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# Social Insurance Reform and Labor Market Outcomes in Sub-Saharan Africa:

Evidence from Ethiopia

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## ABSTRACT

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

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. 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 fully shifting the cost of pension benefits to workers in the form of lower wages. In fact the reform seems to be associated with an increase in real wage rates particularly among large firms. Firm-level employment declined after the reform with a greater contraction among firms without pre-reform provident funds and firms that were initially small. The composition of the workforce also shifted in favor of skilled workers although this effect may not be attributed entirely to the pension reform. We also find an increase in firm-level investment, capital per worker, and labor productivity.

**JEL Classification:**

H55, J2, J3

**Keywords:**

social insurance, pension reform, labor markets, Ethiopia

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## 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. A number of studies show the welfare-improving effects of social insurance programs in developing countries where exposure to shocks is relatively high and insurance markets are poorly developed (Jung and Tran, 2012; Chetty and Looney, 2006; Case and Deaton, 1998). 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 (European Commission, 2010). However, the potential economic inefficiency due to labor market distortions introduced by social protection programs remains a major policy concern. As such social protection could influence the behavior of employers and employees in a manner that ultimately undermines its primary objective (Levy, 2008).

Labor economists argue that the labor market implications of a government mandate to provide social insurance depends on the extent to which the cost of social insurance to employers matches employees’ valuation of the expected benefits (Summers, 1989; Gruber and Krueger, 1991). Equivalence between the two implies insignificant 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 hence preventing job losses. Testing these hypotheses directly is difficult because the value employees attach to fringe benefits is unobservable. A negative employment effect following a social insurance reform thus suggests 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 employment contraction 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 reduce employment in the formal sector as workers switch to informal jobs where they can avoid taxes and insurance contributions (Joubert, 2015). Significant productivity differences between formal and informal sector firms imply that such reallocation of labor may undermine overall economic efficiency.

Previous estimates on the labor market and growth effects of social insurance programs derive from cross-country econometric studies that are shown to have a number of constraints (Gruber, 1997). Since social insurance affects employer and employee behavior, cross-country studies need to be complimented with within country microeconomic studies using data at the firm and worker level. However, the latter have become available to researchers only in recent decades, and panel data remain relatively scarce making it difficult to disentangle reform effects from that of unobserved confounding factors. Moreover, substantial social insurance reforms that involve parameter adjustments large enough to trigger behavioral change are quite rare. Even ambitious social insurance reforms could be rendered inconsequential if enforcement capacity is weak, 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 in developing countries is relatively scarce and with mixed results. The existing studies also come primarily from middle-income Latin American countries which have relatively long and rich experience in providing social insurance for about 50 to 60 percent of the labor force (Palacios and Pallares-Miralles, 2000).

This paper examines the wage and employment effects of a major pension reform in Ethiopia in 2011 using a panel of manufacturing firms. The reform introduced mandatory pension and disability benefits for private sector employees in the formal sector, expanding an existing pension system that catered only for civil servants and the armed forces, who constitute less than 2 per cent of the Ethiopian labor force.

The paper provides new evidence in the context of Sub-Saharan African where social insurance programs are relatively new and coverage remains far below that of Latin American countries; typically less than 10 per cent (Palacios and Pallares-Miralles, 2000). The study also contributes by using a dataset and empirical approach better suited to addressing key questions in this literature as compared to previous studies. We exploit the swift 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 private 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 firms 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 a 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 that have focused mainly on 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. If such margins of adjustment are negligible, the reform may unintentionally reduce jobs that are eligible for pension benefits and ultimately compromise the welfare of private sector workers. By exploring employment changes at different points in the wage distribution, we test for heterogeneity in employee valuation of social insurance and hence implications on skill composition of the workforce at the firm level.

Our analysis shows that firms have experienced substantial post-reform increase in nonwage labor cost and unit labor cost. However, we find no evidence that employers shifted the cost of social insurance to workers in the form of lower wages. In fact, average real wage increased substantially after the 2011 pension reform. Regression results suggest significant reduction in demand for labor among manufacturing firms in the formal private sector, and this negative employment effect is larger for firms without pre-existing provident funds and among initially small firms. We also observe a shift in the personnel policy of firms after the reform that seems to favor skilled workers over low-skilled workers although this composition effect holds equally for firms with and without voluntary provident funds. Firms have also increased investment per worker and capital per worker after the reform, which is consistent with the increase in nonwage labor cost.

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, discussion of results and some robustness checks. Conclusions and policy implications are presented in section six.

## **2. Conceptual Framework and Existing Evidence**

### *a. Framework*

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. Accordingly, 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. The parameter  $a$  represents the extent to which employees discount pension contributions relative to cash income such that  $a = 0$  would indicate that 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 under these assumptions implies that,

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

where  $h^d$  and  $h^s$  are the price elasticities of labor demand and supply, respectively. As shown in Gruber (1997), one of the conditions under which full wage-shifting of employer contribution can occur is when employees value the pension promise at cost. As indicated in (1), this occurs when  $a = 0$  and  $q = 1$  suggesting a strong linkage between benefit incidence and contributions. Full shifting may also be possible if labor supply is completely inelastic or if the elasticity of labor demand is infinity. As indicated earlier, a mandate social insurance program will have no employment effects if employers can fully shift the cost of pension benefits to workers' wages. Such mandated benefits may have negative employment effects in the formal sector under partial shifting of their costs to wages, i.e., when  $\frac{d \ln w}{dt_f} > -1$  implying that  $a > 0$  and  $(1 - at_e) < q < 1$ .

In addition to potential effects on employment levels, social insurance programs may also have a composition effect if  $a$  and  $q$  differ across workers. For instance, it is possible that skilled workers may want to receive the returns to human capital in the form of higher wages as well as fringe benefits. Unskilled workers may be more skeptical about the expected benefits of social insurance. This difference may arise from a higher likelihood of unemployment and/or longer spells of unemployment among unskilled workers as compared to skilled



workers. If benefits are tied to work experience, unskilled workers may benefit less from a pension scheme due to shorter employment spells. Unskilled workers might thus be less likely than skilled workers to accept wage cuts to compensate the employer for the cost of social insurance. Such workers may thus prefer to move to the informal sector or work informally in the formal sector possibly for the same employer to avoid mandatory contributions. Employers may also be inclined to fire unskilled workers and retain relatively skilled workers who value the insurance scheme at cost and are more likely to increase their work efforts now that they are invested in the firm's success.

The conceptual framework discussed so far predicts unintended negative employment effects if wages cannot be lowered sufficiently to offset the cost of mandated social insurance. This argument implicitly assumes that the firm has no margins of adjustment other than wages and employment, or the implied adjustment costs are too high to implement. However, terminating employment contracts are likely to be last resort decisions if firms face hiring and firing costs that are at least comparable to the cost of adjusting nonlabor inputs. Employers may also want to first explore less costly options of improving efficiency of intermediate inputs or adjusting the production cost structure in an effort to accommodate policy induced increases in nonwage labor costs. Social insurance reforms may thus lead to an increase in productivity if employers cannot fully shift the cost of such benefits, and if the cost of adjusting other inputs is less costly than that of adjusting labor. A more complete assessment of the impact of the social protection programs may thus require examining changes in production cost structure including the substitution of capital for labor.

