	-0.20	10.26
1978	8.4	8.4	26.4	23.3	50.3	0.01	0.86	-0.04	5.07	0.01	0.28	-0.26	10.61
1979	8.8	8.8	26.5	24.1	49.4	0.01	0.88	-0.03	4.87	0.01	0.28	-0.35	10.66
1980	8.9	9.0	26.6	24.8	48.6	0.00	0.89	-0.03	4.76	0.01	0.28	-0.35	10.32
1981	8.7	9.2	26.3	25.3	48.4	-0.01	0.88	-0.04	4.77	0.00	0.28	-0.35	10.27
1982	8.4	9.4	25.1	26.5	48.5	-0.02	0.88	-0.05	4.80	-0.00	0.28	-0.40	10.24
1983	8.5	9.2	24.9	26.4	48.8	-0.02	0.88	-0.04	4.82	-0.00	0.28	-0.38	10.34
1984	8.6	9.2	25.8	25.7	48.5	-0.01	0.88	-0.04	4.82	0.00	0.28	-0.28	10.08
1985	8.7	9.3	25.8	26.0	48.2	-0.01	0.89	-0.03	4.76	-0.00	0.28	-0.26	9.90
1986	8.8	9.4	26.3	26.1	47.6	-0.01	0.89	-0.03	4.72	-0.00	0.28	-0.29	9.75
1987	8.9	9.3	26.4	26.1	47.6	-0.01	0.89	-0.02	4.69	-0.00	0.29	-0.30	9.74
1988	9.3	9.3	27.8	25.3	46.9	0.01	0.90	-0.02	4.59	0.01	0.29	-0.21	9.85
1989	9.8	9.4	28.1	25.9	46.0	0.01	0.92	0.00	4.45	0.00	0.29	-0.18	9.53
1990	9.9	9.4	29.6	25.2	45.2	0.02	0.92	-0.02	4.41	0.01	0.30	-0.16	9.19
1991	10.2	9.3	30.7	25.0	44.3	0.03	0.92	-0.01	4.37	0.02	0.31	-0.12	8.94
1992	9.9	9.6	29.2	26.5	44.3	0.01	0.92	-0.01	4.38	0.01	0.30	-0.13	9.05
1993	9.9	9.7	28.0	27.8	44.2	0.00	0.93	0.00	4.32	-0.00	0.31	-0.29	9.30
1994	10.1	10.1	28.2	27.8	44.0	0.00	0.94	-0.01	4.22	0.00	0.31	-0.28	9.50
1995	10.1	10.1	27.6	28.4	44.0	-0.01	0.94	0.01	4.22	-0.01	0.31	-0.31	9.52
1996	10.2	10.0	28.0	28.1	44.0	0.00	0.94	0.01	4.22	-0.00	0.31	-0.31	9.21
1997	10.7	10.6	28.1	28.5	43.4	-0.00	0.96	0.00	4.04	-0.00	0.31	-0.23	9.15
1998	11.6	11.2	29.5	28.1	42.4	0.01	0.99	-0.00	3.81	0.00	0.31	-0.19	9.14
1999	11.3	11.2	29.3	28.2	42.5	0.00	0.99	-0.01	3.85	0.00	0.31	-0.17	9.29
2000	11.2	11.2	29.5	28.4	42.1	0.00	0.99	-0.01	3.85	0.00	0.32	-0.15	8.91
2001	13.2	13.1	30.9	29.5	39.5	0.01	1.06	-0.01	3.37	0.00	0.32	-0.21	9.20
2002	10.7	11.4	28.7	29.0	42.4	-0.01	0.98	-0.02	3.89	0.00	0.32	-0.17	9.00
2003	10.7	11.2	28.4	28.8	42.8	-0.01	0.98	-0.01	3.94	-0.00	0.31	-0.22	9.17
2004	11.0	11.3	29.1	28.0	42.9	-0.00	0.98	-0.02	3.88	0.00	0.31	-0.18	9.66

Notes: Table displays values for the second quarter of each year. Entry=firms without employment at beginning of period. Exit=firms without employment at end of period. S.D.=standard deviation, Kurt=Kurtosis, Skew=skewness.

