GLM|LIC
Growth and Labour Markets in Low Income Countries Programme

WP

GLM|LIC Working Paper No. 45 | April 2019

Wage Growth and Social Security Reform

Admasu Shiferaw (College of William and Mary)
Måns Söderbom (University of Gothenburg)
Arjun Bedi (Erasmus University Rotterdam and IZA)
Getnet Alemu (Addis Ababa University)

IZA Institute of Labor Economics
Initiated by Deutsche Post Foundation

UKaid
from the British people

GLM|LIC

GLM|LIC Working Paper No. 45 | April 2019

Wage Growth and Social Security Reform

Admasu Shiferaw (College of William and Mary)
Måns Söderbom (University of Gothenburg)
Arjun Bedi (Erasmus University Rotterdam and IZA)
Getnet Alemu (Addis Ababa University)

GLM|LIC
c/o IZA – Institute of Labor Economics
Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany
Phone: +49-228-3894-0
Fax: +49-228-3894-510
Email: glm-review@iza.org

IZA Institute of Labor Economics
Initiated by Deutsche Post Foundation

UKaid
from the British people

GLM|LIC Working Paper No. 45 | April 2019

ABSTRACT

Wage Growth and Social Security Reform

This paper uses worker-level panel data to examine the wage-shifting effects of a social security reform in Ethiopia. By relying on differences across firms in the existence of pre-reform provident funds, voluntary schemes that provide lump sum payouts to workers upon separation, we test whether employers have shifted to workers' wages the cost of social security contributions. We find no evidence of such shifting as wages continued to rise significantly after the reform. However, we find that wage growth was substantially slower among employees of firms without provident funds after controlling for standard wage determinants. We also find that this reduction in wage growth affected only less-educated workers with no effect on more-educated workers. The paper also shows rising wage inequality at the lower-end of the distribution driven primarily by rising lower-tail inequality among employees of firms without provident funds.

JEL Classification:
J23, J26, J30, O14

Keywords:
wage growth, social security reform, wage shifting, wage inequality, Ethiopia

Corresponding author:
Arjun S. Bedi
International Institute of Social Studies
Erasmus University Rotterdam
Kortenaerkade 12
2518 AX, The Hague
The Netherlands
E-mail: bedi@iss.nl

1. Introduction

In mid 2011, the Ethiopian government launched a social security reform that instituted, for the first time, pension and disability benefits for private sector employees. The cost of such benefits is shared between employers and employees who contribute 11 per cent and seven per cent of base salary, respectively. This is a mandatory scheme for employees in the formal private sector and managed by the state through the Private Organizations' Employees Social Security Agency (POESSA). Details on other parameters of this social protection scheme and its enforcement mechanisms are discussed in Shiferaw et al. (2017).

There are a number of research questions surrounding state sanctioned social protection schemes that are of academic and policy interest. Key among such questions are who ultimately bears the cost of social security, and how the allocation of costs affects the behavior of employers and employees. The answers to these questions have important implications for the overall coverage of social protection in a country and the likelihood that unintended consequences may arise that could potentially stymie the primary objective of smoothing consumption for broader sections of society (Levy, 2008). Labor economists assume that the subjective valuation of social insurance in the eyes of employees determines the extent to which they may accept equivalent wage cuts given that the employer is paying for their future fringe benefits (Summers,1989). Under such conditions, employment levels may not suffer following a social security reform as the reduction in wages will fully offset the increase in nonwage labor cost (Gruber, 1997).

This paper focuses on the evolution of wages after the 2011 social security reform using worker-level data. This is different from most previous studies where researchers typically use firm-level data on mean wages to assess the impact of a social security reform (Gruber, 1997; Kugler and Kugler, 2009; Bennmarker, Mellander and Öckert, 2009). Since such studies do not capture potential adjustments in the skill composition of the workforce, the estimated changes in mean wage may not necessarily show actual

changes in pay. Other studies estimate wage effects using data at the city or administrative unit level where pay differences across employers and individual works are ignored (Alemida and Carneiro, 2012; Curces, Galiani and Kidyba, 2010). This paper is among a few studies that use worker-level data including Anderson and Meyer (2000), Gruber and Kugler (1991), and Kugler (2005). The wage equations in existing studies that examine the effects of payroll taxes even at the individual level typically exclude human capital indicators of workers with the exception of Kugler (2005). Our wage model follows the Mincerian approach with controls for human capital and other personal characteristics that determine wages in addition to the shift in policy. Our objective in this paper is to contribute to this literature by estimating more accurately the extent to which employers shifted the cost of social security to employers in terms of lower wages. Equally important is capturing the heterogeneity across workers and firms in the wage response to the reform. The latter has important implications for the distribution of wages, and how workers' labor market characteristics interact with employers' business objectives to determine the distribution of wages. The paper thus goes beyond estimating wage effects of the policy reform and provides rare evidence on the associated changes in the wage distribution.

The paper is organized as follows. Section two explains the survey data and provides summary statistics while section three provides results from an earnings function estimated in levels. Section four presents our main findings based on a wage growth equation. Changes in wage inequality at the upper and lower tails of the wage distribution will be discussed in section five. Section six concludes the paper.

2. Data and Descriptive Statistics

Data were collected at the worker and the firm level during April to May of 2016. Our sampling frame was the 2015 census of manufacturing firms conducted by the Central Statistical Agency (CSA) of Ethiopia that captures all manufacturing firms that use power-driven machinery and employ at least 10 workers. We followed a stratified random sampling approach using regional states as strata. Because of their minimal number of manufacturing firms, we excluded five regional administrations at this stage

of sampling. These include the Afar, Benishangul-Gumuz, Gambella, Harari and Somali regions, which are often referred to as small states. The survey thus includes the Amhara, Oromia, SNNPR and Tigray regional states and the city administrations of Addis Ababa and Dire Dawa. In each region, we restricted our survey to firms located in the capital city except for the Amhara region where two cities were included, i.e., the capital Bahir Dara and the city of Gondar. Since nearly 70 per cent of manufacturing firms in the CSA census are located in and around Addis Ababa, the same proportion of firms in our sample were also selected from the nation's capital. The remaining 30 percent of firms were randomly selected from the capitals of the other five regions each with a six per cent share.

