From Many to One: Minimum Wage Effects in Thailand [1]

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ABSTRACT *This article examines the effects of changing the minimum wage policy structure in Thailand, from multilevel wages set geographically to a single statutory minimum. It exploits the recent hike in the minimum wage to evaluate the effects on employment and wage distribution. We find that employment is weakly affected, with reductions in youth unskilled employment and localised downward adjustments for SMEs. Furthermore, wage distribution seems to have improved. Using an application of the Recentered Influence Function applied to provincial wage distributions, we show that wages are affected up to the 60th percentile, suggesting that minimum wage levels serve as numeraire for wage renegotiation in a Middle Income country context. The hike in the minimum has benefited workers in the 15-45th percentiles, with no discernible effects in the lowest quantiles which appear to be driven by non-compliance among microenterprises.*

JEL Codes: C21, D31, J31

Keywords: Minimum wage, Wage structure, Recentered Influence Function

Introduction

There is widespread acceptance that the setting up of a minimum wage may be needed to solve distributional frictions or low compensation for specific fractions of the labour force. However, there is still debate on the adequate policy features to support labour dynamism. This article sheds light on the employment and distributional effects of changes in the minimum wage levels in Thailand in the last decade, with a particular focus on the most recent policy-change, moving from geographically defined minimum wages to a national

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statutory one. Specifically, the article uses Labour Force Survey data spanning the period from 2002 to 2013 to investigate the labour market effects of changes in the minimum wage over the time period. Furthermore, the short run effects of the latest policy change are evaluated using only the 2011-2013 subset of the data. The minimum wage was raised nationwide to 300 Baht per day – an average increase of around 60 percent in real terms which was unprecedented in the country. With its introduction, media reports portrayed public fear that such large and precipitous increase in the minimum wage could curtail jobs and that the harmonization might not translate into higher wages due to non-compliance. We aim to empirically test these suppositions and give an initial account of the responsiveness of the Thai labour market to the policy change.

Our contribution is three-fold: first, we develop an analysis of the employment effects of the minimum wage in Thailand by investigating the temporal dynamics of minimum wage introduction. Second, following the specification proposed by Lathapipat (2016) we apply an application of the Recentered Influence Function (RIF) regression framework (Firpo, et al. 2009) to provincial-level wage distributions instead of a "global" (national) one. Additionally, we employ multi-way clustering to account for the geographic clustering in the labour markets and for the nature of minimum wage setting in Thailand over time. Third, to the best of our knowledge this is the first article to perform an in-depth distributional evaluation of the latest policy change occurring in Thailand during 2012-2013. We differentiate our evaluation from recent articles (Del Carpio et al. 2014, Ariga 2015) by proposing for the first time a systematic investigation on the geographic component of labour markets which may reflect differences in the wage structure in Thailand.

We find that increases in the minimum wage have little impact on aggregate employment, with signs of contraction in employment for low-skilled youth, and some delayed downward adjustments in employment in small-medium enterprises (in both levels and differences) and increase in large enterprise employment six quarters after the policy change. The distributional analysis shows that the minimum wage has a positive effect on the provincial wage distribution. The effects are weak at the lowest percentiles (5^{th} and 10^{th}, especially for the latest policy shift), but it perpetrates until the 60^{th} percentile of the distribution, suggesting that the minimum wage in Thailand is used as a *numeraire* for renegotiation. In light of the insights of the short-run effects of the latest policy hike, we reconcile our findings for Thailand with a scenario of imperfect labour markets, where firms act with some degree of monopsony power. Once a higher minimum is introduced,

the effects on aggregate employment are minimally damaging because some firms are able to comply, while workers' redistribution across firms may apply and the policy instrument generates sizeable positive effects on the wage distribution (Butcher et al, 2012).

The article is organised as follows: the first section below gives a brief review of the literature, followed in Section 2 by an explanation on the minimum wage setting in Thailand. In Section 3, the data and some descriptive analysis of the Thai labour market are highlighted. Section 4 reports the empirical models and findings from the employment analysis, followed by the distributional analysis in Section 5. Lastly, some concluding remarks are given in Section 6.

1. Literature overview

The labour literature has paid close attention to the efficiency effects of the minimum wage, with neoclassical theories suggesting that in a competitive environment the employment level is predicted to decline due to increases in the cost of factors (e.g. Hamermesh, 1986), whereas in a monopsonistic environment the effect on employment may well be non-decreasing (for example Dickens et al., 1999) and the final outcome may depend on the level of compliance, which could reduce employment, pay or hours worked (Danziger, 2009; Danziger 2010). Additionally, in an environment where there is some unutilised technology (such as in the case of a developing nation), as long as some compliance is enforced upon some firms, the minimum wage could act as a "big push" for firms' industrialisation (Magruder, 2013). From a social planner perspective, the minimum wage policy may increase social welfare if the government values the distributional effects of the minimum wage policy and "efficient" unemployment (Lee and Saez, 2012).

On the empirical evaluations of the employment effects, the literature suggests mixed evidence for both developed and emerging economies. There is an ongoing debate over the correct econometric techniques to account for the geographic dimension of labour markets (see for example in the United States recent debate in Addison et al., 2015; Allegretto et al., 2013; Dube et al., 2010; Meer and West, 2016; Neumark et al., 2013, 2014). Our work aims to take into account the recent methodological contributions and test some of them. As for emerging economies, extensive literature for Latin America evaluates the distributional effects of the minimum wage and its interactions with informal labour markets (see for a review Cunningham, 2007). In the South East Asian context, mixed evidence emerge for employment in Indonesia, with small or no negative effects on employment after hikes in the minimum (Alatas and Cameron, 2008; Del Carpio et al.,

2012; Rama, 2001), but positive effect when controlling for spatial clustering of minimum wage in districts (Magruder, 2013). For Vietnam, in an evaluation of the Renovation Reform, the minimum wage policy is found to have no effect on employment, but it is found to reduce wage inequality (Sekalleriou and Fang, 2014).

2. The minimum wage system in Thailand

The minimum wage is defined in Thailand as "the payment sufficient for a "skill-needed worker" to make a living in the current social and economic condition and to have a living standard that is appropriate with the capability of businesses in that locality" (Labor Protection Act 2008). The minimum wage is set as daily rate and it applies for a working day of eight hours (seven hours for occupations involving potential danger for the employee's health and safety). Occupations covered are all those in formal sector industries, except for agricultural work, fishery, any government administration or state-owned enterprises, homeworkers and domestic workers. No restriction on age, gender or nationality is applied (Labour Protection Act 2008).

The history of minimum wage legislation started in 1973 for Bangkok and vicinities followed in 1974 by the whole kingdom, with minimum wage bands set by geographic region. The objective of geographic differentiation was to take into account differences in the cost of living and other socioeconomic conditions such as inflation reflected by the CPI and since 1990 economic growth (Del Carpio et al. 2014). In 1998 the enactment of The Labour Protection Act (No. 2) set the ground for a two-tiered system intended to differentiate minimum-wage levels by province and industry. A committee involving government representatives and two types of province representatives set the wage yearly for each province[2], with no further implementation of industrial differentiation. The objective of province-specific levels was to take into account provincial differences in the cost of living and other socioeconomic conditions (e.g. GPP and inflation)[3]. However, Del Carpio et al. (2014) argues that due to the complex decision-making system, the wage setting was reflecting more political bargaining than real labour market events. In a cross-country comparison, Saget (2008) describes the policy structure to follow a "maxi

[2] The wage was set yearly starting in 2001 with exceptions of year 2005, 2008 and 2010 in which it was adjusted twice, and year 2009 with no change.

[3] We perform a set of preliminary regressions of the determinants of minimum wage levels and find that there is some co-movement of provincial minimum wages with real Gross Provincial Product. Results available on request.

minimum wage set-up", where the minimum is set relatively high to act as an effective wage paid to most unskilled or semi-skilled workers, thus potentially substituting for collective bargaining and also increasing the potentials for non compliance. Leckcivilize (2013) finds that the rate of non-compliance was extremely high in the formal sector in the second half of the 2000s due to low levels of control.

In November 2011 the government announced a change in the regulation aimed at harmonizing wages to one national minimum wage rate. Since April 2012 a daily minimum wage of 300 Baht was applied in seven pilot provinces (Bangkok and vicinities plus Phuket province)[4], while an uptick of approximately 40 percent was applied to the minima in the other provinces. Reports from Bank of Thailand suggest that the immediate lay-off level was not bigger than other previous quarters and the pass-through of labour costs to retail prices was not higher than usual (BOT Annual Report, 2012). The policy lasted for 9 months and was followed by the introduction in January 2013 of a statutory minimum of 300 Baht per day for the whole kingdom. The latest two policies (namely the application of provincial minima and the national minimum wage) will be the focus of this investigation[5].

3. Data description

The main data used in this analysis are individual level cross-sections from the Labour Force Survey (LFS) for the years 2002-2013 provided by the National Statistics Office (NSO) of Thailand. We construct a quarterly panel (48 quarters) of employment information at province-level (76 groups) to evaluate the minimum wage effects on employment and hours worked. Since year 2001 the data are representative at the provincial level, but over this year a miscoding of one variable (firm size) has been detected in the first three quarters so, to ensure comparability and to remove any potential measurement error, we report our main results for the period 2002Q1-2013Q4, using 2001Q4 data for any lagged effect in the employment dynamic specification.[6] We present the main results with the exclusion of the latest three years of data for one province (Nong

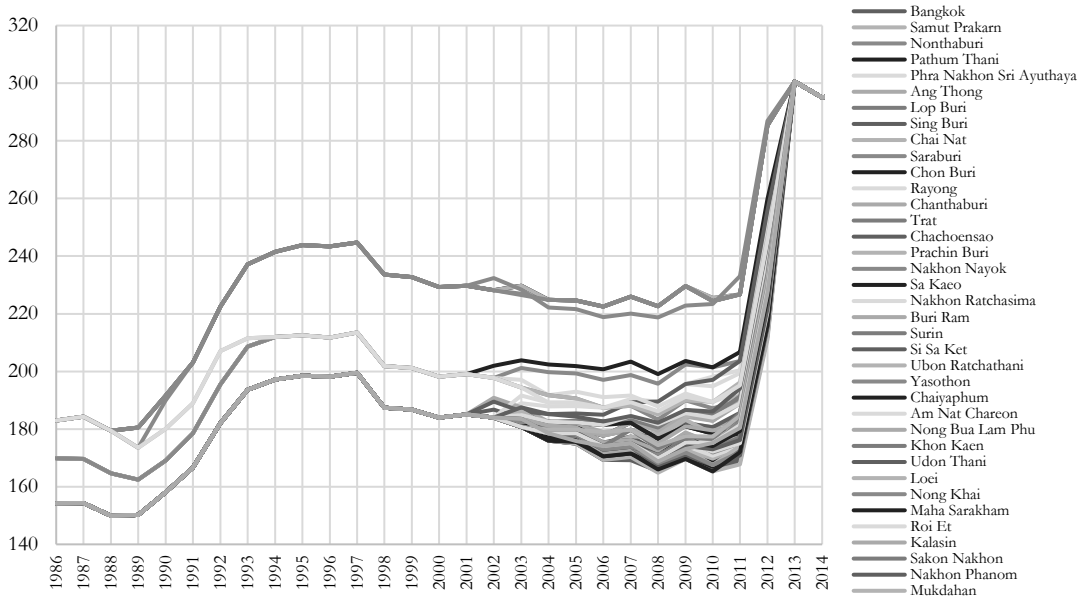
[4] See Appendix A for a summary table on the Thai minimum wage policy.

[5] See Appendix B for more details on the literature on minimum wage effects in Thailand.

[6] In an earlier shorter version of this article (Lathapipat and Poggi, 2016) we applied the analysis for the period 1998-2013 (Q1 and Q3 for 1998 and used all quarters from 1999 to 2013). However, due to change in re-sampling strategy, we prefer a conservative approach and use as main sample the data from Q4 2001 for the employment analysis and year 2002 for the distributional analysis. Nonetheless, we make robustness estimations including year 1998/1999 onwards.

Khai) as its jurisdiction was separated in two during year 2011. This choice prevents any double sampling of population and market information for this province in the employment analysis, without altering the results (specifications with full inclusion or exclusion of the province are available on request). The population under analysis is composed of individuals aged 15-65 (excluding students) with indications in the article about splits by education, gender, age group or firm characteristics.[7]

Figure 1: Real log daily minimum wage by province, 1986-2014.



Note: Authors' own calculations using daily minimum wage data 1986-2014 (annual average) from the Ministry of Labor. Mean provincial daily wages (represented by the solid lines) are expressed in constant 2013 Thai Baht.