3.1. Descriptive Statistics and the Job Creation Distribution

As amply documented in previous research (Coad and Hölzl, 2009; Huber and Pfaffermayer, 2010) most of the 170.000 to 190.000 firms registered each year in our data are small. Over a quarter of them have only one employee and only around 1% have more than 150 employees at any point in time. Average firm sizes are larger in 2004 than in 1974 (the average firm size was 10.7 employees in 1974 and increased to 12.3 in 2004) and median firm sizes increased from 2 employees to 3.Table 1 reports summary statistics on the distribution of annual job creation rates. It displays the familiar pattern of a tri-polar distribution with three spikes located at the growth rates of -2, 0, and 2, associated with exit, inactivity and entry, respectively. The patterns show a remarkable similarity between annual and quarterly data. Between 60% and 65% of the firms do not adjust employment within a quarter and over a year this applies to 40% to 50%. In addition 3% to 7% of the firms end or begin a quarter with no employees (9% to 11% in annual data). This confirms that employment changes are lumpy and rare and that no change in employment as well as entry and exit are fequent phenomena in this distribution.

Table-2. Descriptive Statistics of different Job Creation Rate Distributions: Quarterly data

		Mean		Std. Dev.		Skewness		Kurtosis	
		Av.	S.D.	Av.	S.D.	Av.	S.D	Av.	S.D
(a) including	Unweighted	-0.001	0.06	0.665	0.06	-0.005	0.38	82.541	16.00
entry and exit	firm size weigted	0.043	0.03	0.284	0.05	44.425	0.74	348.042	120.00
(b) excluding	Unweighted	0.000	0.02	0.252	0.03	-0.176	0.81	151.375	14.52
entry and exit	firm size weigted	0.019	0.02	0.192	0.04	23.214	11.37	315.373	77.28

Notes: Table reports the mean and standard deviation across years. Av.=average, S.D. = Standard debiation

The moments of the annual growth rate distribution (see table one for annual data and table 2 for descriptive statistics on the quarterly data). The unweighted cross-sectional distribution is slightly left skewed - especially if we exclude entries and exits - while the weighted job creation rate distribution is right skewed and both weighted and the unweighted distributions are leptokurtic. At any point in time, therefore there was a larger number of (mostly small) firms with growth rates below the mean and a smaller number of (larger) firms with growth rates above the mean and - even when excluding entries and exits - each year there were larger numbers of very rapidly growing and declining firms than would be expected from a normal distribution. Thus the moments of the job creation rate distribution are remarkably stable over time. This connects well with the recent literature on the distribution of growth rates in the industrial organization and econophysics literature, which emphasizes the relative invariance of the growth rate distribution over time but also the invariance to disaggregation that does not hold for the firm size distribution (Stanley *et al.*, 1996; Bottazzi and Secchi, 2006; Dosi, 2007).

3.2. Long-run Trends

Despite this stable shape of the job creation rate distribution there is also substantial variance in the higher order moments. In particular figure 1 and the trend regression results in table 3 suggest some interesting long run trends. The share of firms entering and exiting the market and to a lesser degree of those growing and declining has steadily increased in the period from 1975 to 2004 at the expense of a decline in the share of inactive firms. In 1975 the share of inactive firms in the economy was - using quarterly data - at a level well above 60% and exit and entries were at around 4%. By 2004 the share of inactive firms had declined to well below 60%, while the share of entries and exits exceeded 6%. This suggests that the substantial globalisation experienced by the Austrian economy in this period as well as the institutional reforms have made firm level developments increasingly volatile. Similarly, in all versions of the distribution considered in table 3 a significant negative trend is found for the kurtosis and a significant positive trend for the standard deviation. Thus the distribution has become increasingly dispersed but less leptokurtic over time. For the skewness and the mean, by contrast, we observe significant trends only for the annual job creation rate distribution. Here the weighted growth rate distribution exhibits increasing mean job creation rates and decreasing skewness, while the unweighted growth rate distributions are characterized by a decreasing mean (which is however statistically significant only when excluding entry and exit) and a positive trend coefficient on the skewness.

