

Social Insurance Reform and Labor Market Outcomes in Sub-Saharan Africa: Evidence from Ethiopia*

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Abstract

This paper examines the labor market implications of a mandatory social insurance scheme introduced in Ethiopia in 2011 for private sector employees in the formal sector. The reform expands an existing pension scheme that only catered to civil servants and the armed forces. We use firm-level panel data and exploit differences in pre-reform pension plans across firms to identify the effects of the reform. We find no evidence of employers shifting the cost of pension benefits to workers in the form of lower wages. In fact the reform increased real wages significantly while having no effect on bonuses and other benefits per worker. We also find a significant reduction in total employment after the pension reform particularly among low-wage workers although these effects cannot be attributed entirely to the pension reform. Firms seem to be responding to the increase in labor costs after the reform by raising investment per worker and productivity.

Key Words: Social Insurance, Pension Reform, Employment, Ethiopia.

1. Introduction

Over the last few decades, social protection programs have become increasingly important in the developing world. This reflects the growing recognition that adverse shocks may have long-term impact on welfare, and may undermine the poverty-reducing effects of aggregate growth. The 2010 *European Report on Development* considers social protection, a concept that encompasses social insurance and social assistance programs, as the “missing-link” in the development discourse given the traditional belief that such benefits are only feasible in developed countries (European Commission, 2010). However, the potential economic inefficiency that may arise from a tradeoff between social insurance benefits and labor market outcomes remains a major concern with important policy implications.

Labor economists have long argued that the labor market implications of a government mandate to provide social insurance depends on the equivalence between the cost of social insurance to employers, and employees’ valuation of the benefits (Summers, 1989; Gruber and Krueger, 1991). Equivalence would imply no significant reduction in employment since firms will be able to shift the cost of social insurance to workers in the form of lower wages. An increase in labor supply in response to mandated benefits could also contribute to further reduction in wages. While it is relatively easy to measure the cost of social insurance, the value employees attach to fringe benefits is unobservable. A negative employment effect is presumably indicative of employers’ inability to fully offset the cost of providing social insurance. However, downward stickiness of wages, say due to minimum wage laws, could also lead to negative employment consequences of social insurance even when workers do not discount the benefits of social insurance. In countries with a sizeable and easy to enter informal sector, employee valuation of social insurance below its cost may also lead to contraction of formal employment as workers shift to informal sector jobs where they can avoid taxes including pension contributions. Significant

productivity differences between formal and informal sector firms imply that such reallocation of labor may undermine overall economic efficiency.

Despite the clarity of expected outcomes, previous efforts at estimating the labor market implications of social insurance have encountered a number of constraints. Since social insurance affects employer and employee behavior, one needs micro data at the firm and worker level, which have only become available to researchers in recent decades. Panel data remain scarce, particularly in developing countries, which makes it difficult to control for unobserved characteristics and preferences. Moreover, substantial social insurance reforms that involve parameter adjustments large enough to induce changes in behavior are quite rare. An ambitious social insurance reform may also be rendered inconsequential by weak enforcement capacity just as the timing of a reform may accentuate or dampen its labor market implications. It is thus unsurprising that empirical evidence on the labor market implications of social insurance programs implemented in developing countries is relatively scarce. The existing studies come primarily from middle-income Latin American countries which have a relatively long experience in providing social insurance.

This paper provides new evidence in the African context where social insurance programs are relatively new and coverage remains small and far below that in Latin American countries. We examine the labor cost and employment effects of a major social insurance reform program introduced in Ethiopia in 2011, which mandated contributory pension and disability benefits for private sector employees. The reform expanded an existing pension system that only catered for civil servants and the armed forces, who constitute less than 2 per cent of the labor force. Our empirical approach addresses a number of the constraints that empirical studies in this literature have encountered. We exploit the sudden introduction of the new pension law in Ethiopia as a quasi-natural experiment to study employers' responses to the pension reform using a panel data set of privately owned manufacturing firms covering the period 2008-2013. The firm-

level panel data spans the pre-reform (2008-11) and post-reform (2012-13) periods allowing us to control for employer fixed effects while measuring the effects of temporal variation in policy. Since the new law applies to all firms in the formal sector, our identification strategy relies on the existence of pre-reform provident funds that some firms offered to their employees on voluntary basis. The idea is that for firms with pre-existing provident funds, compliance with the new pension law would involve little to no change in nonwage labor costs as compared to firms that were forced to introduce a pension system. For the latter, the mandated contribution rate introduces a substantial spike in nonwage labor costs that may affect wages and/or labor demand.

As compared to existing studies which have mainly examined adjustments in wages and employment in response to employer provided benefits, we explore additional margins of adjustment that may allow firms to accommodate the cost of providing pension benefits. These include other employee benefits such as transport allowances and bonuses, as well as non-labor production inputs. We also explore employment changes at different points of the wage distribution which could arise because of heterogeneity in employer valuation of social insurance or other institutional factors.

The paper is organized as follows. Section two outlines a conceptual framework which is widely used in this literature and reviews the body of empirical evidence focusing on studies from developing countries. Section three describes the 2011 pension reform and key institutional features that inform our empirical models and the interpretation of results. Section four describes the data and provides descriptive statistics. Section five presents the empirical models and discusses the results. Conclusions and policy implications are presented in section six.

2. Conceptual Framework and Existing Evidence

We follow Gruber (1997) who provides a formal treatment of the conditions under which employers will be able to fully shift the cost of mandated social insurance to workers' wages. Following Gruber we represent the labor demand function as $L_d = f_d(w^*(1+t_f))$ while labor supply takes the form $L_s = f_s(w^*(1-at_e) + qwt_f)$. The variable w represents the pretax wage, t_f is the mandated pension contribution rate firms incur while t_e is the pension contribution rate levied on employees. Variable a represents the extent to which employees discount pension contributions relative to cash income such that $a=0$ would indicate fringe benefits are valued at the mandated contribution rate. Similarly, q captures employees' valuation of employer contributions relative to cash income such that $q=1$ indicates that workers treat employers' contributions as cash income. The equilibrium condition based on the above expressions is

$$\frac{d \ln w}{dt_f} = - \frac{\eta^d - q\eta^s}{\eta^d - (1-at_e)\eta^s} \quad (1)$$

where η^d and η^s are the price elasticities of labor demand and supply, respectively. As shown in Gruber (1997), one of the conditions under which full shifting of employer contribution to social insurance to wages can occur is when employees value the pension promise at its cost. As indicated in (1), this occurs when $a=0$ and $q=1$ suggesting a strong linkage between benefits and contributions. Full shifting may also be possible if labor supply is completely inelastic or if the elasticity of labor demand is infinity.