Once the firms were selected, we conducted a survey on 10 randomly selected workers from each firm. We used backward looking questions on wages and pension contributions based on administrative records of firms. The idea is to trace the evolution of wages before and after the reform at the individual worker level but without relying on memories of interviewees. For each survey year, we collected data on wages and pension contributions pertaining to the month of March. The survey spans for seven years from 2009 to 2015. Since the reform was introduced in June 2011, we consider the period 2009-2011 as the pre-reform period. In addition to wages and pension contributions, the survey captures workers' highest level of formal education, occupation, age, gender, marital status, and parents' educational attainment. The survey has a module on firm-level information including total number employees, hiring and firing activities, and employee training.

Table 1 shows the educational and pay distribution of workers in Ethiopian manufacturing. About 41% of workers in our sample have completed secondary education while 20 per cent have completed higher education. Taking into account the 15 percent of workers with incomplete college education, the table shows that more than a third of the workforce has more than secondary education. In contrast, only about 13 percent of workers have primary education or less. This suggests that the formal

Ethiopian manufacturing sector tends to attract relatively more educated workers given the relatively low, albeit rising, level of educational attainment in the country. For instance, while only 25 percent of the Ethiopian population has completed secondary education, they account for 40 percent of the manufacturing labor force.

Panel b of Table 1 shows the expected outcome where wages rise with the level of education. Workers with tertiary education earn more than four times the monthly wages of their less educated counterparts with only primary education. There is also a clear gender pay gap where women on average earn 73 percent of the monthly wage of men.

Figure 1 shows the trajectory of monthly wages by level of education. It is evident that wages have been rising since the 2011 social security reform. This increase appears to be widespread across workers of all educational backgrounds. This is important in itself as it show no evidence of employers shifting the cost of pension and disability benefits to workers in terms of lower wages. This is consistent with our finding in Shiferaw et al. (2016) where firm-level data collected by the CSA show rising mean wages at the firm level (firm-level wage bill divided by number of workers). Although the firm-level outcome could have been driven by changes in the skill composition of workers, Figure 1 confirms that wages have been rising across the board.

Figure 2 shows an important feature of the Ethiopian labor market where larger firms offer higher wages for workers with the same level of education as compared to smaller firms. This relationship has apparently continued unaltered after the pension reform showing the attractiveness of large firms for employment.

Table 2 provides descriptive statistics on variables that we will be using in the next section to estimate wage equations. Mean wage in logarithms was 7.53 during the sample period. Wage growth measures the log difference in monthly wage in 2015 against the mean wage for the pre-reform years of 2009 to 2011. Accordingly, wages have grown on average by 0.96 log points showing a near doubling of nominal wages. About 63.3 per cent of sample firms did not have provident funds before the 2011 social

security reform. This is the group of firms for which the NPF dummy variable takes the value of one and acts as our control group in the subsequent regression models. This is because the reform has brought about a sudden increase in nonwage labor costs for these firms as compared to the 36.7 per cent of firms who voluntarily provided provident funds before 2011. About 45.5 per cent of workers in our sample are born to educated fathers meaning that their fathers have at least primary education while only 30 per cent of workers have educated mother defined in this manner. Approximately half the workers in our sample were born outside the city in which they have been working at the time of the survey and hence considered to be migrants.

3. Wage setting in the context of non-wage benefits

Extending our descriptive analysis further, we estimate standard Mincerian wage equations to better understand wage determination in the Ethiopian manufacturing sector. Our wage equation includes proxies for human capital indicating a worker's educational attainment, general work experience and experience that is firm specific. We use potential experience calculated as years since leaving school. Our wage equation also captures demographic indicators such as gender, migrant and marital statuses, and parental education as well as occupational choices. Moving beyond a worker's labor market and personal characteristics, we also take into account wage differences due to employer characteristics such as the initial size, region and industry.

We start by estimating the wage equation separately for the pre-reform period from 2009 to 2011 and the post-reform period from 2012 to 2015. This would allow us to capture changes in the wage setting process, if any. The first two columns of Table 3 show regression results for the pre-reform period while the last two columns show the results for the post-reform period.

Table 3 shows substantial and statistically significant returns to education for manufacturing sector workers who completed at least secondary education. While wages are not significantly higher for workers with only primary education relative to those with no formal education, column 2 shows substantial gains in monthly wages prior to the reform for workers with secondary, vocational, some college and completed university education by 31 per cent, 52 percent, 74 per cent and 116 per cent, respectively. We also observe positive and significant returns to potential labor market experience as well as to experience specific to a firm. Column 4 shows similar patterns in returns to education and experience for the post-reform period although the coefficients on education appear to be slightly lower. We will examine whether this apparent reduction in returns to education is statistically significant in Table 4 when we present results using the pooled sample.

Table 3 also shows that female wages are at least 20% less than that of men after controlling for other wage determinants, and that this difference has not narrowed down in the post-reform period. Workers with educated fathers, i.e., fathers who completed at least elementary education, earn approximately 7 to 10 per cent higher than workers with uneducated fathers. Such spillover effect from parental education does not seem to derive from mothers' education.

We find that working for large firms raises the expected wage rate significantly after controlling for standard human capital variables. Interestingly, the wage advantages of working for a large firm has increased significantly in the post-reform period. Conditional on the above-mentioned wage determinants and after accounting for region and industry fixed effects, we find no significant differences in mean wages for firms with and without pre-reform provident funds. This is true for both the pre- and post-reform periods. Nonetheless, the change in the signs of the NPF coefficients in columns 3 and 4 seem to suggest slightly lower wages in the post-reform period among firms without provident funds.

Table 4 uses the entire sample for the 2009 to 2015 period and employs interaction terms to capture changes in mean wage after the reform and compare wage differences for workers with and without pre-existing PFs provided by their employers. Looking at the more complete model in column 4 that includes region and industry fixed effects, Table 4 shows that post-reform wages are on average 56 per cent higher than that of the pre-reform period. This is significant in at least one respect. It shows that there has not been any compensating reduction in wages after the pension reform that would allow employers to offset the increase in pension contributions brought about by the 2011 reform. This is consistent with Shiferaw et al. (2016) who used firm-level, instead of worker-level data, and found rising wage rates after the 2011 reform. Table 3 also shows no major change after the reform in the manner in which the labor market rewards human capital as none of the interaction terms between the post-reform dummy and indicators of educational attainment turned out to be significant. The fact that the coefficients on NPF and its interaction with the post-reform dummy are both negative, albeit insignificant, suggests slightly lower mean wages among firms without PFs. Could these differences in levels be indicative of underlying differences in wage growth among firms with and without provident funds? We now turn to addressing this question.

