Agricultural producer responses to minimum wage changes

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Abstract

South Africa's agricultural sector was exposed to a significant 52% rise in minimum wages in 2013. This study employs an event study design methodology to investigate how farm owners adapted to the minimum wage hike. While prior research on South African minimum wages has primarily concentrated on examining employment outcomes using household survey data due to limited access to micro firm-level data, we take a more comprehensive approach. Utilizing firm-level micro administrative tax data, we extend the analytical framework. Our empirical findings indicate that the minimum wage hike did not have a substantial impact on total labor costs but did lead to a notable decrease in employment. While we do not find a significant impact on firm closures, we demonstrate that the observed decline in employment was driven by farms that ceased operations following the policy change. A sub-sample analysis of surviving farms reveals a temporary surge in employment immediately after the policy hike, as well as an increase in capital accumulation in the last two periods of our sample. Although we do not identify any significant impact on farm revenue and operating profit, we do observe a temporary drop in revenue per worker and operating profit per worker in the same year we observe a temporary increase in employment. Our analysis by firm size reveals that the minimum wage hike had varying effects on the outcomes of surviving farms.

Keywords: Minimum wage, farm-exit, employment, wages, capital, operating profit

JEL Classification: C21, C23, J23, J38

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1. Introduction

The discussion surrounding the impact of minimum wage policies on low-wage employment has remained a central topic in economic discourse ever since the influential research by Card and Krueger (1994). Empirical findings vacillate between suggesting potential job losses (Brown et al., 1982; Brown 1999; Neumark and Wascher 2007; Neumark and Shirley 2022) and more neutral or occasionally positive outcomes (Card and Krueger, 1993; Doucouliagos and Stanley 2009; Dube 2019; Manning 2020). While empirical studies have yielded diverse results, the disagreements among economists on the employment effects of minimum wages are getting weaker (Geide-Stevenson & La Parra-Perez, 2022). Nevertheless, the empirical evidence pertaining to developing nations, characterized by intricacies such as non-compliance with legislative mandates that can mitigate employment effects (Bhorat et al., 2017), remains limited. Moreover, firms affected by minimum wage hikes have potentially a range of adjustments they can make: changes in the size and composition of their workforce, capital investments , output prices, and profits *inter alia*. Firm-side adjustments to minimum wages have been understudied in the developing world, where coping mechanisms may differ significantly from those in developed economies. This paper therefore uses administrative data from South Africa to fill this gap in a sector where it is suggested that minimum wages led to large employment losses, namely commercial agriculture (Bhorat et al. 2013).

The existing literature on the factor market effects of minimum wages can be broadly categorized into two perspectives: labour supply-side and demand-side. Supply-side research primarily relies on household data and typically asks questions that can be learned from households: Changes in earnings and labour supplies. Conversely, the demand-side literature, though scarce due to the limited availability of firm-level data, provides a more comprehensive perspective on firm-level adjustments. However, these insights are primarily derived from industrialized economies and rarely extend to emerging economies. When they do, the focus is typically confined to the manufacturing sector (Bell 1997; Alatas and Cameron 2008; Harrison and Scorse 2010; del Carpio et al. 2015; Mayneris 2018; Garita 2020; Hau et al. 2020; Rubens 2023). In using the minimum wages as a policy instrument to reduce poverty, the studies on agricultural minimum wages can give a more direct assessment relative to the studies on manufacturing minimum wages, given the high employment share of agriculture. Furthermore, farm employment is often among the worst-paid occupations in developing countries. Another important difference between demand- and supply-side research is the latter can give information on informal sector employment while the former rarely does so. We thus believe that precision and completeness of our demand side data complement the across sector spillovers captured in supply-side data.

Our research bridges this gap and makes two significant contributions. Firstly, we study both the demand and supply side effects in response to the minimum wage hike by using matched employer-employee (MEE) data. Barring few studies (Garita 2020), the use of MEE data is relatively rare in a developing country context. Secondly, we utilize administrative tax data, which promises precisionand more comprehensive coverage that are rarely attainable through conventional survey methods.

Following Harasztosi and Lindner (2019) which uses the pre-policy fraction of workers per firm affected by minimum wages, we analyse how firms adjusted to the 52% real minimum wage increase in South Africa's agricultural sector in 2013. Our empirical findings indicate that the minimum wage hike did not have a substantial impact on total labor costs but did lead to a notable decrease in employment. The observed decline in employment was associated with cessesion of farm operations, although the firm closures themselves were not affected following the policy change. A sub-sample analysis of surviving farms reveals a temporary surge in low wage(?) employment immediately after the policy hike, which we interpret as the short-run adjustments to surging labour costs. We also find that surviving farms increase capital accumulation in the last two periods of our sample, which we interpret as sustitution of labour with capital. Consequently, we observe a temporary drop in revenue per worker and operating profit per worker in the same year we observe a temporary increase in employment, given the farm revenue and operating profit did not change. Our analysis by firm size reveals that the minimum wage hike had varying effects on the outcomes of surviving farms.

The following sections are structured as follows: Section 2 offers the background of the study; Section 3 provides an overview of the data, variables, and summary statistics; Section 4 delineates our identification strategy; Section 5 presents our key findings; Section 6 engages in the discussion of the results; and Section 7 brings the study to a conclusion.

2. Background

Prior to the implementation of the National Minimum Wage in 2019, South Africa's minimum wage regulations followed a sectoral approach. Specifically, Sectorial Determinations 8 and 13 governed wage floors and broader employment conditions within the agricultural sector. These agricultural minimum wages were initially introduced in 2003 and were subject to annual adjustments in line with inflation rates. However, following farmworker strikes primarily in the Western Cape region, minimum wages in the sector increased substantially. As of March 1, 2013, the daily minimum wage increased from ZAR 70 to ZAR 105. The effects of this large minimum wage hike is the focus of this study.

On the supply side, previous studies have explored the employment implications of the 2013 wage hike, revealing reduced employment (van der Zee, 2017). A single study focusing on the demand side found that the 2013 wage increase resulted in significant increases in labour costs, with subsequent effects rippling through firms interconnected in agricultural supply chains (Tan, 2021). Our study distinguishes itself as the first attempt to uncover the multifaceted strategies adopted by farmers in response to the wage increase.

While Piek et al.'s (2023) study also used administrative tax data to analyse the impact of the 2013 minimum wage increase on the farming sector, their paper solely relies on employee income tax certificates that were aggregated to the firm to create a firm-level panel. Their study focuses exclusively on the employment effects of the policy change and is as such a supply-side side study. . It therefore does not take into account the effect of the policy change on farm balance sheet information such as revenue, profit, and capital accumulation. In contrast, our study combines Corporate Income Tax (CIT) data which includes balance sheet and income and expense information on farms, with employee income tax certificates. This allows us to study firm adjustments, beyond employment effects, in response to the policy change. Our analysis is thus restricted to farms that match across the two datasets, and our sample is a subset of the one used in Piek et al.'s (2023) study. Therefore, the two studies are based on different samples of the tax data.

3. Data and variables

3.1 Sample selection

Our empirical analysis uses micro-level de-identified tax records from South Africa from 2010/11-2016/17. Two sources of tax data are used: returns from Corporate Income Tax (CIT) and employee income tax certificates (National Treasury & UNU-WIDER, 2019).[6] The CIT data contains XXX.

Our sample consists of formal sector agricultural producers earning annually more than R2000 and their employees , as determined by tax filing thresholds. Given the administrative limitation in tax collection, they exclude the informal sector producers that are not regulated by minimum wages (Bhorat et al., 2017).

The lack of informal sector information does not allow us to estimate the spillover effects on informal sector producers, This, for example, can amplify the employment impacts as we cannot measure the labour movements across these two sectors (see the US example in Fan and Pena, 2019). An employee who lost the formal sector job may find an informal sector job, or increased employment of the formal sector may be accompanied with reduced employment of the informal sector. Therefore, we consider the impacts we observe in our data are only a part of the story, and the economy wide impacts are understated. While this is a limitation to almost all demand-side research of developing countries and the disemployment we find requires a careful interpretation when we quantify the impacts, we note that the lower remuneration and higher transaction costs of informal sector work indicate that they are likely to be associated with welfare losses.

Given that the agricultural minimum wages affect all formal agricultural producers, we do not have a pure control group. Following the previous studies, we use the fraction of affected workers as the continuous exposure variable at the farm level.

The tax certificate data (IRP5) cover the population of formally employed individuals who earn more than R2000 a year at a given employer. They contain information such as job duration, the amount of income received, the source of income, and a firm identifier. The job duration information is key to this analysis for two reasons. Firstly, we used the job duration variable to calculate workers' monthly earnings. Secondly, job duration is used to classify workers as seasonal or non-seasonal workers. Employees are classified as seasonal workers if they work up to six months for a given farmer in one tax year, while non-seasonal workers are defined as those who work more than six months a year. In the sample used in this paper, roughly half of the agricultural workers are classified as seasonal and the other half as non-seasonal. These proportions agree with the distribution of seasonal and non-seasonal farmworkers documented in the *Quarterly Labour Force Survey* contained within the Post-Apartheid Labour Market Series (PALMS) (Kerr et al., 2019).

We create a MEE dataset by aggregating the employee income tax certificates at the firm-level and merging that into the CIT data. Since our sample is limited to registered companies who are required to submit CIT returns, the data excludes mainly smaller farms who are not registered as companies (eg sole proprietors, partnerships, trusts *inter alia*). Our analysis is therefore representative of larger farming operations with multiple shareholders and directors. This group of farmers is the best-positioned in the sector to attract capital from shareholders or to apply for loan financing. Consequently, they are also more likely than other firms to be able to raise cashflow to bankroll temporary changes in labour costs (ensuring a possibly less volatile effect on employment compared to the rest of the sector), but may it also allow them to leverage funds more readily to introduce new capital and technology to the production process. The outcome is that we analyse the part of the agricultural sector that has the

[6] The CIT data is captured via the IT(R)14 form while the employee income tax certificate is captured via an IRP5 or IT3a form. See Kerr (2018) and Pieterse et al. (2018) for a detailed description of the datasets.

greatest degree of adaptability and choice in changing its inputs into the production process. That is, whether they choose to keep employment steady or to increase capital intensity following minimum wage hikes and other labour market shocks.

Before merging the datasets, the PAYE data contained approximately 1,557,077 agricultural-year entities. After merging the PAYE and CIT data and limiting the sample to entities present in both datasets, we ended up with approximately 1,108,729-year agricultural entities. Given our specific focus on the farming sector, which includes activities such as growing non-perennial crops, growing perennial crops, plant propagation, animal production, and mixed farming, we further narrowed down our data to include only these subsectors, resulting in a total of 40,697 farms.

In this paper, we use the fraction of affected workers as the key treatment variable. This variable is defined for farms that were part of the sample before the policy change took effect. Therefore, we excluded all farms that entered the sample after 2013. Ultimately, our final analysis sample consists of 18,919 farms followed in an unbalanced panel (hereafter we refer to it as base sample).

Our base sample comprises two groups of farms: those that ceased their operations after the policy change (exiters) and those that continued to operate (survivors). Within this study, we examine this base sample to assess the overall impact of the policy change on the farming sector. Additionally, we analyse a subset of the survivor farms to understand the strategies they employed in order to absorb the additional costs resulting from the minimum wage increase.

Tables 1 and 2 display the descriptive statistics on employment, sales revenue, capital share of sales revenue, and operating profit. Table 1 encompasses the entire base sample, while Table 2 focuses specifically on the subset of farms that survived. These statistics highlight a noteworthy transformation in the composition of the farming sector following the policy change. Notably, the mean values of employment, sales revenue, and operating profit demonstrate a significant increase within the subset of surviving farms compared to the broader base sample. Consequently, the information within tables 1 and 2 strongly suggests that it was the larger farms that predominantly continued to operate after the minimum wage hike.

