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Separating employment effects into job destruction and job creation

Evidence from a large minimum wage increase in the agricultural sector using administrative tax data

Marlies Piek, Dieter von Fintel, and Johann Kirsten

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Evidence from a large minimum wage increase in the agricultural sector using administrative tax data

Marlies Piek,[1,*] Dieter von Fintel,[1,2] and Johann Kirsten[3]

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Abstract: This paper presents new evidence on the employment effects of a large increase in agricultural minimum wages in South Africa using anonymized tax data. We add to the minimum wage literature by differentiating employment effects resulting from the destruction of existing jobs and from the slower creation of new jobs. Using data from tax years 2010/11 to 2016/17 and difference-in-difference models, our results show that employment decreased by approximately 14 percentage points following the minimum wage increase. Only 5 percentage points can be ascribed to job destruction, while the rest to slower job creation. Slower creation of new jobs is, therefore, the main channel through which minimum wages affect aggregate employment. Moreover, only 37 per cent of the intended increase was actually paid to workers, suggesting partial compliance with the legislation. Together, our results also provide an explanation of the paradoxical large disemployment and large non-compliance relationship; this is because employment was affected mainly by slower job *creation* and not job destruction.

Key words: minimum wages, employment effects, non-compliance, job destruction, job creation

JEL classification: C21, C23, J23, J38

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1 Introduction

Although the effects of minimum wages have been studied for the past few decades, the minimum wage–employment relationship remains highly debated, with empirical studies illustrating that minimum wages can decrease or increase employment levels. Despite this uncertainty, many governments continue to implement new wage floors or they are unifying sectoral minimum wages to protect low-wage workers in their economies. One aspect that is largely absent from the debate is the long-run impact of minimum wages on long-run employment creation. Empirical studies often focus on the effects that they have on short-run job losses, but fail to quantify the permanent changes in employer willingness to create new vacancies. New entrants to particular labour markets are therefore potentially disadvantaged by minimum wage laws.

This paper presents new evidence on the employment effects of a very large and sustained increase in agricultural minimum wages in South Africa using anonymized tax certificate data from the South African Revenue Service (SARS). We add to the broader minimum wage literature by differentiating employment effects resulting from the destruction of existing jobs and from the slower creation of new jobs. Our results indicate that slower creation of new jobs is the main channel through which minimum wages affect aggregate employment. Minimum wages, therefore, disproportionally affect 'would-be' new labour market entrants.

We use data from tax years 2010/11 to 2016/17[1] and use a difference-in-difference model to estimate the causal effect of the policy change on employment and earnings. Our results show that employment decreased by approximately 14 percentage points following the minimum wage increase. Only 5 percentage points can be ascribed to job destruction, while the rest is ascribed to slower job creation. While earnings increased in response to the higher legislated minimum wage, there was only partial compliance with the legislation. Only 37 per cent of the intended increase was actually paid to workers.

Furthermore, our results provide an explanation of how it is possible to have large disemployment while non-compliance is rife. In general, one would associate large disemployment with large compliance and small employment changes with partial compliance. But how does one reconcile large employment losses while there is little compliance? This is because the legislation mainly affected employment through slower job *creation* and not job destruction. While some of the individuals who held onto their jobs were better paid, non-compliance minimized job destruction or immediate firing after wages were hiked. However, the minimum wage hike raised barriers for new entrants, resulting in poorer long-run potential for job creation in the sector. On balance, existing workers had a fair probability of keeping their jobs, but were not guaranteed full wage increases; new entry into the sector slowed down.

Furthermore, we dissect the employment effects by age groups to better understand whether specific groups were particularly vulnerable to the policy change. Indeed, our results show that disemployment effects were 3.5 times larger for the youth (defined as being below 30 years of age) than for older counterparts. The disemployment effect is mainly driven by slower job *creation*. The policy change seems to have exacerbated an existing vulnerability: the youth are faced with even higher barriers to entry into the labour market.

[1] In the context of South Africa, a tax year runs from 1 March until the end of February.

The rest of the paper is structured as follows. Section 2 gives an overview of the minimum wage setting in South Africa. Section 3 discusses the relevant literature. Section 4 describes the dataset and methodological approach. Section 5 presents descriptive statistics on key variables. Section 6 presents the econometric results. Section 7 discusses the paper's findings and concludes.

2 Legislative environment

Prior to the implementation of a national minimum wage in 2019, minimum wages were implemented selectively in South Africa and not all workers were covered. Central government imposed sectoral determinations in selected low-paid sectors. However, collective bargaining agreements are still in place and are negotiated between large firms and unions within industries. These agreements, including wage floors, can be extended to uncovered firms by the Minister of Labour. This paper exploits a large and sustained real increase of 49 per cent in the agricultural minimum wage from ZAR69 to ZAR105 per day in March 2013, as set out by sectoral determinations.[2] This large increase was triggered by the farmworker strikes at the end of 2012 in a farming town, De Doorns, in the Western Cape province. Farmworkers protested against poor working conditions and low pay and demanded a daily wage of ZAR150.[3]

3 Empirical evidence of the minimum wage–employment relationship

The vast majority of the minimum wage literature focuses on net employment, without distinguishing between job destruction (which affects existing workers) and job creation (which affects new entrants). To our knowledge, only a few papers have isolated job creation in their estimate of the minimum wage–employment relationship. However, it plays an important part of estimating the true effect of minimum wages, and arguably has longer-run consequences for job growth in the sector. This is because employers can re-evaluate their input mixes over time; they may substitute to other types of workers or acquire more capital instead of creating jobs for low-skilled individuals. If firms change their production functions permanently, minimum wages are likely to have long-run consequences for the hiring of new low-skilled workers. Traditionally, minimum wage studies measure short-run impacts that do not take into account that there are long-run effects on job *growth*.

Sorkin (2015) shows that wage–employment elasticities are vastly different in the short- and long-run and that even small contemporaneous elasticities can compound to large elasticities in the long-run. Moreover, Meer and West (2016) show that minimum wages impact employment through changes in growth, rather than a drop in employment levels. In other words, legislation does not cause a discrete drop in employment through firing alone, but the new jobs that would have been added in its absence are progressively lost. Research by Harasztosi and Lindner (2019) found that firms substituted labour with capital in response to a large-scale minimum wage increase. Their firm-side analysis showed that altering the production function affected job *creation* over the long-run. While their short-run disemployment estimates were not large, their study illustrates the long-run consequences of minimum wages for production.

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[2] The value of ZAR105 per day is for a full day's work. This equates to ZAR2,274 per month in 2013 terms.

[3] See Ledger (2016) for an in-depth overview of the farmworker strikes that lead to the minimum wage increase.

In the South African case, the introduction of agricultural minimum wages led to severe job losses (Bhorat et al. 2014). The unpublished work of Garbers et al. (2015) is the only study to show that skilled farmworker employment and capital intensified after the introduction of agricultural minimum wages in 2003. Most recently, van der Zee (2017) and Ranchhod and Bassier (2017) analysed the effect of the 2013 large increase in legislated agricultural minimum wages. While van der Zee (2017) found negative employment effects, Ranchhod and Bassier (2017) were sceptical of employment changes in response to the minimum wage increase. However, neither study distinguishes between job destruction and job creation. Furthermore, the survey data used in these two papers are problematic. This is because 'it is … not actually possible to say with any certainty whether the measured changes in employment are real, or simply an artefact of the particular sample of households that were chosen' (Kerr and Wittenberg 2019). By using a new administrative dataset with information submitted to tax authorities by employers, we are able to assess the policy change with information from the universe of formally employed individuals in South Africa and which has the benefit of following short career histories of low-skilled workers longitudinally.