Gruber (1997) provides evidence in support of full shifting of payroll taxes to wages. He found a significant increase in wages following the elimination of an employer mandate to provide social insurance in Chile with no change in

employment. However, since wages are more likely to be flexible upward rather than downward, it is doubtful that this evidence implies that employers can readily offset an increase in mandated benefits by reducing wages. Using firm-level data from Colombia, Kugler and Kugler (2009) find only partial (25%) shifting of a payroll tax increase to workers' wages accompanied by a significant reduction in employment. Interestingly, the negative employment effect in Colombia was stronger among production workers as compared to nonproduction workers. In Brazil, Almeida and Carneiro (2012) find that workers in municipalities with strict enforcement of mandated benefits received lower wages to offset employer contributions while localities with less frequent inspection by the labor office showed a reduction in formal employment and an increase in informal employment. Joubert (2015) also finds that mandatory pension contributions encourage informality in Chile underscoring the fact that mandated pension contributions cannot be imposed on all workers in the presence of sizeable informal sector.

There is also indirect evidence on the negative employment effects of payroll taxes from studies that have examined the impact of noncontributory social protection programs for informal sector workers. Bosch and Campos-Vazquez (2014) find that government provision of health insurance to informal sector workers in Mexico led to a significant reduction in the number of employers and employees among small and medium producers in the formal sector. This finding is consistent with Aterido et al. (2011) who find an increase in informal employment as a result of this social assistance program in Mexico. These studies show a significant reduction in formal sector employment suggesting that workers in the informal sector value the pension benefits less than the cost to employers of providing such benefits (Levi, 2008).

3. Pension Reform and Institutional Background

In June 2011 the Ethiopian government issued Proclamation No. 715/2011 also known as the “Private Organizations Employees Pension Proclamation”. Its stated objectives are expanding the scope of social security in Ethiopia and contribute to social justice, industrial peace, poverty reduction and development. This law establishes a publicly managed mandatory pension scheme that covers permanent employees of formal private organizations. It is a defined benefit social security system purely related to employment in the formal sector. Self-employed and workers in the informal sector are not included in this scheme. The proclamation extends the existing pension scheme that covers federal and state government employees, the armed forces and employees of state owned enterprises.

The proclamation also establishes the Private Organizations Pension Fund (POPF) which is based on contributions of employers and employees. By 2015, that is, four years after the proclamation, employers are required to contribute 11% of an employee’s monthly salary to the pension fund. During the first three years of the pension scheme, employer contributions were set at 7%, 8% and 9%, respectively. Employees are expected to contribute 7% of their salary from 2015 onwards, rising from 5% in 2011 and 2012 to 6% in 2013 and 2014. This implies that the post reform years in our firm-level panel data do not have the same pension contribution rates. Workers in private organizations that have pre-existing “Provident Funds” (PFs) can choose to continue with PFs or transfer their savings to the new POPF. This choice is available only for workers who were hired before the pension reform while new hires should be registered under the new scheme. Employer and employee contribution rates under PFs cannot be below the contribution rates stipulated by the 2011 pension law. Employees need to work for at least 10 years to benefit from the pension scheme after retirement, which is set at 62 years of age. The replacement rate is based on years of experience. Payout is set at 30% of average salary during the three

years preceding retirement for a worker who has contributed for 10 years. Payout increases by 1.25 percentage points for each year of service above 10 years.

This proclamation also establishes the Private Organization Employees Pension Agency (POEPA) to oversee and implement the pension scheme. This is a separate entity from the department that runs pension schemes for government employees. Since there are no stock markets in Ethiopia, the POEPA will invest its funds in treasury bonds and other profitable investment options specified by the Federal Ministry of Finance and Economic Development (MoFED).¹

The pension law seems to be backed by stringent enforcement mechanisms. Employers are required to register with the POEPA and declare the number of existing permanent employees and report employment contracts of new hires to the agency within 60 days. The law empowers the POEPA to deduct arrears from an employer's bank account if it fails to make pension contribution in time.² The pension law is also enforced through the government tax collection system. For instance, firms will not be able to file their profit taxes until they verify payment of pension contributions. Because employer pension contributions are tax deductible and the penalties for failing to pay taxes are stiff, employers cannot ignore pension contributions without facing penalties. Moreover, the POEPA has direct access to the list of employees for whom the firm has withheld income taxes. The POEPA could thus monitor compliance with the pension law by crosschecking the list of employees with pension identification numbers against the list of workers in the income tax system.

¹ The banking sector in Ethiopia remains underdeveloped and highly dominated by state-owned banks. There are no foreign banks and investment banks in Ethiopia while private commercial banks play a limited role in the financial sector (World Bank, 2009; Zewdu 2014). It is possible

that the inexperience in managing private pension contributions and the lack of sophistication in
² If ordered by the Agency to make such a deduction, banks shall do so without a need for a court order. If the private organization does not have sufficient funds in its bank account to cover the arrears, the Agency has the power to liquidate the properties of the private organization to collect the arrears.

The fact that pension benefits are available only for permanent employees may create an incentive to ration permanent employment positions. Anticipating this possibility, the law prevents firms from denying permanent employment status to any worker who has been employed for more than 45 days. Moreover, the POEPA has created a dedicated hotline for workers who have been denied pension benefits.

While these are potentially strong enforcement mechanisms, it is not clear how effective they have been in practice. For instance, while the POEPA has access to the list of workers for whom income tax has been withheld by the firm for the purpose of crosschecking with the list of workers in its pension accounts, these data are not available in electronic format which precludes quick verification. Any weakness in the tax revenue collection system will also weaken enforcement of the pension law as the latter depends on the former. For instance, because taxes cannot be filed electronically, tax offices are typically inundated by tax payers who want to beat the deadline to file taxes. This undermines the ability of tax officers to thoroughly verify each employer's pension contributions before allowing it to pay profit taxes as the new law requires. Overall, the enforcement mechanism seems very strong in regards to workers who are already registered with the POEPA and have pension identification numbers. There remains uncertainty on the agency's ability to monitor employment changes after the firm's initial registration. As shown in Figure 2, while there is significant increase in the proportion of firms making pension contribution in 2012 and 2013 relative to the fraction of firms offering provident funds voluntarily before 2011, compliance with the new law remains below 50 percent based on the CSA data.

While there is a minimum wage for public sector employees in Ethiopia, there is no minimum wage in the private sector. Therefore, there is no restriction on downward adjustment of wages if employees and employers agree to shift the cost of pension benefits to workers' wages. This implies that the pension reform may not reduce firms' demand for low-wage workers if the latter value pension

benefits at cost. The POEPA has a minimum pension which presumably increases the supply of low-wage workers to the formal sector as their pension benefits would exceed their contributions.³

The macroeconomic context within which the pension reform occurred is also relevant. Between 2005 and 2015, the Ethiopian economy has been growing by 10 per cent per annum which is double the rate of growth between 1995 and 2004. Growth in the manufacturing sector, where the data for this study come from, has been growing faster than the rest of the economy (See Figure 1). The sector's demand for labor has clearly been growing both before and after the 2011 pension reform. Set against a background of an overall increase in labor demand in manufacturing, our task is to examine if firm-level demand for labor among incumbent firms was affected by the pension reform.

4. Data and Descriptive Statistics

We use data from the annual census of manufacturing firms in Ethiopia conducted by the Central Statistical Agency (CSA) of Ethiopia. The census covers all manufacturing firms that employ at least ten workers and use power driven machinery. The data contain detailed information on production costs, employment, output and organizational structure. Our data span the period 2008 to 2013 covering both the pre- and post-reform periods. However, due to changes made to firm identification numbers by the CSA in the 2012 and 2013 rounds, we are unable to use the entire census for our econometric analysis. We have been able to put together a panel data set using codes given by the Ethiopian Electric Power Authority for billing purposes.