Table 1: Descriptive statistics from the base sample

Year	employment	Capital-sales ratio	Sales Revenue (ZAR)	Operating profit (ZAR)
2011	83	0.14	4,910,052	1,671,555
2012	92	0.1	5,111,588	1,708,762
2013	82	0.09	4,873,616	1,659,017
2014	80	0.11	5,276,188	1,862,625
2015	81	0.12	5,163,451	1,881,160
2016	83	0.14	6,007,724	2,101,782
2017	85	0.2	5,089,968	1,780,202

Notes: Table 1 shows mean values of employment, capital-sales ratio, Sales revenue, and operating profit. Sales revenue and operating profit are reported in thousands.

Source:

Table 2: Descriptive statistics from the sample of survivors

Year	employment	Capital-sales ratio	Sales revenue (ZAR)	Operating profits (ZAR)

2011	135	0.03	10,417,055	3,367,098
2012	143	0.03	10,710,875	3,289,707
2013	144	0.05	11,250,685	3,375,606
2014	141	0.12	12,251,680	3,769,707
2015	147	0.16	12,486,154	3,860,825
2016	152	0.07	13,748,534	4,141,057
2017	161	0.18	13,603,523	4,151,700

Notes: Table 2 shows mean values of employment, capital-sales ratio, Sales revenue, and operating profit. Sales revenue and operating profit are reported in thousands.

Source:

3.2 Variables

Our analysis focuses on several key variables, including the fraction of affected workers, employment, sales revenue, capital accumulation, and operational profit.

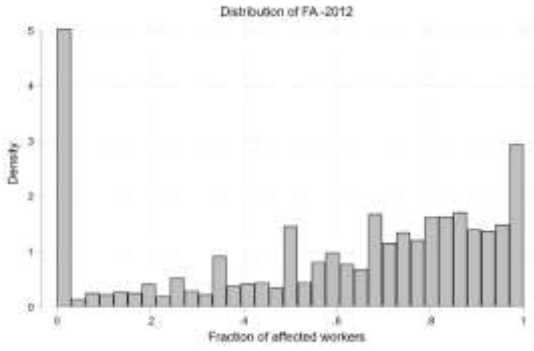
The fraction of affected workers, the treatment variable in our study, is derived from PAYE data. It specifically represents the proportion of workers earning below the new minimum wage in 2012. In essence, this variable serves as a measure of the intensity of treatment, and our event study estimates involve comparing the farms most impacted by this variable to those least affected.

Figure [insert figure number] illustrates the distribution of the fraction of affected workers. In Panel a), we observe the fraction of affected workers in 2012, the year preceding the minimum wage increase. Throughout our analysis, we utilize the 2012 calculation of the fraction as a treatment variable, maintaining its constancy for each firm over the period. Panel a) reveals that approximately 50% of farms had no affected workers, while around 30% had all workers earning below the new minimum wage.

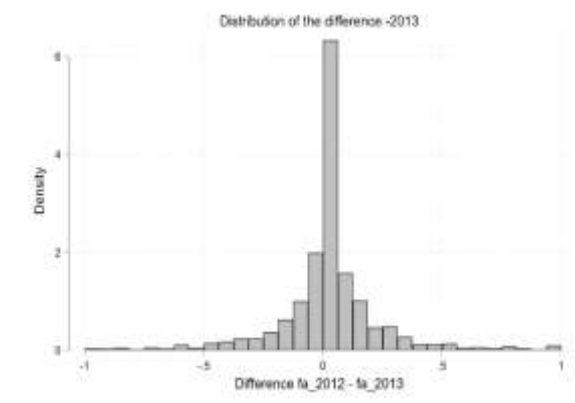
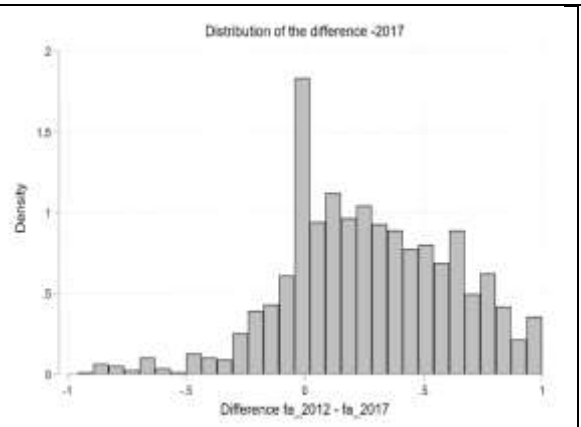
To evaluate compliance levels, we compute the Fraction of affected workers for each year (refer to the appendix for histograms for each year in our sample) and then determine the disparity between the fraction of affected workers in 2012 and subsequent years (i.e., FA_2012–FA_year). A difference of zero signifies no adjustment to the fraction of affected workers, while a positive difference indicates a reduced proportion of affected workers compared to 2012 (i.e., negative adjustment), and vice versa.

Panels b) and c) present the distribution of this difference for 2013 and 2017. In 2013, Panel a) shows that approximately 60% of farms did not modify their proportion of workers earning below the new minimum wage, with a few making negative adjustments (i.e., increased fraction of affected workers) and others making positive adjustments (i.e., decreased fraction of affected workers). By 2017, most farms had made positive adjustments (i.e., reduced the proportion of affected workers), as depicted in Panel c). Nonetheless, Panel c) indicates that for over 15% of farms, the fraction of workers remained unchanged from 2012 (no adjustment), with some farms even increasing the proportion of affected workers (negative adjustment) after five years.

Figure [insert number]: Distribution of fraction of affected workers



a)

	
b)	c)
Notes: Source:	

The "farm-exit" variable is a binary indicator, marked as 1 in the last year of the farm's appearance in our sample and 0 for all other years when the farm is present. It is worth noting that certain farms in the dataset exhibit sporadic exits and re-entries. In such cases, the "exit" variable considers only the ultimate exit year. [Put in a footnote: Sporadic exits and re-entries may reflect earnings fluctuating around R2000 threshold for tax filing. Our definition of farm exit may include farms continuing operations that just break even. While this is a limitation of our data, such pattern is typical for farms with the smallest operation scales and we consider their omission from data results in biases that are quantitatively small enough to be ignored.]

The "employment" variable represents the total workforce on a farm, while "capital" signifies the aggregate spending on fixed assets. "Sales revenue" accounts for the total income derived from sales, and "operating profit" quantifies a farm's value addition, calculated as the difference between sales revenue and the cost of sales. Furthermore, all financial variables are adjusted for inflation using the Consumer Price Index (CPI) deflator, with the base year set as 2012.

4. Empirical strategy

4.1 Research design

Our goal is to estimate the impact of minimum wages on employment, earnings, and other farm level variables.

4.1.1 Design aspects

Our documentation of institutional background shows that the imposition of minimum wage increase is uniformly applied to all regions and sub-sectors, therefore, it is not related to outcome growth rates, our LHS variables.

In addition to the plausible exogeneity of minimum wage changes, we use another design (or data) related assumption that all the employees work full time, because our data does not distinguish between full time and part time employees. Work hour information in the data consists of monthly totals, not daily totals. Employees initially paid below the minimum wage are defined by monthly total

earnings, and we may erroneously classify workers as sub-minimum wage if their hours are less than a full month equivalent, though their hourly rate may be compliant with regulations. This implies that our exposure variable FA may be upwardly biased, which corresponds to a non-classical measurement error problem. If the measurement error is non-negative, then our estimate on FA should be understated, therefore, again, the magnitude of our estimates can be considered conservative.

4.1.2 Modelling aspects

Given that FAs are plausibly exogenous to farm outcomes, we use the OLS estimator after accounting for variable growth rates between periods by using sector wide time FEs, and relying on three other modelling assumptions.

First, following Harasztoshi and Lindner (2019), we assume a common growth, so that the rates of change in outcomes are common at all points in the FA distribution. The common growth is different from the common trend assumed in a difference-in-differences estimates, yet one can test for pre-policy periods. We see, despite limited numbers of lead periods, the differential rates of change are not observed for most outcomes.

We call our estimation an event-study, rather than a traditional DID, because we are assuming common growth and are not controlling for unobservable farm FEs. When we take a difference in LHS, it eliminates farm FEs, yet it reintroduces them when we divide the difference with the initial value of outcome variable. This, however, does not make our estimates inconsistent so long as we have a common growth at all points in FA distribution, so FAs are not correlated with farm FEs in the error terms.

Second, we assume in our specification that the effects of all variables are linear in rates. This assumption, we believe, is a sensible choice. It is sensible because it gives our estimate β a natural interpretation of an elasticity, after suitably adjusting for difference in exposure rates ($\frac{\beta}{FE}$ backs out an elasticity of minimum wages). B

This specification may have a downside: Our impact estimates on level (non-ratio) outcomes can be understatement of the true impacts. This follows that most of level variables grow only linearly given that land areas are fixed in the short-run, so its second time derivative, or rate of change, is close to zero. Linear growths in yields are confirmed globally in the FAOSTAT data. If we fit the rate of change when outcome's instantaneous rate of change (second derivative) is near zero, the elasticity estimates may be attenuated. therefore, we consider them to be conservative.

Third, we assume that output price shocks are idiosyncratic over the distribution of FA. Labour demand can also be affected by output price shocks. If, for example, farms with high FAs experience negative output price shocks, then β for employment impacts will be downwardly biased. Our assumption rules out differing boom or bust in output prices between different levels of FA. If the output prices change uniformly across FA, then it will be subsumed into time FE and the estimate of β will not be affected. While we do not observe output prices in the data, the agricultural sector is known for a tight link with the international markets, and we do not observe anomalous changes in prices during our observation periods of 2011-2017.

4.2 Estimating equation

To estimate the effects of the minimum wage increase on agricultural enterprises, our empirical analysis employs a version of event study design estimator, building upon the work of Harasztsosi and Lindner (2019). Our model is expressed as follows:

(1) $$\frac{y_{it}-y_{i2013}}{y_{i2013}} = \alpha_t + \beta_t FA_i + \gamma X_{it} + \varepsilon_{it}$$

In this equation, y_{it} represents the outcome of interest for firm i at time t. The variable FA_i represents the proportion of employees impacted in firm *I*, assuming full compliance with the minimum wage increase. It is the proportion of workers in 2012 who earned below the new minimum wage. To understand how the pre-policy exposure affects the outcome, we use the initial value of fraction affected variable throughout the examined span of each firm. The vector X_{it} is a set of pre-policy control variables such as pre-policy capital-labour ratio, pre-policy rainfall amount and pre-policy farm-size. Furthermore, we incorporate three-digit Standard Industry Classification and province fixed effects (FEs). ε_{it} is a random error term.

As can be seen in (1), we measure the impacts of the intention to treat on the rate of change in *y*. The LHS of the equation captures the relative change in the respective outcome variables from 2012, the year preceding the wage shift, to respective post-treatment years. The coefficient β_t quantifies the intention to treat impact of the minimum wage increase on the rate of change in variable of interest. In addition, we allow time FEs in α_t so that (1) is an event study design estimator with time-FEs.

Our variables of interest are labour cost, employment, farm-exit, operating profit, sales revenue or capital accumulation.

This analytical framework enables us to assess the effects of the minimum wage increase on various firm-level metrics by comparing the trajectories of treated (i.e., most affected farms) and control entities (i.e., less affected farms), while controlling for important covariates and industry-specific factors.

5. Results

This section presents the outcomes derived from estimating equation 1, including results from the base sample and its subsample of surviving farms. The base sample covers all farms within our base sample, with results reflecting the impact of farm exits. Conversely, the subsample of surviving farms focuses solely on those that maintained operations after introducing the new minimum wages. Results obtained from this surviving subsample illuminate the strategies employed to absorb the additional costs stemming from the minimum wage hike.