Table-3. Results of trend regressions for quarterly and annual data

	Quarterly Data			**Annual Data**		
	Shares of firms					
Entry	0.016*** (0.0004)			0.1097*** (0.0135)		
Exit	0.016*** (0.0003)			0.1055*** (0.0113)		
Growing	0.013*** (0.0013)			0.1293*** (0.0242)		
Declining	0.016*** (0.0013			0.1899*** (0.017)		
Inactive	-0.061*** (0.0018			-0.3192*** (0.0187)		
	Growth rate distribution					
	unweighted	weighted	unweighted (excl. entry &exit)	unweighted	weighted	unweighted (excl. entry &exit)
Mean	0.000 (0.0002)	0.000 (0.0002)	0.000 (0.0001)	-0.0001 (0.0003)	0.0016*** (0.0005)	-0.0003** (0.0001)
Std.Dev.	0.001*** (0.0001)	0.001*** (0.0001)	0.0005*** (0.0001)	0.0049*** (0.0005)	0.0031*** (0.0008)	0.0017*** (0.0001)
Skew	0.0003 (0.0001)	-0.0003 (0.001)	-0.0002 (0.0028)	0.0012*** (0.0002	-0.0239*** (0.0052)	0.0038*** (0.0015)
Kurt	-0.005*** (0.0001)	-0.026*** (0.0036)	-0.0286*** (0.0021)	-0.0444*** (0.0036)	-0.2454*** (0.0501)	-0.0509*** (0.0064)

Notes: Table reports coefficients β of regressions $y = \alpha + \beta t + \eta$ with y the respective indicator at time t, and t a trend term. S.D.=standard deviation, Kurt=Kurtosis, Skew=skewness. Values in brackets are standard error of the estimate. Entry=firms without employment at beginning of period. Exit=firms without employment at end of period. *** (**) (*) report significance at the 1% (10%) (5%) level, respectively

4. THE JOB CREATION RATE DISTRIBUTION OVER THE BUSINESS CYCLE

The main concern of this paper is with cyclical changes, however. Thus given the evidence of both seasonality and long run trends, we detrend and deseasonalise our data using the Baxter and King (1999) band pass filter allowing for an upper bound of 32 quarters and a lower bound of 6 quarters with a truncation of 12 leads and lags for quarterly data. For annual data we use an upper bound of 8 years, a lower bound of 2 years and 3 leads and lags. Table 4 reports standard deviations of the indicators and cross correlations of the filtered series with filtered aggregate employment growth as an indicator series for the state of the business cycle. The standard deviation of the cyclical component of all indicators considered is larger than that of aggregate employment. This underlines the importance of cyclical variation for both the share of adjusting firms as well as the moments of the growth distribution over the business cycle.

In addition, both in annual as well as quarterly data the share of growing firms is strongly pro-cyclical, while the share of entries is weakly pro-cyclical. Firm entry lags behind aggregate employment growth by up to 3 quarters. The share of declining firms, by contrast, is countercyclical and firm exit is insignificantly correlated with aggregate employment growth. Also in quarterly data the pro-cyclicality of the share of growing firms is stronger than the counter-cyclicality of the share of declining firms, so that the share of inactive firms is also countercyclical and leads aggregate employment growth by one quarter. This corroborates results by Davis and Haltiwanger (1999), who also find some cyclical asymmetry between job creation and job destruction and suggests that in times of high employment growth a larger share of firms changes employment levels than in times of slow employment growth. When considering the job creation rate distribution, as expected, the cyclical component of the mean of the job creation rate is positively correlated with cyclical component of aggregate employment growth for all variants of the job creation rate distribution considered. Results for the higher order moments, however, depend more strongly on which of the versions of the job creation rate distribution consideres. When considering the unweighted job creation rate distribution including entry and exit, aside from a small significant pro-cyclical effect on its kurtosis, which is likely to be related with the pro-cyclicality of firm entry, the higher order moments of the job creation rate distribution remain insignificantly correlated with aggregate employment growth. Thus in this case the large share of entries and exits (of in particular small firms) makes it difficult to identify any cyclical changes in the higher moments of the job creation rate distribution. Considering the unweighted job creation rate distribution excluding entry and exit, however, the distribution is also significantly less left skewed in upturns, while its variance increases with little effect on its kurtosis. When giving firms of all sizes equal weight, firms located at the left of the growth rate distribution (i.e firms with low growth rates) are therefore less numerous in upturns but more numerous in downturns. This pattern is able to generate a countercyclical standard deviation and is suggested also by the cyclical behavior of the shares of growing and declining firms. Finally, the pattern for the firm size weighted job creation rate distribution is similar to that of the unweighted distribution excluding entry and exit with the exception of the pro-cyclical kurtosis. This suggest that here too firms located at the left of the growth rate distribution (i.e firms with very low or negative growth rates) are less numerous in upturns and thus react more strongly to the aggregate dynamics. These results, however, also suggest that when giving more weight to large firms, the tails of the job creation rate distribution (i.e. both fast and slow growing firms) are more sensitive to the cyclical variation

Table-4. Correlation results of cyclical component with the cyclical component of aggregate employment growth.