*b. Evidence from developing countries*

There is mixed evidence on the wage and employment effects of social insurance programs in developing countries that are funded by payroll taxes. Gruber (1997) provides rare evidence in support of full shifting of payroll taxes to

wages. He finds a proportionate increase in wages following the elimination of a government 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 would imply that employers can readily offset an increase in mandated benefits by reducing wages. Cruces et al. (2010) find a partial shifting to wages of a reduction in payroll taxes in Argentina with insignificant effects on employment. They attribute the latter to inelastic labor supply. 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. Similarly, Antón (2014) finds a partial but large pass-through effect of payroll tax reductions on wages in Colombia accompanied by an increase in employment in the formal sector. In Brazil, Almeida and Carneiro (2012) find that workers in municipalities with strict enforcement of mandated severance benefits received lower wages to offset employer contributions, hence increasing formal employment, while localities with less frequent inspections 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 a 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. Jung and

Tran (2012) also find that social pension program for informal sector workers in Brazil increases informal employment. These studies show a significant reduction in formal employment suggesting that workers in the informal sector may value the pension benefits at less than their cost to employers (Levy, 2008). These findings seem to be consistent with other studies that show efficiency reducing effects of labor market regulations that tend to protect workers either by increasing informal employment or by reducing the reallocation of labor from less to more efficient firms within the formal sector (Besley and Burgess, 2004; Moscoso Boedo and Mukoyama, 2012).

### **3. Ethiopian Pension Reform and Institutional Background**

The Ethiopian government issued Proclamation No. 715/2011 in June 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 informal sector workers are not protected under this scheme. The proclamation extends an existing pension scheme that covers civil servants in federal and state governments, 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. Employer contribution rates were raised gradually from 7% of gross monthly wage in 2011 to 8% in 2012 and to 9% in 2013 and 2014. Since 2015, employers contribute 11% of monthly wage. Employees contribute 7% of their wage since 2015, after making contributions at 5% in 2011 and 2012, and at 6% in 2013 and 2014. This implies different pension contribution rates in the post-reform years of our dataset. Workers in private organizations with pre-existing “Provident Funds”

(PFs) may choose to continue with PFs or transfer their savings to the new POPF. This choice is available only for workers hired before the pension reform while new hires are required to register under the new scheme. Employer and employee contribution rates under PFs cannot be below the contribution rates stipulated by the 2011 pension law. Employees have to make contributions to the scheme for at least 10 years to qualify for pension benefits at retirement, which is set at 62 years of age. The replacement rate is based on years of work experience. Payout is set at 30% of average wage during the three years preceding retirement for a worker who contributed for 10 years. Payout increases by 1.25 percentage points for each year above 10 years of experience.

The proclamation also establishes the Private Organizations' Employees Pension Agency (POEPA) to run 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).<sup>1</sup>

The pension law seems to be backed by stringent enforcement mechanisms. Employers are required to register with the POEPA and declare the number of permanent employees and regularly report employment contracts of new hires to the agency within 60 days. The law empowers the POEPA to deduct arrears directly from the bank accounts of firms that failed to make pension contributions on time.<sup>2</sup> Pension contributions are collected through the government tax collection system and existing regulations are such that firms will not be able to file their taxes until they verify payment of pension contributions. Because

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<sup>1</sup> 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).

<sup>2</sup> 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.

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 workers whose personal income taxes were withheld by the firm. The POEPA could monitor compliance with the pension law by crosschecking the list of employees who have been issued pension identification numbers against the list of workers a firm has reported in the income tax system.

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 workers who have 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, these data are not available in electronic format, increasing the transaction cost of quick verifications and crosschecking. Since tax authorities collect pension contributions, inefficiencies in the tax system will also weaken enforcement of the pension law. For instance, because taxes cannot be filed electronically, tax offices are typically inundated by tax payers who want to beat the deadline for 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 existing enforcement mechanism appears to be strong with regard to workers who are already registered with the POEPA and have pension identification numbers. There is uncertainty about the agency's ability to monitor employment changes after the firm's initial registration. As shown in Figure 1, while the proportion of firms making pension contribution increased significantly 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 are no restrictions on downward adjustment of wages if employers and employees 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 that presumably increases labor supply of low-wage workers in the formal sector as they expect pension benefits greater than their contributions would guarantee.<sup>3</sup>

The macroeconomic context within which the pension reform occurred is also relevant. Between 2005 and 2015, the Ethiopian economy grew by about 10 per cent per annum which is double the rate of growth between 1995 and 2004. Growth in the manufacturing sector, the focus of our study, has been faster than the rest of the economy (See Figure 2). Arguably this offers ideal conditions to introduce a payroll tax as growth in aggregate demand may suppress the potential negative effect of such a tax on labor demand. The manufacturing sector's demand for labor has clearly been growing both before and after the 2011 pension reform. Given the overall expansion of employment in Ethiopian manufacturing, our task is primarily to examine changes in wage rate and labor demand among incumbent firms following 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.<sup>4</sup> 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,

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

<sup>4</sup> The survey is officially referred to as "Large and Medium Scale Manufacturing Survey".

employment, output and organizational structure. Our data span the period 2008 to 2013 covering both pre- and post-reform periods. However, due to changes made to firm identification numbers by the CSA in the 2012 and 2013 rounds, we were unable to use the entire census for our econometric analysis. We have been able to put together a panel data set using unique firm identification numbers 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 have caused a selection problem. Comparisons of mean employment, sales, wage rate and age between firms in our panel-data and the manufacturing census indicate no major concern about representativeness of our sample. 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 the manner in which our panel data are constructed does not introduce a selection bias.

Figure 2, based on the census data, shows that total manufacturing sector sales and employment have been growing much faster since 2011 than in the preceding three years. As such, there is no evidence that the pension reform has resulted in employment contraction or even a slowdown in the rate of growth of total manufacturing employment at the sector level. It would still be important to examine if average firm size has changed after the reform.

Using census data, Figure 1 shows a significant increase in the fraction of firms making pension contributions after the reform although compliance remains just below 50 percent. The compliance rate is slightly higher in our sample panel-data amounting to 53% in 2012 and 54% in 2013, representing nearly 30 percentage points increase relative to the fraction of firms with voluntary provident funds. Given the large number of non-compliant firms, our empirical approach, discussed in section 5, relies on estimating the intention-to-treat effect of the pension reform rather than the average treatment effect. This also raises

questions about the characteristics of firms that are likely to comply under the existing enforcement mechanisms. In our panel data, 75 percent of firms with pre-reform provident funds have continued to make pension contributions under the new scheme while only 43 percent of firms without pre-existing provident funds complied with the new law. Similarly, about 72.4 percent of initially large firms reported pension contributions after the reform as compared to 45 percent of initially small firms making such contributions. Even among initially small firms, compliance with the new law is more likely if they had voluntary provident funds before the reform (at 64 percent) as compared to small firms without provident funds (at 41.4 percent).

To formalize this observation, we estimated a panel random effects logit model of compliance with the pension law using the logarithm of initial firm size and the presence of pre-reform provident funds as explanatory variables while also controlling for industry fixed effects. As expected, we find that compliance increases significantly with initial firm size (with an average marginal effect of 0.0372) suggesting that small firms are less likely to participate in the new pension scheme. After controlling for initial firm size and industry fixed effects, firms with pre-reform provident funds are strongly likely (with an average marginal effect of 0.2681) to continue providing those benefits after the reform. An interaction of the two variables provides no additional information about compliance.

Table 2 provides descriptive statistics for the entire sample as well for subsamples of firms with and without pre-existing provident funds. We use industry level producer prices provided by the CSA to express sales, wage rates, employer contributions as well as other financial variables in real Ethiopian Birr. The table shows that firms with pre-existing provident funds are significantly 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 the two groups of firms were narrowing before the reform and have widened since the reform. A similar trend can be observed in terms of gaps in real wage rates. Therefore, while firms with and without pre-existing provident funds do not seem to show parallel trends before the reform in employment and wages, which are our main variables of interest, it is clear that these differences were narrowing in the lead up to the reform before showing divergence afterwards.