All findings presented in this section are weighted by the policy values of the respective outcome variables under scrutiny (such as employment, wages, capital, etc.). Unweighted results are detailed in Appendix B.

5.1 Average wage

Figure [insert figure number] presents the estimated effects of the minimum wage hike on average wages. Panels a) and b) illustrate the results for the average wages of all workers, indicating no significant impact on average wages for both the base sample and the sample of surviving farms.

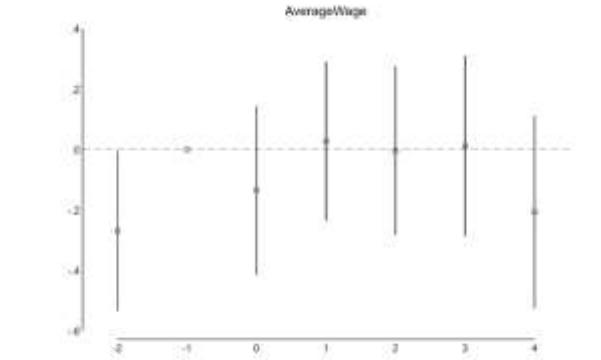
Panels c) and d) show the effect of the minimum wage change on non-seasonal workers (i.e., those employed for more than 6 months on the farm). Here, the results indicate a decrease in average wage growth in the year of the policy change, with insignificant effects in subsequent years. This observed decrease in average wage growth was more pronounced for the base sample.

Panels e) and f) reveal a non-significant effect on average wages for seasonal workers.

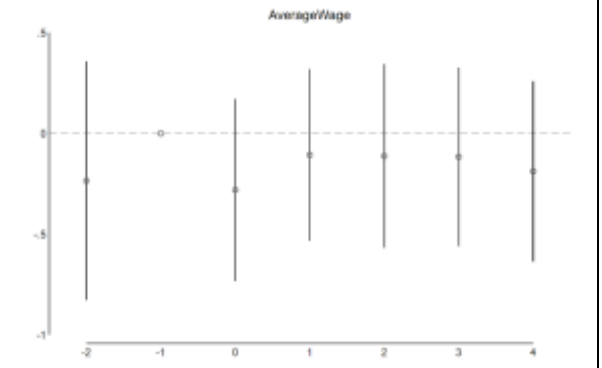
Furthermore, we examine the impact on high-wage workers, defined as those earning a monthly wage of R5400 and above, while low-wage workers earn below R5400. Panels g) and h) show that, like non-seasonal workers, high-wage workers experienced a decrease in average wage growth in the year of the minimum wage increase, although the effect on wage growth was insignificant in subsequent years.

Panel i), however, reveals that average wages for low-wage workers in the balanced panel increased in years 1, 2, and 3 following the minimum wage increase. However, surviving farms gradually increased wages for low-wage workers, with significant wage growth observed only in the sample's last two years.

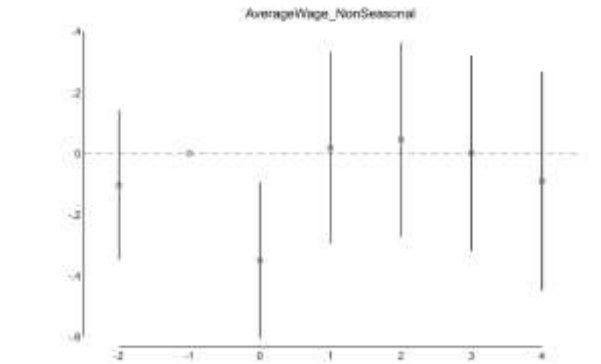
Figure [insert number]: Effect of the minimum wage hike on average wage



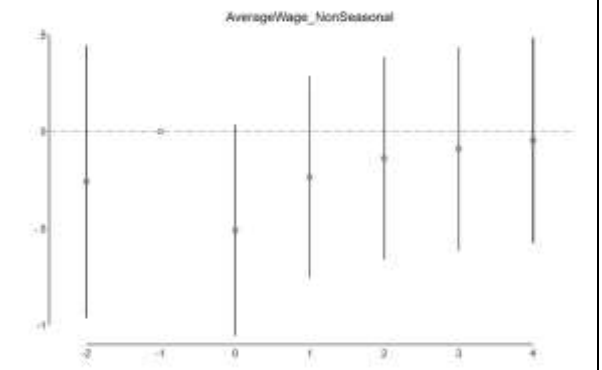
a) Balanced sample: All workers



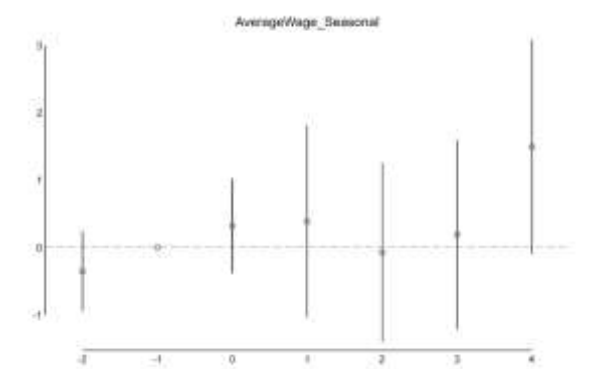
b) Sample of surviving farms: All workers



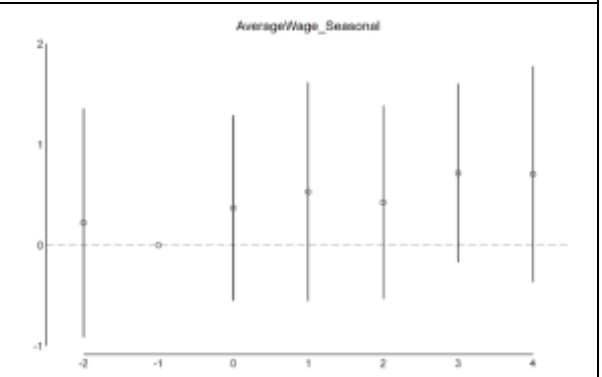
c) Balanced sample: non-seasonal



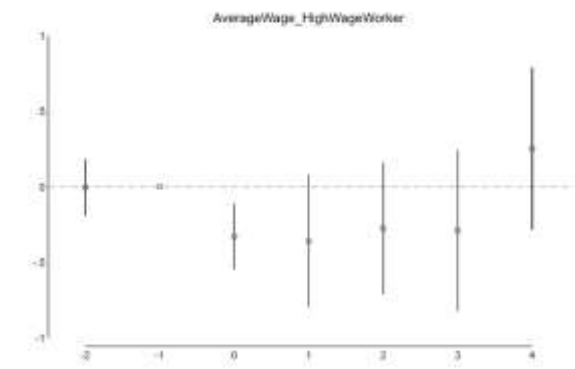
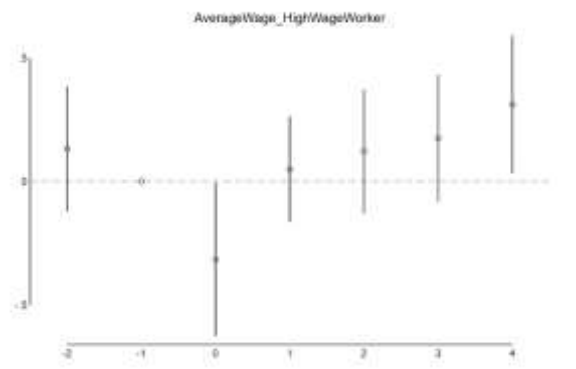
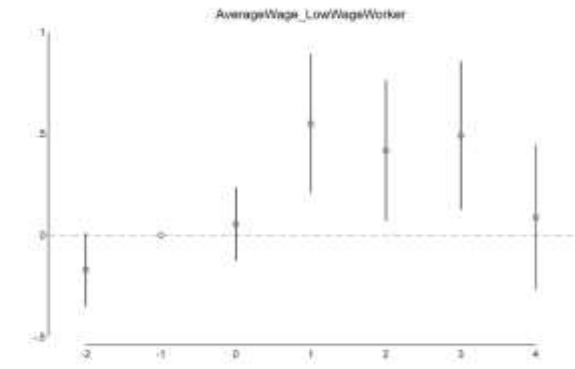
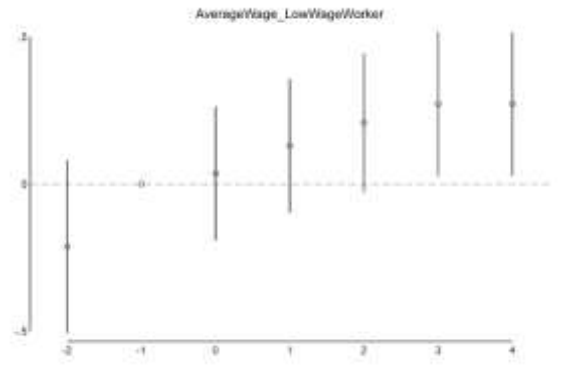
d) Sample of surviving farms: non-seasonal



e) Balanced sample: Seasonal



f) Sample of surviving farms : Seasonal

	
g) Balanced sample: High-wage workers	h) Sample of surviving farms: High wage workers
	
i) Balanced sample: Low-wage workers	j) Sample of surviving farms: Low-wage workers
Notes: Source:	

In summary, the analysis indicates that the minimum wage hike did not significantly influence the overall average wage growth across farms. However, a closer examination of wages among workers at the lower end of the income spectrum reveals a notable impact: the minimum wage increase led to higher wages for low-wage workers, who are the primary targets of minimum wage legislation. Interestingly, this wage increase is more pronounced in the base sample compared to the sample of surviving farms, suggesting that the increase was driven by farms that ceased operations following the minimum wage hike.

Another noteworthy finding is that non-seasonal and high-wage workers experienced a temporary decrease in average wage growth in the year of the policy change. This indicates that farms were trying to control the increasing labour costs with temporary slowdown of the wage growth of highly paid workers.

5.2 Employment

Figure [insert figure number] illustrates the impact of the minimum wage hike on employment. First, we calculated the proportion of job losses by farm closures. In panel a), a notable spike in the proportion of jobs lost due to farm closures is observed from year 2 (i.e., 2015) onwards.

The estimated effects of the minimum wage hike on overall employment (considering all workers, with and without farm closures) are displayed in panels b) and c). These panels reveal a decline in employment from year 2 onwards, with the decrease more pronounced in the base sample compared

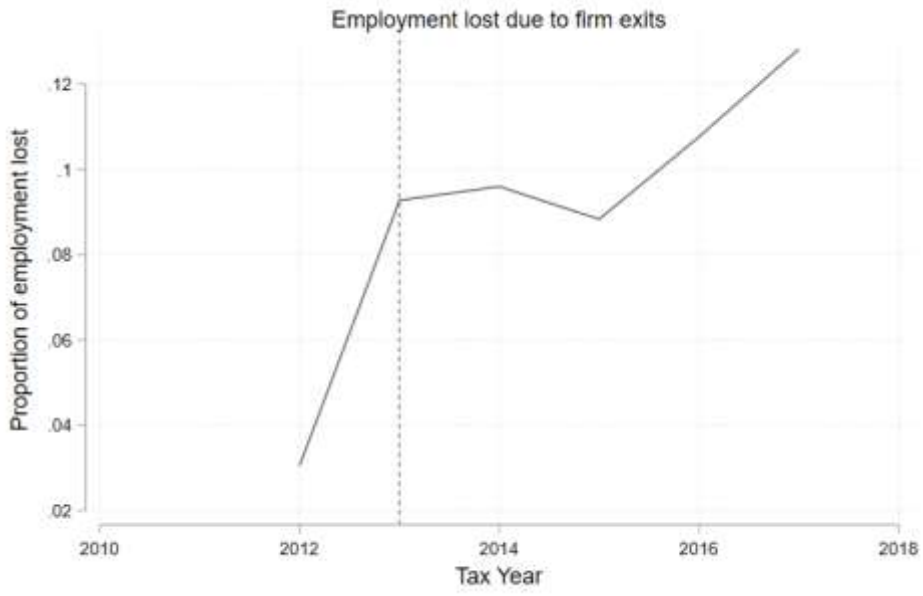
to the sample of surviving farms. Interestingly, both samples show an increase in employment in year 0 (i.e., the year of the minimum wage increase). To understand why farms increased overall employment at the instance of minimum wage increase, we break down employment into several categories.