	Quarterly Data										Annual Data	
	S.D.	**Lead and Lags in Quarters**									**S. D.**	**Lag**
		-4	-3	-2	-1	0	1	2	3	4		0
Share Entry	0.058	-0.05	-0.05	-0.04	0.05	0.20	0.26	0.32	0.36	0.33	0.366	0.17
Share Exit	0.039	0.12	0.02	-0.08	-0.13	-0.13	-0.13	-0.11	-0.07	-0.04	0.300	0.00
Share Gr.	0.205	-0.05	0.10	0.33	0.54	0.66	0.64	0.52	0.32	0.12	0.520	0.58
Share Decl.	0.190	0.48	0.32	0.08	-0.20	-0.42	-0.51	-0.50	-0.41	-0.31	0.364	-0.58
Share Inact.	0.165	-0.11	-0.15	-0.21	-0.28	-0.24	-0.17	-0.10	-0.02	0.09	0.497	-0.18
	Growth rate Distribution											
	Unweighted											
Mean	0.003	0.04	0.02	-0.25	-0.09	0.35	0.32	0.01	0.07	0.32	0.005	0.54
Std. Dev.	0.006	-0.01	0.07	0.00	-0.16	-0.09	0.06	0.04	-0.08	-0.01	0.013	0.11
Skewness	0.057	0.04	0.02	-0.13	-0.17	-0.07	-0.05	-0.09	-0.05	0.02	0.005	-0.06
Kurtosis	0.096	0.04	-0.05	0.04	0.25	0.14	-0.13	-0.13	0.09	0.06	0.093	-0.15
	Firm size weighted											
Mean	0.002	-0.02	0.04	0.00	0.20	0.52	0.52	0.28	0.25	0.36	0.016	0.18
Std. Dev.	0.006	-0.13	-0.13	-0.29	-0.42	-0.28	-0.04	-0.01	-0.03	0.13	0.028	-0.12
Skewness	0.106	0.16	0.16	0.33	0.42	0.18	-0.07	-0.05	0.01	-0.14	0.170	0.10
Kurtosis	1.249	0.22	0.26	0.36	0.46	0.34	0.10	0.02	0.04	-0.05	1.563	0.08
	Unweighted excluding Entry and Exit											
Mean	0.001	-0.05	-0.08	-0.14	0.25	0.70	0.56	0.22	0.28	0.44	0.003	0.60
Std. Dev.	0.002	0.04	-0.03	-0.26	-0.50	-0.43	-0.19	-0.13	-0.17	-0.03	0.001	0.02
Skewness	0.036	0.06	0.15	-0.06	0.11	0.62	0.66	0.25	0.16	0.37	0.032	0.83
Kurtosis	0.172	-0.25	-0.10	0.06	0.12	0.07	0.00	-0.03	-0.04	-0.05	0.127	-0.35
Agg. Empl.	0.002	0.14	0.21	0.31	0.71	1.00	0.71	0.31	0.21	0.14	0.004	1.00

Notes: The table reports correlation for detrended and deseasonalized series (using the Baxter-King filter) with the cyclical component of aggregate employment growth. Entry=firms without employment at beginning of period. Exit=firms without employment at end of period. Coefficients are significant at 5% level for a value of 0.2 (quarterly data) and 0.4 (annual data)

5. FIRM HETEROGENEITY

Given this evidence a natural question to ask is to what degree trends and cyclical characteristics of job creation rates differ for firms of different sizes. The adjustment cost literature (Hammermesh, 1989; Varejao and Portugal, 2007) finds that smaller firms do not adjust their employment as often as larger firms. This is also confirmed in our data. The share of adjusting firms is increasing in firm size. On average over 70% of the firms with an average firm size of between 0 and 5 employees do not change their employment over a quarter, only 1% of the firms with more than 500 employees do not. Furthermore, the higher non-adjustment probability of small firms arises even though most newly entering and exiting firms are small. On average around 7%

of the firms of the size of between 0 to 5 employees in our sample enter or exit the market over a quarter. For large firms with more than 500 employees this share is below 0.1%.