As shown in Table 1, the loss of observation due to this unfortunate incident does not seem to bias our sample. For instance, the average firm size in terms of

³ Minimum pension is adjusted every five years and at the moment it is set at Birr 503.

employment and sales is essentially identical. The fact that the total number of workers and firm-year observations in our panel data relative to the census are about 15 percent each reassures that no sample selection bias is introduced by the manner in which our panel data is constructed.

Figure 1, based on the census data, shows that total manufacturing sector sales and employment have been growing post 2011 at a relatively faster rate than in the preceding three years. There is no evidence therefore that the pension reform has resulted in a reduction in employment or even a slowdown in the rate of growth of total manufacturing employment.

Table 2 shows that firms with pre-existing provident funds are larger and older than those without such schemes. Wage rates, productivity and investment per worker are also higher in the former as compared to the latter. Table 2 also shows that differences in firm size, both in employment and sales, between these two groups of firms were narrowing down before the reform before they started to widen since the reform. The same trend is observed in terms of differences in real wage rates. Therefore, while firms with and without pre-existing provident funds do not show parallel trends before the reform in employment and wages, the two main outcome variables of interest, it is clear that these differences were narrowing down before showing divergence since the reform. Among firms with nonzero pension contributions, the average contribution rate was about 4.5 percent before the reform. Under the mandated scheme, the actual contribution rate for these firms increased by approximately half a percentage and 0.008 percentage points in 2012 and 2013, respectively. For firms without any pre-existing provident funds, pension contributions rates rose to 5.3% in 2012 and 6% in 2013 from zero contributions before the reform.

5. Estimation and Discussion of Results

5.1. Changes in Labor Cost

We start the econometric analysis by showing the change in nonwage labor costs following the pension reform in 2011. The dependent variable here is a firm's contribution to pension and disability benefits in real per worker terms annually. We use industry level producer prices provided by the CSA to change employer contributions in Ethiopian Birr to real values. We then examine the change in real wages to test the hypothesis of full-shifting of social insurance to wages. Similarly, we assess if firms were able to adjust other employee benefits such as bonuses and employee allowances for food and transportation costs.

The basic models we test take the form:

$$\ln\left(\frac{C_{it}}{L_{it}}\right) = \alpha_0 + \beta PR_t + \gamma PR_t * NPF_i + v_i + \varepsilon_{it} \quad (2)$$

where subscripts i and t index employers and year, respectively, C is total employer contribution to social insurance, L is total employment, PR is a post reform dummy which takes the value one for post-reform years and zero for pre-reform years, NPF is a dummy variable that takes the value one for firms without pre-reform provident funds and zero otherwise. Time invariant firm fixed effects are represented by v while ε is the error term. Because the pension contribution rate has been changing during the post-reform period as discussed earlier, it is not realistic to represent them by a single post-reform dummy variable (PR). Instead we treat 2012 and 2013 separately as post-reform years and interact them with the variable NPF . We estimate (2) using a panel fixed effects specification. Standard errors are clustered at the firm level to account for heteroscedastic and autocorrelated errors.

We follow the same approach to estimate the change in firm-level real wage rate which we obtain by dividing the wage bill (W) by total number of employees.

$$\ln\left(\frac{W_{it}}{L_{it}}\right) = \alpha_0 + \beta PR_t + \gamma PR_t * NPF_i + v_i + \varepsilon_{it} \quad (3)$$

As indicated in Figure 2 above, the fraction of firms making pension contributions has increased significantly after the reform but compliance remains just below 50 percent. Our model therefore captures the Intent-to-Treat effect of the pension reform.

The results are presented in Table 3. The first column shows no significant change in real pension contribution per worker before the reform (2008-2011) followed by a substantial spike in the post reform years of 2012 and 2013. As would be expected, the rate of increase in social insurance contributions is much higher for firms without pre-existing provident funds. The large and significant increase in pension contributions even for firms with pre-existing provident funds suggests that these voluntary schemes were typically less generous as compared to the mandated program. The increase in nonwage labor cost is therefore undoubtedly very high.

Column 2 of Table 3 answers the question whether this spike in labor cost has been shifted to workers in terms of lower wages. If any thing, there has been a significant increase in average real wages after the pension reform which is particularly higher for firms without pre-reform provident funds. This finding is contrary to the expected reduction in wages as firms attempt to offset at least part of the increase in social insurance contributions. Since the dependent variable is average wage at the firm-level, this observation could be a reflection of the strong macroeconomic context where per capita income has been rising in Ethiopia during 2008-2013. However, this would have been a plausible explanation had firm-level employment in manufacturing also been growing or even remained stable. As we will show shortly, this is not the case in our sample.

Since we do not have worker-level data, another explanation for the increase in average real wages is a reduction in the number of low-wage workers.

Before we examine firm-level adjustment of employment, we explored changes in other nonwage costs of labor. This is reflected in columns 3 and 4 of Table 3 where the dependent variables are bonuses per worker and allowances per workers (specifically food and transportation allowances). As indicated in Table 3, there has been no change in bonuses and allowances per workers in response to the spike in pension contributions.

Since compliance with the pension law and access to resources including external credit and business networks increase with firm size and age, we expand Eq. 2 and 3 by including real sales and firm age. As reported in Table 4, the results from these extended models are similar to Table 3 except for minor differences in magnitude. The fact that pension contributions per worker increase with sales suggests that larger firms are less likely to evade the pension law and/or they have access to resources that would allow them to comply with the law and remain profitable. The dependent variable in column 5 of Table 4 is the logarithm of unit labor cost calculated as total labor cost (wage and nonwage costs) to output ratio. If total labor cost increases after the reform without any change in productivity, then the rate of increase in unit labor cost should be similar to the rate of increase in pension-contributions and wages. However, the last column of Table 4 shows that while unit labor cost did increase significantly in 2012 and 2013 particularly among firms without pre-existing provident funds, the rate of increase is significantly lower than that of pension contribution and wages per worker. This suggests that productivity has improved at the same time allowing firms to offset some of the increase in labor cost after the reform.

While the preceding discussion addresses the Intent-to-Treat effects of the pension reform, we now examine the effects of the actual pension contribution

rate on labor costs. This is an approach used in Gruber (1997) and Kugler and Kugler (2006) to study the incidence of payroll taxes. The model we estimate is:

$$\ln\left(\frac{W_{it}}{L_{it}}\right) = \beta_0 + \phi \ln\left(\frac{C_{it}}{W_{it}}\right) + v_i + \omega_t + \varepsilon_{it} \quad (4)$$

where $\frac{C_{it}}{W_{it}}$ is the actual pension contribution rate and ω_t represents time fixed effects.