For the distributional analysis of the minimum wage we use pooled individual-level data. The wage is expressed as hourly rate (using survey weights multiplied by hours worked over a week to construct wage distributions). We restrict the main sample of wage distributions to males aged 15-65 (excluding students) employed in the private sector, to make the evaluation of the policy as accurately describing the restriction of the law (i.e. public sector workers are not covered by the minimum wage legislation). The main

[7] A shortcoming of this dataset is that it is limited in differentiating between the formal and informal sector. We thus will extrapolate from workers' characteristics what are the main differences in proxies of informality which contribute in explaining employment and wage schedule of workers affected by the minimum wage, using the difference between wage-work and non-wage work in the employment analysis, or firm size in the wage distributional analysis.

specifications will report information excluding agricultural workers (around 17% of the private sector population), but we will include this category in the robustness checks.[8]

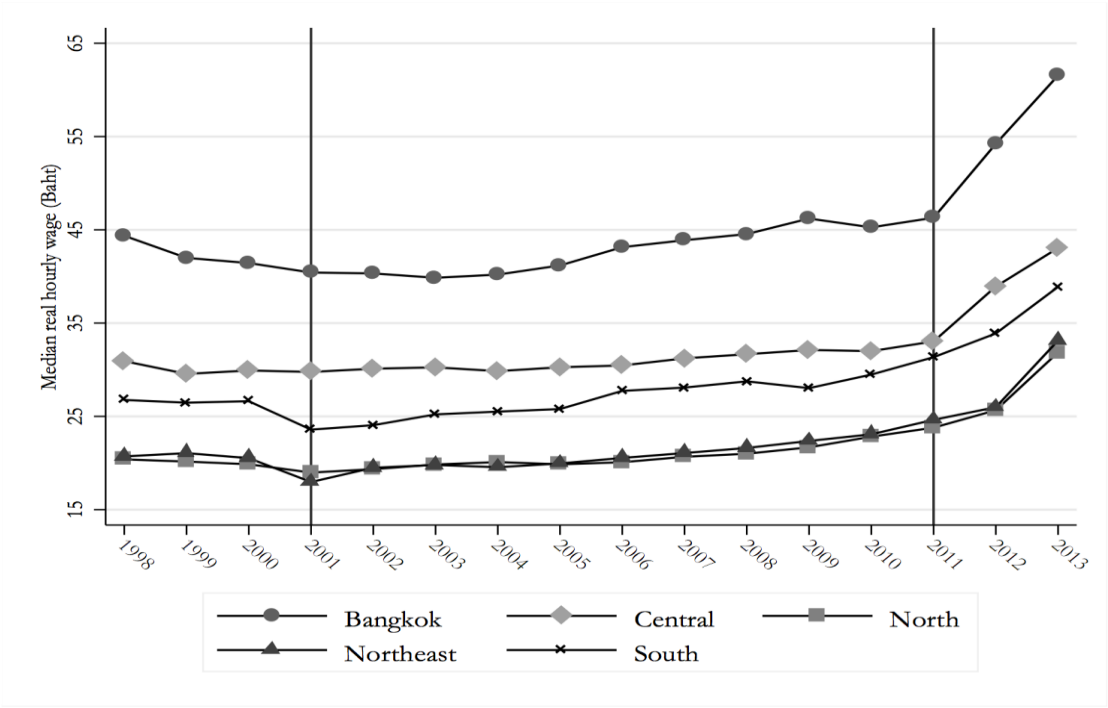
As additional data for our investigation we make use of quarterly minimum wage levels provided by the Ministry of Labour. For the years under analysis changes in the minimum wage occur generally once per year since 2001 (generally during Q1 or Q2), except for years 2005, 2008 and 2010 in which it was adjusted twice, and with no change in year 2009. The total number of revisions was 13 (2002-2013) with a minimum of 3 minima applied (excluding 2013 with one) and a maximum of 32. Thus, it appears that the number of revisions gives enough power to the policy instrument to be investigated (Figure 1). In order to account for production output at the provincial level, we use Gross Provincial Product (GPP) from the National Economic and Social Development Board (NESDB), measured as yearly total value added of sixteen sectors aggregated together and expressed in real terms. We use national Consumer Price Index (CPI) with base-year 2013 Q3 to express the variables in real terms. In order to assess any change in magnitude of the wage distributional analysis, we also apply yearly Spatial CPI as robustness (with regional and urban/rural CPI, base year 2011).

The minimum wage rates at the provincial level appear to have followed yearly adjustments resulting over the first decade of the 2000s (precisely 2001-2011) to be relatively flat (if not decreasing as have happened for some provinces), and never rising harmoniously as experienced before the Asian financial crisis. This flat wage floor for private sector occupations appears to have been reflected also in median wages. As shown in the figure below, the real median hourly wage have grown slowly but steadily over the decade of provincial minima and, after 2011, it has spiked up.

There could be strong linkages between the increase in wages and the hike in the minima which led to the statutory wage, but if this the case, what has happened to the employment rates? Which category of workers has benefited less than others? And if median wages appear to have risen, is this due to shifts in which part of the wage distribution? Are there any spillover effects to wages not directly affected by the policy? To answer these questions, we first report some statistics on wage inequality and the minimum wage bite, followed by statistical inference using regression analysis.

[8] Additionally, we perform robustness of the distributional analysis by either de-trending the wage variable or by using only one quarter of data (Q3, enumerated during the wet season) and the results are not altered (available upon request).

Figure 2: Median hourly wage by geographic region, 1998-2013.



Note: Authors' own calculations using LFS 1998-2013. The figure reports median real hourly wage by geographic region for private sector workers (all quarters except for 1998, using Q1 and Q3) deflated by national CPI (2013). The vertical lines refer to the period of provincial minima applied.

3.1. Wage inequality trends

We start with some background trends in wage inequality among private sector workers.[9] In Appendix A.1 (Figure 7) we report the Gini coefficient for hourly wage in the private sector, split by gender, showing that in more than a decade private sector wage inequality has fallen but at a very slow rate (declining from 0.46 in 2001 to 0.36 in 2013). Next we examine in Figure 8 the evolution of quantile ratios p10/p50 (ratio of 10th percentile to the median, describing the volume of the lower half of the distribution) and the p90/p50 (ratio of 90th percentile to the median, describing the volume of the upper half of the distribution). In terms of gender differentials, both male and female p10/50 show that at the start of recovery from the financial crisis, the bulk of the lower part of the distribution has only slightly increased, but the top gap p90/p50 has reduced, suggesting some degree of wage inequality reduction. Looking at wage differentials for three broadly defined production sectors (Industry, Agriculture, Services) it appears that most of the reduction in wage inequality has taken place in the Services sector (with sizeable reductions in the

[9] Private sector employees account for around 37 percent of total employment over the 1998-2013 period.

p90/p50 ratio)[10] and that in all three aggregate sectors the p10/p50 ratio has slightly increased after 2001.

3.2. The latest minimum wage bite and non-compliance

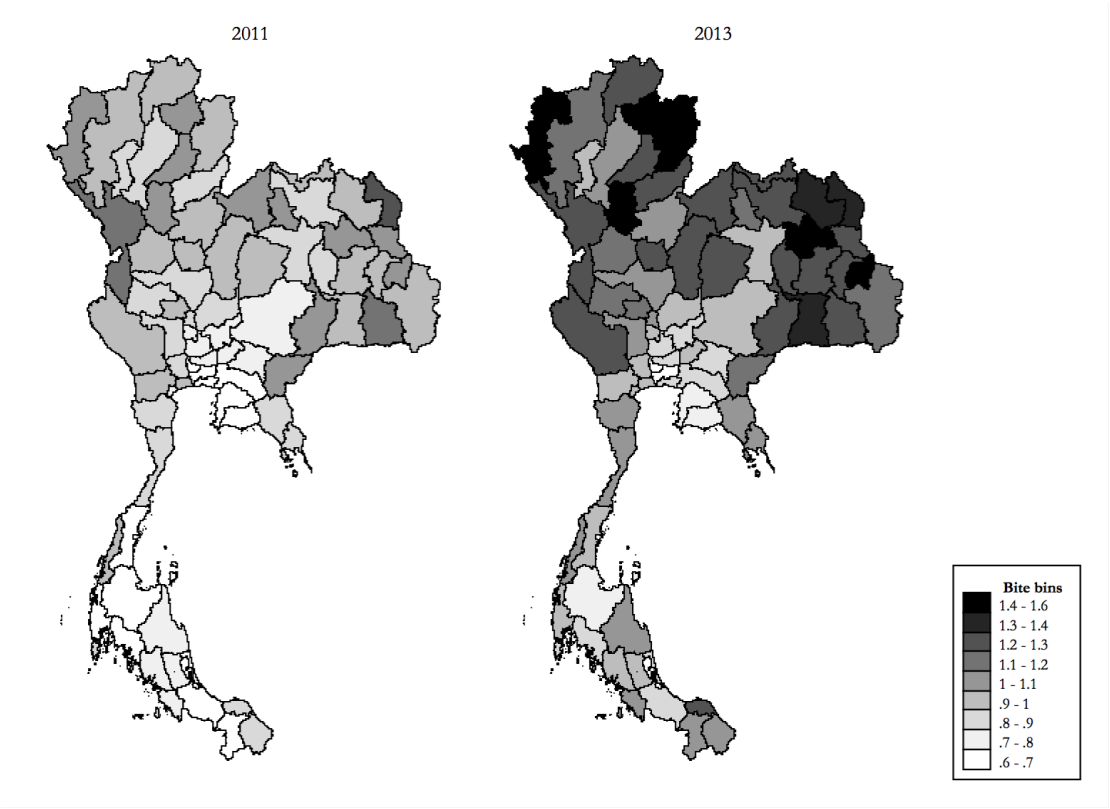
The minimum wage bite (represented by the Kaitz index) is defined as the ratio of nominal minimum wage to the median wage level (following Garnero et al. 2013). In Figure 3 we calculate the bite at provincial level for private sector wages and compare the resulting outcomes between the years 2011 and 2013. The mean provincial Kaitz Indices for 2011 and 2013 are 87% and 108% respectively. The degree of variation in the index suggests that in several provinces the statutory 300 Baht minimum was greater than the median private sector wage (in 48 provinces out of 76). Thus we can already expect that the proportion of wageworkers under the minimum wage might have increased, and the bite will be less effective the higher the share of workers not paid at the minimum wage. Table 7 (Appendix A.1) clearly shows that there has been an increase in the rate of non-compliance over the latest three years (approximately by 20 percentage points for low-skilled and young low-skilled workers).

Table 8 (Appendix A.1) investigates the composition of non-compliance by worker characteristics compared to workers at the minimum or above. Individuals paid below the minimum are low educated (80 percent on average), mostly residing in the Northeast, North or Central regions in provinces with relatively low GPP per capita. They are full time workers and more than 50 percent work in firms with less than 10 employees, suggestive of a higher degree of informality for this type of firm. They mostly work in manufacturing, construction or wholesale and retail (with the latter two sectors seeing their shares increasing between 2011 and 2013). Their average wage has increased during the period (although less than the other groups) and, their average hours worked per week is the highest compared to individuals paid at or above the minimum (though significantly reducing during the policy shift). The statistics above are suggestive of a change happening already only 6 quarters after the policy shift and, acknowledging the need for further data

[10] This statistics has to be interpreted in line with the evolution of employment composition across sectors in Thailand (reported in Figure 9) which has seen workers moving out of agriculture and entering in the service sector. Over the period, employment composition by firm size has also varied, with reductions in participation to micro-enterprises after 2009 and revived participation to large firms since 2011.

points to asses the full effect (forthcoming), below we report initial estimates of the policy effect.

Figure 3: Maps of the minimum wage bite at province level, 2011 and 2013.



Note: The maps above report the minimum wage bite per province in year 2011 and 2013. The bite is defined as the ratio of nominal minimum wage over nominal median wage for private sector workers. Median calculated using survey weights multiplied by hours worked. In 2013 a total of 48 provinces has a bite greater than one (9 in Central region, 16 North, 17 Northeast, 6 South). In 2011 these were 14.

4. The impact of the minimum wage on employment

4.1. Model specification for the employment analysis

We start with an evaluation of the quarterly panel Fixed Effects Model at provincial level of various employment outcomes on log minimum wage and covariates. The basic employment specification uses provincial-level panel data (of 76 provinces with quarter-year data – 12 quarters from 2011 to 2013 for the short run effect or 48 quarters from 2002 to 2013 for a medium run effect), identifying the effect of the policy instrument on an outcome variable Y_{pt} in province p and time t:

$$Y_{pt} = \beta_0 + \beta_1 MW_{pt} + \beta_2 X_{pt} + \phi_p + \phi_t + \varphi_{p*t} + \varepsilon_{pt}$$

As outcome variable Y_{pt}, we report the employment-to-population ratio (conducting robustness with log employment) or log weekly hours worked and, we investigate the differing effects by level of education and age, showing evidence of changes in employment by production type or firm size.[11] As minimum wage policy variable we report a direct measure of log real hourly minimum wage level $MW_{pt} = \ln(rmin_{pt})$.[12] As provincial-level controls X_{pt} we include a set of labour demand shifters representing population characteristics (share of youth and elderly out of the total 15-65 population to account for the ageing population over this decade, share of rural population and share of population with greater than secondary education), in addition to a variable controlling for market performance (yearly log per capita Gross Provincial Product).[13] In order to control for unobserved provincial and time heterogeneity we include in the reduced form equation province (ϕ_p) and time (ϕ_t) fixed effects, reporting robust standard errors clustered at the province level.

The results for the working-age population (15-65), the secondary or less-educated population (low-skilled from hereon), and its young population subgroup (15-24) are reported in Table 1. We focus particularly on the low-skilled as this type of workers is the most likely to be directly affected by variation in the minimum wage. Our estimates suggest that there are minor aggregate employment effects in the full time period under analysis (2002-2013), driven by reduction in employment in the agricultural sector (not covered by the minimum wage law). For private employment-to-population ratio, overall there seems to be no direct impact for the working-age population or for the low-skilled in general. However, a negative and statistically significant effect on private sector employment of the

[11] Firm size is agglomerated in three groups: micro enterprises are defined as those with less than 10 employees, small-medium size firms employ between 10 and 99 people, while large firms employ 100 or more people. Age groups are divided in young (15-24), prime-age (25-54) and senior (55-65). A low-skilled worker is defined having less than secondary education. Unless specified we report employment for any worker in the private sector (excluding non-covered agriculture) and for any gender.

[12] As robustness we will also report a measure of the minimum wage bite (median Kaitz Index) $MW_{pt} = ln\left(\frac{rmin_{pt}}{rmed\ w_{pt}}\right)$. The Kaitz Index should help trying to isolate a relative price for labour which may not be fully reflected in the minimum wage alone. However, we are aware that the Kaitz Index implicitly assumes that the minimum wage increase should not affect the median (mean) wages (Lemos, 2005), but we will show below this to be true for Thailand after the 60th provincial wage percentile.

[13] As robustness log employment is used as dependent variable, adding log population as control and either the unemployment rate or the log median wage, ensuring that the estimates are not affected by the exclusion of these controls.

young low-skilled group suggests some contraction in employment for this group of individuals, with no specific contractions either by sector of production or firm type (

Table 2). Additionally, the elasticity of weekly hours worked to a change in the minimum wage seems to be significant negative for the aggregate worker, but in regards to private sector employment the elasticity is not different from zero at conventional levels.

Table 1: Panel regression of employment-to-population ratio on log minimum wage.