4. Wage Growth and Social Protection.

As indicated earlier, wages often tend to be downward rigid and firms may find it undesirable to cut wages even when nonwage labor costs are rising. A few studies have in fact found partial adjustment of wages, as opposed to a full switching of employer costs predicted under specific theoretical conditions, where the cost of social protection is switched partly to workers in the form of lower wages. Aside from absolute reductions in wages, firms may choose to adjust the trajectory of wage growth when a social policy shift raises nonwage labor costs. In this section, we examine if firms actually reduced the rate of growth of wages in the years following the 2011 social security reform and whether changes in wage growth vary across workers are based on their expected productivity. Our identification strategy remains to be the pre-reform difference in the existence of voluntary PFs at the firm level. The 2011 reform acknowledges

provident funds as valid forms of offering social protection and allows them to co-exist with the new scheme if employers and employees choose to retain them. Because the increase in nonwage labor costs after the 2011 reform are expected to be higher for firms without PFs, it is possible that they may not be able to maintain pay increase by firms with pre-existing PFs.

Our wage growth model takes the following generic form:

$$\ln W_{ijt} - \ln W_{ijt_0} = f\left(X_i, Z_{it}, F_j, NPF_j, NPF_j * X_i\right)$$

where W stands for monthly wage and the subscripts i and j identify workers and firms, respectively. The left-hand-side of the equation capture wage growth for worker i in firm j at time t relative to his/her monthly wage at t_0 prior to the reform. The right-hand-side of the equation includes worker-level wage determinants that remain unchanged during the sample period. Such variables are represented by the vector Xi and include indicators of educational attainment, gender and other personal characteristics. The vector Z_{it} captures time varying explanatory variables such as experience and tenure. The model also includes firm-level characteristics such as initial firm size, the geographic location and industry in which the firm operates that are represented by F_j. The location and industry fixed effects will take into account differences in wage growth that are exogenous to the employer. As shown in Shiferaw and Bedi (2013), graduation rates of firms from small to medium size firms and from medium to large firms has been quite rate in the Ethiopian context. Accordingly, the fact that our model includes initial firm implies that we have taken into accounts a very crucial firm fixed effect. In other words, firm size takes into account important unobserved effects such as access to finance, technology and other sources of productivity growth. As already mentioned NPF is a dummy variable that takes the value 1 for firms without pre-reform provident funds and zero for firms with PFs. The model allows interactions between NPF and Xi.

We measure wage growth using the monthly wage in 2015 relative to the average monthly wage of a worker for the pre-reform period (2009-2011). We have growth measurements for 1783 workers and we estimate the model using OLS. The loss in the number of observations is

due to the fact that some workers in our sample were hired after 2011 and we do not observe their pre-reform wages. We cluster standard errors at the firm-level to allow for correlated unobserved effects among employees of the same firm. The results are presented in Table 5.

The main finding in Table 5 is the negative and statistically significant coefficients on the NPF dummy variable. While wages have risen significantly in the post reform period, the rate of growth of wages is significantly lower for workers employed in firms without provident funds. Regardless of differences in model specification, employees of firms without PFs have experienced wage growth rates that are 20 to 23 per cent lower than that of employees in firms with PFs. Since our model takes into account a wide range of wage determinants, this finding indicates firms' challenges in complying with the mandatory pension contributions while keeping up with the industry wide increase in wages. Since initial firm size is already controlled for, the coefficient on NPF is not driven by small firms raising wages at a slower rate than large firms.

The question then is whether all workers in firms without PFs are locked into an inferior wage growth path. The coefficients on the interaction terms between NPF and level of education suggest significant heterogeneity in wage growth across employees of firms without PFs. Table 5 shows that the reduction in the rate of growth of wages is significant only for unskilled workers with only secondary education or less. For workers with vocational and post-secondary education, there has been no income loss associated with their employer's PF status. To show this more clearly, we calculated the joint effects of NPF and its interactions with education dummy variables which turned out to be: -0.1722(0.0820) for those with primary education, -0.0603 (0.0386) for those with secondary education, 0.0494(0.0745) for those with vocational education, 0.1653(0.0579) for those with incomplete college education, and 0.0813(0.0755) for those with university degrees; where the numbers in parenthesis are standard errors. The estimated joint effects show that among firms without PFs, hence forced to pay pension contribution after 2011, unskilled workers seem to bear the cost of pension benefits in the form of slower growth in wages.

It is important to note that the opposite has been true for workers hired by firms with PFs. The coefficients on educational attainments above secondary school are negative and significant while the coefficients on *Primary* and *Secondary* are statistically insignificant. This suggests that among firms with PFs, wage growth is slightly higher among less educated workers as compared to that of more educated workers. This would imply a reduction in wage dispersion among employees of PF-providing firms while the dispersion is widening for the other group. For firms without PFs, the sudden introduction of pension contributions may have raised the need to increase productivity by attracting and retaining skilled workers to make up for the increase in nonwage labor costs. It is likely that firms with PFs faced relatively less pressures to increase productivity by attracting more skilled workers given that they did not experience a spike in pension contributions. This situation may lead to differences in wage growth rates for skilled workers among firms with and without PFs.

5. Wage Inequality and Social Protection

Given the heterogeneity in wage growth across workers conditional on PF status before 2011, it is important to further explore its implications for wage inequality. While the distribution of wages in the manufacturing sector is arguably a complex process subject to a range of factors, our objective in this section is to examine how wage inequality evolved after the 2011 reform and if the PF status has played any role.

We start by estimating wage growth rates at different percentiles of the distribution. We split the sample based on the firm's PF status and calculate wage growth rates for each percentile using the log difference in monthly wage in 2015 relative to percentiles of mean wage during 2009 to 2011. Figure 3 shows an inverted U-shape relationship between wage growth and wage levels. For workers hired by firms without provident firms, wage growth is positively correlated with wage levels up until the median wage while a negatively correlation sets in for those who earn above the median. Among firms with provident funds, the positive correlation between

wage growth and wage levels continues up until the 60th percentile, with a dent at the median, while a negative correlation is observed above the 60th percentile. The figure also shows that for low-wage workers at the 30th percentile and below, wages grew faster among PF firms relative to those without PFs. At the upper tail of the wage distribution, however, there is no systematic difference in wage growth based on the employer's PF status. For workers at and around the median wage, however, growth was faster among firms without PF, i.e., firms who started making pension contribution only after the 2011 reform.