Panels d) and e) depict the impact of the minimum wage hike on non-seasonal employment. The results from the base sample indicate a decrease in non-seasonal employment from year 2 onwards, which is consistent with a spike in job losses by farm closures in panel a). it is only indicative of job losses because the pre-trend is not flat.

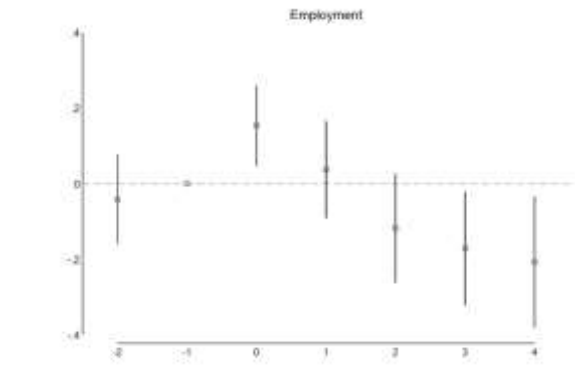
On the other hand, panels f) and g) show no impact on seasonal employment. This is understandable given that seasonal employment is mostly related to planting and harvesting tasks, whose labour requirement cannot be changed without mechanization. Panels h) and i) demonstrate a decrease in high-wage employment at year 0, with the decline more precisely estimated in the base sample due to its larger sample size.

Finally, panels j) and k) present the results for the effect of the minimum wage on the employment of low-wage workers. We observe a temporary increase in the employment of low-wage workers for farms in the base sample, followed by a gradual decline in the employment effect, which becomes more significant in the final year of our sample.

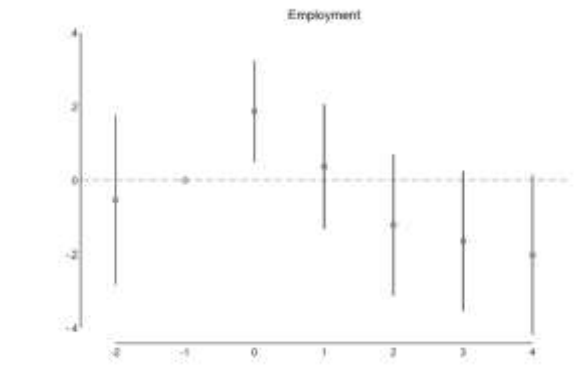
Figure [insert number]: Effect of the minimum wage hike on Employment



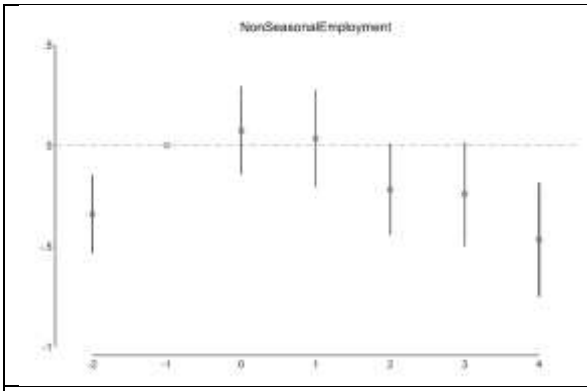
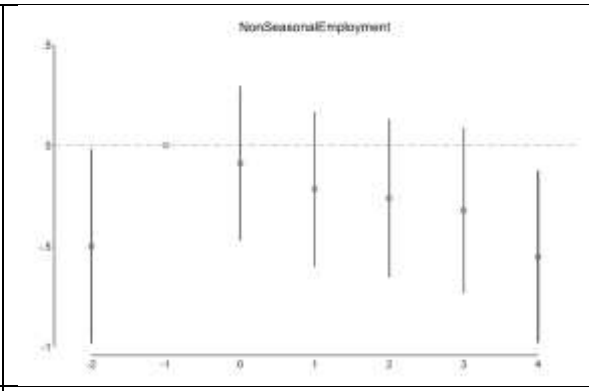
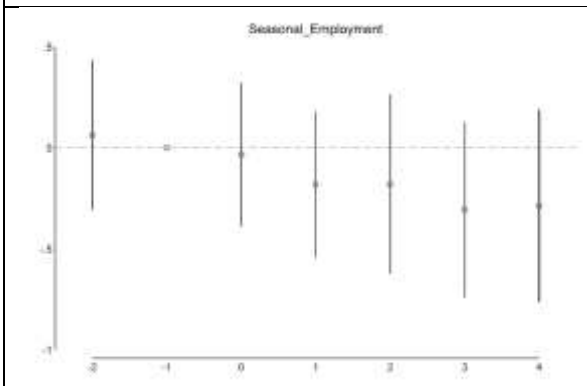
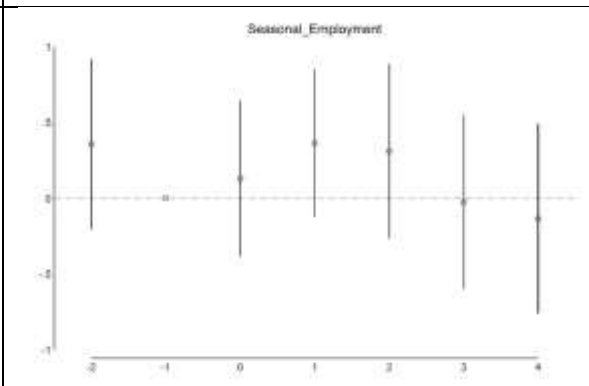
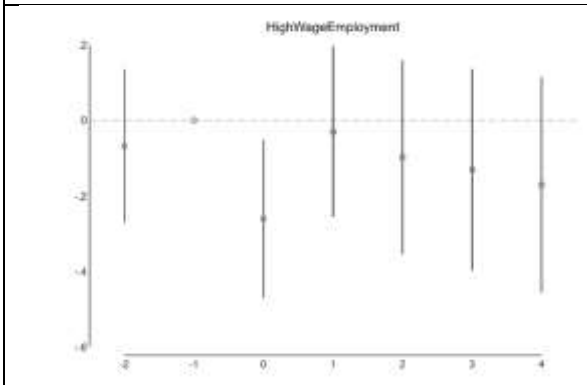
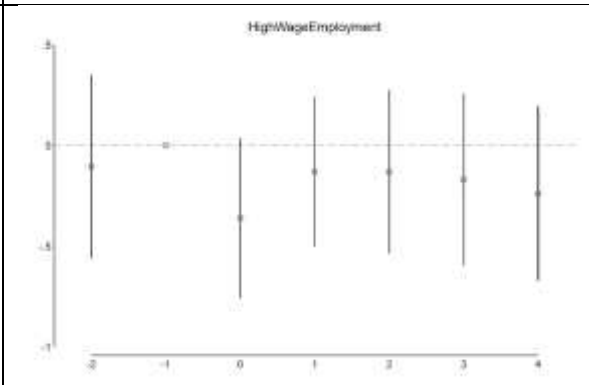
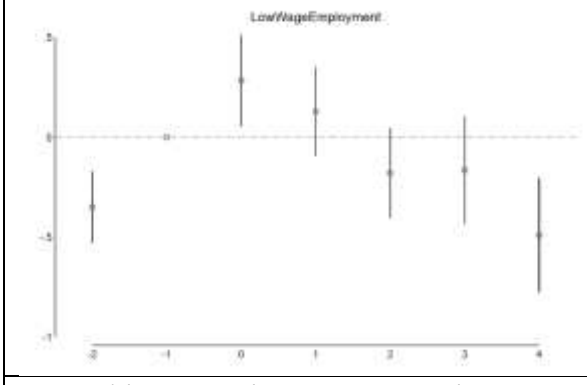
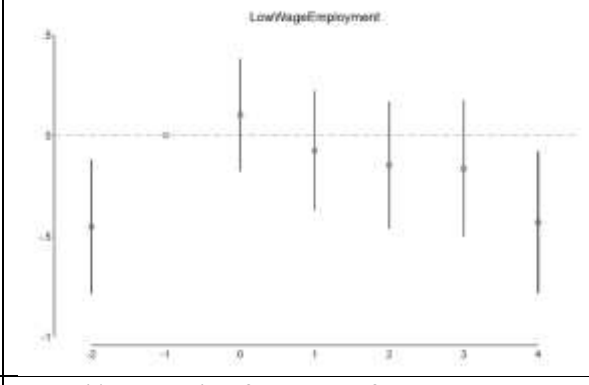
a) Proportion of jobs lost due to farm exit



b) Balanced sample: All workers



c) Sample of surviving farms: All workers

<table>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>d) Balanced sample: Non-seasonal</td><td>e) Sample of surviving farms: Non-seasonal</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>f) Balanced sample: Seasonal</td><td>g) Sample of surviving farms: Seasonal</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>h) Balanced sample: High wage workers</td><td>i) Sample of surviving farms: High-wage workers</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td>j) base sample: Low wage workers</td><td>k) Sample of surviving farms: Low-wage workers</td></tr>
<tr><td colspan="2">Notes :
Source :</td></tr>
</table>

In summary, the findings regarding the employment effects of the minimum wage hike show the significant influence of exiting farms on our results. The observed decrease in non-seasonal employment in the base sample of panel d) aligns with the proportion of jobs lost due to farm closures as illustrated in panel a) of figure [insert figure number].

In the year of minimum wage hike, farms are reducing employment of high paid workers while increasing the employment of low wage workers, and the latter change is dominating. In the longer-run, or after two years and beyond, farms are reducing low wage and non-seasonal employment while holding seasonal employment unchanged.

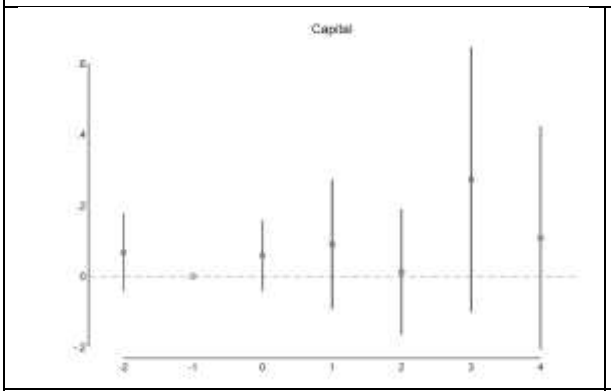
When considered alongside the average wage results, our findings imply that farms responded to the minimum wage hike by expanding low-wage employment, potentially funded by reductions in wages for high-wage and non-seasonal workers.

5.3 Capital and capital intensity

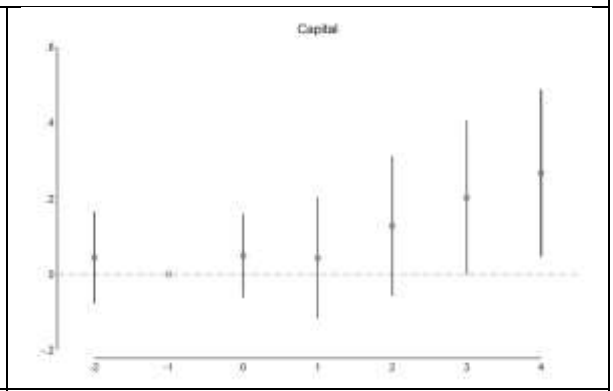
Figure [insert figure number] depicts the estimated effects of the minimum wage on capital and capital intensity. Panels a) and b) present the results for capital. Interestingly, in the base sample, no significant impact on capital is observed. However, within the sample of surviving farms, there is a gradual increase in capital, particularly notable in the last two years of the sample.