2002-2013						
	Any	Non wage	Private	Agri.	Indus.	Service
Working age	-0.019***	-0.012	-0.017	-0.025*	0.006	0.0004
	(0.007)	(0.014)	(0.013)	(0.013)	(0.008)	(0.008)
Low skilled	-0.022***	-0.012	-0.021	-0.022	-0.002	0.003
	(0.008)	(0.015)	(0.014)	(0.014)	(0.008)	(0.009)
Low skilled (15-24)	-0.047***	-0.003	-0.061**	-0.019	-0.031	0.003
	(0.016)	(0.024)	(0.027)	(0.021)	(0.024)	(0.021)
2011-13						
	Any	Non wage	Private	Agri.	Indus.	Service
Working age	0.017***	0.001	0.003	0.015	0.001	0.001
	(0.006)	(0.013)	(0.012)	(0.011)	(0.008)	(0.008)
Low skilled	0.015**	0.007	-0.000	0.019	-0.007	0.003
	(0.006)	(0.014)	(0.013)	(0.012)	(0.009)	(0.009)
Low skilled (15-24)	0.015	0.007	-0.009	0.011	0.002	0.003
	(0.017)	(0.029)	(0.028)	(0.024)	(0.023)	(0.021)

Note: LFS 2002-2013 (3,636 obs.) or 2011-2013 (900 obs.) at province-quarter level. Fixed effects coefficient for log hourly minimum wage and cluster robust standard error are reported. Employment-to-population is calculated for either the for working-age, low-skilled or youth low-skilled population. Dependent variable: Employment-to-population of aggregate employment (Any), Non-wage work occupations (i.e. self-employment or unpaid work), Wage-work in the private sector, private sector participation into the non-covered sector (Agriculture) or covered sectors (Industry and Services). Controls: share of youth, share of elderly, share of female, share of rural and share of high-skilled out of the total population, log per capita GPP, province and time fixed effects (significance: * p<.10, ** p<.05, *** p<.01).

Table 2: Panel regression of private sector employment-to-population ratios and log weekly hours on log minimum wage.

2002-2013					
	Micro	SM	Large	Log Hrs	Log Hrs (Priv.)
Working age	-0.015*	-0.007	0.005	-0.044**	-0.014
	(0.009)	(0.008)	(0.007)	(0.017)	(0.022)
Low skilled	-0.014	-0.008	0.001	-0.044**	-0.017
	(0.010)	(0.008)	(0.007)	(0.018)	(0.023)
Low skilled (15-24)	-0.007	-0.023	-0.030	-0.057**	-0.002
	(0.019)	(0.016)	(0.019)	(0.026)	(0.032)
2011-13					
	Micro	SM	Large	Log Hrs	Log Hrs (Priv.)
Working age	0.009	-0.001	-0.006	0.033**	0.046**
	(0.009)	(0.007)	(0.006)	(0.016)	(0.021)
Low skilled	0.011	-0.003	-0.009*	0.042**	0.049**
	(0.010)	(0.007)	(0.006)	(0.017)	(0.023)

Low skilled (15-24)	0.015	-0.011	-0.014	0.049	0.070*
	(0.019)	(0.016)	(0.015)	(0.030)	(0.036)

Note: LFS 2002-2013 or 2011-2013 at province-quarter level. Log hourly minimum wage (and cluster robust standard error) are reported. Dependent variable: Employment-to-population or log weekly hours for working-age, low-skilled or youth low-skilled population, with splits by private sector occupations in Micro enterprises, Small-medium firms, Large firms. Controls: share of youth, share of elderly, share of female and share of high-skilled out of the total population, log per capita GPP, province and time fixed effects (significance: * p<.10, ** p<.05, *** p<.01).

Over the short-run analysis (2011-2013), although of weaker statistical power, the analysis suggests no direct effects of the policy switch on private-sector employment (lower part of Table 1), with a weakly significant effect on low-skilled employment in large firms (

Table 2). If anything, some positive effects are detected in hours worked for the working-age population and for the low-skilled group.

To investigate further the mechanism of employment responsiveness, we split the province sample by their trends in minimum wage regimes over the period 2002-13. Table 9 (Appendix A.2.1) shows that only in provinces which experienced a low minimum wage regime (fifty six of them) there are signs of contractions during this period, with no statistically significant effects observed for the remaining twenty provinces under a high real average minimum regime.

4.2. Dynamic employment response

After assessing the minimum wage effects using a levels equation, we apply a distributed leads and lags model (following a specification similar to Allegretto et al., 2011) to account for any influence from the past – reflecting any adjustment period – and to detect any anticipation effect associated with the leading minimum wage terms:

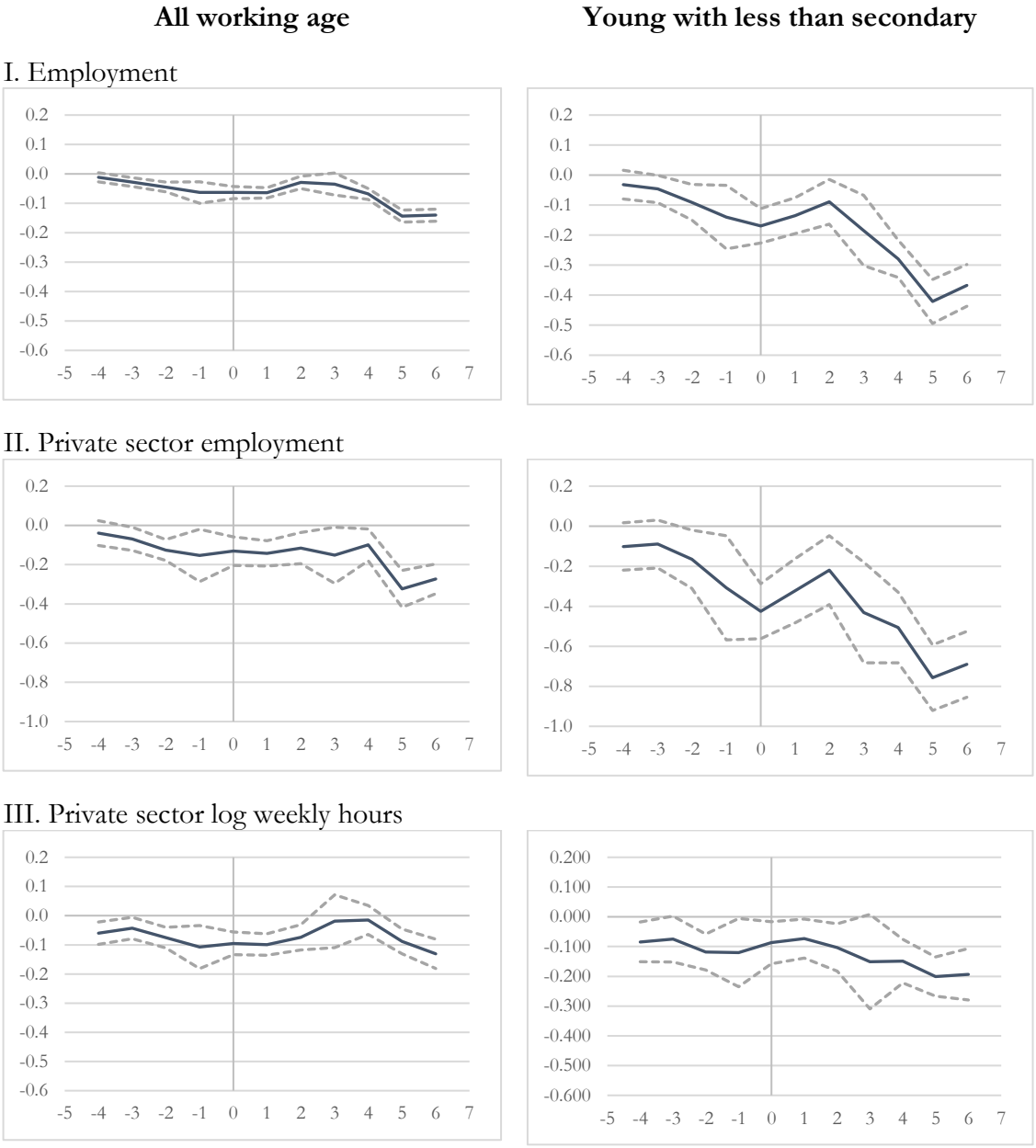
$$y_{pt} = \sum_{k=-4}^{6} \beta_k MW_{pt+k} + \gamma X_{pt} + \phi_p + \phi_t + \varepsilon_{pt}$$

The specification covers a ten quarter window to assess whether any anticipation or delayed effects take place. The window length in the leads (one year) is chosen to capture the latest policy change and any potential anticipation. The length of the lags reflects the maximum gap in between minimum wage changes. Similar to Allegretto et al. (2011), we estimate the cumulative response of the outcome variable from a log point increase in the

minimum wage by successively summing the coefficients β_{-4} to β_6 to show the time path of adjustment.

reports the cumulative response to the minimum wage of employment and weekly working hours elasticities. The left-hand column presents the results for all working age population, while the right-hand column shows the results for the young (15-24) low-skilled population subgroup.

Figure 4: Cumulative response to changes in the minimum wage of employment and log weekly hours elasticities



Notes: Dynamic provincial panel model with distributed leads and lags in log real minimum wage. The specification covers a 10-quarter window (reported on y-axis, four quarters before the change in the minimum wage reported with negative sign and lags till six quarters after the change reported with positive sign). The solid line graphs represent the cumulative response of selected outcomes to a minimum wage increase. For

employment, coefficients are divided by average employment-to-population ratio, so to represent employment elasticities. Each regression equation includes controls at province level for average years of schooling, female composition, average potential work experience, population shares of youth (less than 25 years of age), senior (more than 55 years of age), share of rural population and share of high skilled labour force (completed post-secondary education), log real GPP per capita, year and quarter dummies, and provincial fixed effects. The dotted lines represent the 95% confidence intervals, computed using robust standard errors clustered at the provincial level. Quarterly Labour Force Survey data from NSO.

Panel I () shows that the employment elasticity time path throughout much of the time horizon are slightly negative for the working age population, while the response for the young low-skilled group is substantially greater. However, six quarters after the minimum wage increase, the magnitudes of the negative employment elasticities for both population groups are more than doubled their contemporaneous responses, registering elasticities of -0.140 and -0.367 respectively.

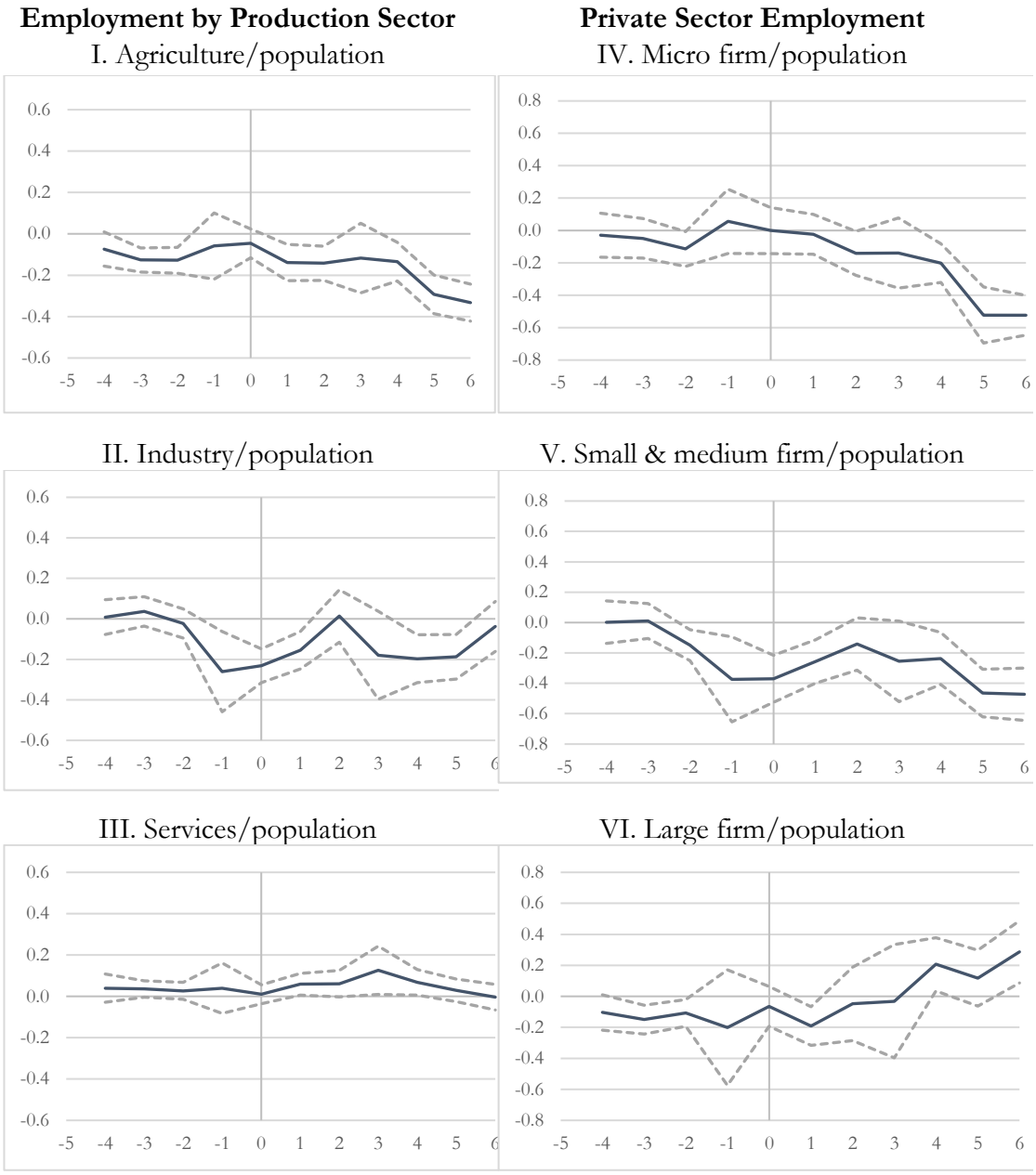
Panel II again shows that private sector employment elasticities are much more negative for the low-skilled youth group. For the whole working age population, there is evidence of some anticipation (by a magnitude of -0.069 three quarters prior to the minimum wage change) with further downward adjustments by the sixth quarter (-0.273). The private sector employment elasticity time path for the low-skilled youth group also shows signs of anticipation, but the contraction at the time of introduction of the minimum is much larger (-0.425), and with even greater adjustments at the sixth quarter after the policy change (-0.688). These evidences clearly suggest that an increase in the minimum wage produces much stronger delayed adjustments for the low-skilled youth population.

