

On discrimination of women in the labor market and determinants of firm survival in Austria*

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Abstract

This study investigates the implications of discrimination of women in the labor market on firms' survival rates in Austria. According to Becker (1975)'s classical theory on employer discrimination, non-discriminatory employers hire more women, enjoy higher profits and survive longer than discriminatory employers. We test this proposition using matched employer-employee data from the Austrian Social Security Database and estimate semi-parametric hazard models. We find that firms that hire more women than their 3-digit industry average have a significantly higher survival rate.

Keywords: Firm survival, profitability, female employment, discrimination, matched employer-employee data

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1983, women earned on average a quarter less than men did. If differences in education, job position, and the like, are taken into account, women earned on average about 17 per cent less than men. For 1997, the mean wage gap, without accounting for observed differences, dropped from 25.5 per cent to 23.3 per cent of men's wages. Accounting for observable differences, the average difference in wages between men and women that cannot be explained was 14 per cent. Geisberger (2007) find that the gender wage gap in 2002 was still of about 26 per cent and once accounting for individual characteristics like education and experience and occupational segregation it is of about 19 percent. This evidence is based on workers' performance. Little is known how this changes firms' situation in the product market. Increased competition, for example from joining the EU (in 1995), should force firms that discriminate against women to exit an industry.

For our empirical analysis, we use matched employer-employee data from the Austrian Social Security Database, which contains detailed information on individual employment, unemployment and earnings histories, public pension contributions and allowances since 1972 plus basic employer information. We concentrate on newly founded firms that were active during the years between 1978 and 2002 and estimate semi-parametric hazard models. We measure discrimination by a firm's ratio of female to all workers with respect to their 3-digit industry average, and further control for firm size, firm growth, human capital, and industry-specific and time effects to account for industry-specific entry and exit rates, industry concentration and GDP growth.⁴

We are not the first to test Becker (1975)'s theory on employer discrimination. Several empirical studies provide evidence for the United States. Ashenfelter and Hannan (1986) investigate the effects of deregulation in the banking sector in the 1980-ties. They use cross section data of different markets and find a negative and statistically significant relation between market concentration and the share of female employment in each bank. Black and Strahan (2001) also investigate the banking sector, but use time series data. They find that male wages fell more than female wages after deregulation and that women's share of employment in managerial positions increased.

⁴See for example, Geroski, Mata and Portugal 2007.

2 Employer discrimination

In this section, we briefly review Becker (1975)'s model on employer discrimination. Assume, a wage-taking firm with a production function Y uses as its two only inputs the labor of men, M , and the labor of women, F . If employers have a taste for discrimination, they do not maximize their profits π , but their utility U so that

$$U(\pi, M, F) = p Y(M, F) - w_M M - w_F F - dF, \quad (1)$$

where p is the product price, w_M is the market wage for men, w_F is the market wage for women, and d is the discrimination coefficient capturing an employer's distaste to hire women. The product and labor market are perfectly competitive and employers are price takers. They maximize their utility (1) by choosing the number of male and female workers, i.e. M and F . In the short run, utility maximization therefore implies

$$MRP_M = p Y'_M(M, F) = w_M, \quad (2)$$

and

$$MRP_F = p Y'_F(M, F) = w_F + d, \quad (3)$$

where the marginal revenue product of male labor MRP_M is equal to the input price of male labor w_M , and the marginal revenue product of female labor MRP_F is equal to the input price of female labor w_F . Employers with prejudices act as if the price for hiring female workers F is equal to $w_F + d$ and employ female workers F if $w_M - w_F \geq d$, i.e. the male wage is higher than the implicit price of female labor.

Compared to employers with prejudices, non-discriminatory employers earn higher profits for two reasons. They hire more women until their value of the marginal product of labor is equal to their wage. They produce a given output at less cost as they choose a cost-minimizing input mix.

covariates and β is the vector of coefficients to be estimated. We use firm size, firm growth in the first year, human capital measured by mean age of employees, and industry-specific, time-specific and region-specific effects as covariates.

The Cox model is flexible with respect to the baseline hazard, but the impact of the covariates is assumed to be proportional to the baseline hazard. It allows a flexible estimation of the effects of the covariates with the survival chances of newly founded firms.