Among firms with nonzero pension contributions, the average contribution rate was about 4.5 percent before the reform. Under the mandated scheme, the actual pension contribution rate (relative to wage bill) increased by approximately half a percentage point in 2012 and by 0.008 percentage points in 2013. For firms without pre-existing provident funds, pension contributions rates rose to 5.3% in 2012 and to 6% in 2013 from zero contributions before the reform.

Table 3 explores changes in average firm size and skill composition of workers before and after the reform. We proxy skill composition of the workforce using CSA data on the number of workers by monthly wage categories as the survey does not capture worker-level human capital and wages. The wage interval that contains the median firm-level monthly wage rate (annual wage bill divided by 12 times the number of workers) is used as a cutoff point to determine the number of low- and high-wage workers in a given year. Because the median firm-level wage rate has been rising over the sample period, we adjusted the cutoff point to a higher wage interval in 2012 and 2013. This adjustment allows us to avoid a situation in which the number of low-wage workers may decline simply because of a shift to the right in the wage distribution while the threshold remains unchanged. In the absence of worker-level data on human capital or occupations, we believe this approach provides a plausible proxy for employee skills.

Table 3 shows that among firms with pre-existing provident funds, most of which have complied with the new pension law, average firm size increased by 5%. This increase is entirely attributable to a rise in the number of high-wage workers as the number of low-wage workers has declined. This indicates a shift in the skill composition of the workforce that is markedly tilted toward skilled workers. Firms without provident funds experienced an 8% reduction in firm size after the reform coupled with a substantial compositional shift also in favor of skilled workers. The share of low-wage works among such firms declined from 72% before the reform to 57% after. This outcome seems to be consistent with our expectation that low-wage workers may discount employer contributions to pension benefits more sharply than high-wage workers.

## 5. Estimation and Discussion of Results

### 5.1. Changes in Labor Cost

We start our econometric analysis by examining changes in nonwage labor costs post 2011. The idea is to show the increase in firm contributions to new pension scheme, and whether this increase is higher among firms without pre-existing provident funds. We then examine changes in real wages to test the hypothesis of full-shifting of the cost of social insurance to wages. Furthermore, we assess if employers have been able to adjust other employee benefits such as bonuses and allowances for food and transportation to accommodate the increase in pension contributions.

The empirical model we test takes the form:

$$\ln\left(\frac{C_{it}}{L_{it}}\right) = a_0 + bPR_t + gPR_t * NPF_i + fPR_t * Small_i + j Small_i * NPF_i * PR_t + v_i + e_{it} \quad (2)$$

where subscripts  $i$  and  $t$  index employers and year, respectively,  $C$  is total employer contribution to social insurance and  $L$  is total employment. The post-reform dummy variable  $PR$  takes the value one for post-reform years and zero

for pre-reform years while  $NPF$  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  $\nu$  while  $e$  is the equation error term. Since pension contribution rates have been rising gradually as discussed earlier, including a single post-reform dummy may not be ideal. Instead we treat 2012 and 2013 separately as post-reform years and interact them with the variable  $NPF$ . Since the probability of compliance with the pension reform as well as the existence of voluntary provident funds before the reform correlate negatively with initial firm size, the model includes a dummy variable  $Small$  which takes the value one if initial firm size is less than fifty workers. Since initial firm size is positively correlated with the likelihood of a pre-existing provident funds and the degree of compliance with the new law, the interaction of initial size with the post reform dummy will allow us to capture any differential responses of small firms to the reform. Finally the model includes an interaction of initial firm size, absence of pre-reform provident funds and the reform dummy to see if initially small firms without provident funds behaved differently after the reform. It should be kept in mind that being small and having no provident funds reduce the probability of compliance with the pension law as described earlier.

We estimate (2) using a panel fixed effects specification to take into account time invariant unobserved characteristics that might affect firms' decisions on wages and fringe benefits. Standard errors are clustered at the firm level to account for heteroscedastic and autocorrelated errors. As indicated earlier, we rely on the interaction term  $PR*NPF$  to identify the intention-to-treat effect as the shock in nonwage labor costs are expected to be higher for firms without pre-existing provident funds relative to firms with such voluntary schemes already in place.

We follow the same approach to estimate the change in firm-level real wage rate calculated as the wage bill ( $W$ ) divided by number of employees.

$$\ln\left(\frac{W_{it}}{L_{it}}\right) = a_0 + bPR_t + gPR_t * NPF_i + fPR_t * Small_i + j Small_i * NPF_i * PR_t + v_i + e_{it} \quad (3)$$

Table 4 reports estimation results from (2). The first column shows a spike in real pension contribution per worker in the post reform years of 2012 and 2013. As would be expected, the increase in social insurance contributions per worker is significantly higher for firms without pre-existing provident funds as indicated by the coefficients on the interaction terms *NPF\*2012* and *NPR\*2013*. Pension contributions per worker also increased significantly even for firms with pre-existing provident funds suggesting that those voluntary schemes were typically less generous as compared to the mandated program. The results indicate that manufacturing firms experienced substantial increase in nonwage labor cost after the reform. Initial firm size does not seem to affect the rate of increase in nonwage labor costs although contribution rates seem to be lower for small firms.

Column 2 in Table 4 addresses whether the post-reform spike in nonwage labor cost has been shifted to workers in terms of lower wages. If any thing, real wages increased substantially after the pension reform and most importantly, the rate of increase is significantly higher for firms without pre-reform provident funds. This finding is contrary to the expected reduction in wages as employers attempt to offset at least part of their contribution to social insurance. It is interesting to note that the coefficients on the interaction of initial firm size and post-reform dummies are negative and significant suggesting a much subdued increase in real wages among small firms after 2011. Since the dependent variable is firm-level mean wage, the observed increase in real wage after the reform could be driven by the strong expansion in aggregate demand during 2008-2013 where per capita income grew rapidly. This would have been a plausible explanation had firm-level manufacturing employment also increased or at least remained stable. As we will demonstrate shortly, this was not the case in our sample. However, since we do not have worker-level data on wages, the increase in average wage rate could be

driven partly by a composition effect whereby firms reduced the number of low-wage workers after the reform, an issue that will be examined shortly.

Before examining employment adjustment, it is important to assess changes in other nonwage labor costs after the reform that firms might have resorted to. The results, using the same model as in equations (2) and (3), are reported in columns 3 and 4 of Table 4 featuring as dependent variables bonuses and allowances per workers (specifically for food and transportation). While there are no significant differences between firms with and without provident funds, we find that initially small firms have significantly reduced bonuses and other non-pension benefits per worker after the pension reform. This seems to be consistent with another observation (table not reported here) where the fraction of large firms offering bonuses remained at 60 percent before and after the pension reform, while the proportion of small firms paying bonuses declined slightly from 32 percent before the reform to 29 percent after. This pattern also applies to other employee benefits except that the fraction of large firms providing such benefits has actually increases from 65 to 68 percent. These adjustments might have allowed small firms to offset some of the pension contributions relative to large firms. However, the fact that the model R-Squared is very low in columns 3 and 4 suggests that these margins of adjustment are perhaps not large enough to provide a cushion for the sharp increase in pension contributions after the reform.