Table-5. Trend in Adjustment Probability by Firm size

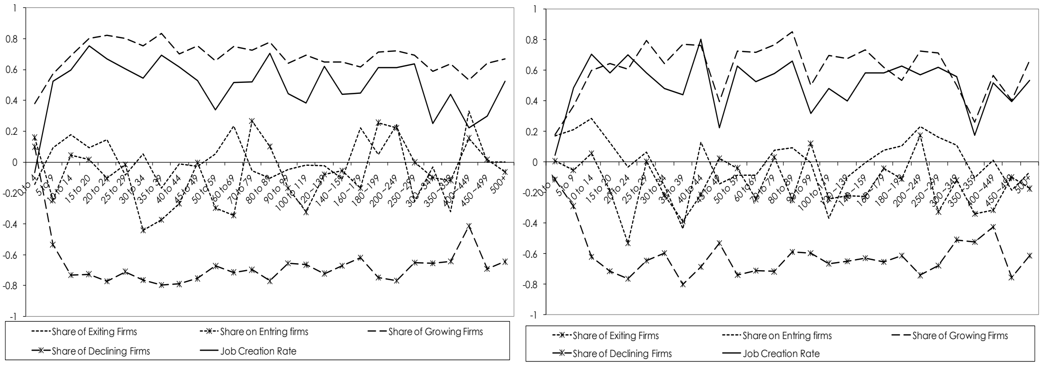
	Inactive		Exit		Entry		Growing		Declining	
	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.	Coeff	S.E.
0-4	-0.075	0.003**	0.024	0.001**	0.025	0.001**	0.010	0.001**	0.015	0.002**
5-9	-0.011	0.002**	0.003	0.000**	0.002	0.000**	-0.003	-0.002	0.008	0.002**
10-14	0.015	0.002**	0.002	0.000**	0.001	0.000*	-0.009	0.003**	-0.009	0.002**
15-20	0.017	0.002**	0.002	0.000**	0.001	0.000**	-0.007	0.003*	-0.013	0.003**
20-24	0.02	0.002**	0.002	0.000**	0.001	0.000**	-0.008	0.004	-0.015	0.003**
25-29	0.013	0.003**	0.001	0.000**	0.001	0.000*	-0.003	0.005	-0.013	0.004**
30-34	0.02	0.003**	0.001	0.000**	0.001	0.000**	-0.008	0.006	-0.015	0.005**
35-39	0.021	0.003**	0.002	0.000**	0.001	0.000*	-0.004	0.006	-0.021	0.006**
40-44	0.016	0.004**	0.001	0.000**	0.002	0.000**	-0.002	0.007	-0.017	0.006**
45-49	0.012	0.003**	0.001	0.000**	0.002	0.000**	0.001	0.007	-0.016	0.007*
50-59	0.016	0.003**	0.001	0.000**	0.001	0.000**	0.003	0.006	-0.021	0.006**
60-69	0.018	0.003**	0.001	0.000**	0.001	0.000*	-0.002	0.007	-0.018	0.007*
70-79	0.019	0.003**	0.001	0.000**	0.002	0.000**	-0.007	0.008	-0.016	0.008
80-89	0.01	0.004*	0.001	0.000**	0.002	0.001**	-0.002	0.008	-0.011	0.008
90-99	0.017	0.004**	0.001	0.000**	0.003	0.001**	0.005	0.010	-0.025	0.009**
100-119	0.017	0.003**	0.00	0.000	0.002	0.000**	0.003	0.009	-0.022	0.009*
120-139	0.013	0.004**	0.000	0.000	0.002	0.000**	0.003	0.010	-0.018	0.011
140-159	0.003	0.004	0.001	0.000	0.002	0.001**	0.009	0.010	-0.015	0.010
160-179	0.006	0.004	0.000	0.000	0.003	0.001**	0.007	0.013	-0.016	0.012
180-199	0.013	0.004**	0.000	0.000	0.002	0.001**	-0.009	0.013	-0.006	0.013
200-249	0.003	0.003	0.000	0.000*	0.002	0.001**	0.025	0.012*	-0.031	0.011**
250-299	-0.004	0.004	0.000	0.000	0.003	0.001**	0.03	0.012*	-0.029	0.012*
300-349	0.009	0.004*	0.000	0.000	0.001	0.001	0.039	0.015*	-0.051	0.015**
350-359	-0.002	0.005	0.000	0.000	0.001	0.001	0.048	0.015**	-0.046	0.016**
400-449	-0.005	0.006	-0.001	0.000	0.001	0.001	0.059	0.016**	-0.055	0.016**
450-499	-0.006	0.005	0.000	0.000	0.002	0.001*	0.017	0.019	-0.013	0.019
500+	-0.004	0.002	0.000	0.000	0.001	0.001	0.026	0.014	-0.023	0.014