The inverted-U relationship between wage levels and growth in Figure 3 has important implications for wage inequality. However, since it does not capture the extent of wage inequality, Figure 3 wouldn't show the actual evolution of inequality and the difference conditional of PF status of the firm. To capture this more directly, we calculate upper- and lower-tail inequality as in Autor, Katz and Kearny (2008). Figure 4 shows, both for firms with and without PFs, that wage inequality has been declining among high wage earners located above the median which is particularly true for firms with PFs. This is consistent with the results reported in Table 5. On the other hand, lower tail inequality has been rising across all worker groups regardless of PF status. While lower-tail inequality is rising among firms without PFs particularly after 2011, it is still substantially less than the lower-tail inequality among employees of PF firms. In 2015, for instance, the median wage was 3.2 and 2.4 times higher than the 10th percentile, respectively, among firms with and without PFs. It is worth noticing that while lower-tail inequality dominates upper-tail inequality among firms with PFs, the opposite is true for the wage distribution among firms without PFs. In other words, while wage dispersion is rising below the median for firms without PFs, it remains more condensed than the wage distribution below the median among firms with PF.

Figure 5 helps us understand the implication for wage distribution at the sector level of differences in upper- and lower-tail inequality among firms with and without PFs. It shows that upper tail inequality has been declining over the sample period while lower-tail inequality

continues to rise in the manufacturing sector. It also shows that upper-tail inequality dominates lower-tail inequality reflecting the fact that most firms had no PFs before the reform. Despite the reduction in upper-tail inequality, we show in Figure 6 that overall wage inequality (90/10 ratio) has been increasing in the manufacturing sector which seems to be driven particularly by the upward trend in overall inequality among firms without PFs. It is important to note that while there have been changes in upper- and lower-tail inequality among firms with PFs, most of these changes occurred essentially during the 2009-2011 period.

6. Conclusions

How wages respond to state-mandated social protection programs remains an important research question. This is particularly important for African countries that only started to roll out social protection programs in recent years as compared to Latin American countries with a long history of providing such benefits. This paper examined the a 2011 social security reform in Ethiopia that mandated employer provided pension and disability benefits for workers in the formal private sector. Using worker-level data from Ethiopian manufacturing, we estimated wage equations with a complete set of human capital and other determinants of wages. We find that while wages have been rising significantly after the reform, there have been important differences across workers in the rate of growth of wages based on the pre-reform provident fund status of the employer. By using the latter difference as our identification strategy we found that wage growth was significantly lower among employees of firms without provident funds. Moreover, the reduction in wage growth is restricted to less educated workers with only high school diplomas or less. The paper also shows that lower-tail inequality has been rising among firms without pre-reform provident funds contributing to the rise in overall wage inequality after the reform.

The finding that less-educated workers experienced slower wage growth because of the sudden shift in nonwage labor costs brought about by the policy reform coupled with the rising trend in wage inequality reveal some of the unintended consequences of state-mandated social protection programs.

References

Almeida, R., and P. Carneiro. 2012. “Enforcement of Labor Regulation and Informality.” *American Economic Journal: Applied Economics* 4, 3, 64-89.

Anderson, M. P., and B. D. Meyer. 2000. “The effects of the unemployment insurance payroll tax on wages, employment, claims and denials,” *Journal of Public Economics* 78, 81-106

Antón, A. 2014. “The effect of payroll taxes on employment and wages under high labor informality,” *IZA Journal of Labor and Development* 3, 1-23.

Autor, D., L. Katz, and M. Kearny. 2008. “Trends in U.S. Wage Inequality: Revising the Revisionists,” *Review of Economics and Statistics* 90,2, 300-323.

Bennmaarker, H., E. Mellander, and B. Öckert. 2009. “Do regional payroll tax reductions boost employment?” *Labor Economics* 16, 480-489.

Cruces, G., S. Galiani, and S. Kidyba. 2010. “Payroll taxes, wages and employment: Identification through policy changes,” *Labor Economics* 17, 743-749.

Gruber, J. 1997. “The Incidence of Payroll Taxation: Evidence from Chile,” *Journal of Labor Economics* 15, 3, s72-S101.

Gruber, J., and A. Krueger. 1991. “The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers’ Compensation Insurance,.” In *Tax Policy and the Economy* , ed. Davide Bradford, 111-144. Cambridge, MA: MIT Press.

Kugler, D. A. 2005. “Wage-shifting effects of severance payments savings accounts in Colombia,” Journal of Public Economics 89, 487-500.

Kugler, A., and M. Kugler. 2009. “Labor Market Effects of Payroll Taxes in Developing Countries: Evidence from Colombia,” *Economic Development and Cultural Change* 57, 2, 335-358.

Levy, S. 2008. Good Intentions, Bad Outcomes: Social Policy, Informality, and Economic Growth in Mexico. Washington, DC: Brookings Institution Press.

Summers, L. 1989. “Some Simple Economics of Mandated Benefits.” *American Economic Association, Papers and Proceedings* 7,2, 177-183.