Since firm heterogeneity in product demand may affect labor demand and wages, we expand the model in (2) and (3) by including real firm sales. We also include firm age to account for the effects of market experience and expansion of business networks. The results from this expanded specification are reported in Table 5 and they are by and large similar to the results in Table 4. Column 5 of Table 5 shows results from a model where the dependent variable is the logarithm of unit labor cost calculated as total labor cost (wage and nonwage costs) to output ratio. We find significant increases in unit labor cost in 2012 and

2013 particularly among firms without pre-existing provident funds. If the reform increases total labor cost without intra-firm productivity growth, then unit labor cost would increase proportionately. However, column 5 shows that the rate of increase in unit labor cost is significantly lower than that of pension contributions and wages per worker. This suggests an increase in firm-level productivity after the reform offsetting some of the increase in labor costs. Such productivity gains are apparently absent among initially small firms as indicated by the negative coefficients on the interaction of small firms and post-reform dummies.

### *5.2. Adjustment in Production Cost Structure*

As discussed in our theoretical framework, firms might want to explore other margins of adjustment in response to the pension reform before resorting to termination of employment contracts. To assess the scope of such adjustments, we examine changes in the share of nonlabor production inputs in total variable costs. These include outlays on intermediate inputs, energy, water and mundane repair and maintenance.

As shown in the first column of Table 6, there is a significant reduction in the cost share of nonlabor production inputs after the pension reform, which is stronger among firms without pre-existing provident funds. This reduction is largely associated with a decline in the cost share of intermediate inputs than that of utilities. While the coefficients lack statistical significance, firms appear to be rationalizing consumption of imported intermediate inputs. In fact, initially small firms have increased their consumption of local intermediate inputs significantly after 2011. Overall, Table 6 shows some evidence of adjustment in production cost structure following the reform primarily by way of lowering expenditure on imported intermediate inputs. Nonetheless, these adjustment margins do not seem to be large enough to offset the increase in nonwage labor costs appreciably.

### 5.3. Changes in Labor Demand and Skill Composition of Workforce

We now examine adjustments in firm-level employment ( $L_{it}$ ) using a similar model for wage and nonwage labor costs.

$$\ln(L_{it}) = a_0 + bPR_t + gPR_t * NPF_i + fPR_t * Small_i + j Small_i * NPF_i * PR_t + v_i + e_{it} \quad (4)$$

As stated earlier, the expectation is that the reform may reduce labor demand particularly among firms without voluntary provident funds such that  $b$  and  $g$  are expected to be negative if workers do not accept compensating wage cuts. If compliance with the pension law is costly for small firms relative to large firms, we would also expect  $f$  and  $j$  to be negative.

In addition to the ITT effects of the reform on firm-level employment, we are interested in understanding changes in the skill composition of the workforce. Consistent with theoretical expectations, Table 3 has already indicated a reduction in the number of low-wage workers after the pension reform. Such heterogeneous outcomes probably reflect underlying differences across workers in the perceived value of pension benefits. Our econometric model allows us to examine this outcome in a more systematic way.

Results from the labor demand model are reported in Table 7. The negative coefficients on post-reform dummy variables suggest a decline in firm-level employment after the pension reform although the coefficients lack statistical significance. Nonetheless, this finding is quite important given the broader context where total employment in Ethiopian manufacturing continued to increase after the pension reform while average employment at the firm level is contracting. Consistent with our expectation, column 1 of Table 7 indicates sharper and statistically significant employment contractions after 2011 among firms without pre-existing provident funds. Jobs among such firms declined by

23.3 percent and 27 percent in 2012 and 2013, respectively, as indicated by the coefficients on the interaction of NPF and post-reform dummies. Significant reduction in employment was also observed among initially small firms by about 20 percent and 24 percent, respectively, in 2012 and 2013. These findings underscore the negative employment effects of the reform among small firms and those without pre-existing provident funds. However, initially small firms without a provident fund seem to experience only a modest decline in employment after the reform as indicated by the positive and significant coefficients on the triple interaction terms. This outcome likely reflects the difference in expected compliance with the new pension law based on initial firm size. As indicated earlier, small firms are less likely to comply with the pension law and descriptive statistics reveal that initially small firms without provident funds are smaller even among small firms. Small firms without provident funds have on average 19 workers while small firms with provident funds have 25 employees; a difference that is statistically significant.

Overall, our econometric analyses shows that employers have not been able to fully shift the increase in nonwage labor costs brought about by the social insurance mandate to wages, such that downsizing was inexorable even in the middle of a rapid increase in demand for manufactured goods. It is important to note that most studies on the employment and wage effects of social insurance reforms test the effects of relatively small changes on pension contributions that are presumably easier to accommodate by lowering wages with minimal employment effects. In that respect, the Ethiopian pension reform poses a significant spike in nonwage labor costs affecting firm's demand for labor.

We also find important adjustment in the skill composition of the workforce. Column 2 of Table 7 shows deeper cuts in the number of low-wage workers in 2012 and 2013 while Column 3 shows a significant increase in the number of high-wage workers. This finding is consistent with the observation in Table 3. However, it is hard to attribute this post-reform composition effect to the pension



reform since it seem to hold both for firms with and without provident funds. Nonetheless, the number of skilled workers exhibits interesting heterogeneity. Relative to large firms with pre-reform provident funds, which constitute the reference category, we find a significant reduction in skilled workers among initially small firms. While firms without voluntary provident funds also have reduced the number of skilled workers particularly in 2013, this effect lacks statistical precision. These findings suggest a post-reform labor adjustment process involving a significant reduction in the share of low-wage workers among large firms as reported in column 4 of Table 7, accompanied by an increase in the share of unskilled workers among initially small firms particularly in the second year of the reform (the coefficient on Small\*2012 is significant only at 14%). This is consistent with a situation where small firms face greater difficulty retaining high-wage workers who are more costly to provide fringe benefits. Whether this affects the productivity of small firms will be explored shortly.

Because we are using pre-determined wage categories defined by the CSA to determine skill composition of workers, some workers close to the cutoff point might have experienced pay raises and moved up to the “high-wage” category despite our efforts to raise the cutoff wage rate as described earlier. However, this potential problem does not seem to be driving our results as the coefficients from the high-wage regression differ in magnitude and statistical significance relative to the coefficients from the low-wage regression. The coefficients in columns 2 and 3 of Table 7 would have been mirror images of one another with opposite signs had the change in the skill 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 attain higher wages just before retirement, they are more likely to secure pension benefits with a higher replacement rate. Since overall health status and longevity

correlate with standard of living, high-wage earners are likely to enjoy pension benefits over a longer time horizon than low-wage workers. Whether high-wage workers have agreed to take wage cuts to offset some of the employer's cost of social insurance cannot be detected directly from our firm-level data which only reveals average wages. Nonetheless, the significant increase in real wages reported in Table 4 is consistent with the reduction in the number of workers at the lower end of the wage distribution as shown in Table 7. Similarly, the post-reform reduction in skilled workers among initially small firms is consistent with the observed reduction in average real wages among such firms in Table 5. The reduction in bonuses and other allowances per worker among small firms as reported in Table 5 may also make small firms less attractive for skilled workers while large firms continue to provide such benefits.

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 the findings in Table 7 suggest a reduction in formal employment in the private manufacturing sector and an increase in the number of workers hired informally by registered firms.