Our contribution to the minimum wage literature is that we separate employment effects between job destruction and job creation. This paper emphasizes that the true employment effect includes the slower rate of employment growth as employers re-evaluate their input mixes and have the option to acquire more capital or substitute towards workers not affected by the minimum wage in the medium to long term. Importantly, our study shows the asymmetric response of employers: workers who stayed in the sector did not receive the full intended benefits of the legislation, but held onto their jobs at a relatively high rate; by contrast, entry barriers have been raised for potential new recruits.

Bhorat et al. (2017) gave an overview of minimum wages in Sub-Saharan Africa and showed that minimum wage compliance and enforcement were weak. The authors argue that non-compliance with minimum wage legislation may have mitigated disemployment effects. While this is important in our understanding of the effects and mechanisms through which minimum wages operate in developing countries, how does one reconcile large non-compliance with large disemployment effects? Our findings may provide the missing piece to this paradox. Large disemployment effects alongside large non-compliance is possible if the disemployment effects stem from slower job *creation*. Explaining this paradox is another contribution to the minimum wage literature.

4 Data and methodological approach

The panel data contain information of formal sector workers in South Africa and allow us to track individuals longitudinally before and after the legislated agricultural minimum wage was increased by 49 per cent in real terms in 2013.[4] The information is obtained from annual employer submitted tax certificates to SARS for each employee and contains information such as the period worked, the amount of income received, and the source of income.[5] The data are superior to those collected in household surveys, since they are not contaminated by recall, and employees cannot misreport labour market-related income. The data are available annually, where the tax year runs from 1 March until end February of the following year—our policy change, therefore, falls in the 2013/14

[4] See Kerr (2018) and Pieterse et al. (2018) for a detailed description of the dataset.

[5] By law, firms need to issue IRP5 or IT3a certificates for employees who earn above ZAR2,000 per tax year. (IRP5 certificates are issued for employees for whom tax has been deducted, while IT3a certificates are issued for employees for whom no tax has been deducted.)

tax year. We are able to identify whether the employees worked for the whole tax year or only a fraction of it. We use this information to construct monthly earnings and restrict our sample to individuals who earn below ZAR5,400 per month.[6] However, we are unable to tell whether the employee worked full-time or part-time. From a demographic perspective, we derive age and gender information from workers' identity numbers in the data.

4.1 Methodological approach

To estimate the impact of the policy change on employment and earnings, a difference-in-difference model is used, as in Card and Krueger (1994) and Lee (1999).

$$Y_{it} = \alpha_0 + \alpha_1 Post_t + \alpha_2 Wage\ gap_i + \alpha_3 Post_t * Wage\ gap_i + X_{it} + \gamma_{it} \qquad (1)$$

where Y_{it} is the outcome variable (employment and earnings) for individual i in period t. $Post_t$ is a dummy variable distinguishing between periods before and after the wage hike. The *Wage gap* variable is the difference between the natural log of the monthly legislated minimum wage and the natural log of monthly earnings of an individual who was in the panel in the tax year prior to the minimum wage increase. This variable essentially measures the extent to which *individual* earnings of agricultural workers fall below the legislated minimum wage before the hike, and by how much they would have to rise for their employers to be compliant with the legislation. For those whose earnings were already above the legislated minimum wage, the wage gap was zero. We study the outcomes of workers who were in agriculture in the year before the shock (i.e. in the 2012/13 tax year); and in alternative specifications, we include individuals who were employed in agriculture in any given tax year.[7]

The interaction of these variables, the difference-in-difference term, measures the effect size for agricultural workers. Changes in variables of interest are measured for individuals with a positive wage gap—where the magnitude of their wage gap indicates the intensity of intended treatment—relative to individuals who have a zero wage gap—those individuals who were already earning above the legislated minima but below our sample restriction threshold of ZAR5,400 per month.

Using this methodology bypasses some of the difficulties of finding an appropriate control group. We run Equation (1) with different samples, to isolate specific employment effects. We start with a limited sample of individuals who were employed in agriculture in 2012/13 (hereafter referred to as Sample 1). Employment models measure whether this group stays or leaves these jobs. Effectively, these results focus only on the probability of exiting the sector (i.e. job destruction). By then including individuals who were employed in the agricultural sector at *any* point in time (hereafter referred to as Sample 2), our effects combine the probability of entry and exit (i.e. job creation and destruction). The difference between our effect sizes provides an indication of slower job creation on total employment. Following this approach allows us to assess the relative importance of job creation and destruction in driving down agricultural employment.

[6] Please see Appendix for more details.

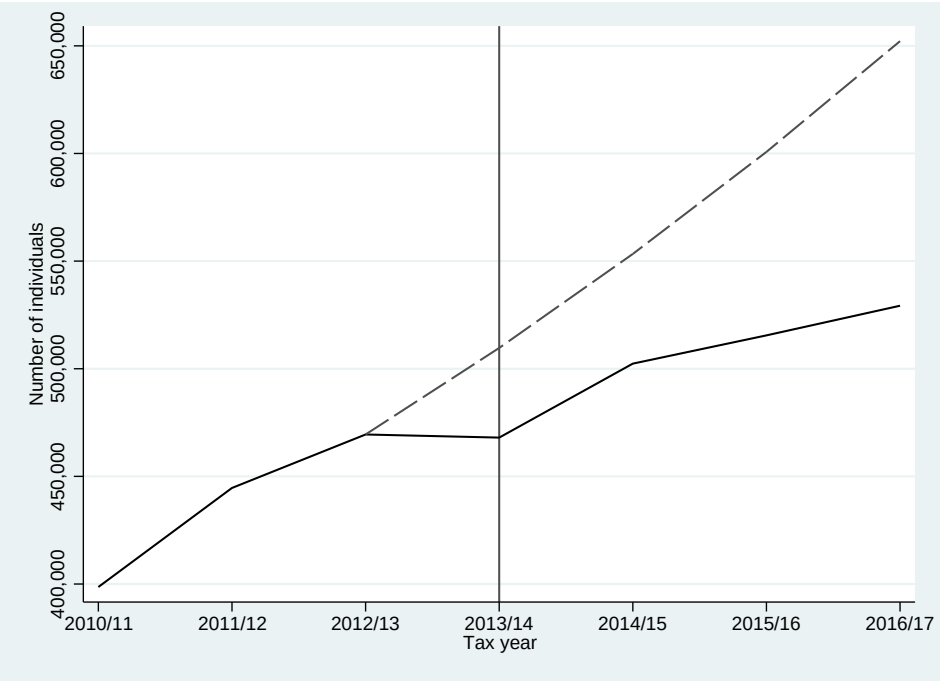
[7] To clarify, the period before the policy change is the 2012/13 tax year, while the policy change occurred in the 2013/14 tax year.