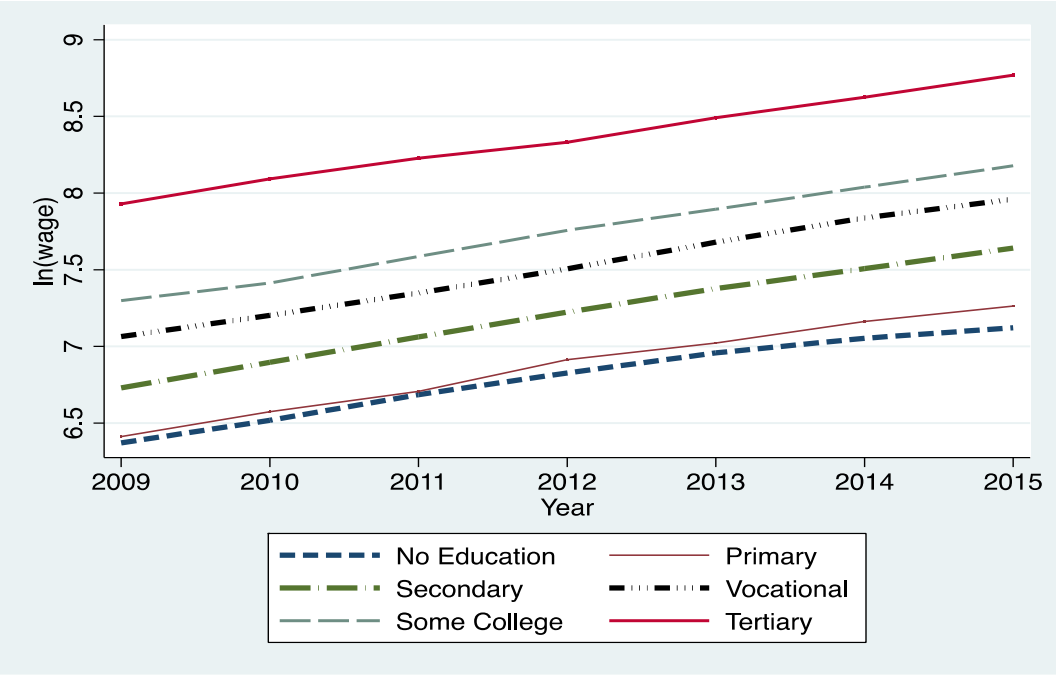

Figure 1: Wage profile by level of education

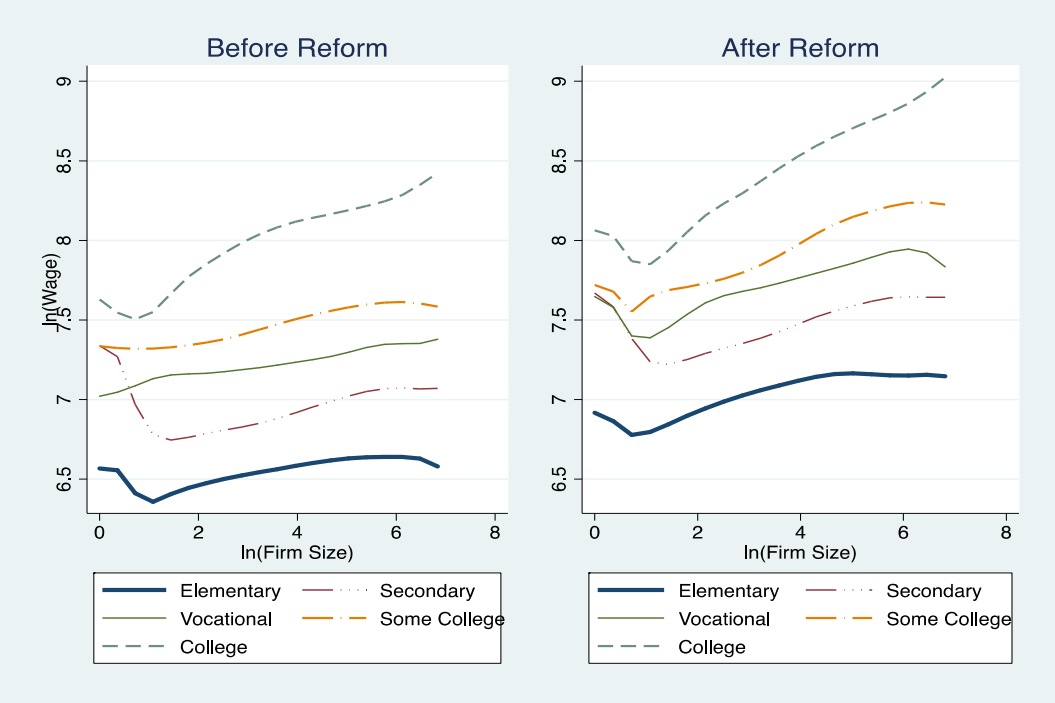

Figure 2: Initial firm size and wages

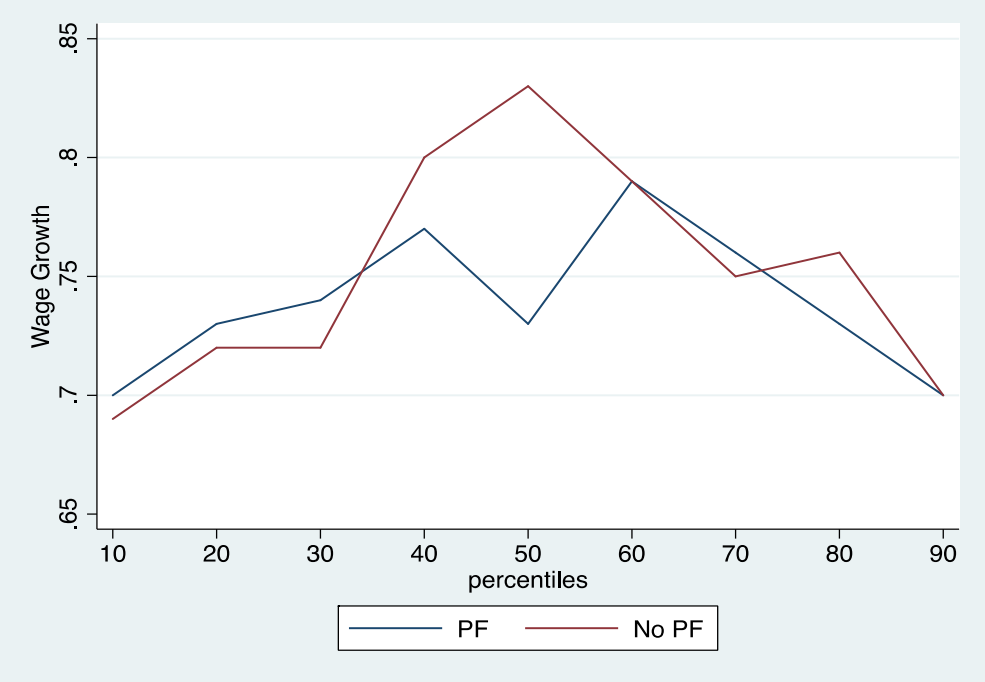

Figure 3: Wage growth at different percentiles for firms with and without

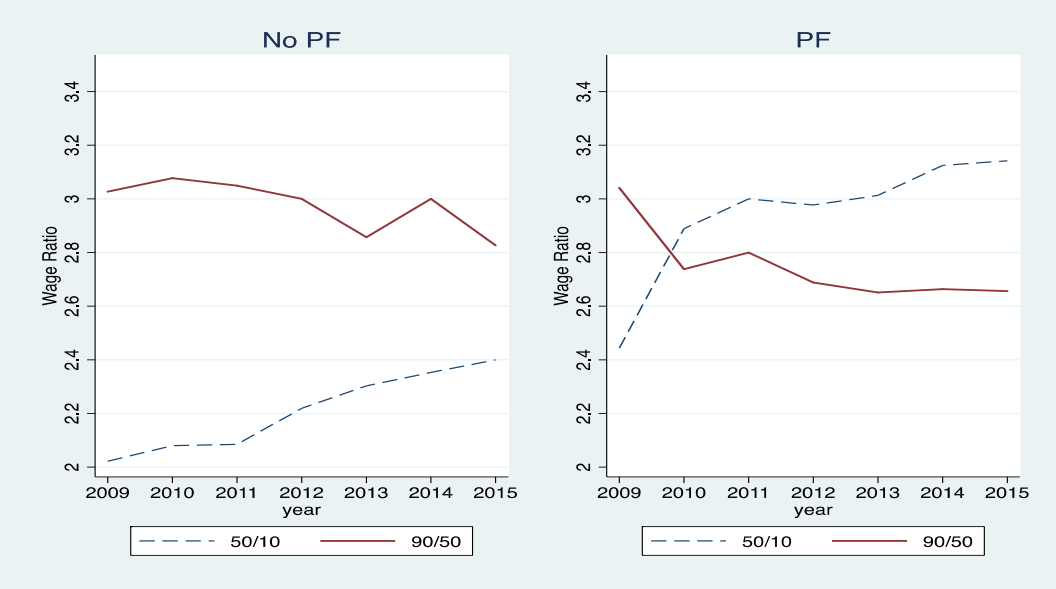

Figure 4: Trends in Upper and Lower Tail Wage Inequality Based on PF Status.