4 Data description

To estimate the Cox proportional hazard model, we use data from the Austrian social security database (ASSD) which covers all workers except tenured civil servants and self-employed since 1972. The data include daily information on employment and registered unemployment status, total annual earnings paid by each employer, and information on workers' and firms' characteristics like age, tenure, worker status, gender, marital status, industry, or firm size. The information in the administrative records is very precise, because it is mainly collected to verify pension claims. The limitations of the data are wages that are censored at the social security contribution limit and no information on working time.

For our analysis we concentrate on newly founded firms that were active, i.e. had at least one employed worker on the payroll, on any of four specific dates (February 10, May 10, August 10, and November 10) during the years between 1978 and 2002. Firms in the ASSD are identified by an employer identifier that is reported with every employment spell. We can however not distinguish between plants or establishments and firms. Firm birth dates are defined by the first quarter in which we observe the firm identifier. Firm closure dates are defined as the last quarter in which a firm has at least one worker on the payroll.

To obtain the sample of firms considered in our analysis, we apply following selection

firms. At the beginning of the observation period, there are 11 (all firms in the ASSD) and 7 (newly founded firms) white collar workers in per firm, and at the end of the observation period, there are 12 and 14 white collar workers per firm.

The median wage is increasing for both samples. The median wage in newly founded firms is higher than in all firms in the ASSD. The median female wage is also increasing in both samples. It is also higher in newly founded firms. Newly founded firms pay on average higher wages. However, as can be observed, the female median wage is smaller than the median wage indicating that women earn less men. As we cannot control for work time and do not control for human capital factors, the difference in wage between women and men might be caused by part time work, human capital endowment or by discrimination.

There are nearly no differences between all and newly founded firms with respect to the average age of workers. The percentage of firms with only women and the percentage of firms with only men are relatively constant over time for both samples. The numbers for firms with only women are different between all firms in the ASSD and newly founded firms. There are roughly the same for firms with only men. In the first sample, there are around 20% of firms with only women and around 11% of firms with only men. In the second sample, there are around 13% of firms with only women and around 13% of firms with only men. This indicates that segregation of women in newly founded firms has reduced.

Summary statistics for different industries are presented in Tables 2-6. Again, we divide the time span into five year periods. In all time periods, we observe differences in firm size, number and ratio of female workers, number of white collar workers, median wage, ratio of median wage, average worker age, percentage of only female and only male firms across industries. Most industries keep their relative position over the years. For example, the average firm size in personal and laundry services is with values between 8 and 9 employees per firm always the smallest across all industries. The largest average firm size we find either in metal manufacturing or health care. Also the ratio of female workers varies across industries but stays constant over time. Female and male workers segregate

region-specific fixed effects. In column (1), we report the results for all newly founded firms, in column (2) for all newly founded firms that enter in the first quarter. When we compare the estimation results in columns (1) and (2), we observe no differences with respect to the statistical significance and the signs of the estimated coefficients. There are some smaller differences in the magnitude of the estimated coefficients. For the further description of estimation results, we therefore concentrate on the results depicted in column (1) only.

Table 7 about here

The estimation results show that the estimated coefficient of the ratio of female workers relative to the 3-digit industry average is negative and significantly different from zero. This indicates that firms that hire more women than their 3-digit industry average have a significantly lower hazard to exit the market and therefore have a significantly higher survival rate. Or put differently, as we proxy discrimination with the ratio of female workers, firms that discriminate less survive longer. This interpretation however depends on the quality of the ratio of female workers as a proxy for discrimination.

We further find that larger firms and those that pay higher wages have a significantly higher survival rate. For both variables, we observe estimated coefficients that are negative and significantly different from zero. Like for the ratio of female workers, this indicates that firms' hazard to exit the market is lower and therefore firms' survival rate is higher. The results are as one would might expect. Larger firms have better opportunities to handle shocks in the economy and therefore survive longer. Firms that pay higher wages survive longer and they seem to be firms with higher profits as only such firms are able to pay their employees better. The mean age of employees in a firm has no effect on firm survival. The same is true of a firm's growth rate in the first year. The estimated quarter-, year-, industry-, and region-specific effects are significantly different from zero.

Table 8 presents further estimation results. There is a non negligible percentage of totally segregated firms. These firms either employ only women or only men. (See also Tables 1-6.) The magnitude and the sign of the estimated coefficient of the ratio of female workers

Our results are consistent with a couple of specifications.