5 Descriptive statistics

This section shows descriptive statistics on key variables—employment and earnings—for Samples 1 and 2 which will be used in the econometric estimates in Section 6. In addition, we also show the descriptive statistics for a third sample: low-paid individuals who have never been employed in the agricultural sector (hereafter referred to as Sample 3). Doing this helps to identify whether changes are unique to the agricultural sector or economy-wide. All descriptive statistics are limited to low-income workers who earned a monthly income of ZAR5,400 or less (hereafter referred to as 'low income') at any point in time.

Figure 1 shows agricultural employment across time and is based on Sample 2. A few notable points emerge from the time series. Low-income employment was roughly 400,000 in the 2010/11 tax year and increased over time. By the 2016/17 tax year, agricultural employment grew to around 530,000. Agricultural employment dropped at the time of the minimum wage increase. Although levels recovered by the 2014/15 tax year, they did not reach employment numbers that would have materialized if the pre-intervention trend had continued, as depicted by the dashed line in Figure 1. More importantly, the employment growth rate declined from tax years 2014/15 to 2016/17, emphasizing that the minimum wage did not have a once-off discrete impact on employment, but reduced job creation capacity over the long-run. Average low-income agricultural employment growth was 8.5 per cent before the minimum wage increase, compared with 2.6 per cent after the minimum wage increase. If the initial growth rate had continued, employment would have reached around 650,000 jobs by 2016/17. Descriptively speaking, employment was, therefore, roughly 23 per cent lower than if the trend had continued. Our empirical models quantify the effects more carefully, taking into account other events that also affected employment (most prominently drought conditions).

Figure 1: Low-income agricultural employment, conditional on being employed in agriculture in any tax year

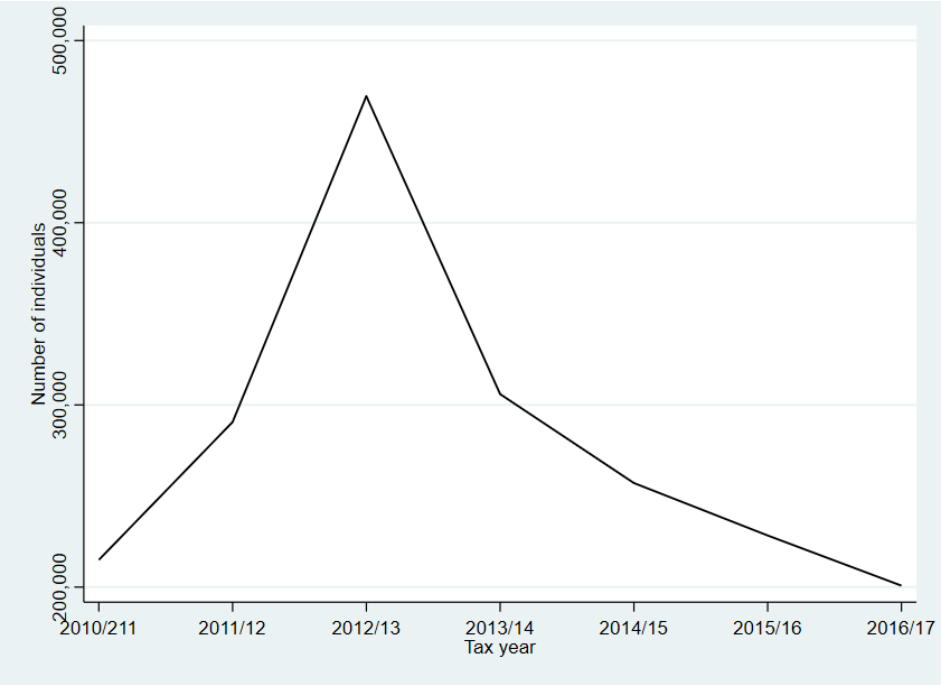


Notes: the solid plotted (ascending) line shows actual agricultural employment, while the dashed plotted line represents employment numbers that would have materialized if the pre-intervention trend had continued. The vertical line at the 2013/14 tax year represents the timing of the policy change. The sample is restricted to low-income individuals, defined as earning below ZAR5,400 per month.

Source: authors' illustration using the IRP5 data.

Figure 2 shows the number of workers employed in agriculture across tax years, conditional on being employed in the agricultural sector in 2012/13, the tax year before the intervention. This is based on Sample 1. Figures for the years leading up to 2012/13 represent the rate at which the stock of jobs in that year were created. In 2010/11, only about 200,000 workers already held the same agricultural job that they did in 2012/13. Moving on to 2012/13, job creation was rapid, growing to about 470,000 low-paid agricultural workers. These high rates of change emphasize the importance of job creation in determining the level of employment realized before the wage hike. By implication, slower job creation after the policy shock also diminished the sector's employment levels. Figures after 2012/13 represent destruction of pre-intervention jobs. While jobs were created at high rates, they were also destroyed rapidly. Despite the wage hike, the rate of job destruction after 2012/13 is slightly slower than the rate of job creation observed before 2012/13. It took approximately 3 years to destroy the jobs gained in 2 years. This evidence also suggests that rapid job destruction is a smaller constraint to employment compared to slower job creation.

Figure 2: Low-income agricultural employment, conditional on being employed in agriculture in 2012/13



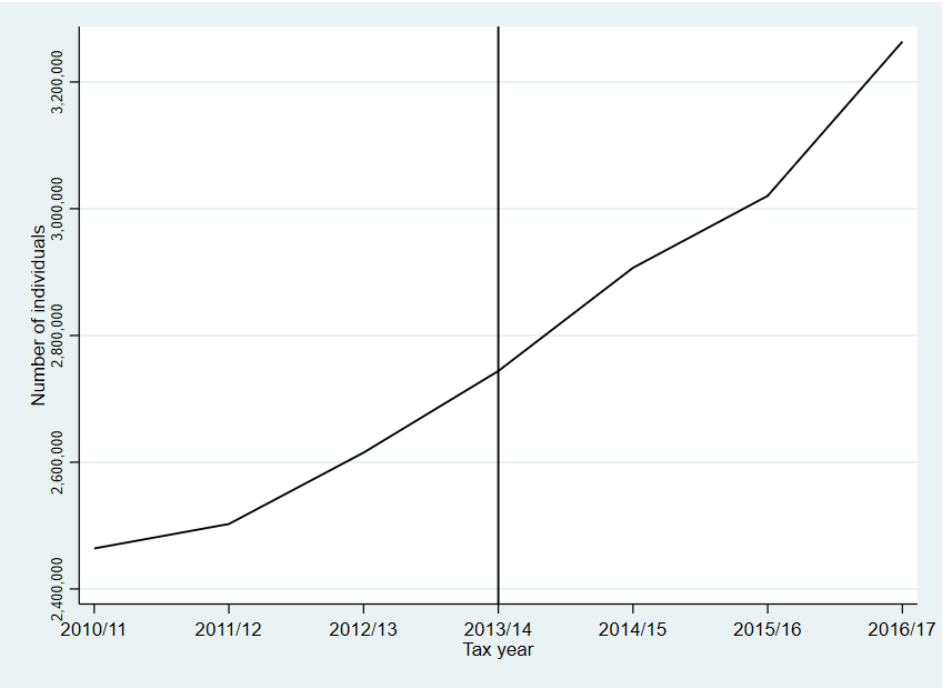
Note: the sample is restricted to low-income individuals, defined as earning below ZAR5,400 per month.

Source: authors' illustration using the IRP5 data.