Note: Upper tail inequality compares the 90th percentile with the 50th percentiles while lower tail inequality compares the 50th percentile with the 10th percentile.

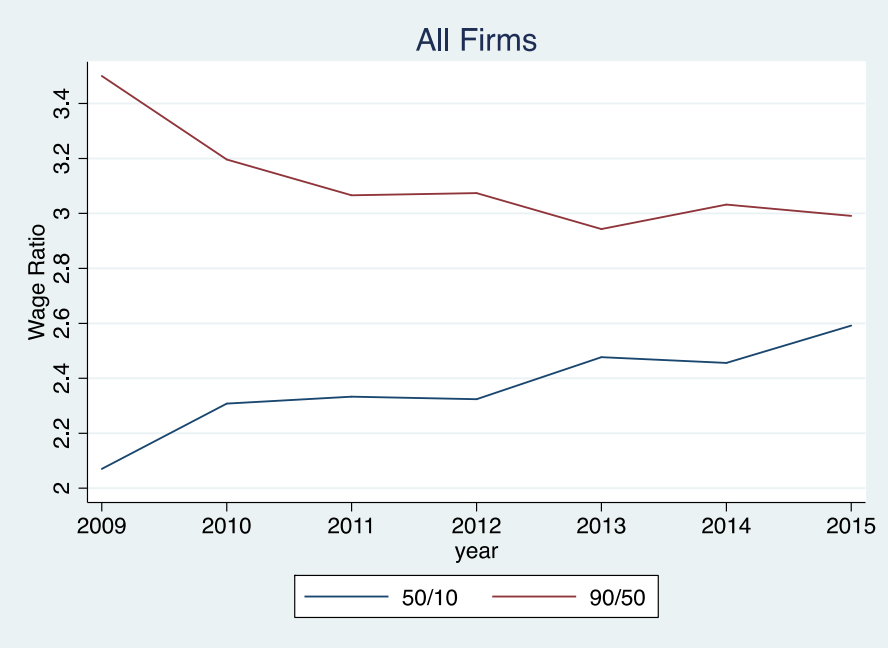

Figure 5: Upper and Lower Tail Wage Inequality in the Pooled Sample

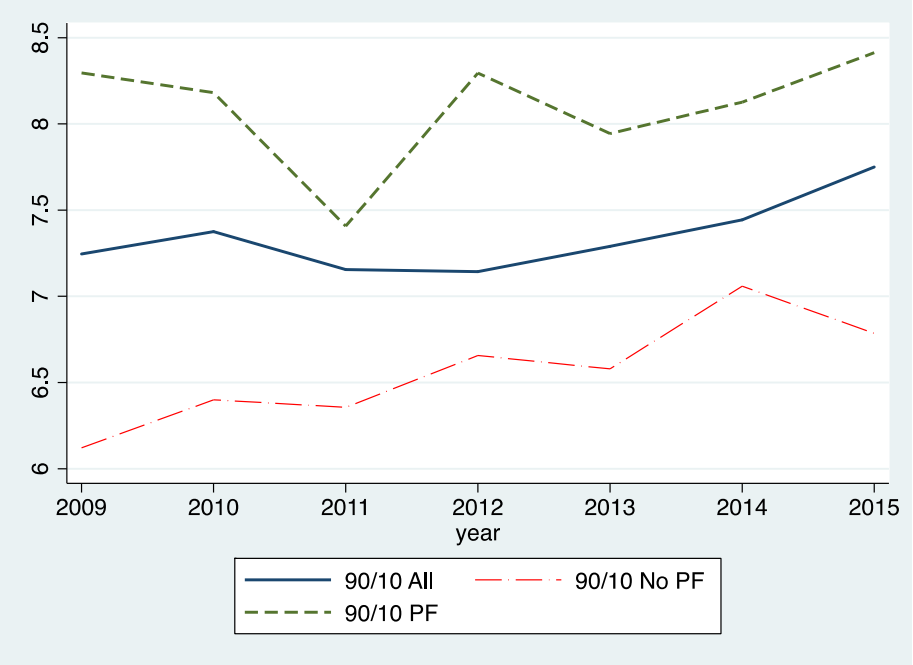

Figure 6: Overall Wage Inequality in the Pooled Sample.

Note that overall inequality compares the 90th percentile with the 10th percentile.