Moving on to panels c) and d), they illustrate the effects on capital intensity. Here, we observe an increase in capital intensity within the base sample, while in the sample of surviving farms, there is a gradual rise in capital intensity from year 2 (2015) onwards.

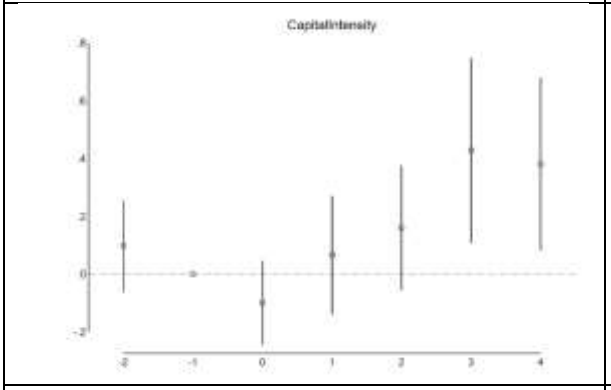
Figure [insert number]: Effect of the minimum wage hike on Capital



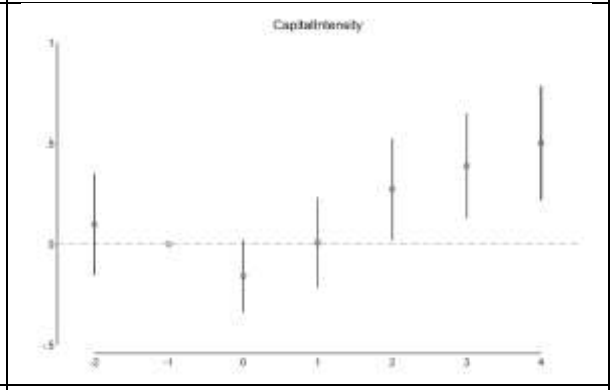
a) Balanced sample



b) Sample of surviving farms



c) Balanced sample



d) Sample of surviving farms

Notes: Source:

The findings regarding the effects of the minimum wage hike on capital and capital intensity indicate a notable trend towards capital intensification among surviving farms. In the balanced panel, where no significant impact on capital is observed, the increase in capital intensity suggests that this shift is likely propelled by a decrease in employment. This inference is drawn from our definition of capital intensity as capital expenditure divided by employment.

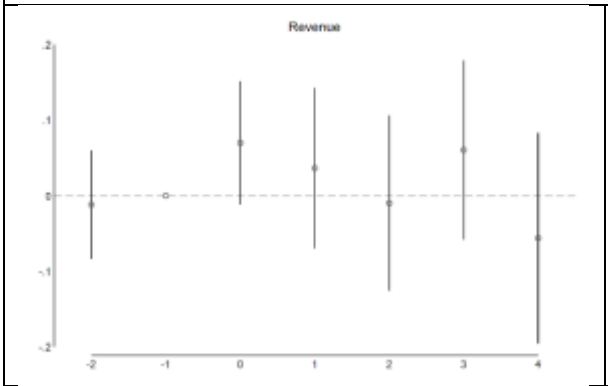
Conversely, surviving farms witnessed an increase in capital intensity despite not experiencing a significant decrease in employment. This suggests that the observed rise in capital intensity was primarily driven by an increase in capital accumulation.

5.4 Revenue

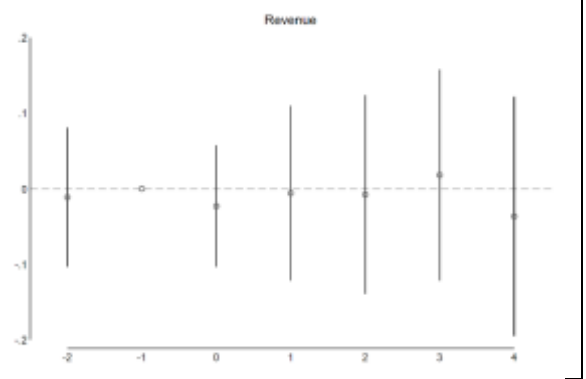
We examined the effects of the minimum wage hike on sales revenue and sales revenue per worker, as depicted in figure [insert figure number]. Panels a) and b) reveal that point estimates are positive on sales revenue at year 0-1 in the base sample, although they are imprecisely estimated. This is surprising after observing farms rely more on low wage workers as they reduced their high wage workers, which can reduce the skill levels of labour.

Moving to panels c) and d), we observe a temporary decrease in revenue per worker, particularly pronounced in the sample of surviving farms. A gradual but insignificant increase follows this decrease in subsequent years. Notably, in year 3, the increase becomes significant for the base sample.

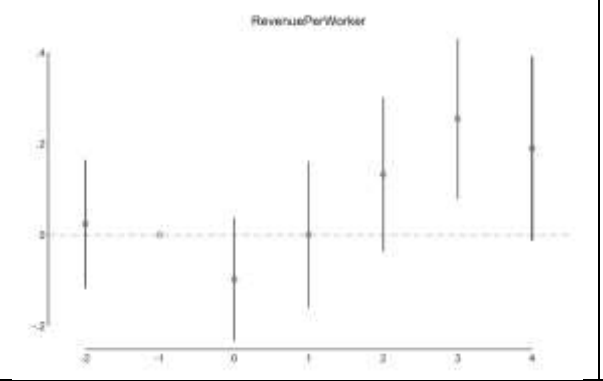
Figure [insert number]: Effect of the minimum wage hike on revenue



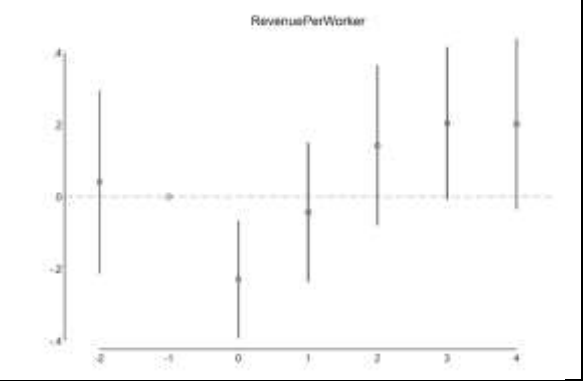
a) Balanced sample



b) Sample of surviving farms



c) Balanced sample



d) Sample of surviving farms

Notes:

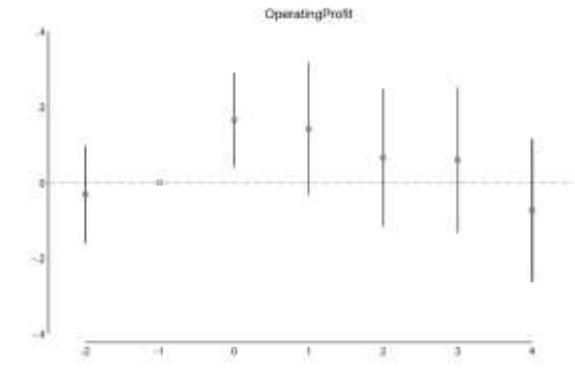
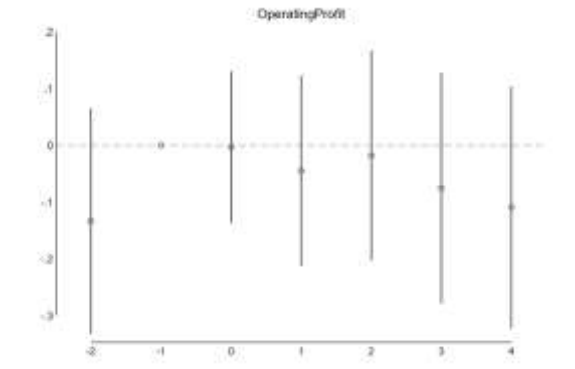
Source:

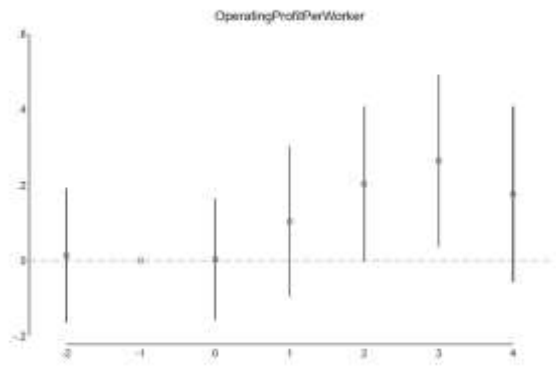
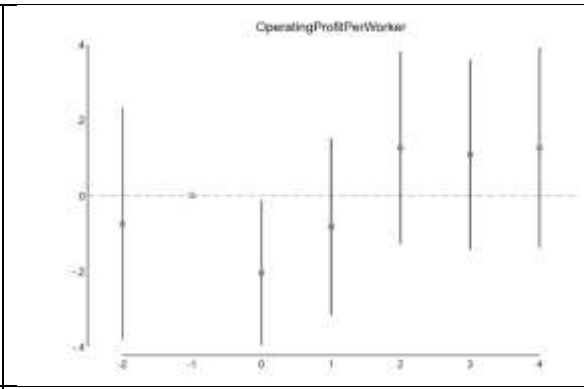
In summary, our analysis reveals that the minimum wage had no significant impact on the sales revenue of farms. Additionally, we did not observe any significant increase in labour productivity in year 3 for the base sample or a significant decrease in labour productivity in year 0 for surviving farms. These findings suggest that any changes in labour productivity were driven by the effects of the minimum wage on employment levels, rather than on other factors.

5.5 Operating Profit

The impact of the minimum wage hike on the operating profit and operating profit per worker of farms is depicted in figure [insert figure number]. Panels a) and b) display the results for operating profit. We observe a temporary increase in profits in year 0 for the balanced panel, while no significant effect on profits is found for surviving farms. This jump in operating profits is expected after observing slightly increased revenue with reduced high wage employment in year 0.

Moving to panels c) and d), they illustrate the effect of the minimum wage hike on operating profit per worker. In the base sample, we note a gradual increase in operating profit per worker, with significance reached only in year 3. Conversely, for the sample of surviving farms, there is a decrease in operating profit per worker in year 0, with no significant impact observed in subsequent years.

Figure [insert number]: Effect of the minimum wage hike on profit	
	
e) Balanced sample	f) Sample of surviving farms

	
g) Balanced sample	h) Sample of surviving farms
Notes: Source:	

Overall, our findings indicate no impact of the minimum wage hike on the profitability of farms except for year 0-1. Like the results on revenue per worker, the observed fluctuations in operating profit per worker are primarily driven by changes in employment, with no evidence suggesting that the minimum wage hike affected farm productivity.

6. General Discussion

Our findings are consistent with firm behaviour characteristic of both monopsonistic and competitive theories. These nuances assist us in understanding how market structure can facilitate dynamic effects of minimum wages at various points in time. They also suggest how competition in the product market can place a ceiling on farms' power in the labour market, even if these farmers show traits of monopsonistic behaviour.

Firstly a large proportion of farmers continues to employ workers below the new minimum wage even four years after the policy implementation, suggesting that significant firm power exists in the sector at all times. While non-compliance is well-documented in the South African context, it is nevertheless plausible that these workers we observe earning less than the new minimum wage are part-time employees, who are challenging to identify in the administrative tax data used in our study.

However, a second factor emerges, which also supports the notion that the agricultural sector has characteristics of a monopsonistic structure. In the year immediately following the wage hike, non-seasonal and high wage workers receive real wage decreases, which corresponds to an increase in hiring low-wage workers and no immediate increase in low wages. The fact that no wage increases emerged suggests that firms had market power in the labour market.