These descriptive figures on agricultural employment have dissected employment changes into job destruction and job creation; where job creation was the main channel through which agricultural employment changed. This finding is in line with research by Sorkin (2015) and Meer and West (2016) who argue that employment growth, instead of contemporaneous changes in employment levels should be investigated following changes in minimum wage legislation.

Investigating the number of low-paid individuals who were never employed in agriculture (based on Sample 3) in Figure 3, we observe that their employment did not respond in the same way as agricultural employment in 2013/14 or in subsequent tax years. In fact, the rate of employment growth accelerated for this group, in contrast to the deceleration noted in agriculture. The changes in the agricultural sector were therefore sector-specific and not an economy-wide phenomenon.

Figure 3: Low-income non-agricultural employment



Notes: the solid plotted (ascending) line represents non-agricultural employment. The vertical line at the 2013/14 tax year represents the timing of the agricultural minimum wage increase. The sample is restricted to low-income individuals, defined as earning below ZAR5,400 per month.

Source: authors' illustration using the IRP5 data.

We also trace individuals' movements between states of employment (in both the agricultural and the non-agricultural sectors) and unemployment. Differences in transition rates are explored before and after the minimum wage increase, and also provide information on job destruction and creation. Table 1 shows that the proportion of individuals moving into agricultural employment from the state of unemployment decreased by 0.38 percentage points (or 12 per cent) after the minimum wage increase. Moreover, there was an increase in the transitions from agricultural workers into unemployment by 1.24 percentage points (or 4.5 per cent) after the minimum wage increase. Slower agricultural job creation dominated job destruction in determining the level of employment.

Table 1: Transition matrices before and after the minimum wage increase

		2012/13 tax year			
		Unemployed (%)	Employed in agriculture (%)	Employed not in agriculture (%)	Total (%)
2011/12 tax year	Unemployed	79.32	3.12	17.55	100
	Employed in agriculture	27.05	66.22	6.72	100
	Employed not in agriculture	29.19	0.96	69.85	100
		2013/14 tax year			
		Unemployed (%)	Employed in agriculture (%)	Employed not in agriculture (%)	Total (%)
2012/13 tax year	Unemployed	79.22	2.74	18.04	100
	Employed in agriculture	28.29	65.85	5.87	100
	Employed not in agriculture	27.24	1.15	71.60	100

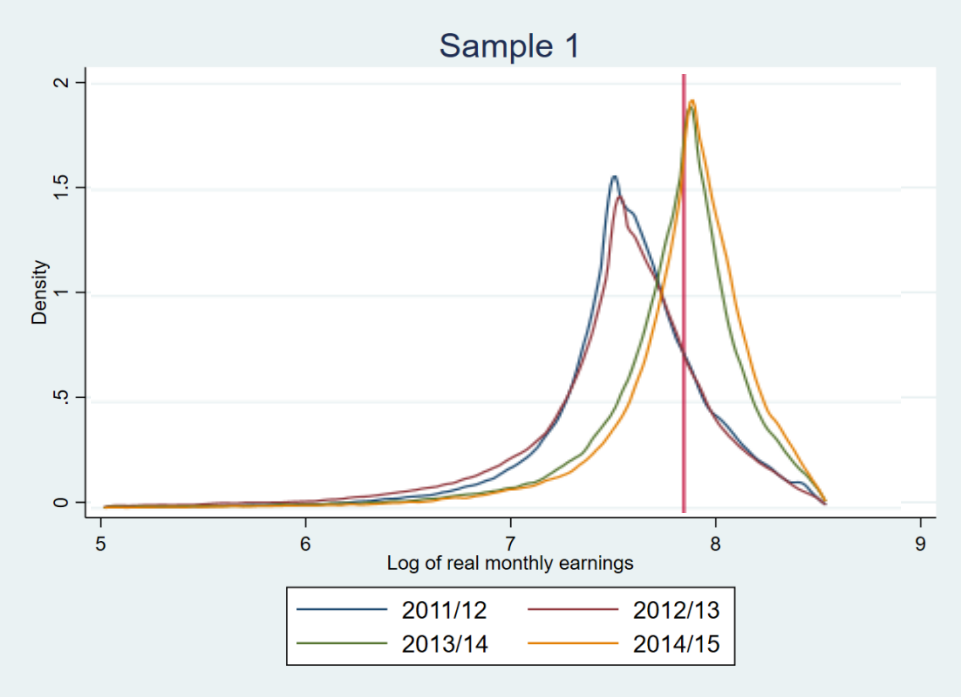
Source: authors' calculations based on the IRP5 data.

Figures 4a–4c show the distribution of real monthly earnings for Samples 1, 2, and 3, respectively, as defined above. In these graphs, the vertical line represents the value of the increased agricultural minimum wage and all values are in 2016/17 real terms. In Figures 4a and 4b, the wage distribution of all agricultural work shifts to the right in the 2013/14 and 2014/15 tax years, directly after the

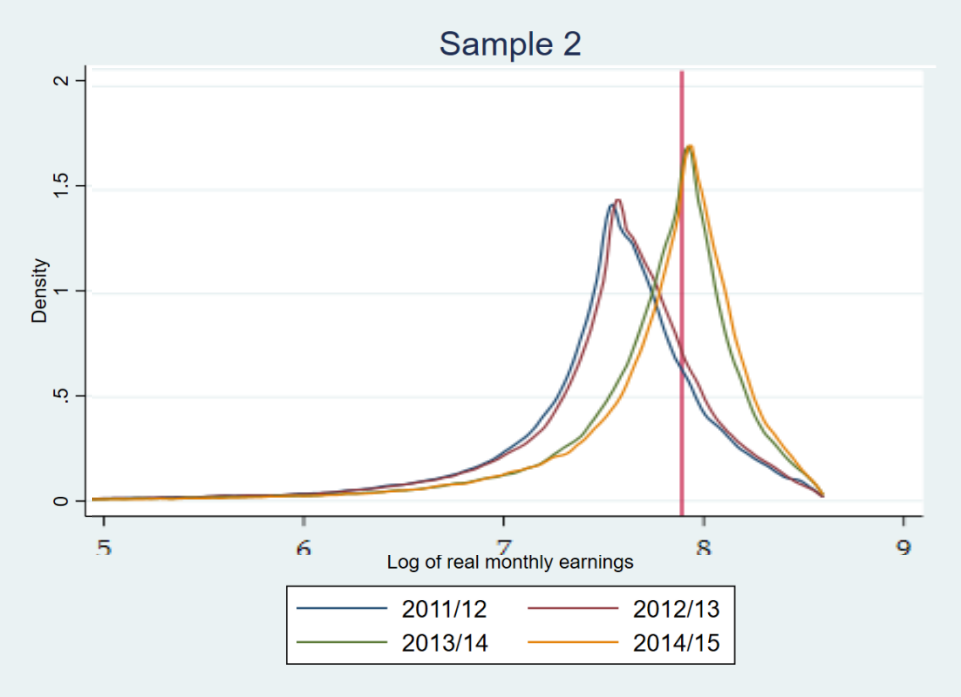
minimum wage increase. The effect is similar, regardless of whether or not the job existed in 2012/13. It is clear that workers' earnings increased as a result of the legislation. However, a significant proportion of workers still earned below the legislated minimum wage and concurs with other research in South Africa on non-compliance with minimum wages (Bhorat et al. 2012). This finding is significant, since it is confirmed with administrative tax records reported by employers. Usually there is concern that self-reported wages are understated by respondents in household surveys. Figure 4c shows the distribution of real monthly earnings for non-agricultural workers. The distributions did not change as they did for the agricultural sector; changes are therefore unique to the agricultural sector.