Our results are consistent with Becker (1975)'s theory on employer discrimination. This is partly in contrast to Kawaguchi (2007), but in line with the empirical evidence for the United States by Ashenfelter and Hannan (1986), Black and Strahan (2001), Hellerstein, Neumark and Troske (2002), Black and Brainerd (2004). Our results however rely on the presumption that the ratio of female workers proxies well for discrimination. Future research includes the exploration of alternative explanations and the application of estimation techniques in line with Olley and Pakes (1996) and Levinson and Petrin (2003) to account for the endogeneity of the relative number of female workers and firms' unobserved productivity.

A Appendix: Tables and Figures

Table 1: Firm characteristics of Austrian firms per five years

Years	1978-1982		1983-1987		1988-1992		1993-1997		1998-2002	
Variable	All firms	Newly founded firms	All firms	Newly founded firms	All firms	Newly founded firms	All firms	Newly founded firms	All firms	Newly founded firms
Firm size	22.75 (179.5)	15.35 (38.2)	21.37 (169.2)	17.67 (52.5)	21.29 (155.4)	21.37 (95.1)	20.99 (156.9)	22.35 (82.5)	22.39 (147.7)	25.91 (90.5)
Number of women	9.21 (80.2)	6.26 (21.6)	8.81 (82.0)	7.02 (23.7)	8.93 (83.4)	7.91 (26.9)	9.04 (91.7)	8.51 (37.2)	9.82 (88.7)	10.21 (43.1)
Number of white collar workers	10.75 (113.9)	7.24 (23.0)	10.67 (118.1)	8.22 (26.7)	11.18 (116.7)	10.30 (39.9)	11.80 (126.1)	11.68 (50.6)	12.95 (118.5)	14.04 (60.0)
Median wage	670.51 (248.4)	743.12 (274.8)	848.18 (316.3)	898.17 (334.5)	1059.74 (399.2)	1129.79 (418.5)	1331.53 (503.3)	1420.26 (522.1)	1492.05 (590.5)	1581.07 (610.9)
Median female wage	550.71 (212.0)	594.13 (230.0)	707.9 (275.6)	734.70 (282.4)	895.34 (354.6)	944.49 (370.0)	1127.22 (452.4)	1196.3 (469.9)	1252.28 (525.2)	1329.04 (539.5)
Average worker age	34.50 (7.0)	33.24 (6.2)	34.45 (6.8)	33.49 (6.1)	34.91 (6.6)	34.07 (5.9)	36.06 (6.4)	35.48 (5.8)	37.19 (6.3)	36.72 (5.8)
Percentage of firms with only women	0.20 (0.4)	0.13 (0.3)	0.21 (0.4)	0.15 (0.4)	0.21 (0.4)	0.15 (0.4)	0.21 (0.4)	0.14 (0.3)	0.20 (0.4)	0.14 (0.3)
Percentage of firms with only men	0.12 (0.3)	0.12 (0.3)	0.13 (0.3)	0.12 (0.3)	0.13 (0.3)	0.11 (0.3)	0.13 (0.3)	0.11 (0.3)	0.13 (0.3)	0.11 (0.3)
Number of observations	1,430,159	74,140	1,508,584	163,319	1,603,052	259,309	1,654,460	335,807	1,624,614	346,684

Notes: Table 1 presents summary statistics for all Austrian firms in the ASSD.

Table 3: Firm characteristics of newly founded Austrian firms per industry from 1983-1987