Although the pension law sets the same contribution rate for all firms, Figure 3 shows substantial variation across firms in $\left(\frac{C_{it}}{W_{it}}\right)$. The figure also shows compression in the distribution of pension contribution rate under the mandatory scheme as compared to the variance under the pre-reform voluntary scheme. While the latter is fully anticipated, it is not entirely clear why there remains substantial variation in the actual employer contribution rate notwithstanding the reduced variation. The mean employer contribution rate is approximately 5% in both 2012 and 2013, which is far below the 8% and 9% mandated contribution rates set by government. One possible explanation is the presence of paid employees for whom the firm does not make pension contributions. If there is across-firm variation in the proportion of such workers, $\left(\frac{C_{it}}{W_{it}}\right)$ will not capture the true cost of the pension scheme to employers. Moreover, using the actual contribution rate as an explanatory variable introduces a selection bias since the pre-reform provident funds were voluntary and not all firms are complying with the new pension law as indicated earlier. While an instrumental variable approach may address these concerns, such variables are unfortunately not available in our dataset.

With these caveats in mind, Table 5 presents panel fixed effects estimates of (4). It is worth noticing that the coefficients on $\left(\frac{C_{it}}{W_{it}}\right)$ are statistically insignificant for wage and non-wages labor costs suggesting no evidence of full switching of pension contributions to wages or other forms of employee compensation. This is interesting particularly for the wage equation where the specification would favor a significant negative coefficient as the dependent variable is the log of $\left(\frac{W_{it}}{L_{it}}\right)$. The bottom line is that among firms with data on actual pension contribution rates, there is no strong negative correlation with average wage rates.

5.2. Adjustment in Production Cost Structure

According to the theoretical framework presented earlier, firms are expected to reduce employment if they cannot offset the cost of social insurance by reducing wages. This requires the implicit assumption about the absence of other margins of adjustment that firms might explore or the associated adjustment costs are much steeper than adjusting labor. However, firms may consider terminating an employment contract as a last resort action partly because the cost of hiring and firing is at least as high as adjusting nonlabor production inputs, and partly because there might be a room for improvement in the efficiency of such inputs. To test this possibility, we examine change in the share of nonlabor production inputs in total variable cost. These include expenditures on intermediate inputs, energy, water and mundane repair and maintenance.

As shown in the first column of Table 6, there is a modest reduction in the share of nonlabor inputs in total variable cost particularly in 2013. This reduction seems to have come from a reduction in the cost share of raw materials which in turn can be traced to a reduction in the cost of imported raw materials. Since the reduction in the cost of imported raw materials is a continuation of a trend that

started before the pension reform, it cannot be indicative of a response to an increase in labor cost after the reform. Overall, it is safe to conclude that firms have not been able to absorb the increase in labor cost following the pension reform by reducing expenditure on other production inputs.

5.3. Changes in Labor Demand

We now turn to the change in firm-level employment (L_{it}) using a similar model for wage and nonwage labor costs.

$$\ln(L_{it}) = \alpha_0 + \beta PR_t + \gamma PR_t * NPF_i + v_i + \varepsilon_{it} \quad (5)$$

We are also interested in exploring if the change in labor demand is accompanied by a change in the skill composition of workers. It is possible that high-skilled workers may want to receive the returns to their human capital in the form of higher wages as well as fringe benefits. Low-skilled workers however may be skeptical about the benefits they will draw from the pension scheme. This may arise from the higher likelihood of unemployment and/or longer duration of unemployment among low-skilled workers as compared to high-skilled workers. Since pension benefits are tied to experience, low-skilled workers may benefit less from the pension scheme due to shorter employment spells. Low-skilled workers are thus less likely to accept wage reductions to compensate the employer for additions costs. These workers may thus choose to move to the informal sector or work informally for the same firm in the formal sector. The firm may also choose to fire low-skilled workers and retain only high-skilled workers who value the pension contribution and are more likely to increase their work efforts now that they are invested in the firm's growth.

To capture this effect we use data provided by the CSA on the number of workers in a firm by monthly wage categories. We use the wage interval that

contains the median firm-level average monthly wage rates (annual wage bill divided by 12 times the number of workers) to determine the number of low- and high-wage workers. Because the median wage so calculated has been increasing over the sample period, we shifted the cutoff point to a higher wage intervals particularly for 2012 and 2013. This approach will avoid a situation in which the number of low-wage workers declines simply because the wage distribution shifts to the right while the threshold remains unchanged.

The results of the labor demand model are presented in Table 7. Although firm-level employment has been declining before the pension reform, column 1 shows that the rate of decline intensified substantially starting from 2011. Average firm size in private manufacturing declined by about 10.6 per cent in 2011 and by 22.8 and 30.2 per cent in 2012 and 2013, respectively. The increase in the rate of decline in labor demand seems to match the increase in the pension contribution rate since 2011. While there is some evidence of further contraction of employment after the reform among firms without pre-existing provident funds, the coefficients on the interaction terms lack precision; the coefficient on NPF*2013 is significant at 12 per cent. Given the rapid increase in firm-level sales particularly in 2012 and 2013, it is quite interesting to find a significant contraction in firm-level employment simultaneously. This suggests that the increase in nonwage labor costs brought about by the social insurance mandate has been too steep for employers to shift to workers in the form of lower wages such that downsizing was inexorable even in the middle of rapid increase in output demand. It is important to note that most studies on compensating differential in wages following pension reforms test the effects of relatively small changes in contributions rates which are presumably easier to shift to wages.

Perhaps the most interesting finding of our analysis is the change in the composition of the workforce after the pension reform. Column 2 of Table 7 shows a deeper and statistically significant cut in the number of low-wage workers during and after the launching of the pension reform. The number of low-

wage workers declined by 37 and 46 per cent, respectively, in 2012 and 2013. To the contrary, there has been no negative employment effect among high-wage workers suggesting that almost all of the reduction in total employment after the reform is explained by job losses among low-wage workers. The last column in Table 7 shows the change in the share of low-wage workers which has declined significantly in 2012 and 2013. Because we are using pre-determined wage categories defined by the statistical agency, some workers might have experienced wage growth and moved into a high-wage category despite our efforts to shift the cutoff wage category. However, this does not seem to be the case in our data as the coefficients from the high-wage regression in column 3 are smaller and statistically insignificant as compared to the coefficient from the low-wage regression. The coefficients in columns 2 and 3 would have been mirror images of one another with opposite signs had the change in the composition of workers was driven by workers closer to the cutoff wage rate crossing from one side to the other.

The findings in Table 7 are consistent with our initial expectation about potential heterogeneity in employees' valuation of pension benefits. Given that high-wage workers are more likely to have uninterrupted employment spells and potentially higher wages just before retirement, they are more likely to secure pension benefits with a higher replacement rate. Since health and longevity are also correlated with current standards of living, high-wage earners may enjoy better benefits over a longer time horizon than low-wage workers. Whether high-wage workers have agreed to take lower wages to offset some of the employer's cost of social insurance cannot be observed directly from the firm level data which only reveals average wages. Nonetheless, results in Table 7 suggests that the significant increase in real wages after the pension reform is consistent with the reduction in the number of workers at the lower end of the wage distribution.

Given potential weaknesses in the enforcement of the pension law discussed earlier, it is possible that firms are underreporting the number of permanent

employees to minimize pension contributions. This is more likely to happen if low-wage workers also attach very low value to pension benefits. In this case our findings in Table 7 suggest a reduction in formal employment in the private manufacturing sector which increases the number of workers hired informally by registered firms.