Notes: Table reports coefficients β of regressions $y_t = \alpha + \beta t + \eta_t$ with y_t the respective indicator at time t, and t a trend term. Coeff= coefficient S.E. = standard error of estimate. Entry=firms without employment at beginning of period. Exit = firms without employment at end of period.*** (**) (*) = significant at the 1% (5%) (10%) level, respectively.

Running regressions of the share of inactive, exiting, entering, growing and declining firms on a trend term for each of the size groups considered (see table 5 for results) indicates that the downward trend in the aggregate share of inactive firms is primarily due to a reduction of the share of inactive small firms over time. Small firms (up to 10 employees) are the only ones that show a significant negative trend in the share of inactive firms. These firms, however, account for around 70% of all firms and hence drive the aggregate picture. Similarly, the increase in entry and exit affected the smaller size classes, only. Small firms with less than 5 employees have by far the largest trend coefficient for the share of entering firms and trend coefficients are statistically insignificant for all size classes covering firms with more than 300 employees. Evidence for trends in the share of growing and declining firms also suggests a positive trend for the smallest firms (with up to 5 employees), but a significantly negative trend for larger firms (with 200 to 450 employees). Thus once more the upward trends in adjustment frequency as well as entry and exit found in aggregate data is primarily due to increased adjustment frequencies of small firms.

Figure-1. Cyclical Response of Employment Adjustment by firm size

Annual Data | Quarterly Data



Note: Figure shows correlation of the cyclical component of aggregate employment with the respective indicator for the each size group, coefficients are significant at the 5% level for a of 0.2 (quarterly data) and 0.4 (annual data). Entering firms = firms without employment at beginning of period. Exiting firms=firms without employment at end of period.

Also the shares of entering and exiting firms are only weakly correlated with aggregate employment growth for all firm size groups (figure 1). Thus there are no statistically significant and economically relevant differences regarding the cyclicality of entry and exit across size classes.

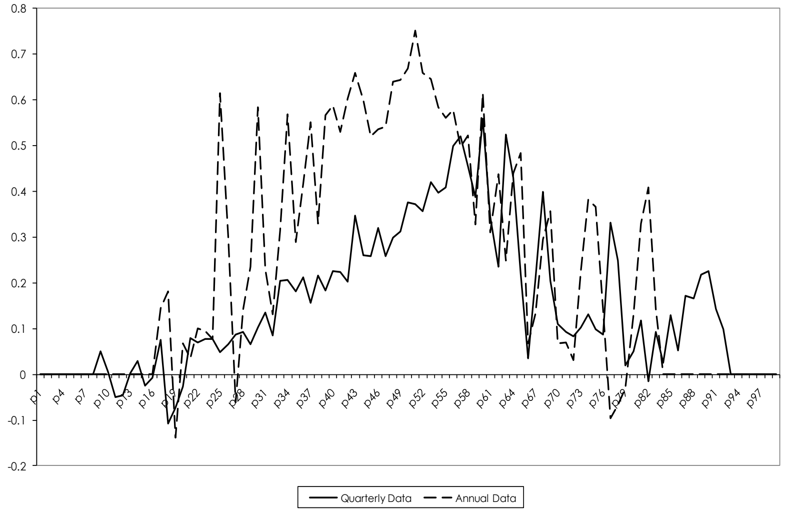
There are, however, such differences in the cyclical behavior of of the share of declining and growing firms. The correlation coefficient is statistically significant for all size groups except the smallest firms (between 0 and 10 employees). This is consistent with adjustment cost models assuming size dependent adjustment costs in employment adjustment. The correlation coefficient for the job creation rate is also statistically significant for all size groups except for the very smallest firms, but falls slightly in firm size for firms with more than 10 employees. The smallest firms in the economy therefore follow aggregate employment fluctuations to a much lower degree than large firms.