However, this trend does not persist over the long run, as we eventually observe an increase in average wages for low-wage workers – albeit with continued high levels of non-compliance - coupled with a decline in low-wage employment primarily due to farm closures. Although farms initially demonstrate monopsonistic behaviour, they eventually align with the typical neoclassical prediction following a minimum wage hike. Firm power is therefore curtailed over the long-run. Our results point to one factor that limits this power. Neither operating profits nor revenue responded to the increase in the minimum wage, suggesting that farmers are price takers whose incomes depend primarily on the demand factors in the product market, and not supply shocks to the labour market. While we cannot directly measure whether farmers can transfer costs of minimum wages to consumer prices, the stability of revenues

suggests that they do not. What does change is the input combination used to generate these revenues. Farms eventually absorb the added costs of minimum wages by adjusting low-wage employment downwards and substituting towards capital, effectively changing the production function without changing production. It is important to note that the sample we use differs from that used by Piek et al (2023) who included farms that were not registered for company tax. Our sample is limited to a group of farmers registered as companies, and therefore have access to loans and shareholder funding. Our conclusion that they increase capital is therefore warranted. But these larger farmers, with more market power, are also able to delay employment losses while maintaining profitability.

This study highlights the dynamic interaction between labor market structure and product market dynamics in South Africa's agricultural sector. The findings suggest that while there may be scope for monopsonistic power in the agricultural labor market, competition in the product market steers the labor market closer to competitive features.

Our study emphasizes the important role of policymakers in recognizing the impact of a minimum wage increase in the agricultural sector. While monopsonistic tendencies on farms may initially cause delays in wage hikes for employees below the minimum wage, long-term effects reveal an eventual increase in average wages for low-wage workers, coupled with a decline in employment due to farm closures. Addressing and monitoring these monopsonistic behaviors is crucial for ensuring fair wages. Non-compliance with new minimum wage standards calls for enhanced enforcement mechanisms to safeguard workers' rights.

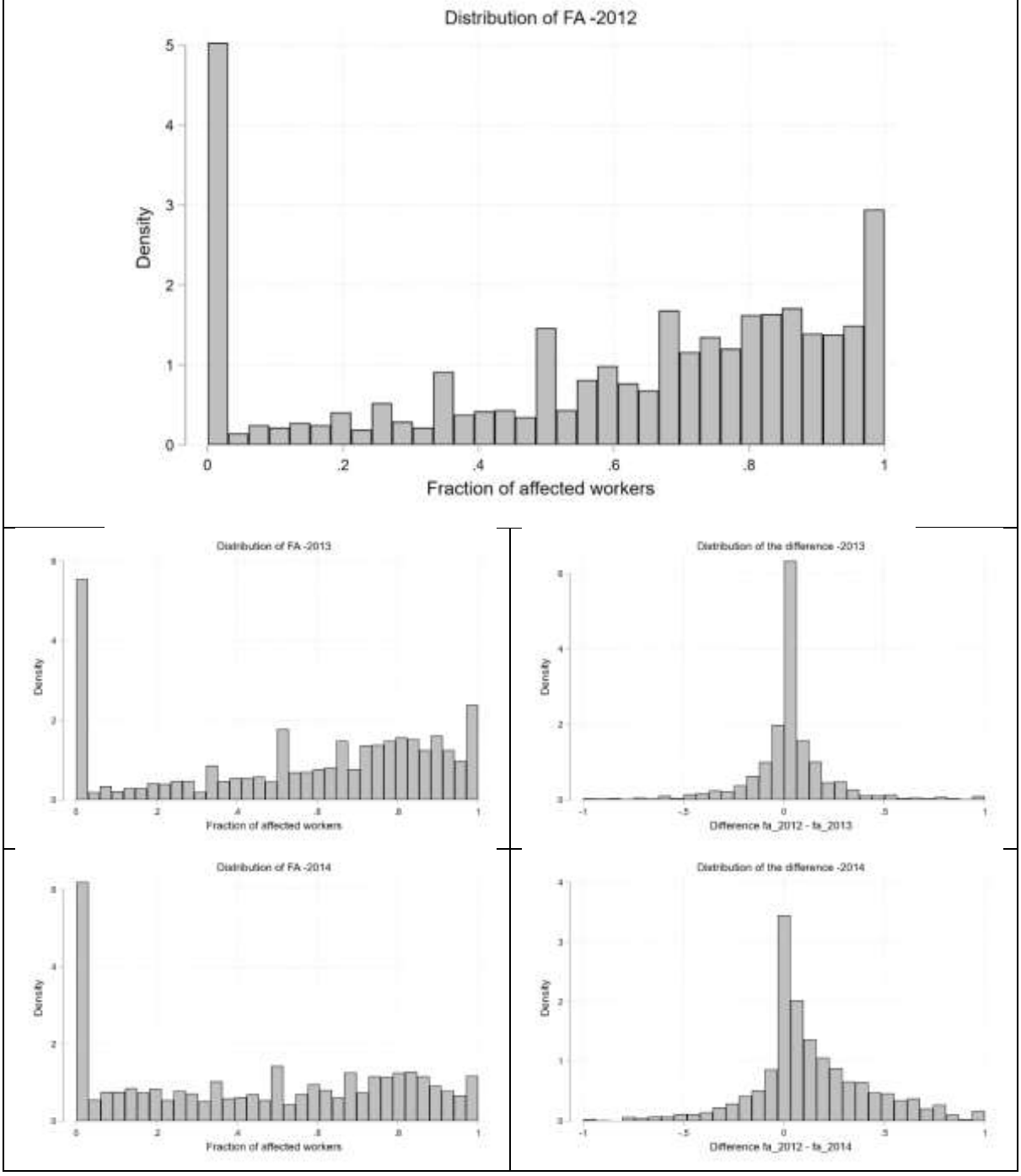
Lastly, our study addresses the influence of product market competition on labor dynamics. Policymakers should support measures towards a competitive product market to counteract monopsonistic behavior on farms and foster equitable wages in the labor market.

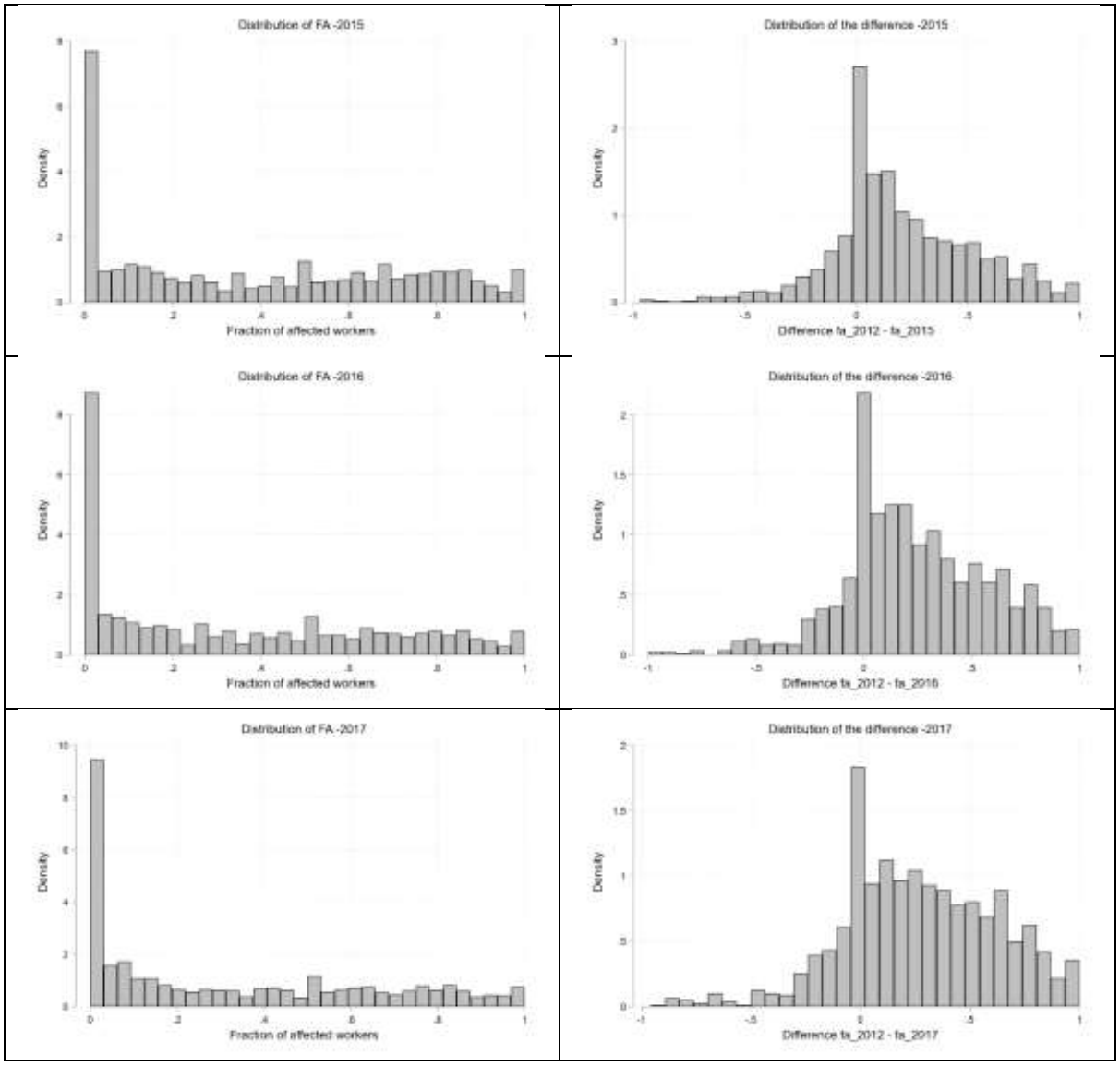
7. Conclusion

In this study, we employ an event study design using South African tax data to investigate the demand-side effects of a substantial minimum wage hike. Focusing specifically on the effects on employment, wages, capital, revenue, and profits within the agricultural sector, our analysis aligns with the predictions of oligopsonistic and competitive theories following such policy changes. Initial findings indicate that farms did not immediately raise wages for low-wage workers; instead, they decreased wages for higher-wage and non-seasonal workers while increasing employment among low-wage workers. However, our long-term analysis reveals a subsequent increase a reduction in employment, primarily driven by farm exits, and increased capital accumulation, consistent with both oligopsonistic and competitive market dynamics. The results show that the minimum wage increase had no significant effect on revenue and profits, as expected within the framework of a perfectly competitive agricultural product market where firms act as price takers. Our findings suggest the existence of monopsonistic tendencies in South Africa's agricultural labour market, ultimately yielding to the neoclassical neo-classical predictions due to the nature of the product market. In light of these findings, we recommend that policymakers consider both short-term and long-term effects when implementing minimum wage increases. This entails enhancing monitoring and evaluation mechanisms to ensure compliance with mandated wages, providing training programs to facilitate the transition of displaced workers to other sectors, and promoting a competitive product market environment to mitigate the potential monopsonistic behavior among farms.