We now turn to the relationship between the actual pension contribution rate and labor demand using a similar specification in (4) for labor costs. This approach restricts the analysis to firms with non-zero pension contributions as explained in section 5.1 and the results are presented in Table 8. The first column indicates a strong negative association between the cost of social insurance and firm-level labor demand. This is consistent with the results in Table 5 where there is no evidence of full-switching of the cost of social insurance to workers' wages. Comparison of columns 2 and 3 in Table 8 reveals that this negative association is evident among low-wage rather than high-wage workers echoing the findings in Table 7.

5.4. Investment and Productivity

As relative factor prices change, firms are expected to adjust the composition of factor inputs. Given the increase in labor costs and the reduction in firm-level employment documented above, it is important to examine the extent to which manufacturing firms have substituted capital for labor. This substitution may also boost labor productivity given the potential complementarity between skilled labor and capital although firms can also engage in other productivity enhancing activities such as training of workers. In this section we examine changes in investment per worker after the pension reform to capture the extent of factor substitution. We also analyze productivity growth using partial factor productivity defined in terms of real value added per worker as well as total factor productivity

calculated as a residual from the widely used Levinsohn-Petrin production function.⁴

The results are presented in Table 9. The first column shows a negative, albeit insignificant, trend in investment per worker prior to the pension reform that has been reversed in 2012 and 2013. The increase in investment per worker was very large and highly significant in 2013. The positive and statistically significant coefficients on the interaction terms suggest further intensification of investment activities among firms without pre-existing provident funds which is consistent with the sharp increase they experiences in nonwage labor costs. Given the pervasive scarcity of external credit for private sector firms in Ethiopia (World Bank 2009; Shiferaw 2016), it is remarkable to see an uptick in investment following the pension reform. Consistent with our expectations, columns 2 and 3 of Table 9 show that labor productivity and total factor productivity have risen significantly in 2012 and 2013.

In Table 10 we estimate the relationship between the actual employer pension contribution rate and the firm's investment and productivity outcomes. We find significant positive association between pension contribution rate and indicators of firm-level productivity among firms making pension contributions while the relationship with investment remains positive but insignificant. This is broadly consistent with the results in Table 9 using the Intent-to-Treat approach for the broader sample.

⁴ The Levinsohn-Petrin (2003) method of estimating production functions uses a proxy variable approach to address endogeneity of factor inputs. We implemented this model using value added as the dependent variable and, raw materials and electricity consumption as proxies for productivity shocks. All variables are in constant prices and enter the model in logs.

6. Conclusion

This paper examined the labor market implications of a major social insurance reform program in Ethiopia that for the first time mandated pension and disability benefits to employees in the formal private sector. Using firm-level panel data from Ethiopian manufacturing, we found no evidence of employers shifting the cost of social insurance to workers in the form of wage reductions despite substantial increases in nonwage labor costs after the reform. If any thing firm-level average wages calculated as wage bill per worker increased significantly after the pension reform while other employee benefits such as bonuses and transportation allowances remained largely intact. We also found no major change in the structure of variable production costs after the reform except for a small reduction in the cost share of imported intermediate inputs.

Consistent with the post-reform increase in labor costs, we find significant reduction in firm-level employment. This reduction in employment comes almost entirely from reduction in employment among low-wage workers. This finding seems to be consistent with the increase in average wage rate at the firm level. While the absence of minimum wages together with the existence of minimum pension should have prevented significant contraction of low-wage employment, the fact this has occurred suggests that the fringe benefits the reform provides carry less value for low-skilled workers as compared to skilled workers. This is unsurprising given the fact that average manufacturing wages are already low in Ethiopia and the law requires workers to contribute 7% of their salary to the pension scheme on top of the wage reductions employers may want to impose on workers to offset at least part of their contribution.

The paper also shows increases in investment per worker after the reform particularly among firms that never had provident funds, which is consistent with the increase in the relative price of labor. We also find an increase in labor and total factor productivity in the first two years after the reform which is consistent

with the increase in investment per worker and the retention of more skilled workers.

The reduction in employment particularly among low-wage workers suggests that reforms that introduce flexibility in the pension scheme, such as lower contribution rates for low-wage workers and/or small firms that disproportionately employ low-skilled workers, may help reduce the negative employment effects associated with the social insurance program.

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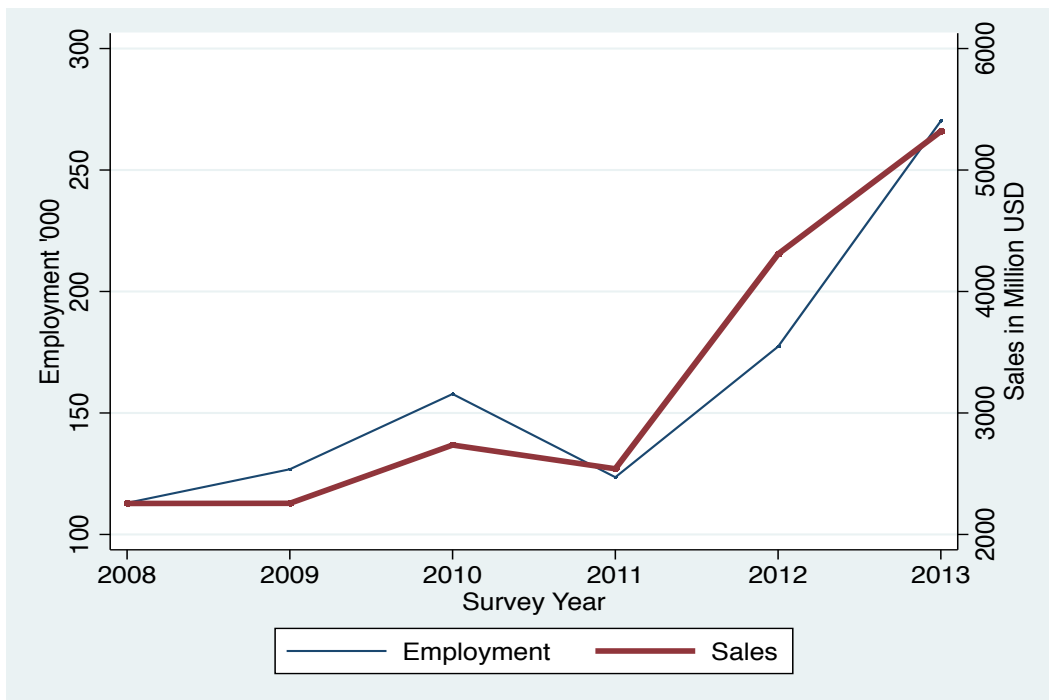