The time paths for private sector weekly working hours' elasticities are presented in Panel III. They show a small negative, but significant reduction in weekly working hours for both population groups of interest four quarters prior to policy introduction. The effects persists at the time of introduction, with contemporaneous elasticity estimates of -0.095 and -0.087 for the working age and for the low-skilled youth population subgroup respectively. The cumulative effects continue six quarters after the increase in the minimum wage, where the elasticities are respectively -0.131 and -0.193 for the two population groups of interest. The findings suggest that some substitution away from low-skilled youth workers is taking place.

As additional evidence, we compare this low-skilled youth subpopulation to the high-skilled group (more than secondary education), finding that the employment elasticity time paths of high-skilled workers react positively to the increase in the minimum wage, and the estimated time paths are almost mirror images of those of the low-skilled youth

group, suggesting an adjustment in employment composition in response to the minimum wage hike (Figure 11 in Appendix A2).

Figure 5: Cumulative response to changes in the minimum wage of employment elasticities by sector and firm size (private sector), working-age population.



Notes: The solid line in each graph represents the time path of minimum wage effects on selected outcomes for the working-age population. The coefficients are divided by average employment-to-population ratio, so to represent employment elasticities. The dotted lines represent the 95% confidence intervals, computed using robust standard errors clustered at the provincial level. For further details see the notes in the figure above.

The cumulative response of employment for the working-age population in three broadly-defined production sectors (Agriculture, Industry, Services) is reported in the left-

hand column of Figure 5. There seems to be no sign of anticipation with the exception of Agriculture employment, where an elasticity of -0.068 is estimated three quarters before the minimum wage increase. At policy introduction, some negative adjustments occur for the Industry sector (-0.232), which persist after one quarter. Conversely, Services shows positive though not statistically significant trend in its cumulative response. Over the entire time path, Agriculture seems to be the only sector responsive six quarters after the policy change, with an elasticity of -0.332. Private sector elasticities by firm size (right-hand column of Figure 5) reveal that at the time of the minimum wage increase, the employment response of small and medium enterprises (SME) is negative and significant (-0.370). Adjustments to employment in the different private sector firms appear to take differing trends, with micro and SME firms contracting employment six quarters after introduction by -0.523 and -0.472 respectively, whereas large firm elasticity increases by 0.287. These graphs therefore provide evidence that the Thai labour market has been flexible in absorbing the policy changes through no systematic contraction in the covered sectors (Industry and Services), and partial employment adjustments between large and smaller sized firms.

Noting that the inclusion of lags and leads in a static framework may induce correlation in the error terms, as robustness we investigate any time-related effect of the policy on employment changes rather than on levels, using two methods similar to Addison et al. (2015) and Meer and West (2016). First, we report a differenced specification to assess if the minimum wage acts on employment-to-population growth rather than on its stock:

$$\Delta_k y_{pt} = \beta_1 \Delta_k MW_{pt} + \gamma \Delta_k X_{pt} + \phi_t + \Delta_k \varepsilon_{pt}$$

where Δ_k represents the difference over k periods of employment outcome y_{pt} and we report the differenced equation with one- up to eight-quarter differences (two years). Second, we also implement a distributed lag specification (as in Meer and West, 2016) to assess if there are any dynamic effects in employment growth adjustments:

$$\Delta y_{pt} = \sum_{k=0}^{8} \Delta\, MW_{pt-k} + \gamma \Delta X_{pt} + \phi_t + \Delta \varepsilon_{pt}$$

In this differenced equation Δ represents a change of one quarter and the policy variable is included with up to eight lags, thus requiring up to two years for lagged effects to influence the change in employment-to-population.

The results from Table 10 in Appendix A2.2 confirm the effects found in the levels equation, where some decrease in growth of youth low-skilled employment-to-population is observed, and this seems to be driven by reductions in small and medium enterprises between one and two years (differencing 4 to 8 quarters).

Then, we proceed to extrapolate if any dynamic effects are permanent in the growth analysis. Using a distributed lag approach and aggregating linearly the lag-differences measures for minimum wage (Table 11), we show that changes in the minimum wage have delayed negative effects on growth of employment-to-population in SMEs, showing delayed impact on changes in employment between two and six quarters after the increase in minimum wage. However, as also noted by Meer and West (2016), the high variation in treatment intensity, combined with the choice of lags are of major concern when one wants to assess the causal inference of higher-order lags in a distributed lag model, so until stressed with more robustness, we caution interpreting these as solid results. [14]

Overall, the employment analysis suggests no direct negative response of the Thai labour markets to a minimum wage rise, with the exception of youth low-skilled employment which is found in both levels and changes specifications to be subject to dynamic negative adjustments in small and medium enterprises.

5. The impact on the earnings distribution

5.1. Modelling the heterogeneous response of provincial distributions

We evaluate the impact of the minimum wage policy on the wage distribution by presenting the structure of the Recentered Influence Function (RIF) Regression method proposed by Firpo, Fortin, and Lemieux (2009, FFL henceforth) and the extension by Lathapipat (2016) used in this article. FFL (2009) develop a method to estimate the Unconditional Quantile Partial Effects (UQPE) of the explanatory variables of interest on

[14] For the time period under analysis, the latest policy change has a great weight on this growth specification and (forthcoming) we will assess with other estimators (e.g. Generalized Method of Moments) against potential bias generated by the arbitrary choice of lags inclusion (which we construct to follow a half-year trend). In addition to this, given that our data are quarterly, we will test if there is any strong dependence in the error structure due to seasonality or spatial dependence (forthcoming). Thus, for now the growth results have to be interpreted with caution.

the quantiles of an outcome variable (in our instance, the log wage distribution). The method proposes a solution to the lack of linearity condition in Conditional Quantile Regression analysis (CQR) widely used in the wage literature, which does not average up to the unconditional population counterparts. As our aim is to extract a population effect, this method seems highly appropriate to evaluate the distributional changes for private sector workers directly affected by the minimum wage law. The RIF (FFL, 2009) for the τ^{th} quantile, q_τ, is given by:

$$RIF(Y; q_\tau, F_Y) = q_\tau + \frac{\tau}{f_Y(q_\tau)} - \frac{\boldsymbol{I}(Y \leq q_\tau)}{f_Y(q_\tau)}$$

Where $f_Y(q_\tau)$ is the kernel density estimator of outcome Y in quantile q_τ and $\boldsymbol{I}(Y \leq q_\tau)$ is an identity measure. FFL (2009) shows that an important property of the RIF is that it integrates to the quantile q_τ of interest. That is,

$$\int_{\mathbb{R}} RIF(y; q_\tau, F_Y) dF_Y(y) = q_\tau$$

where $F_Y(y)$ is the marginal (or unconditional) distribution function of outcome variable Y. Applying the Law of Iterated Expectation to the previous expression yields:

$$E[RIF(y; q_\tau, F_Y)|X)] = m^{q_\tau}(X) = q_\tau$$

where the conditional effect in the covariate space of X averages up to the unconditional population mean, and $m^{q_\tau}(X)$ is the RIF regression model (FFL, 2009). The model is easily estimated using conventional parametric regression methods[15] such as Ordinary Least Squares, where the RIF regression can be defined as:

$$E[RIF(y; q_\tau, F_Y)|X)] = X'\gamma$$

where the OLS regression provides an estimate for γ which represents the effect of the covariates X on the unconditional τ^{th} quantile of the outcome Y (log wage distribution). When we evaluate the log hourly wage probability densities at national level compared to the ones per province, heterogeneous distribution of wage densities appear across provinces and over time[16]. This is of no surprise in an economy where markets are highly

[15] Firpo, Fortin and Lemieux (2009) also report the application of the estimator to other parametric methods such as probit, logit or non-parametric estimators.

[16] See Appendix A.1 (

Figure 10) for a representation of the provincial wage density distributions of private sector wages at national level compared to selected provinces over time.

segmented (both geographically and across sectors). The difference in densities suggests that applying a single RIF transformation to the distribution may hide variations within local labour markets in terms of wage structure and variation. In addition to this, the fact that the minimum has always been agreed to reflect the different labour market structures, makes an evaluation of the geographic wage distribution compelling. So the effect of a minimum wage change on a single national distribution may be partially confounded[17]. To account for the nature of multiple localized treatments that the policy induces over time, we focus (as in Lathapipat, 2016) to the treatment dimension at provincial level.

We aim to capture the unconditional provincial wage distribution effect accounting for geography in the construction of the wage distributions[18]. So, to exploit the nature of the wage distributions we observe over time, we ask the following question: What is the effect of a 1% rise in the provincial minimum wage on the τ^{th} quantile of provincial earnings, *ceteris paribus*? Thus, we aim to account for two aspects of Thai labour markets: to identify local labour market dynamics and to exploit the heterogeneity in magnitude of the policy over time.

Specifically, Lathapipat (2016) develops a RIF function in which for each province p and time t it specifies the RIF transformation of individual wage i:

$$RIF\left(Y_{i,p,t}; q_{\tau,p,t}, F_{Y,p,t}\right) = q_{\tau,p,t} + \frac{\tau}{f_{Y,p,t}(q_{\tau,p,t})} - \frac{\boldsymbol{I}(Y_i \leq q_{\tau,p,t})}{f_{Y,p,t}(q_{\tau,p,t})}$$

As the traditional RIF (FFl 2009) we perform this transformation locally and then regress it (with OLS) to the explanatory variables of interest. Since $q_{\tau,p,t}$, $f_{Y,p,t}(q_{\tau,p,t})$, and $\boldsymbol{I}(Y_i \leq q_{\tau,p,t})$ all vary across province and time, we include in our RIF-OLS a vector of regressors controlling for province and time fixed effects, together with individual and provincial time-varying covariates:

$$RIF_{w_{i\,p\,t},q_{\tau pt}} = \beta_0 + \beta_1\, ln\left(MW_{p\,t}\right) + \beta_2\, X_{i\,p\,t} + \psi_p + \psi_t + \phi_{p*t} + \mu_{i\,p\,t}$$

[17] This characteristics of the data suggests for caution in the use of a single national distribution. The reason behind it is that there may be a set of pre-trends in wage construction which could skew the representativeness of part of the sample in the wage distribution. This goes in line with those studies which suggests that for a full distribution, the estimation of any quantile of interest and of its density function can be problematic if treated and control have very dissimilar distributions prior treatment (see for example Dube (2013)'s application of the RIF for a full distribution of the income-to-needs ratio).

[18] See Appendix A.4 for a comparison between the national RIF and provincial wage transformations.

Specifically, we introduce as controls a set of individual characteristics (on years of schooling, marital status, expected experience and its squared, whether in full-time work) interacted with time dummies, a set of industry indicators (6 groups if excluding agriculture), firm size indicators (5 groups, respectively of size with less than 10 employees, 10-49, 50-99, 100-199 or 200 and more), provincial-level information (share of young population, share of elderly population, share of individuals in the labour force with secondary education or greater, yearly log per capita GPP), in addition to time and geographic controls (rural binary, year, quarter and province fixed effects and province-specific time trends) to account for geography and unobserved time varying confounders. Note that time either represents round-year (main results) or year (if using only one quarter of data, Q3 – not shown in this version of the article). We refer to this model as the most saturated (as it includes time interactions and province-specific trends), and we report estimations from the fifth to the ninety-fifth percentiles in intervals of five.

The fact that we impose the transformation of the wage distributions to be "geographically determined" but not conditioned by any other covariate could induce correlation in the error terms, thus a simple one-way clustering in regression analysis may not be enough to control for simultaneous geographic interactions. To ensure the statistical inference of our research, we will apply as robustness a multiway clustering method (Cameron, Gelbach and Miller 2011), which allows the error dependence to account for multiple layers (in our case related to the location of the wage earners and the time) and to test the robustness of the estimation. Allowing the standard errors to be multi-way clustered will account for (1) the potential co-movement of wage distributions in neighbouring provinces and (2) for the non-random assignment of the provincial level minima which appear to be relatively clustered over time[19].

To assess the strength of the RIF measures created at provincial level we investigate in Appendix A.4 their behaviour over time and we compare them to the national ones. The main difference between the two distributions (national and provincial) is that the provincial distributions give on average greater weight to the lowest percentiles of the wage distribution, whereas the national is relatively more right-skewed, giving greater weight to percentiles at and above the median[20]. In addition, the mean yearly difference between the

[19] See Appendix C for a visualization of spatial clustering in the minima prior year 2013.

[20] On average the provincial (national) distribution displays more concentration below (above) the 45th percentile, both in terms of number of individuals falling in greater (smaller) number within the percentile cut-off, and of average value of the mean quantile.

average provincial quantile and the national quantile values shows that the provincial means are slightly smaller than the national one. This behaviour (left-skewed distributions) is expected in an economy where wage negotiation may be segmented according to geographic areas (and physical location of industries), thus making the case for a comparison of provincial wages and considerations on their evolution. On the other side, the application may induce bias in the estimation (if for example measurement error is greater in the bottom of distribution or if it would be systematic in specific provinces), so we can already expect a direction of the bias to be upwards (as more individuals fall under the lower percentile categories and they show a higher mean percentile wage).

5.2. Wage effects: minimum wage as a *numeraire*

We find positive spillover effects of an increase of the minimum wage on the private sector wage distribution. Over the medium-run of analysis (twelve years, 2002-2013) the multiple variations in the minimum wage appear to affect the wage distribution between the 15th and the 60th percentile (as reported in Table 3 below). On average, an increase of the minimum wage by 10 percent increases the average wage in a quantile below the median by 2.5 percent. The effect appears to be stronger between the 25th and 45th percentiles. The effect starts reducing at the median and does not bite beyond the 60th percentile[21].