Table 1: Distribution of Education and Wages by Gender

Panel a: Education				
	Male (%)	Female (%)	Total (%)	Number of Workers
No Education	3.2	2.4	2.9	86
Primary	11.4	9.2	10.6	315
Secondary	41.2	40.6	41.0	1,218
Vocational	9.9	11.4	10.5	311
Some College	12.5	19.1	15.0	445
Tertiary	21.8	17.3	20.1	599
Total	100	100	100	2,974
Panel b: Monthly Wages (Ethiopian Birr)				
Education	Male	Female	Total	Gender Wage Ratio
No Education	1203.6	874.4	1101.6	0.73
Primary	1366.3	957.5	1236.7	0.70
Secondary	2114.3	1417.5	1863.1	0.67
Vocational	2664.5	2169.9	2480.4	0.81
Some College	3641.8	2690.0	3205.0	0.74
Tertiary	6151.5	4246.7	5518.0	0.69
Total	2997.9	2139.8	2684.4	0.73

Table 2: Descriptive Statistics

Variable	Mean	Standard Deviation
ln(wage)	7.5300	0.8195
Wage growth	0.9620	0.4353
No Education	0.0277	0.1640
Primary	0.0926	0.2899
Secondary	0.4305	0.4952
Vocational	0.1093	0.3120
Some College	0.1601	0.3667
Tertiary	0.1799	0.3841
Potential Experience	19.5830	11.9346
Potential Experience Squared	525.9147	615.1901
Tenure	11.4969	7.6822
Gender (Female=1)	0.3741	0.4839
NPF	0.6329	0.4820
ln(Initial firm size)	4.1919	1.1544
Single Never Married	0.2735	0.4458
Married	0.6919	0.4617
Divorced	0.0187	0.1353
Widowed	0.0108	0.1031
Separated	0.0051	0.0715
Father Educated	0.4556	0.4980
Mother Educated	0.3002	0.4584
Migrant	0.5074	0.5000

Note: The mean of ln(wage) is the average monthly wage for 2009-15, while wage growth as discussed further below, measures wage growth in 2015 relative to the pre-reform mean wage. *Potential Experience* is calculated as age minus years of schooling minus six. Tenure measures years since a worker joined the firm at the time of survey. Initial firm size measures the mean pre-reform (2009 to 2011) total number of workers of a firm. *Father Educated* is a dummy variable that takes the value one for workers whose father have at least primary education and zero otherwise. *Mother Educated* is also measured in the same manner. Migrant is a dummy variable that takes the value one if a worker is not born in the same city where he/she is working at the time of the survey.

Table 3: Wage determinants before and after the social security reform

	Before Reform (2009-2011)		After Reform (2012-2015)	
	1	2	3	4
Primary	0.0912	0.1087	0.0451	0.0545
	(0.0885)	(0.0900)	(0.0970)	(0.1017)
Secondary	0.3338***	0.3110***	0.2471***	0.2362**
	(0.0920)	(0.0957)	(0.0921)	(0.0961)
Vocational	0.5514***	0.5227***	0.4575***	0.4256***
	(0.1078)	(0.1113)	(0.1120)	(0.1158)
Some College	0.8333***	0.7407***	0.6732***	0.5771***
	(0.1051)	(0.1074)	(0.1090)	(0.1129)
Tertiary	1.2876***	1.1660***	1.1198***	0.9999***
	(0.1157)	(0.1145)	(0.1143)	(0.1125)
P_EXP	0.0322***	0.0278***	0.0346***	0.0306***
	(0.0040)	(0.0038)	(0.0034)	(0.0032)
P_EXP Square	-0.0005***	-0.0004***	-0.0005***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Tenure	0.0097***	0.0062**	0.0072***	0.0025
	(0.0026)	(0.0025)	(0.0021)	(0.0019)
Female	-0.2066***	-0.2071***	-0.2166***	-0.2213***
	(0.0313)	(0.0319)	(0.0260)	(0.0253)
NPF	0.0388	0.0336	-0.1473	-0.1108
	(0.0887)	(0.1001)	(0.1086)	(0.1114)
Primary*NPF	-0.0729	-0.0694	0.0616	0.0529
	(0.1042)	(0.1084)	(0.1162)	(0.1169)
Secondary*NPF	-0.0647	-0.0231	0.0832	0.0850
	(0.1007)	(0.1083)	(0.1097)	(0.1099)
Vocational*NPF	-0.0598	-0.0353	0.1755	0.1755
	(0.1334)	(0.1402)	(0.1320)	(0.1322)
SomeCollege*NPF	-0.2002*	-0.1429	0.0294	0.0765
	(0.1167)	(0.1241)	(0.1222)	(0.1235)
Tertiray*NPF	-0.2106	-0.1048	-0.0471	0.0170
	(0.1486)	(0.1493)	(0.1253)	(0.1225)
Father educated	0.0654**	0.0780***	0.0729**	0.0878***
	(0.0316)	(0.0298)	(0.0292)	(0.0261)
Mother educated	0.0202	-0.0021	0.0306	0.0182
	(0.0335)	(0.0310)	(0.0292)	(0.0262)
Migrant	-0.0096	0.0135	-0.0028	0.0267
	(0.0288)	(0.0276)	(0.0236)	(0.0224)
ln(firm size)		0.0615***		0.1032***
		(0.0195)		(0.0170)

Intercept	6.4938*** (0.1292)	6.2740*** (0.1491)	7.2473*** (0.1258)	6.9025*** (0.1571)
Marital Status	Y	Y	Y	Y
Occupation	Y	Y	Y	Y
Region	N	Y	N	Y
Industry	N	Y	N	Y
Year	Y	Y	Y	Y
R^2	0.54	0.58	0.50	0.55
N	5,020	4,869	9,746	9,459

Note: See notes under Table 2 for variable definitions. Asterisks ***, ** and * represent statistical significance of coefficients at the 1 per cent, 5 per cent and 10 per cent levels, respectively. There are a range of variables controlled for in different specifications and their inclusion is indicated by the letter Y if they are included and by the letter N if not.