#### 5.4. Responses in Firm-level Investment and Productivity

As relative factor costs evolve, firms are expected to adjust factor proportions and explore possibilities to boost productivity. Given the increase in unit labor costs and the reduction in firm-level employment, 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 physical capital although firms can also engage in other productivity enhancing activities such as training of workers. In this section we compare changes in investment per worker and capital per worker among firms with and without PFs 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.<sup>5</sup>

The results are presented in Table 8. The first column shows a significant increase in investment per worker after the pension reform, although investment activities appear to be weaker, albeit insignificantly, among small firms. Column 2 shows substantial increases in capital intensity after 2011 particularly among firms without voluntary provident funds (the coefficient on  $NPF*2013$  is significant at 13%). For small firms without pre-existing provident funds, however, capital per worker shows a significant decline. 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 activities following the pension reform. These observations are consistent with the increase in labor costs after the reform inducing firms to substitute capital for labor. This shift has been associated with an increase in labor productivity since the reform which is stronger for firms that never had provident funds before the reform. Labor productivity has declined for small firms which also seem to corroborate the previous observation where small firms not only shed skilled workers but also experienced weaker than average investment activities after the reform. The last column of Table 8 shows a significant increase in total factor productivity without noticeable difference between firms with and without pre-existing provident funds.

## 5.5. Robustness Checks

### *Checking pre-reform trends*

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<sup>5</sup> 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.

An important concern is whether the wage and employment changes we documented after the 2011 pension reform were a continuation of underlying processes that started before the reform. Since our identification strategy relies on differential responses of firms with and without provident funds, we can test for this alternative explanation by examining the evolution of outcome variables between the two group of firms before the reform. To this effect we estimate a version of Eq.(2) and (3) for the period 2008 to 2011, and compare the difference in firm-level wage and employment between firms with and without PFs during 2009 to 2011 relative to 2008. The results are reported in Table 9. Our interest lies in the coefficients on the interaction term  $NPF*Year_{2009\_11}$ . The coefficients on this interaction term are statistically insignificant both for the wage and employment equations as shown in columns 2 and 3. This suggests a lack of systematic divergence between these two groups of firms before the enactment of the mandatory pension scheme in 2011. Columns 4 and 5 in Table 9 report results from a similar exercise where employment and wage trajectories in 2010 and 2011 are assessed against observation in 2009. The coefficient on  $NPF*Year_{2010\_11}$  is statistically insignificant for the employment equation, which is different from the statistically significant divergence in employment after the reform based on a firm's provident fund status. While the coefficient on this interaction term is negative and significant for the wage equation, suggesting widening wage gap between firms with and without PFs, this trend has been reversed after the reform with faster growth in mean wage among firms without voluntary provident funds. These findings are inconsistent with the scenario that the observed changes in firm-level employment and wage after the 2011 pension reform are mere continuations of a momentum that started before the reform.

#### *Using actual pension contribution rate*

While the preceding analyses reveal the Intention-to-Treat effects of the pension reform, we now examine the effects of actual increase in the pension contribution rate on the cost of and demand for labor for compliant firms only. This is similar

to the approach followed in Gruber (1997) and Kugler and Kugler (2006) where they studied the incidence of payroll taxes. The basic estimation model is:

$$\ln\left(\frac{W_{it}}{L_{it}}\right) = b_0 + \beta \ln\left(\frac{C_{it}}{W_{it}}\right) + v_i + W_t + e_{it} \quad (5)$$

where  $\frac{C_{it}}{W_{it}}$  is the actual pension contribution rate and  $W_t$  represents time fixed effects and  $v_i$  stands for firm fixed effects.

Unlike Eq(2) to (4), Eq(5) will be estimated only for firms with non zero employer contributions to the pension fund. While all firms are subject to the same contribution rate set by the pension law, Figure 3 shows substantial cross-firm variation in  $\frac{C_{it}}{W_{it}}$ . The figure also shows compression in the distribution of pension

contribution rates 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% both in 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 cross-firm variation in the proportion of such workers,  $\frac{C_{it}}{W_{it}}$  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 due to the voluntary nature of the pre-reform provident funds, and the incomplete compliance with the new law. In the absence of suitable instrumental variables in our data (variables that determine compliance but do not influence employment and wages directly), we attempt to address this concern by including an interaction term of the pension contribution rate with initial firm size, as the probability of compliance rises with firm size. We

use a similar specification to estimate the correlation between the incidence of pension contribution and labor demand at the firm level.

The estimates are reported in Table 10. The first two rows correspond to the wage equation. The coefficients on  $\left(\frac{C_{it}}{W_{it}}\right)$  are negative but statistically insignificant and relatively small. This observation suggests no evidence of wage shifting as firms increasingly comply with the requirements of the new law. On the other hand, Table 10 shows a significant reduction in firm-level employment as pension contribution rates rise. This reduction in employment is attributable entirely to the reduction in low-wage workers as the number of high-wage workers is insignificantly correlated with the contribution rate. The result is a significant reduction in the share of low-wage workers as the contribution rates increase. These findings are consistent with the estimated ITT effect reported earlier.

## **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 fully 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 particularly among firms without pre-existing provident funds. We also found no major change in the structure of variable production costs after the reform except for modest 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 particularly among firms without voluntary provident funds. This contraction in firm-level employment comes largely from reduction of 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 in Ethiopia together with the existence of minimum pension are expected to prevent significant contraction of low-wage employment, the fact this has occurred suggests that the promised pension benefits carry less value for unskilled workers as compared to skilled workers. This is unsurprising given the fact that manufacturing wages are still very low in Ethiopia and the law requires workers to contribute 7 percent 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 and capital intensity 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 a statistically significant increase in labor productivity and at least a positive trend in total factor productivity in the first two years after the reform which are 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 unintended negative employment effects associated with the Ethiopian social insurance program.

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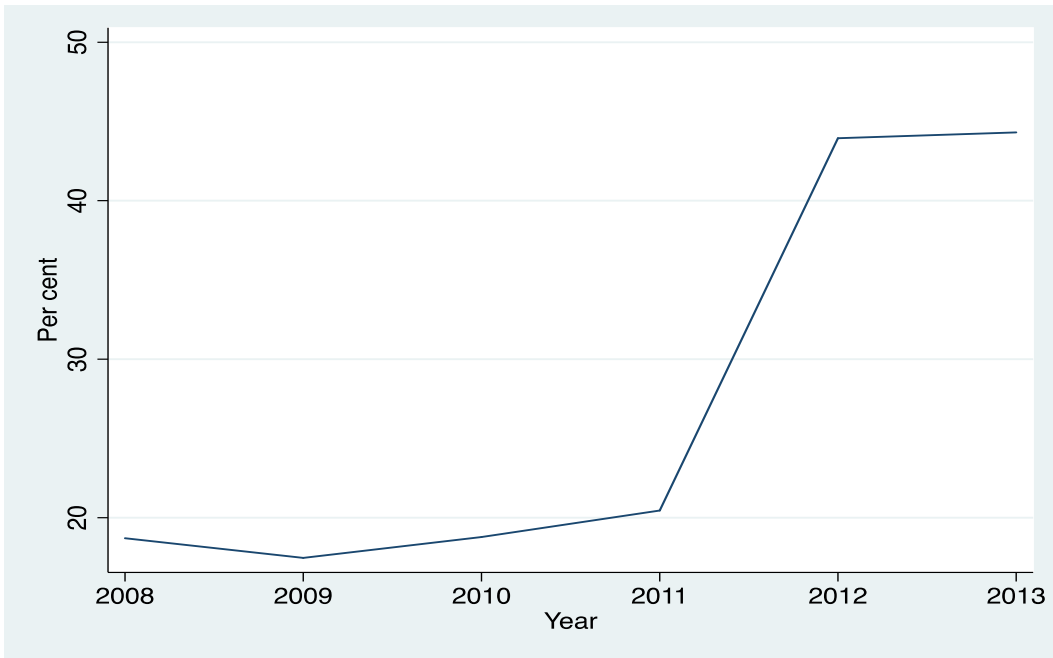