Focusing on the latest policy change, we investigate on the time period 2011-2013 (five quarters before the first big hike in Q2 2012 and then covering the introduction of the national minimum in 2013 Q1 till the end of the year). The RIF regression (Table 4) suggests that the shift in the minimum wage strongly affects the mean provincial quantiles from the 15th to the 45th percentiles and then its effect halves (50th-60th) and gets weaker in terms of significance. In between the 15th and 25th percentiles, on average an increase of the minimum wage by 10 percent increases the mean log hourly wage by 5 percent. The effect extends till the 45th percentile with an average increase of 3 to 4 percent.

The first message arising from this investigation is that the minimum wage increase has reached wages of private sector workers in the lower half of the distribution, thus benefiting parts of its beneficiaries. The second message is that the great hike introduced between year 2012 and 2013 may have not translated in higher wages for the lowest fraction of provincial wage earners. Our most saturated model suggests that the 5th

[21] With exception for the 95th percentile which may be more prone to measurement error. We rely on findings of previous literature on the minimum wage and consider the effects on top tale of wage distribution as spurious.

and 10th provincial quantile average wages were not significantly affected by the hike[22]. One explanation why this is the case is that a too sharp rise may have rendered some of the very low-paid workers being kept at sub-minimum due to non-compliance.

Figure 6: Comparison of the minimum wage effects at provincial level, 2002-2013; 2011-2013.

Note: Provincial RIF regressions of hourly wage for male private sector workers (excluding agricultural workers, pooled quarterly LFS 2002-2013). The left figure displays coefficient and confidence intervals for log real hourly minimum wage for the period 2002-2013, and the right figure for the period 2011-2013. Other controls and clustering follow the main saturated specification reported. All monetary variables are deflated by national CPI (base 2013 Q3).

To ensure that the chosen estimators do not affect the results, we report in Appendix A.2 (Table 12) a comparison of the estimations for male private sector workers with a set of controls from least- to most-saturated specifications. The effects over 2002-2013 from the most saturated model appears to be smaller in magnitude than without province-specific trends, with smaller standard errors[23]. For the period 2011-2013 all the

[22] Notwithstanding that lower power generated by fewer data points between 2011 and 2013 may be also affecting the estimates, for any type of specification (changing the saturation of the model with controls) and clusters applied, we find no effect at the lowest 5th percentile.

[23] On one side the province-specific time trends aim to account for omitted variable bias which could affect the nature of provincial wage structure over time. On the other, they could remove much of the relevant variation as it generally applies to employment estimations, or it could add confounders as the control assumes linearity in time. Thus, if we assume that the introduction of a province-specific time trend adds spuriousness to the regressors, the estimates from the saturated model should be considered lower bound of the policy effect.

specifications point to no statistically significant effect on the lowest (5^{th}) percentile of the provincial wage distribution, corroborating the result that the lowest percentile has not been affected just after policy introduction. Noting that the literature on minimum wage argues for the use of large time periods to allow markets to react, our results suggest that six quarters after the introduction of a statutory minimum wage, there has been a positive effect on the provincial quantile distributions below the median. Additionally, estimations with different sets of controls over both time periods suggest positive effects up to the 60^{th} percentile.

Table 3: The effect of the minimum wage on the provincial wage distribution, 2002-2013.

Percentile	5^{th}	10^{th}	15^{th}	20^{th}	25^{th}	30^{th}	35^{th}	40^{th}	45^{th}	50^{th}
Log MW	0.085	0.085	0.201***	0.179***	0.219***	0.260***	0.244***	0.249***	0.247***	0.184***
	(0.141)	(0.083)	(0.063)	(0.052)	(0.066)	(0.065)	(0.062)	(0.058)	(0.059)	(0.038)
R^2	0.11	0.18	0.23	0.26	0.28	0.30	0.32	0.34	0.35	0.37
Percentile	55^{th}	60^{th}	65^{th}	70^{th}	75^{th}	80^{th}	85^{th}	90^{th}	95^{th}	
Log MW	0.165***	0.122***	0.036	0.062	0.030	0.088	0.089	0.094	0.249*	
	(0.041)	(0.044)	(0.068)	(0.047)	(0.059)	(0.073)	(0.090)	(0.099)	(0.127)	
R^2	0.37	0.38	0.38	0.39	0.38	0.36	0.34	0.29	0.20	

Note: The summary table reports the point estimates of log hourly minimum wage on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2002-2013 for male private sector workers (excluding agricultural workers, 791,542 obs.). Robust standard error reported in parenthesis, clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 4: The effect of the minimum wage on the provincial wage distribution, 2011-2013.

Percentile	5^{th}	10^{th}	15^{th}	20^{th}	25^{th}	30^{th}	35^{th}	40^{th}	45^{th}	50^{th}
Log MW	-0.234	0.166	0.499***	0.449***	0.548***	0.383***	0.473***	0.341***	0.323***	0.188
	(0.301)	(0.146)	(0.143)	(0.121)	(0.121)	(0.107)	(0.112)	(0.099)	(0.108)	(0.115)
R^2	0.08	0.15	0.23	0.27	0.29	0.32	0.33	0.35	0.36	0.37
Percentile	55^{th}	60^{th}	65^{th}	70^{th}	75^{th}	80^{th}	85^{th}	90^{th}	95^{th}	
Log MW	0.245**	0.230*	0.128	0.206	0.052	0.042	-0.033	0.116	0.333**	
	(0.109)	(0.136)	(0.117)	(0.138)	(0.130)	(0.136)	(0.169)	(0.184)	(0.155)	
R^2	0.37	0.38	0.38	0.38	0.37	0.35	0.33	0.29	0.19	

Note: The summary table reports the point estimates of log hourly minimum wage on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2011-2013 for male private sector workers (excluding agricultural workers, 205,075 obs.). Robust standard error reported in parenthesis, clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Additionally, we report a comparison of the specification with single or multi-way clustering (Appendix A.6), used to ensure that the estimates are not sensitive to multiple

geographic and/or temporal error dependence. Our estimates seem to be stable across specifications. We apply several types of two-way clustering which assume that there could be a specific within-geographic clustering (i.e. due to shocks) affecting some grouped observations. Specifically, we focus on cluster groups based on Province-Year or Region-Year (looking at spatial-time error dependence) and Province with Region-year grouping (accounting for within province and across region-time dependence). For the period 2002-2013 the cluster groups increase the standard errors and show significance of the estimator from the 15th to 60th quintile, thus strengthening the reliance of the estimates found with one-way clustering. For the 2011-2013 period, the multi-way clustering procedure suggests that reliance on the one-way clustering is enough to interpret the estimators and, the significance of the coefficients resembles the one of the main results reported using one-way clustering.

5.2.1. Understanding the mechanisms of provincial labour markets

The main findings are drawn from the most saturated model restricted to male private sector workers (excluding workers in the agricultural sector). Next, we test what is the effect of the minimum wage if we modify the sample under analysis, first reporting an expansion of the sample including agricultural workers to male private sector workers, then expanding to all private sector workers (investigating briefly into the gender dimension). Following, we investigate if there is any systematic difference among provinces, preliminary investigating two dimensions: by differentiating between the seven pilot provinces of the policy shift in year 2012 and all other provinces and, looking at poverty rates and splitting the sample to identify any differing trend in relatively poorer geographic areas.

The inclusion of agricultural private sector workers (a non covered sector which employs approximately 17 percent of the private sector workers, Table 13) appears to be consistent with expectations. In the medium-run analysis (2002-2013, Panel A) the estimates are slightly smaller, the minimum wage affects the distribution from the 20th to the 60th percentile, suggesting that the population of agricultural wageworkers populate the lower tail of the wage distribution and thus weakens the policy effect. In the latest policy shift (Panel B), the distribution is affected between the 15th and 60th, where a 10 percent increase in the minimum induces more than 4 percent increase in average wage between

the 15th-45th percentiles on average. The effect then decreases to around 2 percent in between the 50th and 60th percentile.

We then expand to all private sector including female workers (Table 14). The medium-run analysis (Panel A) suggests that on average the minimum wage induces a 3 to 3.5 percent rise in average wage between the 5th and 50th percentiles, with effects up to the 60th percentile[24]. For the short-run analysis of private sector workers (Panel B) we find that still no effect is detected at the lowest two percentiles (5th-10th). Assuming that over the years 2011-2013 the employment decision of female labour force has not changed drastically, in Table 15 we investigate also on the wage effects for the female population singularly for the latest policy change. The results are in line with the male wage RIF regressions. The effect on the first three quantile groups (5th to 15th) is insignificantly different from zero. Following, a greater effect is found between the 20th and 50th percentiles (10 percent increase in the minimum leading to 4.5 to 6 percent increase) with a decreasing (and weakly statistically significant) positive effect persisting till the 75th percentile. Thus, it appears that for the female wage distribution the latest minimum wage hike has a strong positive effect, lacking to affect wages at the very bottom of the distribution, but strongly benefitting wageworkers up till the provincial median.

Following, we examine if there is any differential behaviour in minimum wage effectiveness among provinces. We report an estimation with the inclusion of a binary variable if the provinces were non-piloted in year 2012 for the introduction of the national minimum, and we add an interaction term of this variable with the minimum wage (Table 16). The findings suggest that even if the minimum wage has a positive effect on the wage distributions, the wage in the non-pilot provinces have performed worse than the seven pilot provinces. Potential reasons behind this is that the seven pilot provinces are the most dynamic in terms of economic activity, they also host the greatest majority of private sector employment and there is where several large firms are located.

Consequently, we look at workers' wage distributions by firm size, which could help exploring the mechanisms behind the minimum wage effects and its interactions with the informal sector. Initially, we rule out that the effect on wage distributions is coming only from participation to large-sized firms. Table 17 reports the RIF regression with

[24] Note that for the private sector RIF regression, we identify greater spuriousness in the top wage distribution with positive and strongly statistically significant results between the 80th and 95th percentiles. Additionally, although in line with the more saturated model estimates, this result should be interpreted with caution as the female wage structure has been changing drastically over the 2000s and in this estimation we do not aim to model selection if not by controlling for observables.

sample split by firm size (large versus micro, small and medium). The results suggest positive effect for both types of workers, and with some statistically greater effects for large firms (only between 25-35 percentiles). Furthermore, in Table 18 we compare workers in micro-enterprises (less than 10 employees) versus small and medium (SMEs, with 10-99 employees). The results suggest that most of the improvements in provincial wage distributions apply to SMEs and are not different from zero in micro enterprises. We thus infer that the low level of compliance may have reduced the effectiveness of the minimum wage changes where the likelihood of informal employment is highest.

Lastly, we aim to check the robustness of the differences in provincial economic performance, and we use poverty rates to test the results. Thailand has experienced drastic reduction in its poverty rates over the 2000s[25], but with a high degree of geographic clustering in provincial poverty rates (in North, Northeast and the deep South). Using information at provincial level on the headcount ratio for 2011 (when the national minimum was announced and only 13.2 percent of the population was considered poor), we rank provinces by their poverty rate and split the sample equally to compare relatively poorer provinces versus less (Table 19). Tentatively, the results suggest that only in provinces where economic conditions are more flourishing, a combination of economic activity and law enforcement improves the provincial wage distribution.

5.2.2. Model comparisons and robustness

We assess the strength of our estimator across different dimensions. First, we compare the provincial RIF measure to the national RIF (Appendix A.4) and establish that there is a statistical difference between the two measures and that the provincial transformation seems to behave more consistently. The unconditional partial effects for the 2002-13 period (Table 21) are concentrated around the median (between the 30th and the 65th percentiles) and they are of greater magnitude than the provincial RIF regressions (by 0.1 on average, although note that the point estimates are not referring to the same distribution). The 2011-13 analysis seems to inflate the effect of the minimum wage around the 40th percentile. As expected, the national RIF attributes greater weight to the top tale of the distribution, and the results display inconsistencies especially in the top percentiles

[25] Poverty headcount has declined from 32.6 in 2002 to 10.9 percent in 2013 (SES data 2002-13, using national household-specific poverty lines.

(for both time periods). Thus, we sustain the use provincial wages to investigate the policy effect.

Second, a potential issue in pooling individual observations for different provincial percentiles together is that we may be capturing some "aggregation bias" in different wage structures, that is noise in individual observations which is not controlled for by the geographic dimension of each wage distribution and its controls. To address this, we perform an eyeballing exercise and compare the estimation with a two-step procedure, in a fashion similar to a selection model (see Appendix A.5.1 for details). We first model the RIF transformation for each quantile in each year on a set of individual characteristics, quarter and province dummies. Then we take the predicted value of the provincial binary variables, pool them together over time and regress them on our policy variable and a set of geographic-specific controls using weighted least squares (WLS), where the weights are provided by the inverse of the standard error for the corresponding provincial fixed effect. The results go in line with the provincial RIF, as the estimates report an effect which is similar in significance (for the two-step approach significant up to the 55th percentile) albeit smaller in magnitude (on average 0.84 smaller in between the 15-60 percentiles). Additionally, the two-step minimum wage effects fall within the confidence interval of the provincial RIF specification up to the median of the distribution, that is where the effect are sizeable in both specifications. Thus, even if this exercise does not consist a formal testing, it suggests that no strong aggregation bias is driving the results.

Lastly, we test the robustness of the deflator (quarterly CPI), by substituting it with a yearly spatial CPI (SCPI, see Appendix A.5.2). Although of less precision (as we apply a yearly SCPI to quarterly data), the robustness suggests similar effects (Figure 15 , Figure 16).

5.3. Theoretical interpretation of employment and wage effects

Given our preliminary findings, we can reconcile our estimations to the theoretical model proposed by Butcher, Dickens and Manning (2012) investigating the imposition of a minimum wage on imperfect labour markets, where the effects may be non-relevant in aggregate employment, but redistribution among firms may apply and there are sizeable effects on the wage distribution.

Butcher, Dickens and Manning (2012) sets up a reduced-form static labour supply curve to employers, which differ in their marginal products of labour. The employer faces a fixed supply of labour[26], and the share of workers which will supply labour to the firm is dependent on the hiring costs incurred and the wage paid. The firm (in absence of minimum) will maximise its profits and set wages depending on the elasticity of labour supply, with hiring costs being higher the greater the productivity of workers (Butcher, Dickens and Manning, 2012). Their set up suggests that rents in the monopsony power may be explained in the gap between productivity and wage, thus (borrowing the wording from Pischke and Acemoglou, 1999) meaning that the wage structure is compressed. If the rents were not present, the introduction of a minimum wage should force the firm to reduce its workers. However, if the gap is sufficiently high, the firm would retain the worker despite the higher minimum.