Industry	Number of firms	Firm size	Number of women	Ratio of female workers	Number of white collar workers	Median wage	Median female wage	Ratio female wage	Average worker age	Percentage of firms with only women men	
Food and beverage manufacturing	7,384	13.55 (25.5)	5.63 (9.8)	0.50 (0.3)	4.28 (20.9)	-0.00 (0.3)	-0.06 (0.3)	0.82 (0.2)	33.52 (6.1)	0.08 (0.3)	0.07 (0.3)
Metal manufacturing		22.83 (56.7)	4.21 (13.9)	0.22 (0.2)	6.05 (15.5)	0.18 (0.3)	0.05 (0.4)	0.78 (0.3)	34.29 (5.6)	0.02 (0.2)	0.19 (0.4)
Furniture and related product manufacturing	6,598	16.57 (29.8)	3.72 (11.3)	0.22 (0.2)	3.58 (8.1)	0.02 (0.2)	-0.12 (0.4)	0.77 (0.3)	31.93 (5.82)	0.02 (0.1)	0.23 (0.4)
Auto and repair services, gasoline stations	9,838	19.16 (99.7)	2.84 (7.5)	0.22 (0.2)	6.21 (14.9)	0.08 (0.3)	0.03 (0.4)	0.22 (0.3)	31.86 (4.9)	0.02 (0.1)	0.19 (0.4)
Wholesale trade	22,197	16.12 (26.0)	6.19 (12.5)	0.40 (0.3)	10.07 (16.5)	0.20 (0.4)	0.14 (0.4)	0.83 (0.2)	34.8 (5.6)	0.07 (0.3)	0.11 (0.3)
Retail trade	28,614	12.51 (26.8)	6.73 (15.5)	0.62 (0.3)	8.29 (18.1)	-0.04 (0.3)	0.00 (0.3)	0.91 (0.2)	33.02 (6.1)	0.27 (0.4)	0.06 (0.2)
Ground passenger transportation	6,900	12.38 (15.5)	1.48 (2.4)	0.14 (0.2)	2.29 (3.8)	0.11 (0.4)	-0.01 (0.4)	0.79 (0.3)	35.08 (5.5)	0.02 (0.1)	0.36 (0.5)
Professional, scientific and technical services	15,445	12.59 (22.6)	5.50 (8.9)	0.52 (0.3)	7.82 (11.1)	0.08 (0.4)	0.07 (0.4)	0.87 (0.2)	33.02 (5.6)	0.18 (0.4)	0.10 (0.3)
Health care	4,835	20.76 (95.4)	15.75 (61.9)	0.84 (0.2)	15.41 (77.3)	-0.22 (0.4)	-0.08 (0.4)	0.97 (0.1)	31.23 (6.04)	0.50 (0.5)	0.02 (0.1)
Personal and laundry services	8,378	8.65 (9.5)	5.24 (7.6)	0.86 (0.2)	0.74 (1.7)	-0.31 (0.3)	-0.15 (0.3)	0.97 (0.1)	29.22 (6.6)	0.58 (0.5)	0.01 (0.1)
Other industries	46,675	25.12 (69.7)	10.28 (34.9)	0.42 (0.3)	10.91 (36.1)	0.09 (0.4)	0.06 (0.4)	0.84 (0.2)	34.49 (6.1)	0.09 (0.3)	0.11 (0.3)

Notes: Table 3 presents summary statistics for newly founded Austrian firms per industry from 1983-1987 in the ASSD.

Table 5: Firm characteristics of newly founded Austrian firms per industry from 1993-1997

Industry	Number of firms	Firm size	Number of women	Ratio of female workers	Number of white collar workers	Median wage	Median female wage	Ratio female wage	Average worker age	Percentage of firms with only women	Percentage of firms with only men
Food and beverage manufacturing	11,841	19.97 (40.0)	7.98 (15.7)	0.49 (0.3)	6.08 (19.0)	-0.04 (0.3)	-0.10 (0.3)	0.83 (0.2)	35.61 (5.5)	0.10 (0.3)	0.08 (0.3)
Metal manufacturing	13,128	26.31 (48.5)	4.56 (12.6)	0.18 (0.2)	7.60 (16.7)	0.21 (0.3)	0.09 (0.4)	0.79 (0.3)	35.76 (5.3)	0.01 (0.1)	0.19 (0.4)
Furniture and related product manufacturing	10,499	21.46 (49.6)	5.05 (14.7)	0.21 (0.2)	5.24 (13.1)	0.01 (0.2)	-0.12 (0.4)	0.78 (0.3)	33.82 (5.6)	0.02 (0.2)	0.25 (0.4)
Auto and repair services, gasoline stations	19,888	17.13 (27.9)	3.12 (5.5)	0.24 (0.2)	7.23 (15.6)	0.07 (0.3)	0.04 (0.4)	0.86 (0.3)	34.43 (5.1)	0.02 (0.1)	0.15 (0.4)
Wholesale trade	42,608	20.44 (37.3)	8.12 (20.8)	0.39 (0.3)	13.39 (25.7)	0.18 (0.4)	0.15 (0.4)	0.85 (0.2)	36.57 (5.6)	0.06 (0.3)	0.10 (0.3)
Retail trade	54,885	16.56 (42.2)	9.74 (29.8)	0.62 (0.3)	12.06 (34.0)	-0.04 (0.4)	0.01 (0.4)	0.92 (0.2)	35.24 (5.8)	0.27 (0.4)	0.06 (0.2)
Ground passenger transportation	16,632	16.90 (49.4)	2.07 (4.9)	0.14 (0.2)	3.62 (12.2)	0.04 (0.4)	-0.05 (0.5)	0.81 (0.3)	36.95 (5.4)	0.01 (0.1)	0.34 (0.5)
Professional, scientific and technical services	36,047	17.09 (46.1)	7.61 (19.6)	0.51 (0.3)	8.59 (17.7)	0.10 (0.4)	0.11 (0.4)	0.88 (0.2)	34.95 (5.5)	0.14 (0.3)	0.08 (0.3)
Health care	12,876	30.15 (210.6)	22.26 (144.2)	0.81 (0.2)	24.00 (183.1)	-0.16 (0.4)	-0.03 (0.4)	0.96 (0.2)	34.48 (5.7)	0.41 (0.5)	0.01 (0.1)
Personal and laundry services	14,145	9.04 (13.1)	5.89 (9.0)	0.88 (0.2)	1.13 (4.8)	-0.32 (0.3)	-0.17 (0.3)	0.98 (0.1)	30.61 (6.4)	0.65 (0.5)	0.02 (0.1)
Other industries	103,258	30.66 (113.6)	9.97 (31.4)	0.39 (0.3)	15.74 (54.0)	0.14 (0.4)	0.12 (0.4)	0.86 (0.2)	36.21 (5.7)	0.07 (0.3)	0.11 (0.3)