Figure 4: Distribution of log of real monthly earnings for (a) Sample 1, (b) Sample 2, and (b) Sample 3

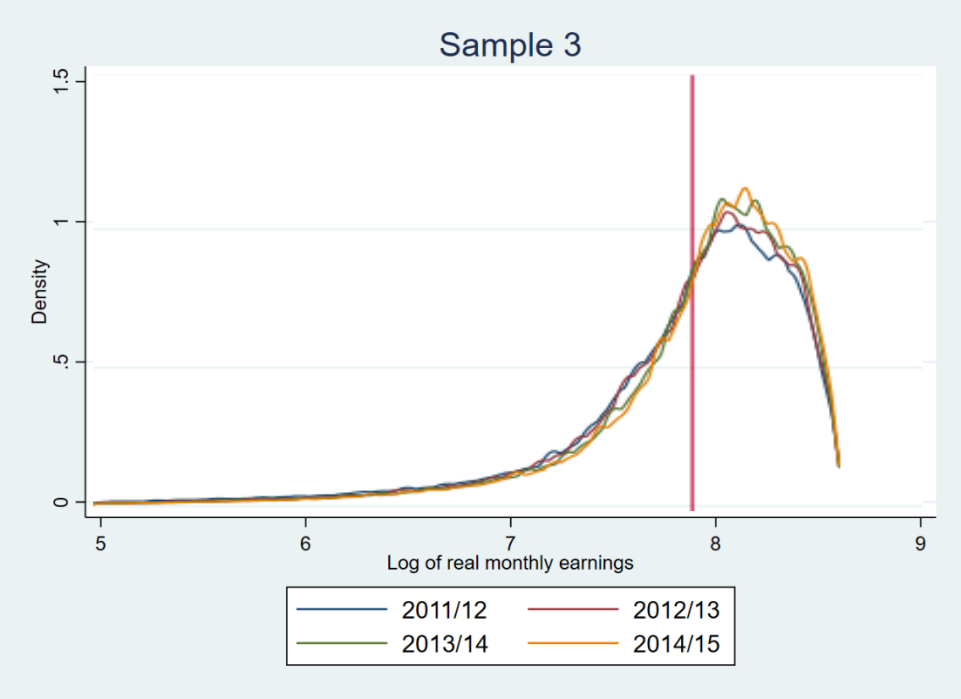
(a)



(b)



(c)



Notes: the vertical line represents the natural log of the new minimum wage. All values are in 2016/17 real terms. The samples are restricted to low-income individuals, defined as earning below ZAR5,400 per month.

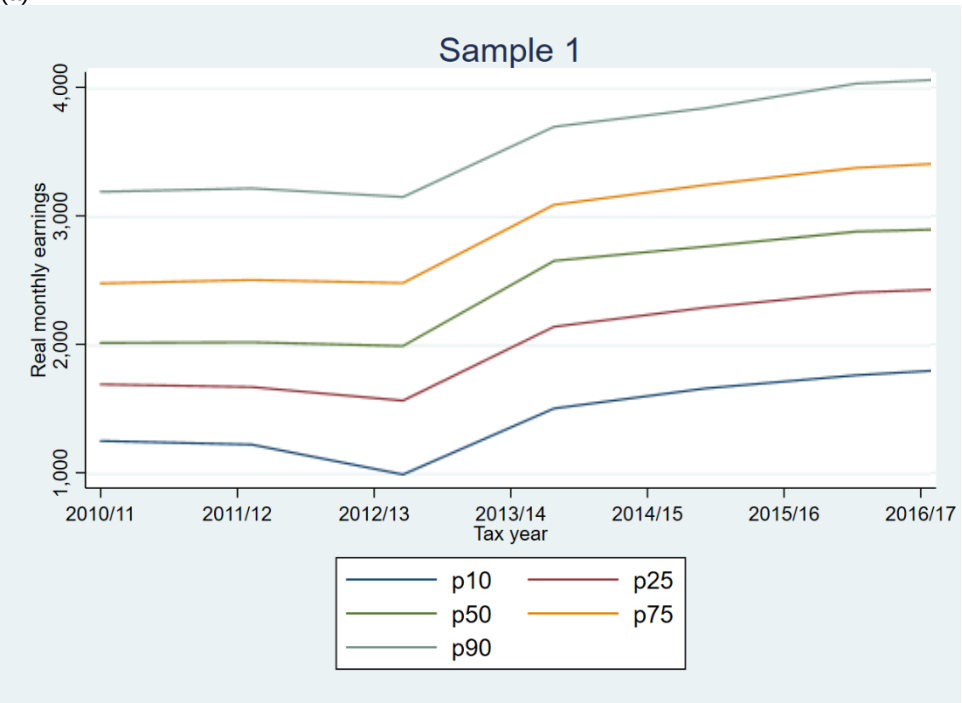
Source: authors' illustration using the IRP5 data.

We also plot various percentiles of earnings across time in Figures 5a–5c for Samples 1–3, respectively. In Figures 5a and 5b, we observe that earnings increased at all low-pay percentiles at the time of the minimum wage increase in the 2013/14 tax year. The increase is strongest for the 50th and 75th percentiles, which are also closest to the legislated minimum (in 2017 prices, ZAR2,685). Irrespective of whether the job existed in 2012/13 or not, approximately half of low-income agricultural workers earned below the new legislated minimum wage. Interestingly, earnings for the 10th and 25th percentiles in Figure 5a seem to have decreased in the tax year before the minimum wage increase. By 2016/17, the10th and 25th percentiles in Figure 5a were greater than those in Figure 5b. This suggests that those workers who remained employed since 2012/13 earned more than workers who entered agriculture at any point in time. As evident in Figure 5c, trends for non-agricultural workers are continuous over time, and do not reflect those of agriculture. The patterns in agriculture, therefore, clearly reflect the minimum wage increase, while those in the rest of the economy show a business-as-usual scenario.