6. Conclusions (incomplete version)

This article investigates the effect of the changes of the minimum wage policy in Thailand between 2002 and 2013. The evaluation disentangles the effects of the introduction of multiple minima at provincial level and the fastest rise in the country's history to a uniform rate with an accounting of the short run effects induced by the policy change. We focus on the temporal effects of policy introduction on employment and we propose an analysis of the distributional effects it induced.

We find aggregate employment to be rather stable with some minor downward adjustments in agriculture, some evidence of immediate dis-employment effect for young low-skilled workers and no major contraction in other groups of the population. Investigating the dynamic response of markets, we show some evidence of anticipation effects in microenterprises and SMEs participation with contractions.

Additionally, in provinces with low minimum wage regimes Industry employment shows some contraction, while Services has been responding positively with rises in employment. The distributed-lag growth equation suggests negative effects on growth of employment-to-population in SMEs and micro-enterprises especially, showing effects one year after the policy change. In terms of wage analysis, we propose an application of the

[26] The assumption of fixed labour supply could be relaxed by the introduction of a dependency of labour supply on hiring and wages, and still be valid as long as it would not be dependent on firms' decision (Butcher et al., 2012).

RIF regression to provincial-level wage distributions. We find positive effects of the minimum wage on the hourly wage distribution, with effects spanning between the 15th and 60th percentile, but with no effect on the lowest percentiles.

Note that our analysis does not encompass two important aspects of minimum wage policy: an evaluation of hiring versus layoffs, and a screening of the survival of firms over time, as we do not possess firm-level data. We believe that more research on these two aspects could be extremely beneficial in assessing future minimum wage revisions.

Nevertheless, the application of a higher minimum appears to induce some gains and losses. As suggested by our findings, after a prolonged period of stagnation in real wages some gains arise for wage workers, who can now obtain a higher reward for their labour; and also gains arise for firms, which can find a bigger pool of candidates in the wage sector available for work. However, we tentatively conclude that losses may apply to firms and wage workers too. Some firms, especially the micro enterprises, could be forced out of the formal sector or out of the market all together if they cannot compete for workers with larger monopsonistic firms. Furthermore, these large firms could temporarily see their profits reduce to adjust to the higher minimum wage. Workers could be penalized too if the bargaining power of some, namely the very low-paid, is reduced due to increases in non-compliance.

Although we are only able to show some evidence for the early stages of the new policy, this article is suggestive of the need for consistent and gradual minimum wage adjustments, which we find to be useful in reviving the wage distribution without dampening employment, while potentially avoiding excessive profit losses on one side and unnecessary close-down or regression into informality on the other. Future adjustments of the minimum wage should be set at a prudent level, with simple guidelines for employers on compliance and better enforcement activity.

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Appendix

A. Additional tables and figures

Table 5: Resume of Minimum Wage Policies in Thailand, 1973-2013.

Law	Years of implementation	Institutions *	Coverage	Minimum wage type
Revolutionary Party Decree No. 103	1973/4 – 1998	NWC	Bangkok, and three provinces** (1973), Whole kingdom (1974)	Minimum wage bands by geographic region
Labor Protection Act B.E. 2541 (1998)	1998-2008 (with effective wage change since 2001)	NWC PSMWs STAR	Whole kingdom (2001)	Province-specific
Labor Protection Act B.E. 2551 (2008)	2008-2012	NWC PSMWs STAR	Whole kingdom (2008)	Province-specific
Notification of the Wage Committee on the Minimum Wage Rate (No. 6)	2012/3- today	NWC PSMWs STAR	Bangkok and six provinces*** (2012) Whole kingdom (2013)	Province-specific (2012) Single statutory wage (2013)

* Note: NWC stands for National Wage Committee, which includes government, employer, and employee representatives, it recommends minimum wage adjustments; PSMWs stand for Provincial Subcommittees on Minimum Wages, which are tripartite subcommittees composed of government, employer, and employee representatives at provincial level, which recommend minimum wage adjustments; STAR stands for Subcommittee on Technical Affairs and Review, the body submitting technical reviews of the recommendations. Final recommendations are handed over the deciding authority that is the Ministry of Labor that announces the law on the Royal Gazette (source: Ministry of Labor (2008), Del Carpio et al., (2014)).

** Nonthaburi, Pathum Thani and Samut Prakan

*** Nakhon Pathom, Nonthaburi, Pathum Thani, Phuket, Samut Prakan, Samut Sakhon.

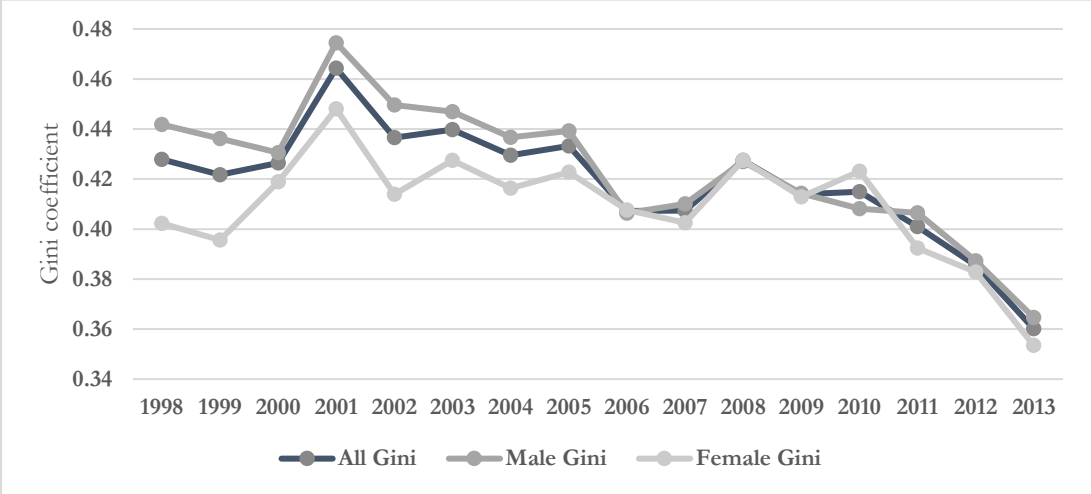
A.1. Summary statistics

Table 6: Descriptive statistics for private sector male workers (pooled quarterly data, including agriculture), selected years.

	2002		2011		2013		Test 02-11		Test 11-13	
	Mean	SD	**Mean**	SD	**Mean**	SD	test	p-val	test	p-val
Age	**33.15**	10.65	**35.30**	11.24	**35.66**	11.30	-39.5	0.00	-6.4	0.00
Edu below 2ary	**0.77**	0.42	**0.69**	0.46	**0.66**	0.47	920.0	0.00	47.2	0.00
Bangkok	**0.20**	0.40	**0.14**	0.35	**0.14**	0.34	32.2	0.00	1.7	0.20
Central	**0.30**	0.46	**0.33**	0.47	**0.34**	0.47	54.3	0.00	39.5	0.00
North	**0.16**	0.36	**0.15**	0.36	**0.14**	0.35	8.6	0.00	22.7	0.00
Northeast	**0.22**	0.42	**0.24**	0.43	**0.25**	0.43	2.9	0.09	71.3	0.00
South	**0.12**	0.33	**0.14**	0.34	**0.14**	0.35	0.6	0.42	31.0	0.00
Firm <10	**0.43**	0.50	**0.45**	0.50	**0.42**	0.49	0.0	0.98	83.8	0.00
Firm 10-99	**0.32**	0.47	**0.30**	0.46	**0.30**	0.46	10.3	0.00	0.1	0.70
Firm 100+	**0.25**	0.43	**0.25**	0.43	**0.28**	0.45	7.0	0.01	133.7	0.00
Agriculture	**0.20**	0.40	**0.17**	0.37	**0.15**	0.36	81.4	0.00	8.2	0.00
Manufacture	**0.29**	0.46	**0.28**	0.45	**0.30**	0.46	27.1	0.00	28.8	0.00
Construction	**0.20**	0.40	**0.22**	0.41	**0.22**	0.41	3.4	0.06	12.6	0.00
Wholesale	**0.16**	0.36	**0.16**	0.37	**0.17**	0.37	4.2	0.04	3.6	0.06
Hospitality	**0.03**	0.18	**0.04**	0.19	**0.03**	0.18	6.4	0.01	16.6	0.00
Services	**0.08**	0.27	**0.10**	0.30	**0.10**	0.30	125.4	0.00	13.7	0.00
Other	**0.04**	0.19	**0.04**	0.19	**0.04**	0.20	5.0	0.03	1.1	0.29
Workers not in agri.	**0.80**	0.40	**0.83**	0.37	**0.85**	0.36	81.4	0.00	8.2	0.00
Full time	**0.87**	0.34	**0.88**	0.33	**0.88**	0.33	49.6	0.00	4.0	0.05
Married	**0.64**	0.48	**0.62**	0.49	**0.62**	0.48	132.2	0.00	21.9	0.00
Hourly wage (r)	**44.33**	75.44	**46.92**	86.39	**58.29**	115.84	-8.8	0.00	-18.8	0.00
Weekly hours	**48.82**	12.48	**48.75**	11.85	**47.87**	11.36	4.4	0.00	17.2	0.00
Log MW (r)	**3.21**	0.10	**3.19**	0.10	**3.63**	0.00	30.0	0.00	-1271	0.00
Log GPP pc (r)	**11.61**	1.01	**11.53**	0.85	**11.56**	0.86	3.7	0.00	1.1	0.29
Youth pop sh .	**0.26**	0.02	**0.21**	0.04	**0.20**	0.04	287.8	0.00	32.9	0.00
Elderly pop sh .	**0.08**	0.02	**0.11**	0.02	**0.12**	0.02	-301.5	0.00	-134.4	0.00
High skilled sh .	**0.15**	0.08	**0.20**	0.09	**0.21**	0.10	-139.5	0.00	-26.5	0.00
Obs.	72,339		79,099		80,069					

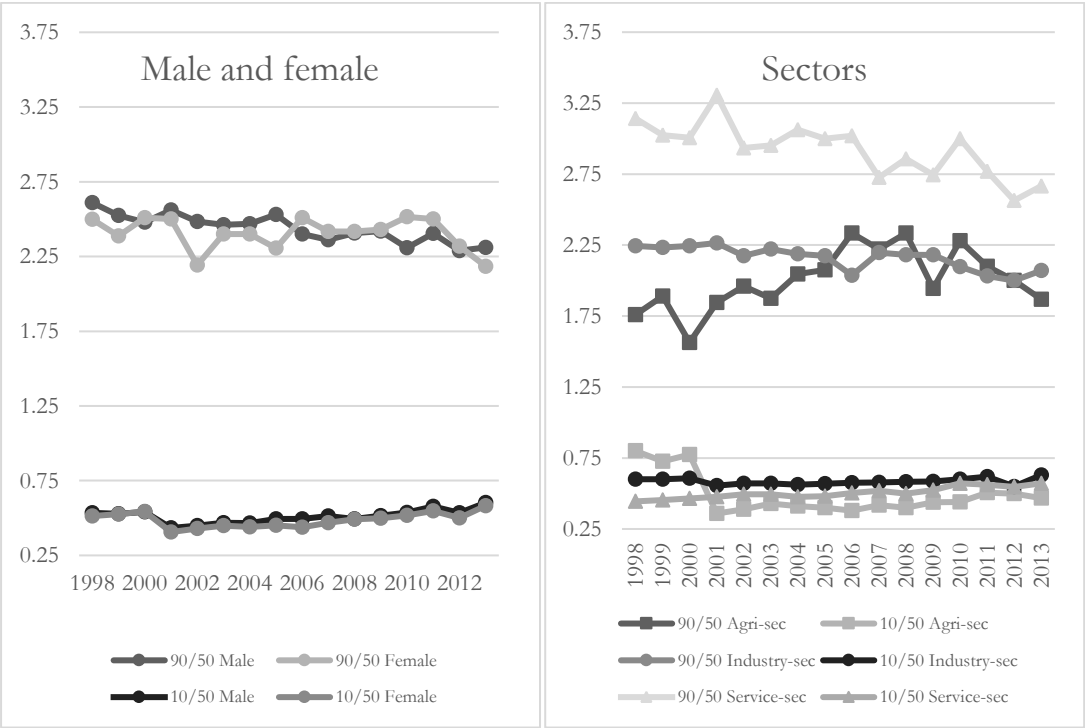
Note: LFS data at individual level for private sector male workers aged 15-65 (pooled Q1-Q4 for years 2002, 2011, 2013). Monetary variables are expressed in real terms ® by quarterly CPI (base Q3-2013). All variables at individual level with exception of log minimum wage, youth, elderly and high-skilled shares (expressed in province-quarter) or log GPP (in province-year). The data report yearly means and standard deviations for binary and continuous variables (using survey weights). Test statistics are performed between year 2002 and 2011 or 2011 and 2013 reporting test and p-value (equal or unequal variance test for levels, χ^2 test for binary variables).

Figure 7: Wage Gini for private sector workers: all, male and female, 1998-2013.