Notes: Table 5 presents summary statistics for newly founded Austrian firms per industry from 1993-1997 in the ASSD.

Table 7: Cox hazard model estimation results

Variable	Entry in all quarters	Entry in first quarter
	(1)	(2)
Ratio of female to all employees relative to 3-digit industry average	-0.532 (-10.88)***	-0.511 (-5.91)***
Firm size $\times 10^3$	-5.244 (-5.92)***	-4.023 (-3.48)***
Median wage	-0.001 (-15.66)***	-0.001 (-10.27)***
Mean age of employees	-0.001 (-0.25)	-0.003 (-0.79)
Growth rate in the first year of entry	0.002 (1.24)	0.004 (2.15)*
Quarter-specific fixed effects		
10-May	0.275 (9.28)***	
10-August	0.344 (11.30)***	
10-November	0.365 (12.07)***	
Year-specific fixed effects (22)	Yes***	Yes***
Industry-specific fixed effects (160)	Yes***	Yes***
Region-specific fixed effects (35)	Yes***	Yes***
Number of observations	34426	13702

Notes: Table 7 presents the Cox regression estimation results for the duration model. Explanatory variables are the ratio of female to all employees relative to the 3-digit industry average, firm size, median wage, mean age of employees, growth rate in the first year of entry, and quarter-, year-, industry- and region-specific fixed effects. In column (1), we report the results for all firms, in column (2) for firms that enter in the first quarter. The data is from the ASSD. Values of t-statistics are shown in parentheses below the parameter estimates. The value of the χ^2 -statistic is shown for the fixed effects. *** (**, *) denotes a 99% (95%, 90%) level of significance.