Figure 1: Proportion of Manufacturing Firms Making Pension Contributions

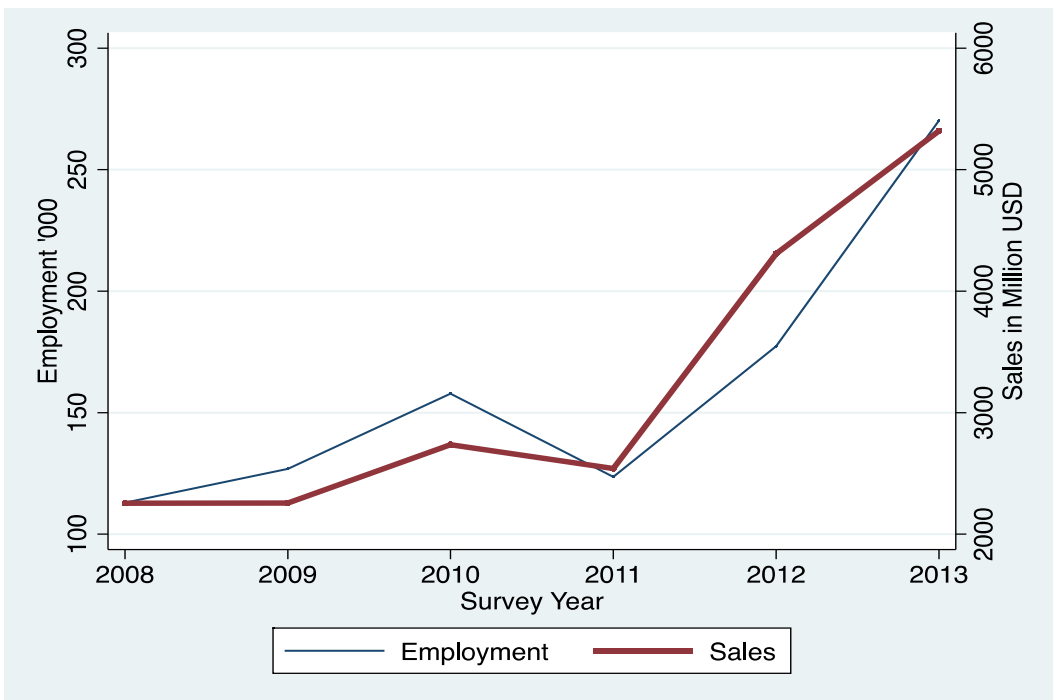


Figure 2: Trends in Manufacturing Employment and Sales

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

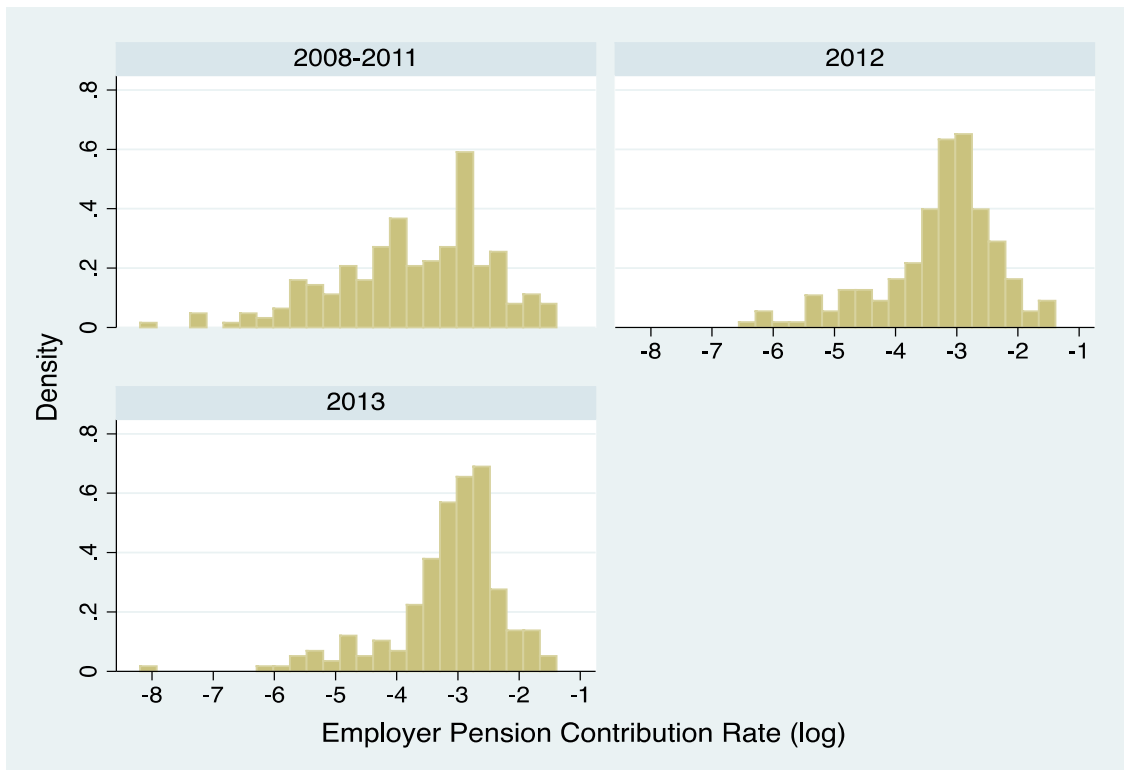


Figure 3: Distribution of Employer Contribution Rates Under the Pre-from (2008-2011) Provident Funds and the Post-reform Mandatory Pension Scheme.

Table 1: Comparing Sample and Census Data

	Census	Panel Data
ln(Employment)	3.18 (1.25)	3.39 (1.21)
ln(Sales-million-USD)	11.84 (2.17)	12.47(2.06)
ln(wage_rate)	8.89 (1.13)	9.08 (0.99)
ln(firm age)	1.87 (1.03)	2.20(0.83)
Observations	11812	1752
Employment Share		0.15
Sales Share		0.18

Note: Numbers in parentheses are standard deviations.

Table 2: Summary Statistics: Sample Means

		2008	2009	2010	2011	2012	2013
Employment	All Firms	3.7	3.6	3.4	3.4	3.3	3.3
	NPF=0	4.4	4.2	3.8	4.1	4.2	4.2
	NPF=1	3.0	3.0	3.1	3.0	2.9	2.9
	p-value	0.000	0.000	0.000	0.000	0.000	0.000
Sales	All Firms	14.8	14.7	14.2	14.2	14.9	15.3
	NPF=0	15.9	15.8	14.8	15.5	16.1	16.6
	NPF=1	13.7	13.8	13.9	13.6	14.3	14.8
	p-value	0.000	0.000	0.001	0.000	0.000	0.000
Firm Age	All Firms	13.5	13.3	11.7	11.8	12.8	13.8
	NPF=0	16.9	15.0	13.6	14.0	15.3	16.3
	NPF=1	10.4	11.8	10.5	10.8	11.7	12.7
	p-value	0.005	0.195	0.045	0.011	0.005	0.005
Wage Rate (monthly)	All Firms	8.3	8.2	8.4	8.1	8.8	9.2
	NPF=0	8.8	8.5	8.9	8.5	9.1	9.6
	NPF=1	7.9	7.9	8.0	7.9	8.6	9.1
	p-value	0.000	0.000	0.000	0.000	0.000	0.000
Labor Productivity (value added per worker)	All Firms	10.0	9.9	10.7	9.8	10.4	10.9
	NPF=0	10.6	10.5	10.8	10.2	11.0	11.4
	NPF=1	9.4	9.4	10.6	9.6	10.2	10.7
	p-value	0.000	0.000	0.405	0.000	0.000	0.000
TFP	All Firms	8.3	8.2	9.0	8.2	8.7	9.0
	NPF=0	8.8	8.7	9.3	8.5	9.2	9.5
	NPF=1	7.7	7.8	8.8	8.0	8.4	8.8
	p-value	0.000	0.000	0.184	0.000	0.000	0.000
Investment per worker	All Firms	8.2	7.7	7.5	7.3	8.1	8.5
	NPF=0	8.8	8.4	7.3	7.8	8.6	9.1
	NPF=1	7.2	6.4	7.6	7.0	7.8	8.2
	p-value	0.001	0.000	0.523	0.005	0.014	0.003
Pension Contribution Rate(% of wage bill)	All Firms	0.054	0.045	0.040	0.043	0.051	0.057
	NPF=0	0.054	0.045	0.040	0.043	0.050	0.053
	NPF=1	0.000	0.000	0.000	0.000	0.052	0.060
	p-value					0.575	0.190