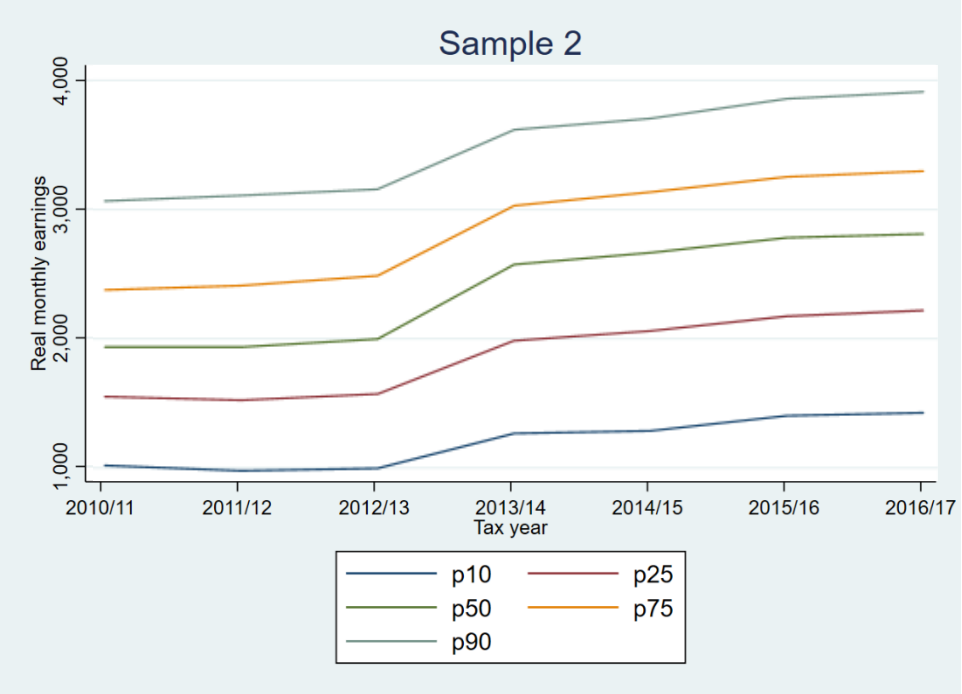
Before turning to the econometric analysis, we briefly report wage gaps. As explained in Section 4.1, the wage gap captures how far agricultural workers' earnings were below the minimum wage. For the sector as a whole, the wage gap was 0.42. When we dissect the wage gap by age category, we observe that younger individuals had larger wage gaps than their older counterparts. We categorize individuals into four age categories: (i) below 30 years, (ii) between 30 and 39 years, (iii) between 40 and 49 years, and (iv) between 50 and 65 years. The wage gaps were 0.43, 0.35, 0.31, and 0.28 for the respective age groups. In turn, this indicates that wages had to increase by the most for younger individuals compared with older workers if their employers were to comply with the legislation and that the legislated minimum wage was most binding for the youth.

Figure 5: Time trend of real monthly earnings for (a) Sample 1, (b) Sample 2, and (c) Sample 3

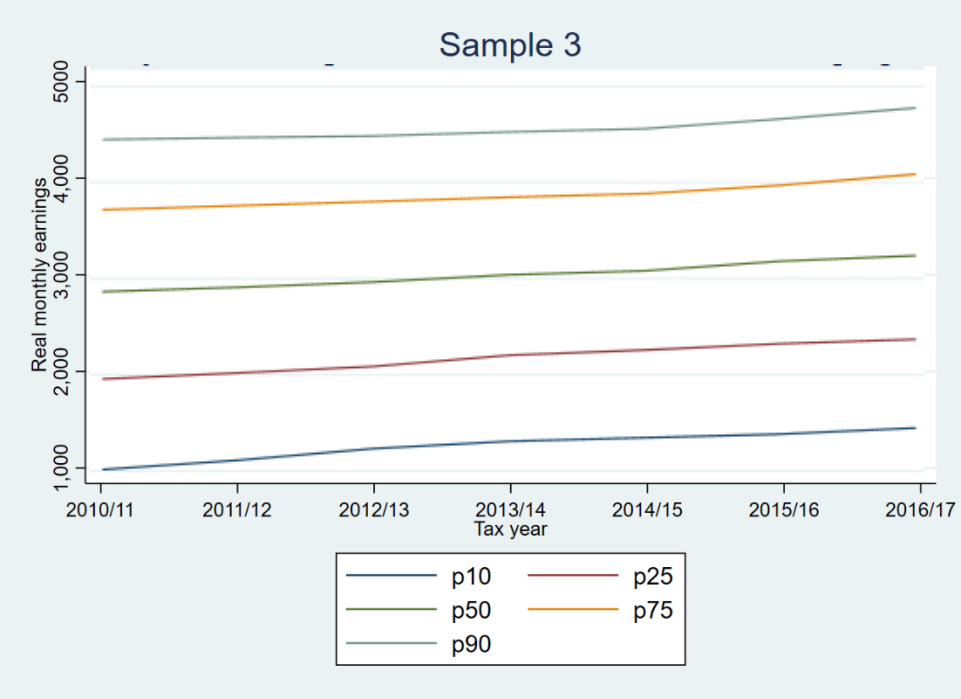
(a)



(b)



(c)



Notes: the samples are restricted to low-income individuals, defined as earning below ZAR5,400 per month. The plotted lines represent the 10th, 25th, 50th, 75th and 90th percentiles of real monthly earnings. All values are in 2016/17 real terms.

Source: authors' illustration using the IRP5 data.

This section has presented some descriptive statistics on agricultural employment and earnings. These suggest that the increase in agricultural minimum wages lowered employment, not only the level, but also the rate at which employment grew. Further, agricultural earnings increased at the time of the policy change, but a substantial proportion of workers were still earning below the legislated threshold, indicating only partial compliance.

6 Econometric results

This section presents econometric results, starting with employment effects. Table 2 shows regression results for the probability of employment in agriculture. Columns (I) and (II) include individuals who were employed in the agricultural sector in 2012/13 (Sample 1). Effectively, these results focus on the probability of exiting the sector (i.e. job destruction). Columns (III) and (IV) include individuals who were employed in the agricultural sector at any point in time in our period of analysis (Sample 2). These effects, therefore, combine the probability of entry and exit (i.e. job creation and destruction).

Table 2: Probability of employment in the agricultural sector

	Sample 1		Sample 2	
	(I)	(II)	(III)	(IV)
Post	–0.005***	–0.009***	0.186***	0.175***
	(0.001)	(0.001)	(0.001)	(0.001)
Wage gap	–0.062***	–0.100***	0.029***	0.056***
	(0.000)	(0.001)	(0.000)	(0.001)
Wage gap×*Post*	–0.051***	–0.045***	–0.134***	–0.144***
	(0.001)	(0.001)	(0.001)	(0.001)
Controls	No	Yes	No	Yes
Constant	0.950***	–4.924***	0.762***	5.800***
	(0.000)	(0.141)	(0.000)	(0.141)
R-squared	0.022	0.087	0.016	0.108
N	2,165,733	2,040,818	4,148,069	3,882,174

Notes: ***p<0.01, **p<0.05, *p<0.1. Standard errors are shown in parentheses. The dependent variable is whether the individual is employed in the agricultural sector or not. Controls include age, gender, seasonal worker indicator, firm size (in terms of number of workers), provincial climate shocks, log of real gross domestic product (GDP), and provincial fixed effects. The samples are restricted to low-income individuals, defined as earning below ZAR5,400 per month. A linear probability model has been used.

Source: authors' calculations based on the IRP5 data.

Turning directly to the difference-in-difference terms in the first two columns, the probability of being employed in agriculture decreased between 4.5 and 5.1 percentage points among the group that started out in the sector. Therefore, the minimum wage increase led to job destruction. The difference-in-difference coefficients in Columns (III) and (IV) indicate that the probability of employment in the agricultural sector decreased by approximately 14 percentage points when also including entrants to the sector in the estimation. These coefficients are significantly larger than in the previous columns. Therefore, the lower job creation contributed more towards declining employment than immediate job losses did. This corresponds to the descriptive evidence in Section 5, which showed that the rate of employment growth was substantially lower in the period after the minimum wage increase.