Since the most extreme forms of job creation and destruction (i.e. entry and and exit) are less responsive to the business cycle and the kurtosis to the cyclical component of aggregate growth for the unweighted growth rate distribution suggests that firms at the extremes of the job creation rate distribution react less strongly to the business cycle, we follow Higson et al. (2002; 2004) in considering the individual percentiles of the job creation rate distribution.[2] These correlation coefficients (see figure 2) show that the growth rate of firms with extreme growth events (both

[2] For this we proceed as follows: For each time period considered we sort observations by job creation rates and calculate percentiles of the distribution. Then we correlate each of the resulting time series of percentiles of the job creation rates with aggregate employment growth rates.

expansion and decline) is only weakly correlated with the business cycle, while growth rates of firms in the middle ranges of the job creation rate distribution are most strongly associated with business cycle fluctuations. Our findings thus extend those of Higson *et al.* (2002; 2004) and Döpke *et al.* (2005) to employment growth. This suggests that extreme growth events are driven primarily by firm-specific shocks, while averagely growing firms contribute most to aggregate employment changes.

Figure-2. Cyclical Response of Employment Adjustment by growth percentiles



Note: Figure shows correlation of the cyclical component of aggregate employment with the respective indicator for percentiles of the distribution, coefficients are significant at 5% level for a value of 0.2 (quarterly data) and 0.4 (annual data)

6. PARAMETRIC ANALYSIS

In order to corroborate these findings we estimate an econometric model of the determinants of the adjustment hazard and size of adjustment at the firm level. The primary goal is to assess the robustness of our findings by providing more rigorous complementary evidence. When moving to the firm level we have to take into account the potential selection problem associated with a firm's decision to adjust employment or not. Therefore we implement a two-step selection model proposed by Nilsen *et al.* (2007) in a similar setting. The first step provides an estimate of the adjustment probability while the second step focuses on adjustment size. In the first step we estimate an ordered probit selection equation which excludes all entering and closing firms[3] but allows us to differentiate between inactive, growing and declining firms. In the second step - to account for potential asymmetries between firms with increasing or decreasing employment - we differentiate between positive and negative job creation rates and control for selection.

[3] These are excluded because for them some important dependent variables (e.g age and frequency of moves) are undefined.

6.1. Adjustment Probability

In the first step we include (the log of the) contemporaneous aggregate employment growth and (since descriptive evidence suggests differences in adjustment between different firm sizes) an interaction between the (log of) contemporaneous aggregate employment growth with log firm size and its square as covariates. In addition we include firm age and its square as well as (log) firm size and its square to control for effects of firm size and firm age on firm growth, and a set of (NACE 2 digit) industry dummies interacted with seasonal dummies, to account for industry specific growth and seasonality. The results with respect to aggregate employment growth in these estmiates (see table 5) suggest that for the smallest firms the probability of an upward movement is negatively correlated with aggregate employment growth (i.e. countercyclical), but increases with a decreasing rate as firm size increases. The total coefficient including the quadratic term of firm size, however, suggests that this negative impact applies only to firms with one employee. Starting from firm sizes of 2 employees onward the probability of an employment adjustment is increasingly positively correlated with aggregate employment changes for the relevant range of the firm size distribution. The coefficients on the control variables, by contrast, imply that younger and larger firms adjust employment more often than older and smaller firms. These effects are, however, not linear. The coefficient on the squared age suggests that the increase of upward adjustment probability declines with age with the turning point at an age of 81 years. By contrast the coefficient on log firm size squared suggests that from a firm size of 6 employees onwards larger firms start to have lower upward adjustment probabilities, which suggests that in general large firms grow less strongly than small firms after a size of 6 employees.

Table-6. Regression Results for ordered probit selection model

	Adjustment		**Adjustment Size**			
	Probability		**Growth**		**Decline**	
	Coef	S.E.	Coef	S.E.	Coef	S.E.
ln(agg.empl. growth)	-2.02***	0.06	1.65***	0.10	-1.57***	0.10
ln(agg. Empl. growth) *ln(firm size)	4.41***	0.02	-0.40**	0.09	0.38***	0.10
ln(agg. Empl. growth) *ln(firm size)^2	0.02***	0.01	0.42***	0.01	-0.39***	0.01
1000*age	-2.95***	0.03	-0.45***	0.02	0.18***	0.02
1000*age^2	0.018***	0.03				
100*Ln(firm size)	1.90***	0.01	-0.90***	0.10	-0.94***	0.10
100*ln(firm size)^2	-0.52***	0.01	1.87***	0.02	2.12***	0.02
100*Duration of non-adjustment			-0.07***	0.01	-0.49***	0.01
Frequency of moves			1.66***	0.02	1.70***	0.02
Frequency of moves^2			-4.93***	0.04	-5.13***	0.04
Frequency of moves^3			4.55***	0.02	4.77***	0.02
λ			0.20***	0.02	0.22***	0.02