Note: All variables are in logarithms except for firm age and pension contribution rate. All monetary variables are in real Ethiopian Birr. NPF (No Provident Fund) is dummy variable that takes the value 1 for firms without pre-existing provident funds and zero for firms with provident funds. The p-values indicate the statistical significance of a t-test for differences in sample means of the relevant variables for firms with and without pre-existing provident firms.

Table 3: Comparison of Firm Size and Skill Composition of Workers Before and After Pension Reform: Sample Means

	Total Employment	High-wage Workers	Low-wage Workers	Low-wage Share
	1	2	3	4
A. Firms with pre-existing voluntary provident funds (NPF=0)				
2008-2011	4.12(1.25)	3.21(1.56)	3.51(1.33)	0.58(0.29)
2012-2013	4.17(1.35)	3.53(1.51)	3.19(1.38)	0.47(0.29)
B. Firms without pre-existing voluntary provident funds (NPF=1)				
2008-2011	3.02(0.92)	1.89(1.16)	2.63(1.10)	0.72(0.26)
2012-2013	2.94(0.94)	2.07(1.19)	2.22(1.10)	0.57(0.30)

Note: Columns 1-3 report logarithms of workers at the firm level while the last column reports percentage shares of low-wage workers. The numbers in parentheses are standard deviations.

Table 4: Response in Wage and Nonwage Labor Costs

	Pension Contribution	Wage Rate	Bonuses	Other Benefits
	1	2	3	4
2012	1.4339*** (0.3371)	0.6008*** (0.0941)	0.5582 (0.3670)	0.1075 (0.3807)
2013	1.4138*** (0.3709)	1.1631*** (0.1099)	0.7345* (0.3849)	0.4860 (0.4061)
NPF*2012	1.8010*** (0.6231)	0.6276*** (0.1693)	0.2494 (0.7783)	0.0247 (0.6554)
NPF*2013	1.9073*** (0.6556)	0.5038** (0.2128)	0.1118 (0.7517)	0.3023 (0.7745)
Small*2012	-0.2206 (0.5965)	-0.4967*** (0.1537)	-1.3531** (0.5545)	-0.5797 (0.5873)
Small*2013	-0.3845 (0.6130)	-0.7150*** (0.1964)	-1.2751** (0.5852)	-1.0543* (0.6056)
NPF*Small*2012	-0.6790 (0.8192)	-0.1076 (0.2158)	0.3702 (0.9019)	0.5753 (0.8095)
NPF*Small*2013	-0.0585 (0.8462)	0.0945 (0.2745)	0.5300 (0.8963)	0.4484 (0.9095)
$R^2$	0.26	0.27	0.01	0.01
$N$	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. *Small* is a dummy variable that takes the value one for firms with less than 50 number of workers at the beginning of the sample period and zero other wise. The results are from a panel fixed effects specification and the numbers in parentheses are robust standard errors clustered at the firm-level. \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 5: Change in Wage and Nonwage Labor Costs Per Worker Since the Pension Reform

	Pension Contribution	Wage Rate	Bonuses	Benefits	Unit Labor Cost
	1	2	3	4	5
2012	1.1185*** (0.3291)	0.5117*** (0.0913)	0.3421 (0.3948)	-0.0412 (0.3862)	0.4292*** (0.1075)
2013	0.7386* (0.3972)	0.9932*** (0.1141)	0.2465 (0.4302)	0.1706 (0.4255)	0.8102*** (0.1366)
NPF*2012	1.6439*** (0.6107)	0.6287*** (0.1764)	0.1441 (0.7603)	-0.1417 (0.6429)	0.5780*** (0.1970)
NPF*2013	1.8812*** (0.6338)	0.5215** (0.2170)	0.0931 (0.7378)	0.1478 (0.7733)	0.6226** (0.2753)
Small*2012	-0.2446 (0.5887)	-0.4515*** (0.1542)	-1.2462** (0.5484)	-0.5350 (0.5776)	-0.6464*** (0.1698)
Small*2013	-0.2325 (0.6100)	-0.6291*** (0.1976)	-1.0016* (0.5817)	-0.9418 (0.5975)	-0.8431*** (0.2148)
NPF*Small*2012	-0.5172 (0.8065)	-0.1228 (0.2226)	0.3274 (0.8871)	0.5655 (0.8002)	0.0151 (0.2492)
NPF*Small*2013	0.0083 (0.8269)	0.0696 (0.2788)	0.3533 (0.8876)	0.4334 (0.9065)	0.0470 (0.3337)
Ln(Sales)	0.3344*** (0.0689)	0.1316*** (0.0347)	0.2933*** (0.0801)	0.2163*** (0.0717)	-0.6527*** (0.0431)
Ln(Firm Age)	0.4198 (0.3360)	-0.0615 (0.1270)	0.1882 (0.4174)	0.2830 (0.3404)	0.0934 (0.1402)
$R^2$	0.28	0.30	0.03	0.02	0.42
$N$	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 4 for all other variables. Standard errors are clustered at the firm-level and reported in parentheses. \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively.



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

	Non-Labor	Intermediate Inputs			Other
	Inputs	Total	Local	Imported	Inputs
	1	2	3	4	5
2012	-0.0285* (0.0154)	-0.0223 (0.0175)	-0.0294 (0.0407)	<del>0.0304</del> (0.0304)	-0.0010 (0.0118)
2013	-0.0637*** (0.0199)	-0.0470** (0.0234)	-0.0364 (0.0456)	<del>0.0356</del> (0.0356)	-0.0127 (0.0146)
NPF*2012	-0.0656** (0.0275)	-0.0368 (0.0343)	0.0473 (0.0707)	<del>0.0695</del> (0.0695)	0.0006 (0.0187)
NPF*2013	-0.0906** (0.0408)	-0.0618 (0.0503)	0.0238 (0.0729)	<del>0.0854</del> (0.0854)	0.0162 (0.0209)
Small*2012	0.0522 (0.0373)	0.0453 (0.0396)	0.1985*** (0.0641)	<del>0.0627</del> (0.0627)	-0.0093 (0.0152)
Small*2013	0.0594 (0.0411)	0.0457 (0.0416)	0.1540** (0.0727)	<del>0.0805</del> (0.0805)	-0.0019 (0.0175)
NPF*Small*2012	0.0180 (0.0460)	-0.0032 (0.0513)	-0.1544* (0.0899)	<del>0.0946</del> (0.0946)	0.0078 (0.0221)
NPF*Small*2013	0.0424 (0.0570)	0.0141 (0.0636)	-0.1113 (0.0973)	<del>0.1170</del> (0.1170)	-0.0006 (0.0249)
Ln(Sales)	0.0346*** (0.0065)	0.0432*** (0.0068)	0.0091 (0.0097)	<del>0.0103</del> (0.0103)	-0.0087*** (0.0032)
Ln(Firm Age)	0.0220 (0.0237)	0.0116 (0.0247)	-0.0376 (0.0360)	<del>0.0468</del> (0.0468)	0.0121 (0.0106)
$R^2$	0.07	0.08	0.02	<del>0.02</del>	0.02
$N$	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 include expenditure on energy, water and lubricants. The dependent variables on column heads are percentage shares of the relevant input(s) in total variable production cost which includes labor costs. See notes under Table 4 for all other variables. \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 7: Change in Labor Demand and Skill Composition of Workers