Appendix A: Fraction of affected workers

Figure A.1: Fraction of affected workers and changes in fraction of affected workers



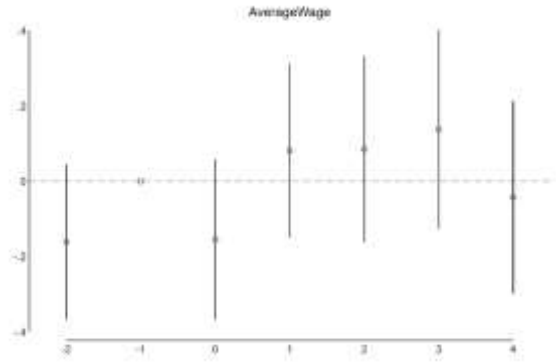

Distribution of FA -2015
Density
Fraction of affected workers
Distribution of the difference -2015
Density
Difference fa_2012 - fa_2015
Distribution of FA -2016
Density
Fraction of affected workers
Distribution of the difference -2016
Density
Difference fa_2012 - fa_2016
Distribution of FA -2017
Density
Fraction of affected workers
Distribution of the difference -2017
Density
Difference fa_2012 - fa_2017

Appendix B: Unweighted results

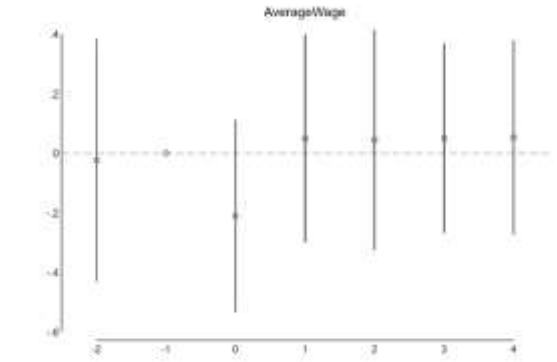
The main text features weighted regression results. In this appendix, we display the results obtained prior to applying the pre-policy values as weights.

i) Average wage

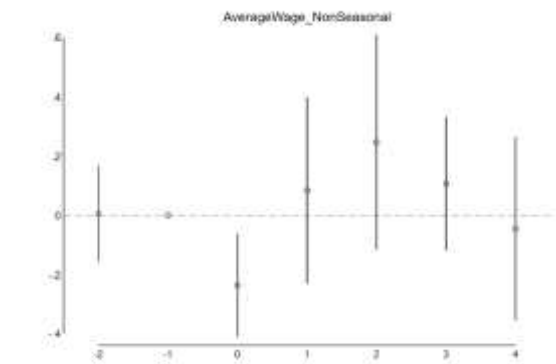
Figure B.1) Effect of the minimum wage hike on average wage



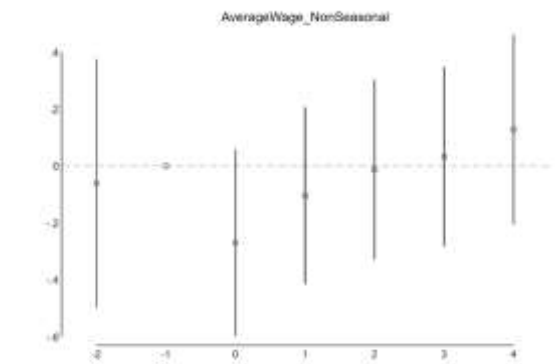
a) Balanced sample



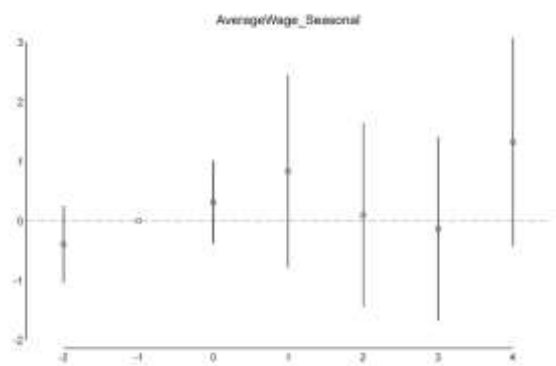
b) Sample of surviving farms



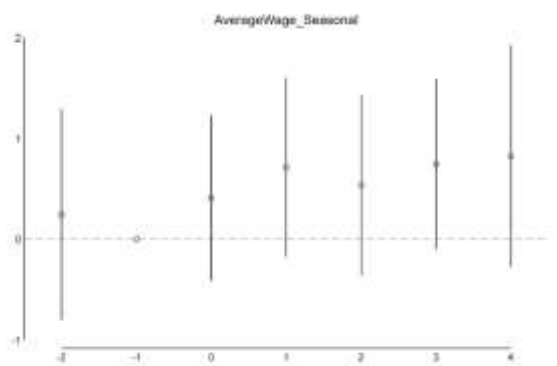
c) Balanced sample: Non-seasonal



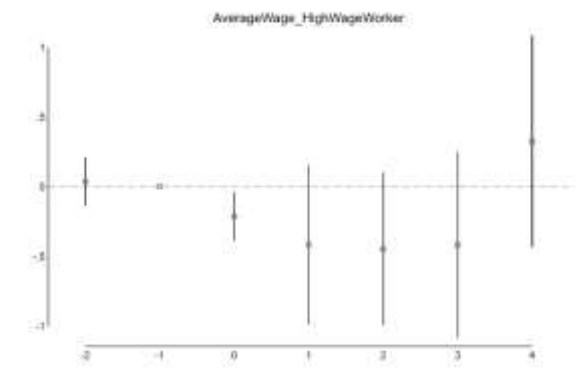
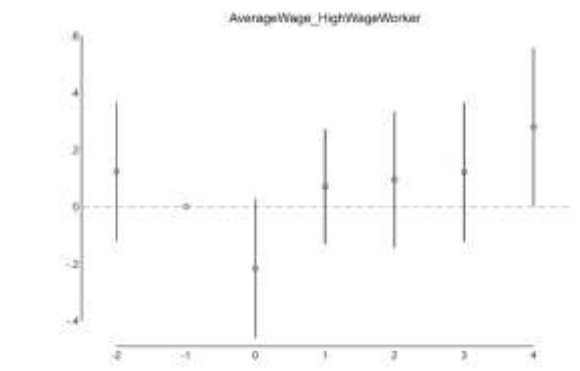
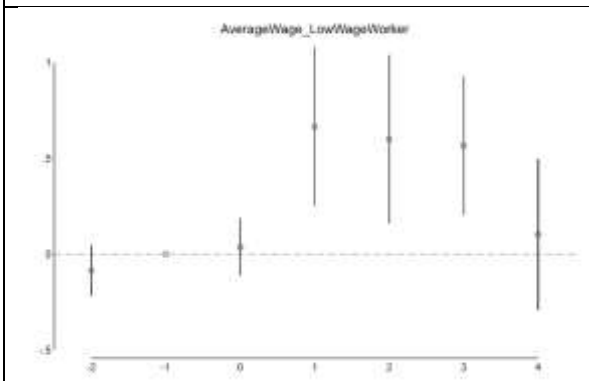
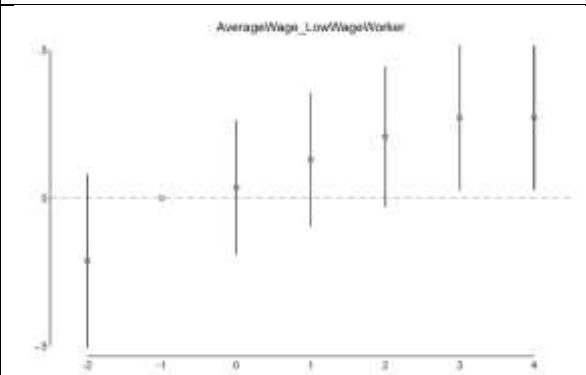
d) Sample of surviving farms: Non-seasonal



e) Balanced sample: Non-seasonal

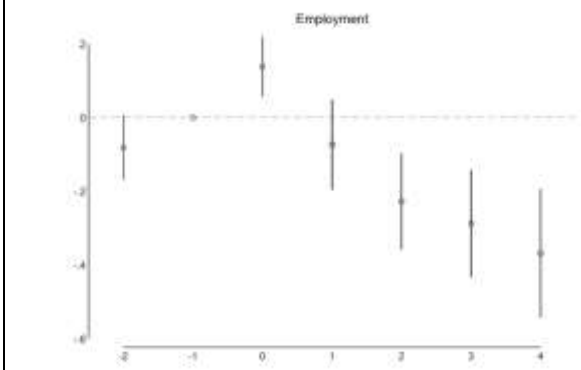


f) Sample of surviving farms: Seasonal

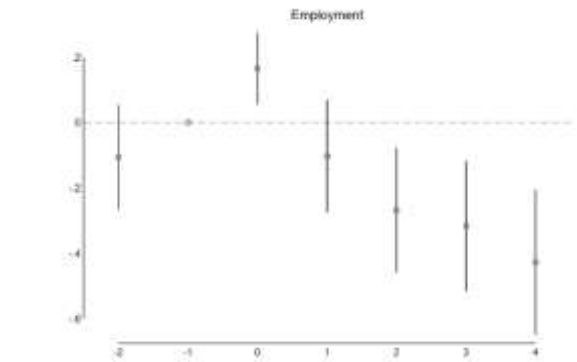
	
g) Balanced sample: High-wage workers	h) Sample of surviving farms: High-wage workers
	
i) Balanced sample: Low-wage workers	i) Sample of surviving farms: Low-wage workers
Notes: Source:	

ii) Employment

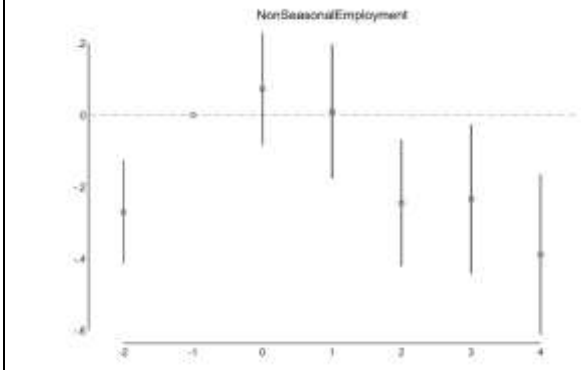
Figure B.2: Effect of the minimum wage hike on employment



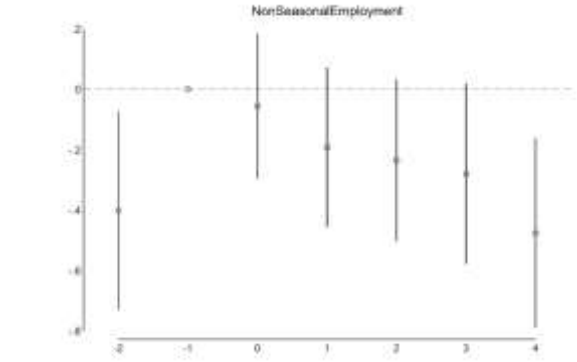
a) Balanced sample



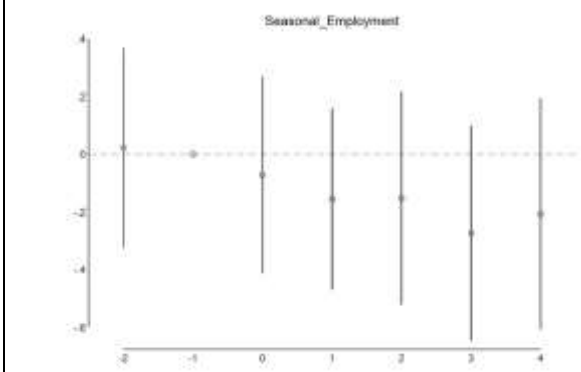
b) Sample of surviving farms



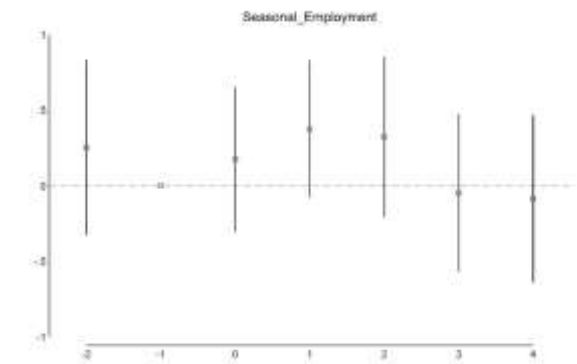
c) Balanced sample: Non-seasonal



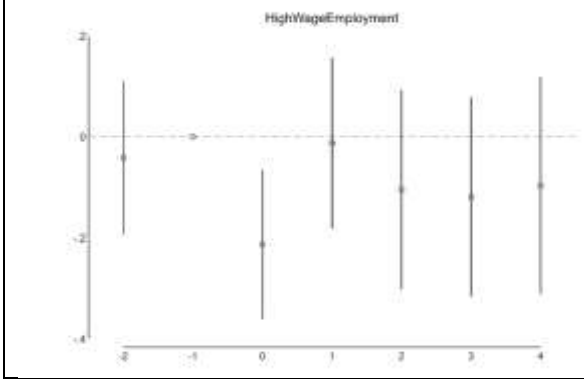
d) Sample of surviving farms: Non-seasonal