Figure 1: Trends in Manufacturing Employment and Sales

Note: This graph is based on the census data including all manufacturing firms

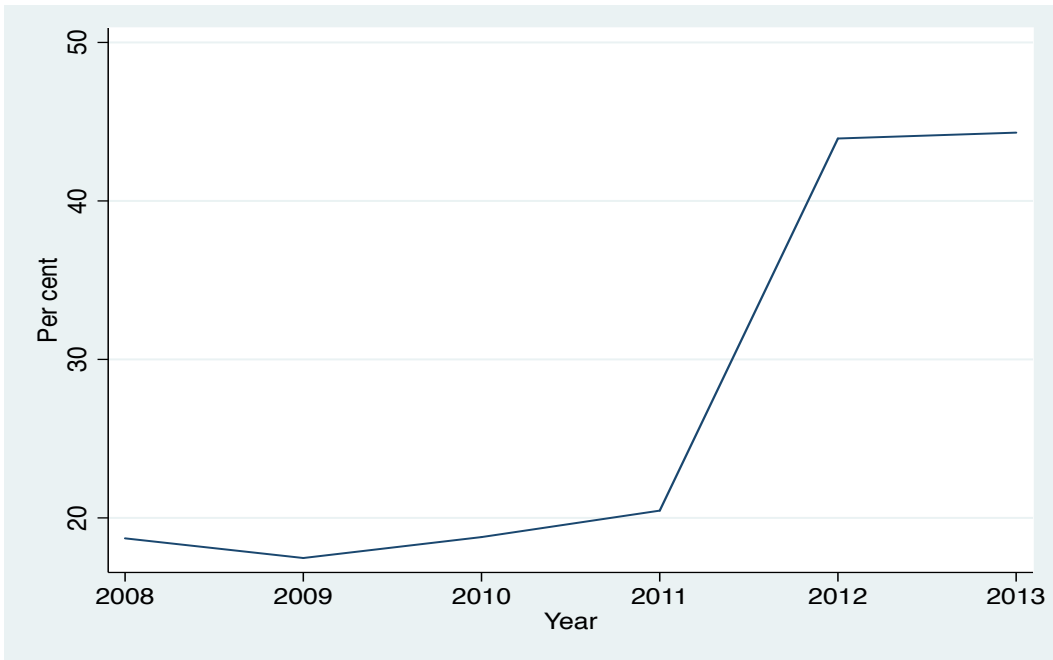


Figure 2: Proportion of Manufacturing Firms Making Pension Contributions

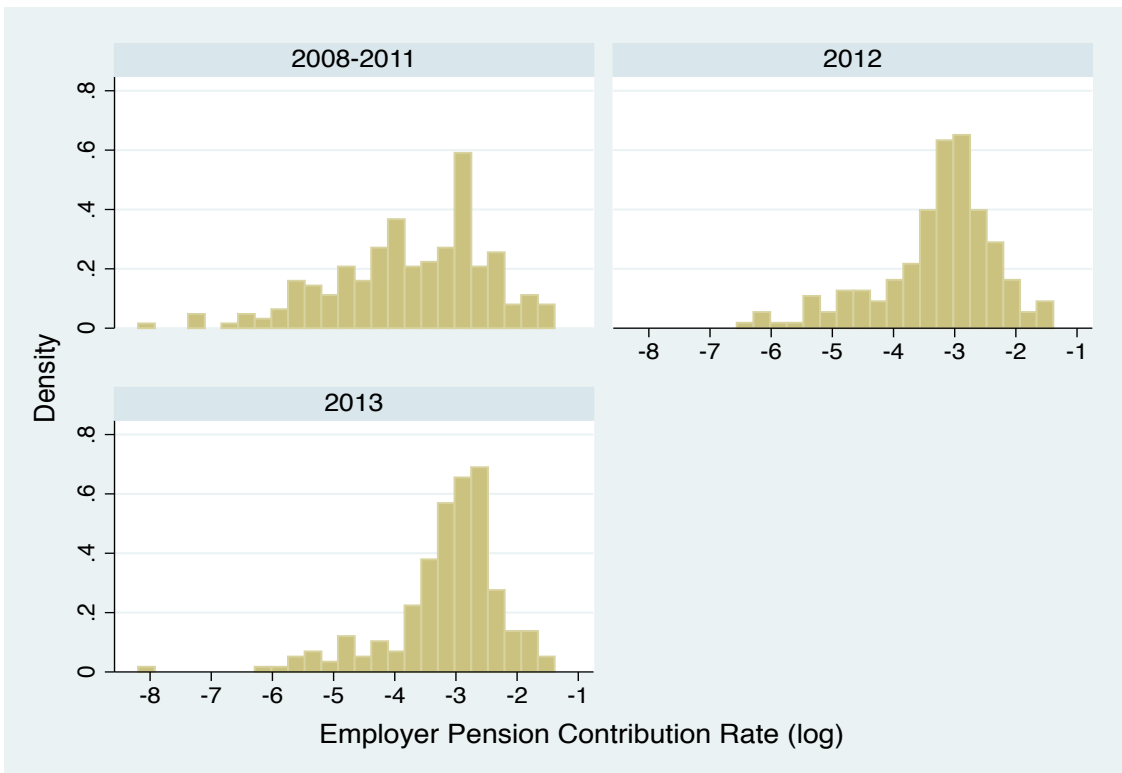


Figure 3: Distribution of Employer Contribution Rates Under the Pre-from (2008-2011) Provident Funds and the Post-reform Mandatory Pension Scheme.

Table 1: Comparing Sample and Census Data

	Census	Panel Data
Observations	11812	1752
ln(Employment)	3.18 (1.25)	3.39 (1.21)
Employment Share		0.15
ln(Sales-million-USD)	11.84 (2.17)	12.47 (2.06)
Sales Share		0.18

Note: numbers in parenthesis are standard errors.

Table 2: Summary Statistics: Sample Means

		2008	2009	2010	2011	2012	2013
Employment	All Firms	102.7	82.6	63.6	66.5	70.7	84.2
	NPF=0	171.6	136.7	92.6	136.0	145.0	184.8
	NPF=1	34.7	37.3	43.7	32.4	34.8	35.7
	Difference	136.9	99.4	48.9	103.6	110.2	149.1
Sales ('million)	All Firms	18.6	12.4	9.5	10.3	22.2	35.0
	NPF=0	34.7	23.1	16.1	24.6	51.6	78.4
	NPF=1	2.8	3.4	4.7	3.2	7.9	12.0
	Difference	31.9	19.7	11.4	21.4	43.7	66.4
Firm Age (years)	All Firms	13.7	13.5	12.0	12.0	13.0	14.0
	NPF=0	16.9	15.1	13.8	14.1	15.3	16.4
	NPF=1	10.6	12.1	10.8	11.0	11.9	12.9
	Difference	6.4	3.0	3.0	3.0	3.4	3.5
Monthly Wage	All Firms	485.1	394.4	590.2	374.0	684.2	1064.3
	NPF=0	689.3	532.0	699.5	528.1	850.4	1382.4
	NPF=1	283.9	275.5	515.5	296.3	607.6	927.1
	Difference	405.4	256.5	184.0	231.8	242.8	455.3
Labor Productivity ('000)	All Firms	150.0	130.3	230.4	120.4	263.3	428.0
	NPF=0	217.2	170.5	308.0	165.0	356.6	563.3
	NPF=1	83.7	96.1	174.2	98.6	218.2	364.2
	Difference	133.6	74.4	133.8	66.4	138.4	199.1
TFP ('000)	All Firms	8.3	8.4	36.7	7.6	13.5	19.4
	NPF=0	12.8	11.3	45.9	10.5	21.6	30.9
	NPF=1	3.7	5.9	30.3	6.1	9.8	14.1
	Difference	9.1	5.4	15.6	4.4	11.8	16.8
Investment per worker ('000)	All Firms	18.1	12.2	40.1	10.8	20.3	43.7
	NPF=0	24.2	15.3	30.8	13.5	25.3	33.8
	NPF=1	8.8	4.1	33.3	9.4	13.4	23.0
	Difference	15.5	11.2	-2.2	4.0	11.9	10.9
Pension Contribution Rate(share of wage bill)	All Firms	0.054	0.045	0.040	0.041	0.051	0.057
	NPF=0	0.054	0.045	0.040	0.041	0.049	0.053
	NPF=1	0.000	0.000	0.000	0.000	0.053	0.060
	Difference	0.054	0.045	0.040	0.041	-0.003	-0.008

Note: All monetary variables are in real Ethiopian Birr.