Table 4: Wages and Pension Reform

	1	2	3	4
Primary	0.1543***	0.0523	0.0785	0.0738
	(0.0510)	(0.0857)	(0.0926)	(0.0880)
Secondary	0.5453***	0.2952***	0.3087***	0.2859***
	(0.0617)	(0.0886)	(0.0947)	(0.0915)
Vocational	0.9617***	0.4786***	0.4660***	0.4543***
	(0.0701)	(0.1066)	(0.1126)	(0.1085)
Some College	1.1538***	0.7564***	0.7036***	0.6648***
	(0.0661)	(0.1026)	(0.1075)	(0.1045)
Tertiary	1.7081***	1.2416***	1.1760***	1.1279***
	(0.0708)	(0.1113)	(0.1112)	(0.1092)
P_EXP	0.0465***	0.0344***	0.0312***	0.0305***
	(0.0036)	(0.0033)	(0.0032)	(0.0031)
P_EXP Square	-0.0006***	-0.0005***	-0.0004***	-0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Tenure	0.0023	0.0073***	0.0038*	0.0030
	(0.0020)	(0.0021)	(0.0019)	(0.0019)
Female	-0.2363***	-0.2005***	-0.2139***	-0.2056***
	(0.0241)	(0.0310)	(0.0303)	(0.0311)
Father educated	0.1048***	0.0711**	0.0838***	0.0854***
	(0.0308)	(0.0281)	(0.0249)	(0.0254)
Mother educated	0.0402	0.0285	0.0239	0.0135
	(0.0301)	(0.0281)	(0.0253)	(0.0253)
Migrant	-0.0206	-0.0047	0.0148	0.0231
	(0.0252)	(0.0235)	(0.0231)	(0.0225)
NPF		-0.0771	-0.0182	-0.0363
		(0.0927)	(0.1007)	(0.0980)
Primary*NPF		0.0109	-0.0068	0.0078
		(0.1024)	(0.1097)	(0.1056)

Secondary*NPF		0.0268	0.0324	0.0436
		(0.0976)	(0.1047)	(0.1017)
Vocational*NPF		0.0918	0.1053	0.0994
		(0.1211)	(0.1283)	(0.1247)
SomeCollege*NPF		-0.0561	-0.0311	-0.0026
		(0.1095)	(0.1157)	(0.1149)
Tertiray*NPF		-0.1089	-0.0689	-0.0307
		(0.1176)	(0.1206)	(0.1181)
Reform		0.5370***	0.5569***	0.5633***
		(0.0548)	(0.0554)	(0.0557)
NPF*Reform			-0.0221	-0.0306
			(0.0286)	(0.0282)
Primary*Reform		0.0264	0.0237	0.0121
		(0.0501)	(0.0479)	(0.0479)
Secondary*Reform		-0.0072	-0.0094	-0.0158
		(0.0537)	(0.0518)	(0.0526)
Vocational*Reform		0.0397	0.0333	0.0335
		(0.0632)	(0.0616)	(0.0626)
SomeCollege*Reform		-0.0200	-0.0227	-0.0245
		(0.0602)	(0.0582)	(0.0589)
Tertiray*Reform		-0.0732	-0.0765	-0.0787
		(0.0686)	(0.0668)	(0.0671)
Female*Reform		-0.0162	-0.0126	-0.0138
		(0.0217)	(0.0215)	(0.0216)
ln(Firm size)			0.0915***	0.0888***
			(0.0167)	(0.0169)
_cons	6.1290***	6.6747***	6.3113***	6.3575***
	(0.0786)	(0.1195)	(0.1468)	(0.1425)
Marital Status	Y	Y	Y	Y
Occupation	N	Y	Y	Y
Region	N	N	Y	Y

Industry	N	N	N	Y
R2	0.41	0.55	0.58	0.59
N	14,803	14,766	14,668	14,328

Note: See notes under Table 2 for variable definitions. Asterisks ***, ** and * represent statistical significance of coefficients at the 1 per cent, 5 per cent and 10 per cent levels, respectively. There are a range of variables controlled for in different specifications and their inclusion is indicated by the letter Y if they are included and by the letter N if not.

Table 5: Estimates of the Wage Growth Model

	1	2	3	4
Primary	0.0186	0.0182	-0.0221	-0.0166
	(0.1102)	(0.1146)	(0.1142)	(0.1130)
Secondary	-0.0528	-0.0899	-0.1164	-0.0975
	(0.1105)	(0.1117)	(0.1131)	(0.1117)
Vocational	-0.1846	-0.2416**	-0.2665**	-0.2309**
	(0.1125)	(0.1132)	(0.1139)	(0.1121)
Some College	-0.2192*	-0.3149***	-0.3376***	-0.3189***
	(0.1140)	(0.1147)	(0.1154)	(0.1141)
Tertiary	-0.1890	-0.3164**	-0.3445***	-0.3263***
	(0.1186)	(0.1228)	(0.1247)	(0.1234)
P_EXP	-0.0152***	-0.0142***	-0.0137**	-0.0126**
	(0.0053)	(0.0054)	(0.0054)	(0.0055)
P_EXP Square	0.0002	0.0002*	0.0002	0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Tenure	-0.0021	-0.0054***	-0.0052**	-0.0052**
	(0.0020)	(0.0021)	(0.0021)	(0.0021)
Female	-0.0079	-0.0368	-0.0390	-0.0384
	(0.0248)	(0.0278)	(0.0278)	(0.0289)
NPF	-0.1977*	-0.2063*	-0.2204*	-0.2306**
	(0.1150)	(0.1150)	(0.1146)	(0.1138)
Primary*NPF	0.0082	0.0389	0.0761	0.0584
	(0.1362)	(0.1396)	(0.1379)	(0.1394)
Secondary*NPF	0.1125	0.1698	0.1864	0.1703
	(0.1211)	(0.1214)	(0.1214)	(0.1206)
Vocational*NPF	0.2263*	0.2815**	0.2927**	0.2799**
	(0.1373)	(0.1365)	(0.1367)	(0.1340)
SomeCollege*NPF	0.2888**	0.3645***	0.3901***	0.3959***
	(0.1277)	(0.1281)	(0.1277)	(0.1266)
Tertiray*NPF	0.2101	0.2999**	0.3203**	0.3119**
	(0.1368)	(0.1368)	(0.1377)	(0.1356)
ln(Firm size)		0.0777***	0.0845***	0.0801***
		(0.0111)	(0.0115)	(0.0117)
Migrant		0.0244	0.0222	0.0335
		(0.0248)	(0.0247)	(0.0254)
Intercept	1.3508***	1.0609***	1.0200***	1.0087***
	(0.1064)	(0.1315)	(0.1373)	(0.1396)
Marital Status	Y	Y	Y	Y
Parent Educated	Y	Y	Y	Y
Occupation	N	Y	Y	Y
Region	N	N	Y	Y
Industry	N	N	N	Y

R2	0.04	0.10	0.11	0.12
N	1,685	1,658	1,658	1,620

Note: See notes under Table 2 for variable definitions. Asterisks ***, ** and * represent statistical significance of coefficients at the 1 per cent, 5 per cent and 10 per cent levels, respectively. There are a range of variables controlled for in different specifications and their inclusion is indicated by the letter Y if they are included and by the letter N if not.