Given this finding, we may expect that specific groups may be particularly affected; one such group is the youth. We, therefore, dissect the employment loss by age in Table 3, with successive columns restricted to different age categories. Furthermore, regression results are shown without (Columns (I)–(IV)) and with controls (Columns (V)–(VIII)).

In Sample 1 in Table 3, younger workers experienced the largest reduction in employment probabilities in the agricultural sector—job destruction was more than five times higher among the youngest age category than among the oldest age category. A similar trend holds for Sample 2: the effects that include slower rates of job creation are also largest for younger individuals. Employment losses resulting from job destruction and slower job creation amounted to approximately 19 percentage points for the youth—about four to five times larger than for the oldest age category. Therefore, the minimum wage increase affected the youth the most, contributing to worsening prospects for an already vulnerable group.

Table 3: Probability of employment in the agricultural sector by age categories

	Without controls				With controls			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Age (years)	<30	30–39	40–49	50–65	<30	30–39	40–49	50–65
Sample 1: conditional on being employed in agriculture in 2012/13								
Post	–0.001	–0.006***	–0.003***	0.000	–0.015***	–0.016***	–0.009***	0.001
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)
Wage gap	–0.098***	–0.073***	–0.046***	–0.034***	–0.142***	–0.094***	–0.071***	–0.051***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Wage gap×*Post*	–0.064***	–0.038***	–0.022***	–0.007***	–0.050***	–0.037***	–0.020***	–0.008***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
Constant	0.938***	0.950***	0.959***	0.967***	–9.216***	–2.012***	–2.743***	–1.461***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.264)	(0.262)	(0.270)	(0.307)
R-squared	0.041	0.022	0.011	0.006	0.137	0.084	0.042	0.024
N	715,838	679,137	472,521	298,237	669,681	638,190	448,227	284,720
Sample 2: employed in agriculture in any tax year								
Post	0.194***	0.200***	0.177***	0.137***	0.176***	0.186***	0.168***	0.138***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Wage gap	0.044***	0.019***	0.023***	0.009***	0.062***	0.057***	0.048***	0.036***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Wage gap×*Post*	–0.194***	–0.125***	–0.085***	–0.040***	–0.183***	–0.136***	–0.096***	–0.052***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
Constant	0.731***	0.753***	0.797***	0.849***	4.119***	7.865***	5.880***	6.469***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.230)	(0.265)	(0.308)	(0.363)
R-squared	0.018	0.018	0.018	0.015	0.140	0.105	0.067	0.041
N	1,668,485	1,260,330	770,051	449,203	1,558,062	1,174,661	724,221	425,230

Notes: ***p<0.01, **p<0.05, *p<0.1. Standard errors are shown in parentheses. The dependent variable is whether the individual is employed in the agricultural sector or not. Controls include gender, seasonal worker indicator, firm size (in terms of number of workers), provincial climate shocks, log of real GDP, and provincial fixed effects. The samples are restricted to low-income individuals, defined as earning below ZAR5,400 per month. A linear probability model has been used.

Source: authors' calculations based on the IRP5 data.

6.1 Earnings

Table 4 measures changes in agricultural workers' earnings in response to the minimum wage hike. Unlike the employment regressions, the earnings regressions are only run for employed individuals in the agricultural sector as we would like to only measure changes in earnings coming from the agricultural sector. Furthermore, we only run the earnings regressions for those who were already employed in agriculture in 2012/13; this is done because of the nature of the constructed *Wage gap* variable. Between 36 and 38 per cent of pre-treatment wage gaps were eliminated in the post-treatment period, suggesting that earning did increase as a result of the minimum wage increase, but that there was only partial compliance. This concurs with work by Bhorat et al. (2012) who showed that non-compliance with minimum wages is high in South Africa.

Table 4: Log of real monthly earnings

	(I)	(II)
Post	−0.838***	−0.820***
	(0.001)	(0.001)
Wage gap	0.153***	0.061***
	(0.001)	(0.001)
Wage gap×*Post*	0.365***	0.378***
	(0.001)	(0.001)
Controls	No	Yes
Constant	7.861***	−10.693***
	(0.000)	(0.194)
R-squared	0.475	0.486
N	1,954,356	1,839,010

Notes: ***p<0.01, **p<0.05, *p<0.1. Standard errors are shown in parentheses. The dependent variable is the log of real monthly earnings. Controls include gender, seasonal worker indicator, firm size (in terms of number of workers), provincial climate shocks, log of real GDP, and provincial fixed effects. The sample is restricted to low-income individuals, defined as earning below ZAR5,400 per month. All values are in 2016/17 real terms. A linear probability model was used.

Source: authors' calculations based on the IRP5 data.

Table 5 splits the earnings results in Table 4 by age category and uncovers heterogeneous effects. Wage gaps were bridged the most for the youngest age category and this is decreasing for the subsequent age categories. Nearly half of the wage gap was eliminated within the youngest age category, while less than a third was compensated for the oldest workers. However, referring back to the wage gaps by age category in Section 5, we know that pre-intervention earnings differed by age category. Pre-intervention earnings for the youth were the lowest and highest for the oldest age category. Therefore, while wage gaps were bridged the most for the youth, the base from which they started off with was lower. Post-intervention earnings, may, therefore, still vary significantly by age category.

Table 5: Log of real monthly earnings by age categories

	Without controls				With controls			
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Age (years)	<30	30–39	40–49	50–65	<30	30–39	40–49	50–65
Wage gap	−0.799***	−0.843***	−0.871***	−0.901***	−0.787***	−0.822***	−0.850***	−0.880***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Post	0.133***	0.150***	0.159***	0.147***	0.054***	0.058***	0.066***	0.066***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Wage gap×*Post*	0.426***	0.385***	0.313***	0.261***	0.430***	0.393***	0.327***	0.282***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
Controls	No	No	No	No	Yes	Yes	Yes	Yes
Constant	7.816***	7.866***	7.895***	7.922***	−10.936***	−11.455***	−10.784***	−8.647***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.373)	(0.346)	(0.376)	(0.466)
R-squared	0.467	0.459	0.482	0.485	0.480	0.467	0.494	0.500
N	627,939	608,510	436,837	281,070	585,635	570,631	414,326	268,418

Notes: ***p<0.01, **p<0.05, *p<0.1. Standard errors are shown in parentheses. The dependent variable is the log of real monthly earnings. Controls include gender, seasonal worker indicator, firm size (in terms of number of workers), provincial climate shocks, log of real GDP, and provincial fixed effects. The sample is restricted to low-income individuals, defined as earning below ZAR5,400 per month. All values are in 2016/17 real terms. A linear probability model was used.

Source: authors' calculations based on the IRP5 data.

7 Discussion and conclusion

This paper investigated the employment and earnings effects of a very large and sustained increase in agricultural minimum wages in South Africa using anonymized tax certificate data from SARS. We add to the broader minimum wage literature by differentiating employment effects resulting from the destruction of existing jobs and from the slower creation of new jobs. Our findings also provide an explanation for the paradoxical relationship between large disemployment and large non-compliance.

Our econometric results showed that the probability of employment decreased by 14 percentage points after the minimum wage increase. This occurred mainly due to slower job creation instead of contemporaneous job destruction. This result highlights the importance of evaluating both job destruction and job creation after minimum wage changes. Job destruction is likely to have instant effects, while slower job creation resulting from a change in production methods can have longer lasting impacts. Studies that do not take into account the slower job growth are likely to underestimate the true *long-run* disemployment effects.