Table 3: Response in Wage and Nonwage Labor Costs

	Pension Contribution	Wage Rate	Bonus	Other Benefits
2009	-0.1488 (0.1723)	-0.1021 (0.0642)	-0.1507 (0.2871)	-0.0384 (0.2338)
2010	0.0782 (0.2249)	0.1383 (0.1219)	0.0008 (0.3065)	0.2428 (0.2820)
2011	0.1808 (0.1836)	-0.1048 (0.0668)	-0.1703 (0.2481)	0.0491 (0.2265)
2012	1.4196 (0.3088)***	0.4009 (0.0773)***	-0.0382 (0.3269)	-0.0260 (0.3370)
2013	1.3386 (0.3291)***	0.8825 (0.0893)***	0.1690 (0.3497)	0.1786 (0.3646)
NPF*2012	1.1424 (0.3358)***	0.2782 (0.0939)***	-0.1059 (0.3390)	0.2420 (0.3295)
NPF*2013	1.7017 (0.3565)***	0.2224 (0.1129)**	-0.0677 (0.3579)	0.1771 (0.3457)
R^2	0.25	0.26	0.00	0.00
N	1,691	1,664	1,683	1,683

Note: Column heads are dependent variables expressed in real per worker terms. 'Other Benefits' includes transportation and food allowances. The post-reform period is represented by dummy variables for 2012 and 2013. *NPF* is a dummy variable that takes the value one for firms without pre-reform provident funds and zero for firms providing such benefits voluntarily. The results are from a panel fixed effects specification and the numbers in parenthesis are robust standard errors clustered at the firm-level. Asterisks ***, ** and * represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 4: Response in Wage and Nonwage Labor Costs

	Pension Contribution	Wage Rate	Bonus	Other Benefits	Unit Labor Cost
2009	-0.1478 (0.1952)	-0.0867 (0.0724)	-0.2232 (0.2998)	-0.0015 (0.2487)	-0.1322* (0.0769)
2010	0.1322 (0.2521)	0.2038 (0.1308)	0.0056 (0.3253)	0.3307 (0.3072)	0.1268 (0.1370)
2011	0.1801 (0.2690)	-0.0578 (0.0902)	-0.3141 (0.3295)	0.0700 (0.2933)	-0.1072 (0.1054)
2012	1.1566*** (0.3706)	0.3526*** (0.1111)	-0.3389 (0.4478)	-0.1099 (0.4064)	0.1424 (0.1323)
2013	0.7964* (0.4444)	0.7573*** (0.1352)	-0.3719 (0.5001)	-0.0508 (0.4647)	0.4319*** (0.1583)
NPF*2012	1.1170*** (0.3322)	0.2929*** (0.0944)	-0.2166 (0.3382)	0.0862 (0.3301)	0.2651** (0.1053)
NPF*2013	1.8168*** (0.3534)	0.2669** (0.1131)	-0.1284 (0.3599)	0.0707 (0.3488)	0.2473* (0.1302)
Ln(Sales)	0.3443*** (0.0687)	0.1483*** (0.0354)	0.3143*** (0.0820)	0.2363*** (0.0722)	-0.6338*** (0.0442)
Ln(Age)	0.2195 (0.4486)	-0.0469 (0.1623)	0.3641 (0.5378)	0.1970 (0.4504)	0.1237 (0.1748)
R^2	0.28	0.29	0.02	0.02	0.40
N	1,657	1,637	1,650	1,650	1,643

Note: Sales are measured in real Ethiopian Birr while firm age is measured in years. Unit Labor Cost is calculated as the ratio of total labor cost to total sales.

See notes under Table 3.

Table 5: Incidence of Pension Contribution and Labor Cost

	Wage Rate	Bonuses	Other Benefits	Unit Labor Cost
$\ln\left(\frac{C_{it}}{W_{it}}\right)$	-0.0854 (0.0683)	-0.0123 (0.1638)	0.0557 (0.1803)	-0.0955 (0.0772)
2009	-0.1505 (0.1713)	0.1663 (0.8163)	-0.4435 (0.5652)	-0.2761* (0.1601)
2010	0.6337* (0.3224)	1.0972 (0.7833)	1.6206** (0.7652)	0.6538* (0.3372)
2011	-0.1831 (0.1483)	-0.0907 (0.7144)	-0.4353 (0.5919)	-0.2644 (0.1840)
2012	0.4013** (0.1669)	0.4010 (0.7570)	-0.3312 (0.6078)	0.1109 (0.1935)
2013	0.8402*** (0.2055)	0.5915 (0.8921)	-0.4768 (0.6898)	0.3551 (0.2378)
Ln(Sales)	0.1951** (0.0852)	0.1464 (0.2390)	0.5496*** (0.1785)	-0.5579*** (0.0888)
Ln(Age)	-0.3839 (0.2983)	0.8085 (1.0279)	1.2732 (0.7836)	-0.1792 (0.4486)
R^2	0.30	0.03	0.09	0.42
N	609	609	609	609

Note: $\left(\frac{C_{it}}{W_{it}}\right)$ is the actual pension contribution to wage bill ratio for firms with nonzero contributions. Sales is measured in real Ethiopian Birr while firm age is measured in years. Unit Labor Cost is calculated as the ratio of total labor cost to total sales. See notes under Table 3.