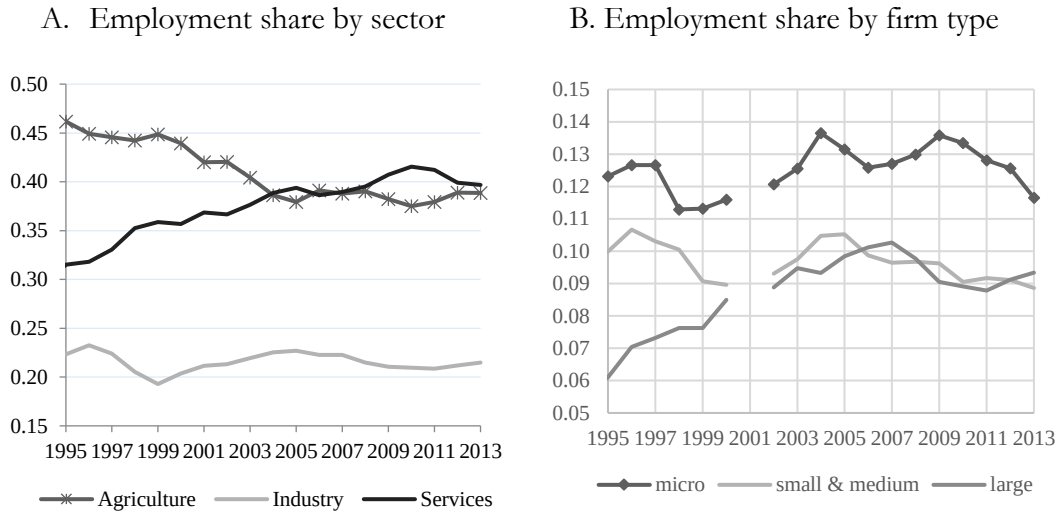
Note: LFS private sector workers 1998-2013, we report Gini coefficient (y-axis) for hourly wage which is defined as the comparison of cumulative proportions of a population against cumulative proportions of log hourly wage they receive (using survey weights multiplied by hours supplied), ranging between 0 (perfect equality) and 1 (perfect inequality). The measure suggests moderate reduction in wage inequality

Figure 8: p10/p50 and p50/p90 ratios by gender and aggregate sectors for private sector workers, 1998-2013.



Note: LFS 1998-2013 Q3. Annual ratios constructed for private sector workers. The left-hand graph reports the ratios by gender, the right-hand graph for sectors: Agriculture (including forestry and fishery), Industry (including manufacturing, mining, construction) and services

Figure 9: Average employment shares by aggregate sectors or firm type, 1995-2013.



Note: LFS 1995-2013, data for average yearly employment. Survey weights applied.

Table 7: Non compliance – share of private sector worker with wage below the minimum (%), 2002-2013.

Year	Overall	Low skilled	Young	Young low skilled
2002	35.72	44.71	40.39	49.79
2003	33.69	42.94	39.62	49.07
2004	33.45	42.28	37.48	46.52
2005	33.11	42.90	36.14	46.38
2006	28.96	37.97	32.53	41.91
2007	26.56	35.11	29.82	38.79
2008	26.23	34.49	30.36	37.79
2009	26.46	34.65	32.45	39.36
2010	22.20	29.17	26.42	31.92
2011	19.82	26.54	25.36	31.60
2012	34.38	45.94	43.17	51.55
2013	33.36	44.71	44.06	51.94

Note: LFS data 2002-2013 for private sector employees. Share expressed as percentages (%). Young stands for aged 15-24; Low skilled stands for individuals with less than secondary education.

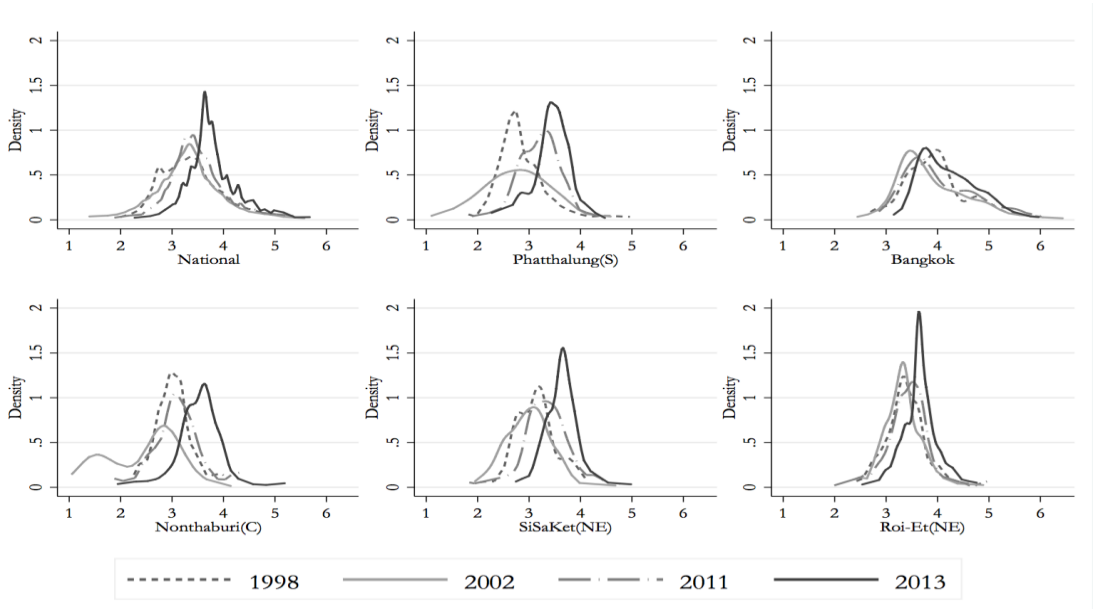
Table 8: Descriptive statistics for private sector wage workers by relative position to the minimum wage level, Q3 2011-2012-2013.

Population +/-5%	2011			2012			2013			Test 2011-12		Test 2012-13	
the MW	Below	At	Above	Below	At	Above	Below	At	Above	test	p-val	test	p-val
Age	35.6	34.0	35.0	35.3	34.1	35.5	34.9	33.8	35.7	2.41	0.02	-2.33	0.02
Male	0.46	0.47	0.58	0.52	0.54	0.57	0.54	0.56	0.56	47.25	0.00	7.43	0.01
Edu below secondary	**0.84**	**0.81**	**0.52**	**0.81**	**0.78**	**0.44**	**0.78**	**0.77**	**0.43**	**14.35**	**0.00**	**27.42**	**0.00**
Full time	0.94	0.98	0.94	0.94	0.97	0.93	0.94	0.99	0.92	5.63	0.02	5.89	0.02
Married	0.56	0.62	0.61	0.60	0.63	0.63	0.61	0.64	0.63	-5.00	0.00	-0.52	0.60
Bangkok	0.12	0.12	0.23	0.09	0.11	0.26	0.05	0.08	0.28	35.92	0.00	31.43	0.00
Central	**0.27**	**0.42**	**0.38**	**0.26**	**0.46**	**0.41**	**0.24**	**0.55**	**0.40**	**14.10**	**0.00**	**1.53**	**0.22**

North	0.22	0.15	0.12	0.22	0.12	0.10	0.23	0.11	0.08	2.12	0.15	1.67	0.20
Northeast	**0.30**	**0.21**	**0.17**	**0.31**	**0.23**	**0.14**	**0.34**	**0.20**	**0.14**	**2.52**	**0.11**	**14.37**	**0.00**
South	0.10	0.10	0.11	0.13	0.08	0.09	0.14	0.05	0.10	25.98	0.00	1.52	0.22
Firm < 10	**0.59**	**0.36**	**0.28**	**0.57**	**0.33**	**0.21**	**0.57**	**0.24**	**0.19**	**10.09**	**0.00**	**0.32**	**0.57**
Firm 10-99	0.28	0.26	0.33	0.29	0.29	0.34	0.29	0.30	0.34	0.17	0.68	5.28	0.02
Firm 100 +	0.13	0.38	0.39	0.14	0.38	0.45	0.14	0.46	0.48	16.37	0.00	4.85	0.03
Manufacture	0.32	0.47	0.39	0.28	0.48	0.42	0.29	0.57	0.41	1.52	0.22	0.06	0.81
Construction	**0.21**	**0.15**	**0.15**	**0.26**	**0.19**	**0.12**	**0.26**	**0.16**	**0.10**	**65.32**	**0.00**	**6.73**	**0.01**
Wholesale	0.17	0.14	0.20	0.19	0.17	0.18	0.21	0.15	0.20	3.29	0.07	0.00	0.99
Hospitality	0.13	0.09	0.06	0.09	0.06	0.05	0.09	0.04	0.05	26.30	0.00	1.77	0.18
Services	0.07	0.07	0.13	0.07	0.06	0.14	0.05	0.06	0.16	3.00	0.08	0.74	0.39
Other	0.11	0.08	0.08	0.11	0.05	0.08	0.10	0.03	0.08	17.07	0.00	3.51	0.06
Hourly wage	17.60	24.65	58.17	23.58	33.46	72.92	27.94	37.79	81.00	-58.87	0.00	-48.53	0.00
Weekly hours	55.33	52.90	49.04	53.48	50.02	48.26	51.05	50.58	47.93	8.72	0.00	16.67	0.00
Ln MW	3.16	3.19	3.21	3.46	3.50	3.53	3.62	3.62	3.62	-198.42	0.00	-207.31	0.00
Ln GPPpc	**11.33**	**11.61**	**11.79**	**11.29**	**11.65**	**11.95**	**11.17**	**11.72**	**11.99**	**3.07**	**0.00**	**10.16**	**0.00**
Obs.	5524	2605	22752	10397	3131	19364	9767	2952	17634	15921		20164	

Note: LFS Q3 2011-2013. The table reports summary statistics for private sector workers (excluding agriculture) by year and real hourly wage relative position to the real hourly minimum wage (+/- 5% of the minimum wage). Means are evaluated using survey weights, monetary variables are deflated by CPI (Q3 2013). Sectors: Manufacture (including mining), Construction, Wholesale (and retail), Hospitality (restaurants), Services, Other. Tests for population of individuals below the minimum wage by years (either 2011-2012 or 2012-2013), reporting test and p-value (equal or unequal variance test for levels, χ^2 test for binary variables).

Figure 10: Kernel wage density distributions, national and for selected provinces.



Note: LFS Q3 for years 1998 2002 2011 2013; Epanechnikov kernel applied with default bandwidth based on Silverman's rule-of-thumb, survey weights are multiplied by hours supplied. In this table we plot the distribution of log real hourly wage for private sector workers (CPI, base Q3 2013) at national level (top left figure) and compare it to the kernel density for the capital (top right figure) and other selected provinces (displayed with the geographic region acronym into parenthesis). The provincial distributions show a high degree of between and within variation.

A.2. Employment Regressions

A.2.1. Fixed effects regression

Table 9: Fixed Effects regression of Private sector Employment-to-population by firm size in high versus low minimum wage regime provinces, 2002-13.

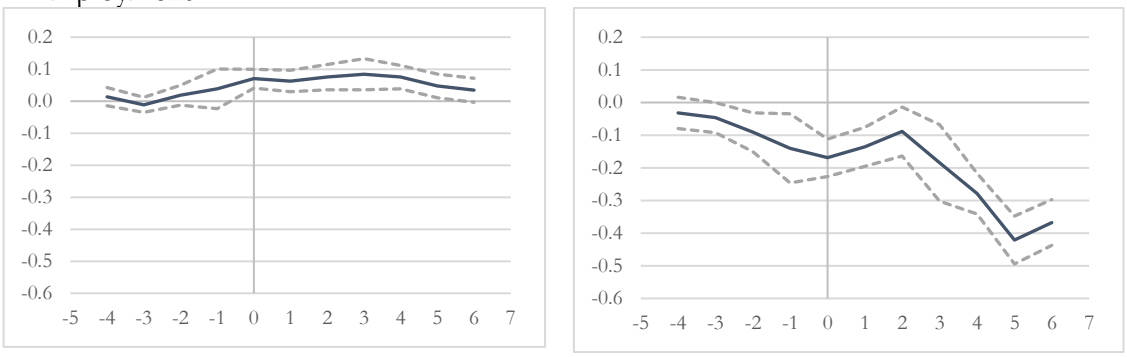
	Low Minimum wage provinces								
	Any	Non wage	Private	Agri.	Indus.	Service	Micro	SM	Large
Working age	-0.022***	-0.010	-0.011	-0.020*	-0.001	-0.000	-0.017	0.002	0.004
	(0.008)	(0.018)	(0.018)	(0.012)	(0.008)	(0.007)	(0.012)	(0.009)	(0.005)
Low skilled	-0.025***	-0.015	-0.015	-0.027**	-0.007	0.008	-0.017	0.002	0.001
	(0.009)	(0.019)	(0.018)	(0.013)	(0.009)	(0.008)	(0.013)	(0.010)	(0.005)
Low skilled (15-24)	-0.007	0.018	-0.036	-0.008	-0.023	0.023	-0.021	-0.013	-0.001
	(0.022)	(0.035)	(0.034)	(0.029)	(0.021)	(0.024)	(0.025)	(0.021)	(0.013)
Low skilled (25-65)	-0.027***	-0.019	-0.011	-0.027**	-0.004	0.005	-0.016	0.004	0.002
	(0.008)	(0.019)	(0.017)	(0.013)	(0.008)	(0.007)	(0.013)	(0.009)	(0.004)
	High Minimum wage provinces								
	Any	Non wage	Private	Agri.	Indus.	Service	Micro	SM	Large
Working age	0.006	0.024	-0.025	0.005	0.012	-0.011	-0.005	-0.024	0.003
	(0.009)	(0.030)	(0.031)	(0.028)	(0.016)	(0.022)	(0.013)	(0.018)	(0.019)
Low skilled	0.003	0.025	-0.035	0.011	-0.000	-0.007	-0.002	-0.030	-0.005
	(0.011)	(0.033)	(0.033)	(0.032)	(0.017)	(0.024)	(0.016)	(0.020)	(0.019)
Low skilled (15-24)	-0.066*	0.001	-0.080	-0.004	-0.025	-0.037	0.029	-0.043	-0.066
	(0.032)	(0.050)	(0.070)	(0.047)	(0.058)	(0.040)	(0.031)	(0.037)	(0.055)
Low skilled (25-65)	0.012	0.028	-0.028	0.011	0.006	-0.005	-0.005	-0.032	0.008
	(0.013)	(0.032)	(0.032)	(0.033)	(0.015)	(0.024)	(0.016)	(0.021)	(0.018)

Note: LFS 2002-13. High (Low) minimum wage provinces are defined as those provinces with a real mean minimum wage higher (lower) than the national average over the period. High regime provinces are 20: Bangkok, 13 from the Centre, 1 from the North, 1 from Northeast, and 4 from the South (low regime are the remaining 56 provinces). Controls as main specification (significance: * p<.10, ** p<.05, *** p<.01).