Our results also showed that between 36 and 38 per cent of pre-treatment wage gaps were eliminated in the post-treatment period, suggesting that earnings did increase as a result of the minimum wage increase, but that there was only partial compliance.

Together, our results provide an explanation for the paradoxical relationship between large disemployment despite large non-compliance; this is because the majority of the employment effects came from lower job creation. For those with existing jobs, their earnings did not increase by the full amount, and job destruction was relatively benign. For those hoping to obtain new jobs in the agricultural sector, their prospects in the industry declined substantially as fewer new jobs were created. Furthermore, our results showed that the minimum wage hike mainly affected the youth and exacerbated weak prospects for this vulnerable group.

The impact of the minimum wage increase is two-fold: (i) there are higher barriers for prospective entrants to the sector, leaving them unemployed; (ii) existing workers are able to hold onto their jobs, but did not experience the full benefit of minimum wage hike due to partial compliance. Together, the policy has had mixed results that have not necessarily been good for low-skilled individuals who are either in the market or hoping to enter it.

References

Bhorat, H., R. Kanbur, and N. Mayet (2012). 'Minimum Wage Violation in South Africa'. *International Labour Review*, 151(3): 1–46.

Bhorat, H., R. Kanbur, and B. Stanwix (2014). 'Estimating the Impact of Minimum Wages on Employment, Wages, and Non-Wage Benefits: The Case of Agriculture in South Africa'. *American Journal of Agricultural Economics*, 96(5): 1402–19.

Bhorat, H., R. Kanbur, and B. Stanwix (2017). 'Minimum Wages in Sub-Saharan Africa: A Primer'. *World Bank Research Observer*, 32(1): 21–74.

Card, D., and A.B. Krueger (1994). 'Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania'. *American Economic Review*, 84(4): 772–93.

Garbers, C., R. Burger, N. Rankin (2015). 'The Impact of the Agricultural Minimum Wage on Farmworker Employment in South Africa: A Fixed Effects Approach'. Unpublished paper,

Biennial Conference of the Economic Society of South Africa. Available at: http://2015.essa.org.za/fullpaper/essa_2895.pdf (accessed March 2020).

Harasztosi, P., and A. Lindner (2019). 'Who Pays for the Minimum Wage?'. *American Economic Review*, 109(8): 2693–727.

Kerr, A. (2018). 'Job Flows, Worker Flows and Churning in South Africa'. *South African Journal of Economics*, 86(S1): 141–66.

Kerr, A., and M. Wittenberg (2019). 'Earnings and Employment Microdata in South Africa'. SA-TIED Working Paper 63. Helsinki: UNU-WIDER. Available at: https://sa-tied.wider.unu.edu/article/earnings-and-employment-microdata-in-south-africa (accessed March 2020).

Ledger, T. (2016). *An Empty Plate*. Johannesburg: Jacana Media.

Lee, D. (1999). 'Wage Inequality in the United States During the 1980s: Rising Dispersion or Falling Minimum Wage?'. *Quarterly Journal of Economics*, 114(3): 977–1023.

Meer, J., and J. West (2016). 'Effects of the Minimum Wage on Employment Dynamics'. *Journal of Human Resources*, 51(2): 500–22.

Pieterse, D., E. Gavin, and C.F. Kreuser (2018). 'Introduction to the South African Revenue Service and National Treasury Firm-Level Panel'. *South African Journal of Economics*, 86(S1): 6–39.

Ranchhod, V., and I. Bassier (2017). 'Estimating the Wage and Employment Effects of a Large Increase in South Africa's Agricultural Minimum Wage'. REDI3x3 Working Paper 38. Cape Town: SALDRU, University of Cape Town. Available at: http://www.redi3x3.org/sites/default/files/Ranchhod%20%26%20Bassier%202017%20REDI3x3%20Working%20Paper%2038%20Agricultural%20minimum%20wages.pdf (accessed March 2020).

Sorkin, I. (2015). 'Are There Long-Run Effects of the Minimum Wage?'. *Review of Economic Dynamics*, 18(2): 306–33.

van der Zee, K. (2017). Assessing the Effects of Two Agricultural Minimum Wage Shocks in South Africa. Unpublished Master's Thesis. Cape Town: University of Cape Town.

Appendix

The paper uses the IRP5 dataset (version 0.6) for the 2010/11–2016/17 tax years, available at the National Treasury in South Africa. The panel is created from administrative tax data submitted by employers for their employees. The data were accessed between November 2019 and March 2020.

In the preparation of the data, a few judgement calls warrant a brief mention. Firstly, IRP5 certificates are issued to individuals and non-individual entities. Since we are interested in employment, we drop observations that are not for individuals. Moreover, the data are available on the job-contract level, meaning that an individual can have multiple IRP5 certificates in a tax year, either from the same employer or from multiple employers. We decided to work on the individual level, where we only keep the main job per individual per tax year.[*] This was done so that we can follow individuals between employed and unemployed states across time. Secondly, IRP5 certificates report on payments such as bonuses, travel allowances, salaries, and so forth which can be identified by a source code. Since we are mainly interested in labour market earnings, we drop observations that have missing or zero salaries.[†] By doing so, we are ensuring that we only include certificates that are related to labour income and not pension income, for example. In addition, we restrict our sample to the working-age population and to observations for which we have ID or passport numbers, as the latter would prevent us from tracking individuals across time.

The data include industry codes that we use to identify agricultural workers. Occupation codes would also be useful to identify farmworkers, but these are not recorded on tax certificates. Earnings cut-offs allow us to identify low-paid workers in agriculture, which should correspond most closely to those who would otherwise be classified as elementary 'farmworkers'. This cut-off is obtained by the Quarterly Labour Force Survey that contains occupation codes, industry codes, and earnings. In 2017, the 95th earnings percentile for farmworkers was ZAR4,500 per month (equivalent to ZAR54,000 per annum). However, since underreporting is common in household surveys, we add a 20 per cent premium to counter likely underreporting; this equates to ZAR5,400 per month or ZAR64,800 per annum. Therefore, we run our analysis for those with monthly earnings below ZAR5,400. We use the periods worked to create monthly earnings since IRP5 data are on an annual basis. See Appendix Table A1 for a description of the main variables that were used in our analysis.

Table A1: Variables used from the IRP5 data

Variable name	Variable description	Restrictions
taxyear	Time period identifier	We used data from 2010/11 to 2016/17
amt3601	Main source code for labour market earnings	We restricted our sample to low-income individuals earning below ZAR64,800 per annum
dateofbirth	Date of birth	We only kept those in the working-age population
idno	Personal identifier	We dropped observations for whom this was missing
taxrefno	Firm identifier	We dropped observations for whom this was missing

[*] We identified the main job by taking the job with the highest earnings.

[†] The source code for salaries is 3601.

mainincomesourcecode	The industry code is defined on the firm level, based on the main income source code and is available on the three-digit level	We use the mode of the industry across tax years
natureofperson	Specifies whether the certificate was issued for an individual, a trust, an association, etc.	We dropped all observations that were not issued for an individual
totalperiodsinyearofassessment	Indicates how many periods there are in the year of assessment	N/A
totalperiodsworked	Indicates how many periods the employee worked in the year of assessment	N/A

Source: authors' compilation.