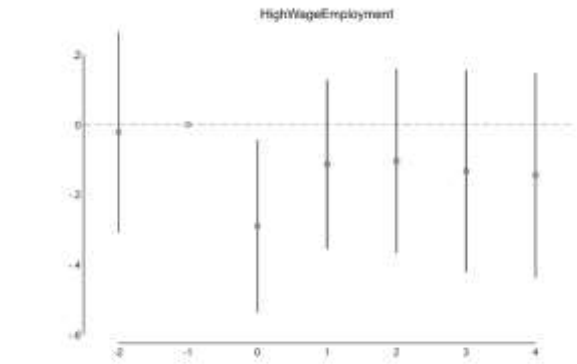


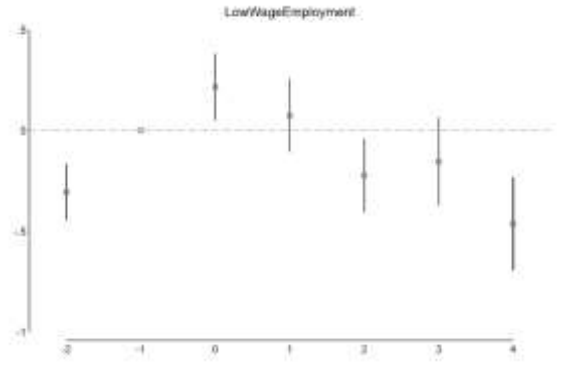
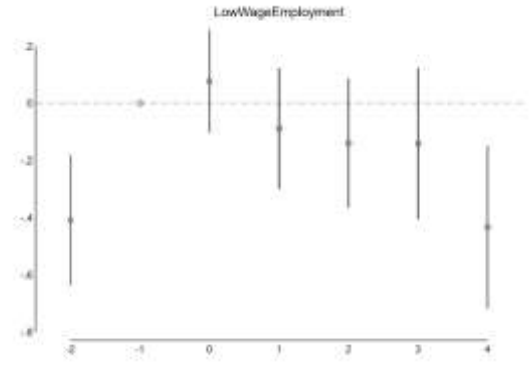
e) Balanced sample: Seasonal



f) Sample of surviving farms: Seasonal

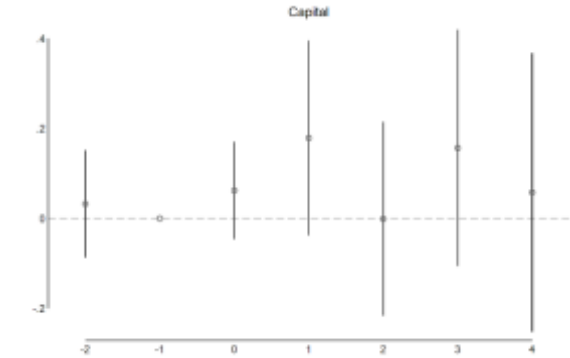




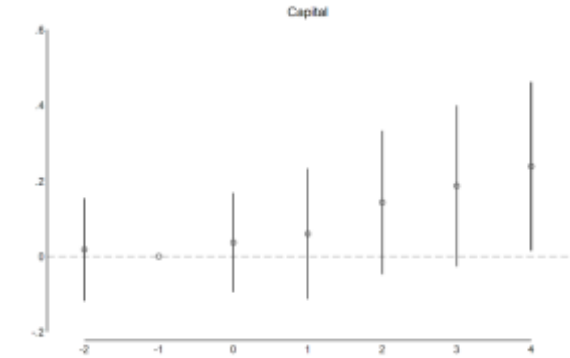
g) Balanced sample: High-wage workers	h) Sample of surviving farms: High-wage workers
	
i) Balanced sample: Low-wage workers	j) Sample of surviving farms: Low-wage workers
Notes: Source:	

iii) Capital

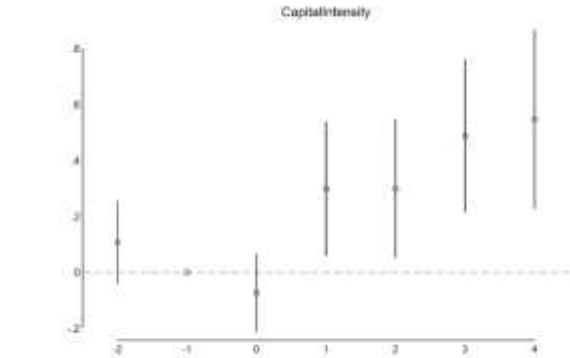
Figure B.3: Effect of the minimum wage hike on Capital



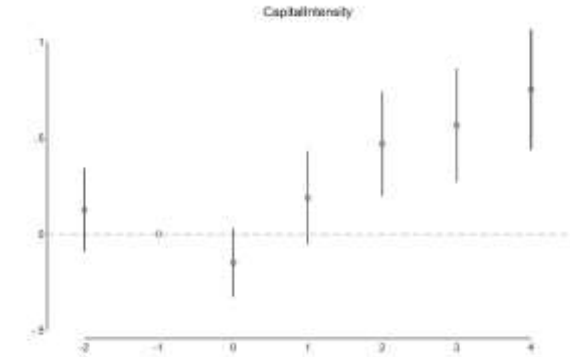
a) Balanced sample



b) Sample of surviving farms



c) Balanced sample

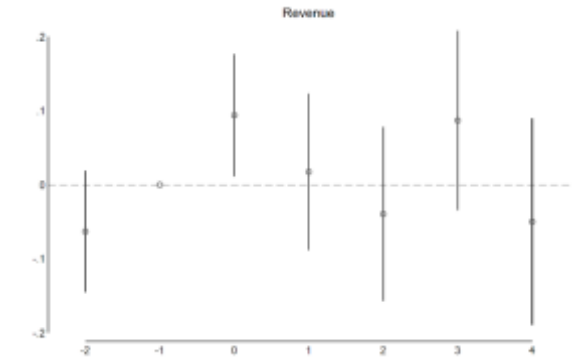


d) Sample of surviving farms

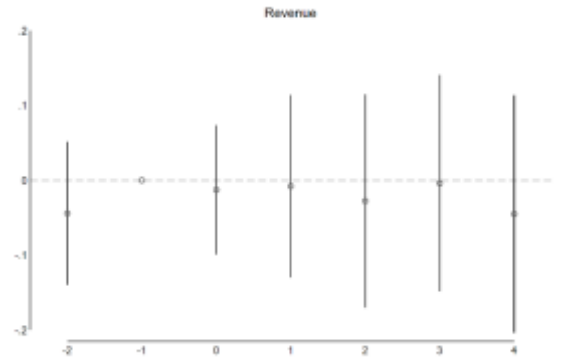
Notes:
Source:

iv) Revenue

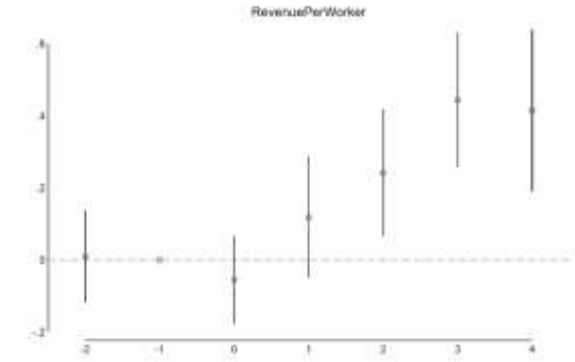
Figure B.4: Effect of the minimum wage hike on revenue



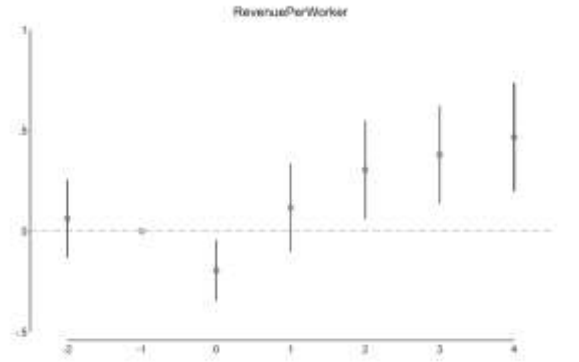
a) Balanced sample



b) Sample of surviving farms



c) Balanced sample

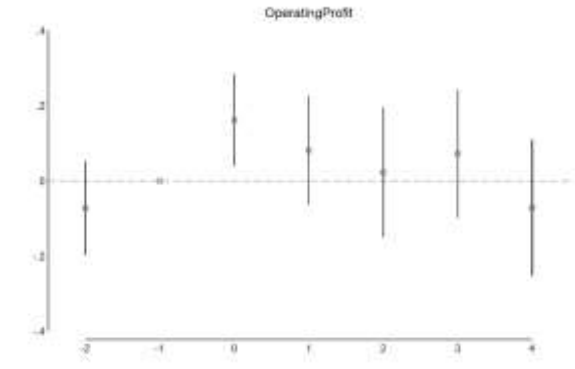


d) Sample of surviving farms

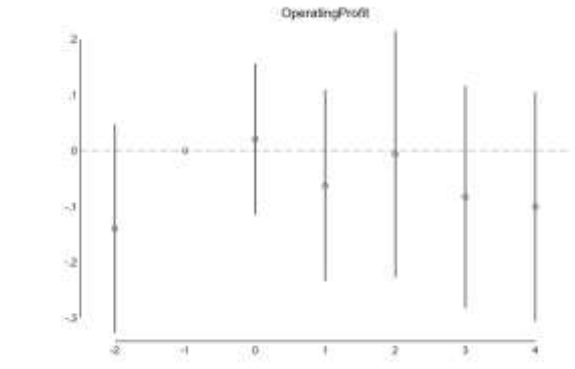
Notes:
Source:

v) Operating profit

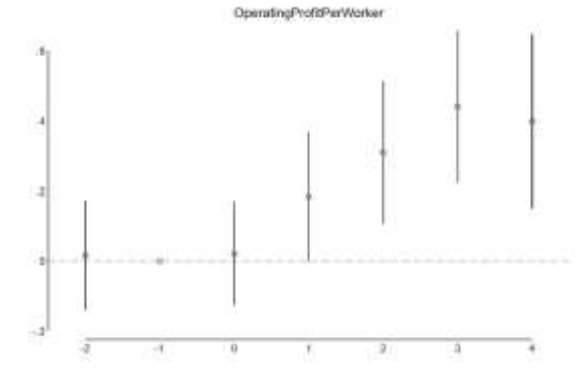
Figure B.5: Effect of the minimum wage hike on operating profit



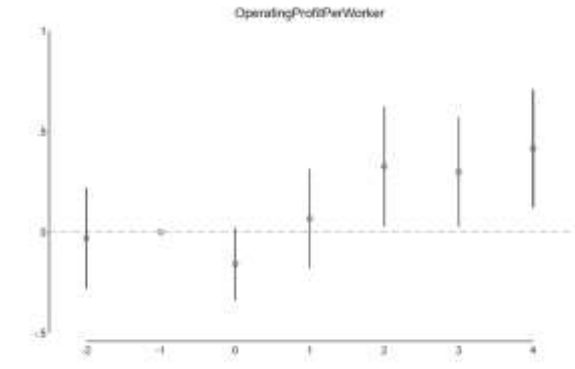
a) Balanced sample



b) Sample of surviving farms



c) Balanced sample



d) Sample of surviving farms

Notes:
Source:

Appendix B: Data