Table 6: Adjustment in Composition of Variable Production Costs (Percentage Shares)

	Non-Labor	Intermediate Inputs			Other
	Inputs	Total	Local	Imported	Inputs
	1	2	3	4	5
2009	0.0026 (0.0131)	0.0057 (0.0137)	-0.0414 (0.0350)	-0.0891*** (0.0296)	-0.0032 (0.0058)
2010	-0.0546*** (0.0208)	-0.0818*** (0.0241)	-0.0115 (0.0344)	-0.0714* (0.0407)	0.0272** (0.0125)
2011	-0.0085 (0.0165)	-0.0062 (0.0191)	0.0155 (0.0340)	-0.0751** (0.0351)	-0.0023 (0.0090)
2012	-0.0307 (0.0219)	-0.0310 (0.0241)	0.0519 (0.0475)	-0.0842* (0.0446)	0.0003 (0.0112)
2013	-0.0621** (0.0253)	-0.0532* (0.0281)	0.0288 (0.0543)	-0.1102** (0.0524)	-0.0089 (0.0141)
NPF*2012	-0.0183 (0.0177)	-0.0198 (0.0213)	0.0098 (0.0382)	-0.0300 (0.0371)	0.0015 (0.0104)
NPF*2013	-0.0194 (0.0204)	-0.0327 (0.0238)	0.0039 (0.0403)	-0.0113 (0.0391)	0.0133 (0.0117)
Ln(Sales)	0.0315*** (0.0061)	0.0391*** (0.0070)	0.0073 (0.0097)	0.0322*** (0.0100)	-0.0076** (0.0033)
Ln(Age)	0.0327 (0.0264)	0.0194 (0.0303)	-0.0539 (0.0434)	0.0731 (0.0563)	0.0133 (0.0139)
R^2	0.08	0.10	0.01	0.04	0.03
N	1,657	1,657	1,466	1,111	1,657

Note: Non-labor inputs include intermediate inputs, which are decomposed into 'Local' and 'Imported' inputs, and 'other inputs' which is the summation of expenditure on energy, water and lubricants. The dependent variables on column heads are percentage shares of the relevant inputs in total variable production cost which includes labor costs. See also notes under Tables 3 and 4.

Table 7: Labor Demand and Skill Composition of Workers

	Total Employment	Low-wage Workers	High-wage Workers	Low-wage Share
	1	2	3	4
2009	-0.0890 (0.0632)	-0.1552** (0.0769)	0.0698 (0.0785)	-0.0732*** (0.0239)
2010	-0.0897 (0.0834)	0.1381 (0.1086)	0.1883 (0.1427)	-0.0019 (0.0285)
2011	-0.1126* (0.0671)	-0.1873** (0.0884)	-0.0019 (0.0948)	-0.0434 (0.0267)
2012	-0.2586** (0.1064)	-0.4636*** (0.1207)	0.1769 (0.1326)	-0.1260*** (0.0332)
2013	-0.3596*** (0.1265)	-0.6243*** (0.1365)	0.2240 (0.1542)	-0.1692*** (0.0379)
NPF*2012	-0.0943 (0.0725)	-0.0456 (0.1018)	-0.0914 (0.0982)	-0.0294 (0.0279)
NPF*2012	-0.1258 (0.0789)	-0.0216 (0.1104)	-0.1286 (0.1027)	-0.0203 (0.0306)
Ln(real sales)	0.1916*** (0.0278)	0.1185*** (0.0323)	0.2545*** (0.0400)	-0.0227*** (0.0077)
Ln(firm age)	0.3022** (0.1324)	0.0680 (0.1495)	-0.0676 (0.1771)	0.0557 (0.0425)
R^2	0.15	0.10	0.15	0.13
N	1,650	1,581	1,449	1,636

Note: The cutoff for low- and high-wage workers is based on the median firm-level average wage. The dependent variables in Columns 1-3 are logarithms of the number of workers while Column 4 features the percentage share of low-wage workers. See also notes under Table 4 .

Table 8: Incidence of Pension Contribution and Labor Demand

	Total Employment	Low-Wage Workers	High-Wage Workers	Low-Wage Ratio
$\ln\left(\frac{C_{it}}{W_{it}}\right)$	-0.0700** (0.0334)	-0.1711*** (0.0541)	-0.0161 (0.0453)	-0.0336*** (0.0091)
2009	-0.0848 (0.1159)	-0.0972 (0.1935)	-0.1443 (0.1374)	0.0028 (0.0416)
2010	0.0057 (0.1688)	0.1660 (0.2418)	0.4225 (0.2798)	0.0238 (0.0583)
2011	-0.0614 (0.1202)	-0.0422 (0.1940)	-0.0913 (0.1372)	0.0171 (0.0373)
2012	-0.2419* (0.1432)	-0.2778 (0.2025)	-0.0733 (0.1654)	-0.0393 (0.0422)
2013	-0.4147** (0.1779)	-0.4001* (0.2338)	-0.1837 (0.2104)	-0.0570 (0.0507)
Ln(Sales)	0.2207*** (0.0751)	0.0366 (0.0558)	0.3950*** (0.0777)	-0.0402** (0.0158)
Ln(Age)	0.1775 (0.2313)	-0.3739 (0.3357)	-0.1424 (0.3821)	-0.0373 (0.0618)
R^2	0.20	0.22	0.26	0.22
N	609	586	593	607

Note: The cutoff wage rate for low- and high-wage workers is based on the median firm-level average wage rate and the pre-determined wage categories provided by the Central Statistical Agency(CSA) of Ethiopia. The dependent variables in Columns 1-3 are logarithms of the number of workers while Column 4 features the percentage share of low-wage workers. $\left(\frac{C_{it}}{W_{it}}\right)$ is the pension contribution to wage bill ratio for firms with nonzero contributions. See also notes under Table 4.

Table 9: Firm-Level Investment and Productivity Responses to Pension Reform

	Investment Per Worker	Labor Productivity	Levinsohn-Petrin TFP
2009	-0.4594 (0.3262)	-0.0011 (0.1056)	0.0374 (0.1032)
2010	-0.2655 (0.3987)	0.7057*** (0.1806)	0.8524*** (0.1866)
2011	-0.0789 (0.3731)	0.0421 (0.1073)	0.1648 (0.1106)
2012	0.4526 (0.4687)	0.6357*** (0.1202)	0.6515*** (0.1262)
2013	1.0212** (0.5170)	1.0320*** (0.1434)	0.9534*** (0.1422)
NPF*2012	0.6677* (0.3621)	0.0928 (0.1371)	0.0499 (0.1429)
NPF*2013	0.6138* (0.3549)	0.1382 (0.1527)	0.0763 (0.1536)
R^2	0.10	0.19	0.14
N	931	1,465	1,433

Note: Investment per worker is real total expenditure on fixed capital to employment ratio. Labor productivity is real valued added to employment ratio. Total Factor Productivity(TFP) is the residual from the Levinsohn-Petrin production functions. All variables are in logarithms. The investment model controls for firm sales and age while the productivity models exclude firm sales.

Table 10: Actual Pension Contribution Rate and Firms Investment and Productivity Responses

	Investment Per Worker	Labor Productivity	Levinsohn-Petrin TFP
$\ln\left(\frac{C_{it}}{W_{it}}\right)$	0.1087 (0.1162)	0.0971* (0.0506)	0.0938* (0.0525)
2009	-0.6464 (0.4113)	0.1635 (0.2037)	0.1252 (0.2047)
2010	-0.9131 (0.7909)	0.6667 (0.4060)	0.8524** (0.3860)
2011	-0.6851 (0.5402)	0.1588 (0.1625)	0.2874 (0.1908)
2012	-0.3264 (0.6033)	0.6240*** (0.1693)	0.6654*** (0.1909)
2013	0.2760 (0.7046)	1.1281*** (0.1803)	1.0494*** (0.2024)
R^2	0.09	0.24	0.20
N	412	562	549

Note: $\left(\frac{C_{it}}{W_{it}}\right)$ is the actual pension contribution to wage bill ratio for firms with nonzero contributions. See also notes under Table 9.