	Total Employment	Low- Wage	High- Wage	Low-Wage Share
	1	2	3	4
2012	-0.0763 (0.1005)	-0.3774*** (0.1146)	0.2243** (0.1038)	-0.1142*** (0.0249)
2013	-0.1487 (0.1163)	-0.5278*** (0.1376)	0.2890** (0.1218)	-0.1612*** (0.0295)
NPF*2012	-0.2655* (0.1401)	0.0063 (0.2074)	-0.0043 (0.1476)	-0.0280 (0.0447)
NPF*2013	-0.3140** (0.1412)	0.1061 (0.2233)	-0.1585 (0.1740)	0.0137 (0.0511)
Small*2012	-0.2143* (0.1182)	0.0250 (0.1702)	-0.3005* (0.1572)	0.0642 (0.0425)
Small*2013	-0.2703* (0.1379)	0.0482 (0.1772)	-0.3346* (0.1771)	0.0813* (0.0480)
NPF*Small*2012	0.3311** (0.1627)	-0.0378 (0.2521)	0.0827 (0.2079)	-0.0340 (0.0604)
NPF*Small*2013	0.3849** (0.1738)	-0.1346 (0.2627)	0.2409 (0.2376)	-0.0803 (0.0680)
Ln(Sales)	0.1901*** (0.0292)	0.1113*** (0.0330)	0.2453*** (0.0407)	-0.0228*** (0.0076)
Ln(Firm Age)	0.2358** (0.1062)	-0.0816 (0.1188)	-0.0669 (0.1557)	0.0265 (0.0354)
$R^2$	0.16	0.08	0.15	0.13
$N$	1,650	1,581	1,449	1,636

Note: Response variables in columns 1, 2 and 3 are, respectively, the logarithms of total firm-level employment, number of low-wage workers and number of high-wage workers. The dependent variable in column 4 is the percentage share of low-wage workers at the firm-level. See notes under Table 4 for all other variables. \*\*\*, \*\* and \* represent statistical significance at the 1%, 5% and 10% level, respectively.

Table 8: Responses in Firm-level Investment, Capital Intensity and Productivity

	Investment per Worker	Capital per Worker	Labor Productivity	Total Factor Productivity
	1	2	3	4
2012	0.7777** (0.3400)	0.6183*** (0.1420)	0.5508*** (0.1469)	0.4812*** (0.1420)
2013	1.5158*** (0.3212)	1.2000*** (0.1688)	0.9886*** (0.1774)	0.7858*** (0.1701)
NPF*2012	0.7654 (0.6115)	0.5799** (0.2809)	0.5945** (0.2401)	0.2955 (0.2508)
NPF*2013	0.5567 (0.4553)	0.4503 (0.2942)	0.6300* (0.3231)	0.3285 (0.3303)
Small*2012	-0.1538 (0.6848)	-0.0484 (0.2690)	-0.1936 (0.2319)	-0.3426 (0.2442)
Small*2013	-0.3307 (0.7008)	-0.3287 (0.2822)	-0.2864 (0.2773)	-0.3844 (0.2755)
NPF*Small*2012	-0.2738 (0.8967)	-0.8134** (0.3802)	-0.5385* (0.3208)	-0.1797 (0.3393)
NPF*Small*2013	-0.0807 (0.8327)	-0.4942 (0.3907)	-0.4857 (0.4082)	-0.1848 (0.4148)
$R^2$	0.07	0.08	0.15	0.10
$N$	962	1,634	1,473	1,442

Note: All response variables are in logarithms. Investment per worker is real total expenditure on fixed capital to employment ratio. Capital per worker is real capital stock 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 models control for firm age and firm fixed effects, and include an intercept. Standard errors are clustered at the firm level and reported in parentheses. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% level, respectively.

Table 9: Wage and Employment Changes Before the Pension Reform

	Wage Rate	Total Employment		Wage Rate	Total Employment
	1	2	3	4	5
<i>2009_11</i>	-0.2863* (0.1601)	-0.1708 (0.1088)	<i>2010_11</i>	0.1390 (0.1852)	-0.1422 (0.1437)
<i>NPF* 2009_11</i>	-0.1215 (0.1976)	0.2002 (0.1435)	<i>NPF* 2010_11</i>	-0.5777** (0.2451)	0.4362 (0.2816)
<i>Small* 2009_11</i>	0.6898*** (0.2523)	0.1667 (0.1682)	<i>Small* 2010_11</i>	0.7363*** (0.2763)	0.0825 (0.2010)
<i>Small*NPF* 2009_11</i>	-0.0201 (0.2929)	-0.2581 (0.2043)	<i>Small*NPF* 2010_11</i>	0.0852 (0.3443)	-0.3456 (0.3269)
<i>R</i> <sup>2</sup>	0.04	0.13	<i>R</i> <sup>2</sup>	0.06	0.13
<i>N</i>	883	887	<i>N</i>	740	743

Note: Dependent variables are log wage and log employment at the firm level. Columns 1 and 2 report regression results for the period 2008-20011 where 2008 is treated as a pre-reform period. *2009\_11* is a dummy variable that takes the value 1 for the period 2009-2011 and zero for 2008. Columns 4 and 5 report regression results for the period 2009-2011 where 2009 is treated as a pre-reform year. *2010\_11* is a dummy variable that takes the value 1 for the period 2010-2011 and zero for 2009. *NPF* and *Small* are dummy variables that identify firms without provident funds and initially small firms, respectively. All models include an intercept term and control for firm sales and age as well as firm fixed effects. Numbers in parentheses are standard errors clustered at the firm level. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% level, respectively.

Table 10: Wage and Employment Responses to Changes in Pension Contribution Rates

	$\ln\left(\frac{C_{it}}{W_{it}}\right)$	$\ln\left(\frac{C_{it}}{W_{it}}\right) * Small$	R <sup>2</sup>	N
Wage Rate	-0.1073 (0.0839)		0.33	582
Wage Rate	-0.0479 (0.0908)	-0.1764 (0.1785)	0.34	582
Total Employment	-0.0645** (0.0291)		0.21	582
Total Employment	-0.0603* (0.0344)	-0.0125 (0.0668)	0.21	582
Low-wage Workers	-0.1639** (0.0714)		0.20	563
Low-wage Workers	-0.0849 (0.0617)	-0.2329 (0.1548)	0.20	563
High-wage Workers	0.0155 (0.0499)		0.26	566
High-wage Workers	0.0501 (0.0480)	-0.1057 (0.1167)	0.26	566
Low-wage Share	-0.0317*** (0.0110)		0.23	580
Low-wage Share	-0.0236* (0.0128)	-0.0245 (0.0217)	0.23	580

Note: Each row reports a regression model featuring a dependent variable in the first column while the last two columns report the R-square and number of observations. The models include an intercept term, and control for firm sales and age, as well as firm and time fixed effects. Numbers in parentheses are standard errors clustered at the firm level. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% level, respectively.