Figure 1: Firm size

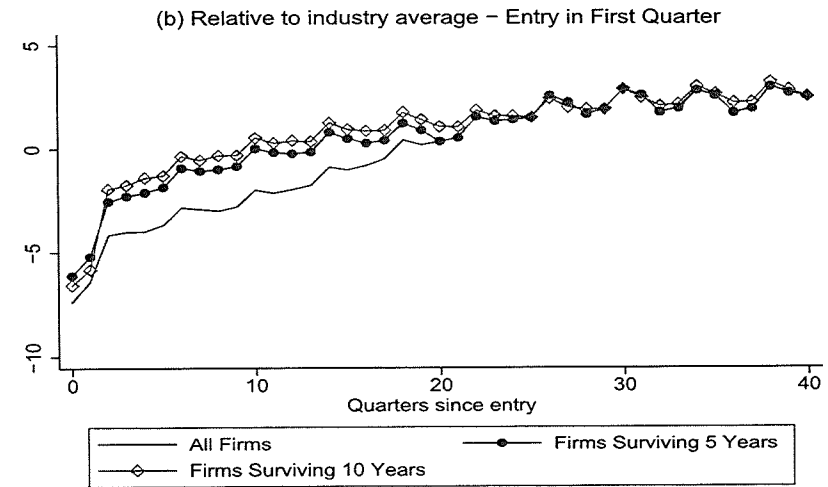
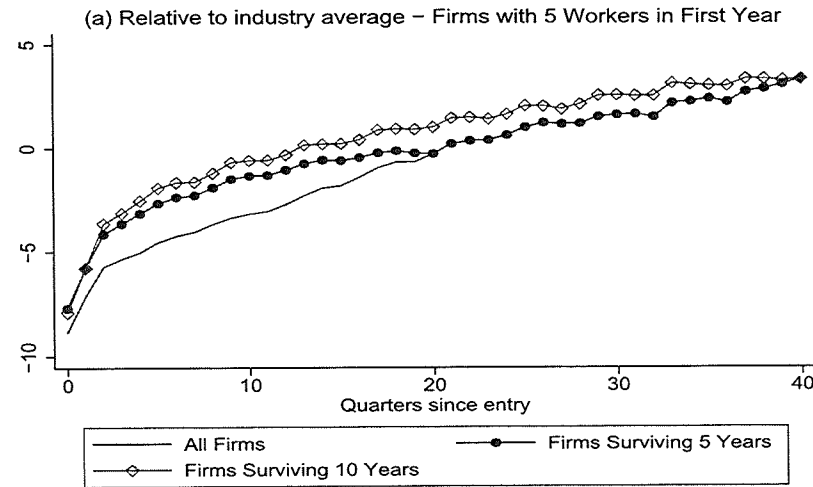
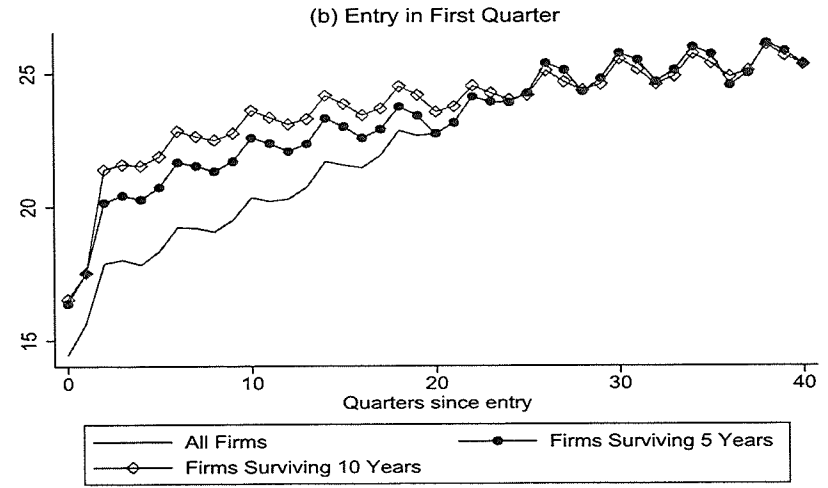
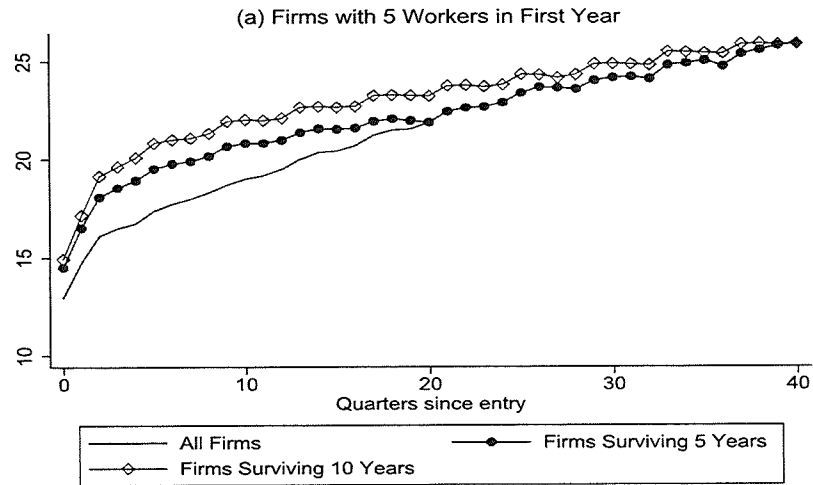


Figure 3: Logarithmic median wage