Notes: NACE 2 Digit dummies interacted with seasonal dummies omitted, Coef= Coefficient, SE= standard error of the estimate. *** (**) (*) report significance at the 1% (10%) (5%) level, respectively

6.2. Size of Adjustment

The second step is estimated separately for positive and negative job creation rates including (log) contemporaneous aggregate employment growth and (log) aggregate employment growth interacted with log firm-size and its square as covariates. In order to control for the fact that firms with a lower adjustment frequency are likely to have larger adjustments we include an indicator for the frequency of moves of the firm[4], its square and cube as well as the time elapsed since the last adjustment period. The correction term for selectivity is denoted by λ. In addition we include the control variables firm age and firm size as well as (NACE 2 digit) industry dummies interacted with seasonal dummies that were also used in the first stage as controls. In order to identify the model we exclude age squared. Starting first with the coefficients for aggregate employment growth we see that (conditional on an upward expansion of employment) the size of upward adjustment is pro-cyclical (columns 2 and 3 of table 6). This pro-cyclicality is also increasing in firm size for all firms at an increasing rate. With respect to the size of a downward adjustment we also find clear counter-cyclicality for all firms, which is more pronounced for larger firms. The results for these variables are strongly asymmetric for upward and downward adjustments.

However, the coefficients are quite similar in absolute magnitude. Furthermore, the control variables suggest that firms that have not adjusted for a longer time period have a smaller adjustment size. Finally, firms that move more frequently also tend to have a larger adjustment size. Except for firm age the results are symmetric and of similar magnitude suggesting that the average expansion and decline of firms is governed by quite similar determinants. Older firms have - ceteris paribus - a larger downward adjustment size and smaller upward adjustment size. Overall these results confirm our earlier findings. The cyclical sensitivity of adjustment hazards and adjustment size are increasing in firm size..

7. CONCLUSIONS

Tracing the evolution of cross-sectional job creation rates for a large quarterly firm-level data set over the years 1975 to 2004 in Austria in line with previous studies shows that the shape and location of this distribution is remarkably stable over time. We are, however, also able to show that it is also characterized by important long-run trends and meaningful cyclical variation: The dispersion of job creation rates and the share of entry and exit as well as the share of adjusting firms increased over time while the kurtosis and the share of non-adjusting firms are characterized by a downward trend. This is in line with findings for other countries that have documented an increase in microeconomic volatility in the last decades (Comin and Mulani, 2006; Comin and Philippon, 2006) but adds to existing results with respect to entry, exit and non-adjustment and the other higher order moments of the job creation rate distribution.

With regard to the cyclical behavior of the job creation rate distribution the share of firms increasing employment is more strongly related to the business cycle than the share of firms

[4] This is the number of adjustments made by the firm relative to the number of periods for which this firm existed.

reducing employment, so that the share of firms adjusting employment is higher in times of rapid aggregate employment growth. Firm entry is weakly pro-cyclical, while firm exit is largely unrelated to the business cycle. In addition the higher order moments of the job creation distribution follow distinct cyclical patterns. The skewness and kurtosis of this distribution is pro-cyclical while the standard deviation is countercyclical, suggesting increased heterogeneity in firm level job creation behavior in upturns, and stronger effects of the business cycle on firms in the medium ranges of the job creation rate distribution.

Analyzing variations in the response to aggregate employment changes of firms of different sizes and growth performance, our descriptive as well as our econometric results clearly confirm that firm size is of great importance in explaining these stylized facts: We find that large firms adjust employment more frequently, which points to size dependent adjustment costs, and that the upward trend in the share of firms adjusting employment is primarily due to changes in the adjustment hazard of small firms. Furthermore, small firms and firms with different positions in the job creation rate distribution differ in their cyclical behavior. In particular adjustments of the smallest firms and firms at the extremes of the growth rate distribution are largely uncorrelated to aggregate employment fluctuations. In particular this last stylized facts corroborates previous results on the cyclical behavior of individual firms, that were based on smaller samples of firms and turnover data. It would therefore be interesting to see, whether these stylized facts also apply to other countries and indicators.

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