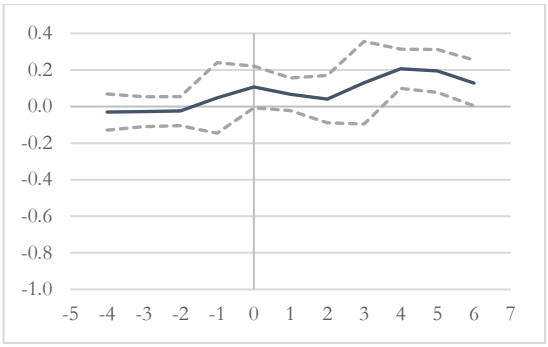
Figure 11: Cumulative response to changes in the minimum wage of employment elasticity for high versus young low skilled populations

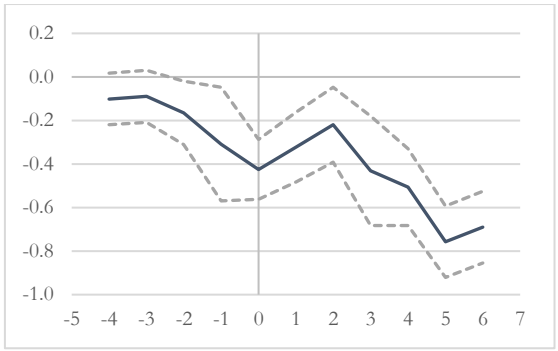
High skilled population **Young low skilled population**

I. Employment

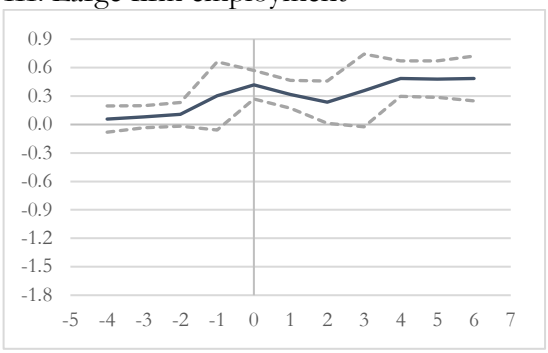


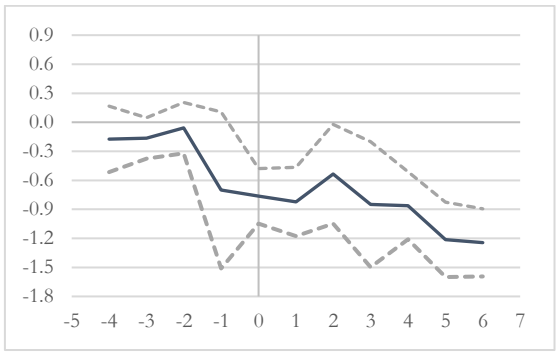
II. Private sector employment





III. Large firm employment





Notes: Dynamic provincial panel model with distributed leads and lags in log real minimum wage. The specification covers a 10-quarter window (reported on y-axis, four quarters before the change in the minimum wage reported with negative sign and lags till six quarters after the change reported with positive sign). The solid line graphs represent the cumulative response of selected outcomes to a minimum wage increase. Coefficients are divided by average employment-to-population ratio, so to represent employment elasticities. Each regression equation includes controls at province level for average years of schooling, female composition, average potential work experience, population shares of youth (less than 25 years of age), senior (more than 55 years of age), share of rural population and share of high skilled labour force (completed post-secondary education), log real GPP per capita, year and quarter dummies, and provincial fixed effects. The dotted lines represent the 95% confidence intervals, computed using robust standard errors clustered at the provincial level. Quarterly Labor Force Survey data from NSO.

A.2.2. Differenced and distributed lags models

Table 10: Differenced model of youth low-skilled employment-to-population on log minimum wage,1st to 8th quarter difference, (2002-2013).

	Any	Private	Indus	Service	Agriculture	Micro	Small-med	Large
MW △1	-0.043*	-0.050*	-0.008	-0.030	-0.005	-0.016	-0.041**	0.007
	(0.024)	(0.029)	(0.026)	(0.026)	(0.036)	(0.024)	(0.020)	(0.017)
R^2	0.14	0.06	0.03	0.04	0.18	0.02	0.04	0.02
Obs	3560	3560	3560	3560	3560	3560	3560	3560
MW △2	-0.056**	-0.070**	-0.011	-0.026	-0.019	-0.023	-0.051**	0.005
	(0.027)	(0.031)	(0.029)	(0.030)	(0.038)	(0.027)	(0.023)	(0.019)
R^2	0.12	0.06	0.04	0.03	0.15	0.02	0.04	0.02
Obs	3484	3484	3484	3484	3484	3484	3484	3484
MW △3	-0.067**	-0.089**	-0.018	-0.025	-0.024	-0.030	-0.063**	0.005
	(0.030)	(0.035)	(0.032)	(0.032)	(0.043)	(0.030)	(0.026)	(0.022)
R^2	0.10	0.07	0.04	0.03	0.12	0.02	0.04	0.02
Obs	3408	3408	3408	3408	3408	3408	3408	3408
MW △4	-0.070**	-0.096**	-0.021	-0.021	-0.029	-0.031	-0.069**	0.005
	(0.033)	(0.038)	(0.034)	(0.034)	(0.046)	(0.031)	(0.028)	(0.024)
R^2	0.07	0.07	0.05	0.03	0.10	0.02	0.04	0.02
Obs	3332	3332	3332	3332	3332	3332	3332	3332
MW △5	-0.080**	-0.106**	-0.027	-0.021	-0.033	-0.033	-0.076**	0.003
	(0.037)	(0.041)	(0.037)	(0.037)	(0.049)	(0.033)	(0.031)	(0.026)

R^2	0.06	0.08	0.05	0.03	0.08	0.02	0.04	0.02
Obs	3256	3256	3256	3256	3256	3256	3256	3256
MW △6	-0.084**	-0.112**	-0.031	-0.025	-0.028	-0.033	-0.081**	0.003
	(0.040)	(0.045)	(0.039)	(0.039)	(0.050)	(0.034)	(0.034)	(0.029)
R^2	0.06	0.08	0.06	0.03	0.08	0.02	0.04	0.03
Obs	3180	3180	3180	3180	3180	3180	3180	3180
MW △7	-0.087*	-0.116**	-0.034	-0.031	-0.022	-0.032	-0.085**	0.002
	(0.045)	(0.050)	(0.042)	(0.044)	(0.052)	(0.037)	(0.038)	(0.034)
R^2	0.06	0.09	0.06	0.03	0.07	0.03	0.05	0.03
Obs	3104	3104	3104	3104	3104	3104	3104	3104
MW △8	-0.091*	-0.116**	-0.036	-0.037	-0.018	-0.030	-0.087**	0.002
	(0.053)	(0.058)	(0.047)	(0.050)	(0.056)	(0.041)	(0.044)	(0.040)
R^2	0.06	0.08	0.06	0.03	0.07	0.03	0.05	0.03
Obs	3028	3028	3028	3028	3028	3028	3028	3028

Note: This table reports the coefficient of log hourly minimum wage expressed in differences (2002-2013 data at province-quarter level) for youth low skilled population, where △# represents the quarter-differenced log hourly minimum wage on differenced log employment-to-population ratio. Robust standard errors clustered at province level. Note that by increasing the differencing to higher level than two years (8 quarters) the results do not change.

Table 11: Distributed lags differenced model – aggregate effects of minimum wage lags on selected low-skilled employment-to-population changes, 2002-13.

Dep.	△Lags	Cumulated effects	Se	Dep.	△Lags	Cumulated effects	Se
Private	2	-0.112*	0.067	Micro	2	0.012	0.049
	4	-0.007	0.097		4	0.071	0.067
	6	-0.260	0.210		6	-0.067	0.152
	8	-0.625	0.538		8	-0.343	0.429
Agriculture	2	-0.202***	0.072	SMEs	2	-0.092*	0.053
	4	-0.047	0.093		4	-0.118*	0.062
	6	-0.326*	0.193		6	-0.240*	0.144
	8	0.210	0.406		8	-0.450	0.279

Note: This table reports the aggregate coefficient of log hourly minimum wage and its lags expressed in long-differences (2002-2013 data at province-quarter level), where △ lags represent the sum of lag differenced log hourly minimum wage on differenced youth low-skilled employment-to-population ratio. Robust standard errors clustered at province level.

A.3. RIF Regression tables

Table 12: RIF regressions of log minimum wage with a set of controls, 2002-2013; 2011-2013.

Panel A: β estimate of log minimum wage, 2002-2013										
Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Simple	0.262	0.262**	0.327***	0.293***	0.320***	0.341***	0.325***	0.321***	0.318***	0.249***
	(0.165)	(0.108)	(0.078)	(0.069)	(0.082)	(0.077)	(0.074)	(0.061)	(0.058)	(0.057)
Interactions	0.260	0.232**	0.305***	0.262***	0.277***	0.306***	0.289***	0.297***	0.295***	0.230***
	(0.162)	(0.105)	(0.075)	(0.065)	(0.077)	(0.077)	(0.076)	(0.074)	(0.073)	(0.057)
P*T Trends	0.061	0.103	0.210***	0.200***	0.249***	0.279***	0.260***	0.250***	0.244***	0.175***
	(0.137)	(0.085)	(0.065)	(0.056)	(0.069)	(0.065)	(0.058)	(0.043)	(0.039)	(0.041)
Saturated	0.085	0.085	0.201***	0.179***	0.219***	0.260***	0.244***	0.249***	0.247***	0.184***
	(0.141)	(0.083)	(0.063)	(0.052)	(0.066)	(0.065)	(0.062)	(0.058)	(0.059)	(0.038)
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Simple	0.250***	0.238***	0.180**	0.197***	0.180**	0.198**	0.150*	0.180**	0.458***	
	(0.056)	(0.060)	(0.071)	(0.059)	(0.071)	(0.088)	(0.088)	(0.087)	(0.155)	
Interactions	0.218***	0.181***	0.111	0.106*	0.081	0.104	0.052	0.059	0.251**	
	(0.058)	(0.063)	(0.083)	(0.061)	(0.071)	(0.087)	(0.107)	(0.100)	(0.123)	
P*T Trends	0.166***	0.154***	0.077	0.123**	0.091	0.121	0.097	0.098	0.323**	
	(0.042)	(0.042)	(0.052)	(0.050)	(0.057)	(0.074)	(0.082)	(0.089)	(0.137)	
Saturated	0.165***	0.122***	0.036	0.062	0.030	0.088	0.089	0.094	0.249*	
	(0.041)	(0.044)	(0.068)	(0.047)	(0.059)	(0.073)	(0.090)	(0.099)	(0.127)	
Panel B: β estimate of log minimum wage, 2011-2013										
Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Simple	0.123	0.233**	0.360***	0.321***	0.355***	0.357***	0.313***	0.316***	0.310***	0.241***
	(0.118)	(0.098)	(0.070)	(0.056)	(0.058)	(0.050)	(0.041)	(0.039)	(0.034)	(0.045)

Interactions	0.131	0.210**	0.349***	0.305***	0.334***	0.349***	0.297***	0.315***	0.305***	0.234***
	(0.111)	(0.093)	(0.066)	(0.053)	(0.062)	(0.056)	(0.042)	(0.049)	(0.049)	(0.033)
P*T Trends	-0.257	0.143	0.479***	0.416***	0.527***	0.364***	0.461***	0.326***	0.317***	0.203*
	(0.318)	(0.156)	(0.139)	(0.123)	(0.110)	(0.105)	(0.097)	(0.103)	(0.093)	(0.105)
Saturated	-0.234	0.166	0.499***	0.449***	0.548***	0.383***	0.473***	0.341***	0.323***	0.188
	(0.301)	(0.146)	(0.143)	(0.121)	(0.121)	(0.107)	(0.112)	(0.099)	(0.108)	(0.115)
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Simple	0.249***	0.307***	0.187***	0.233***	0.218***	0.194**	0.202	0.232**	0.557***	
	(0.042)	(0.033)	(0.062)	(0.043)	(0.060)	(0.095)	(0.129)	(0.115)	(0.136)	
Interactions	0.235***	0.250***	0.153***	0.160***	0.143***	0.112	0.093	0.102	0.344***	
	(0.031)	(0.033)	(0.052)	(0.040)	(0.053)	(0.085)	(0.130)	(0.112)	(0.108)	
P*T Trends	0.279***	0.284**	0.168*	0.287**	0.141	0.184*	0.044	0.306	0.423***	
	(0.102)	(0.127)	(0.089)	(0.116)	(0.097)	(0.098)	(0.212)	(0.197)	(0.148)	
Saturated	0.245**	0.230*	0.128	0.206	0.052	0.042	-0.033	0.116	0.333**	
	(0.109)	(0.136)	(0.117)	(0.138)	(0.130)	(0.136)	(0.169)	(0.184)	(0.155)	

Note: The table reports the coefficient of log real hourly minimum wage on the RIF measure from a set of estimation with different controls from least to most saturated models (Panel A 2002-2013 data, Panel B 2011-2013, sample of pooled quarterly LFS data for male private sector workers excluding agriculture). Standard errors in parenthesis are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). In each sub-panel the first row ("Simple") uses as controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects. In the second row ("Interactions") the individual-level variables of the first specification are interacted with quarter-year dummies. In the third row ("P*T Trends) we add to the first specification the province-specific time trends. In the last row ("Saturated") we jointly add the individual-level variables interacted with time and the province-specific time trends.

Table 13: The effect of the minimum wage on the provincial wage distribution for male private sector workers (including agriculture), 2002-2013; 2011-2013.

Panel A.	**2002-2013**									
Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.217	0.133	0.133	0.161**	0.189***	0.237***	0.212***	0.202***	0.213***	0.149***
	(0.158)	(0.096)	(0.08)	(0.061)	(0.057)	(0.06)	(0.062)	(0.062)	(0.065)	(0.042)
R^2	0.15	0.23	0.27	0.29	0.32	0.34	0.35	0.36	0.37	0.38
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.178***	0.144***	0.02	0.044	0.031	0.082	0.063	0.115	0.155	
	(0.04)	(0.044)	(0.066)	(0.053)	(0.058)	(0.069)	(0.092)	(0.099)	(0.115)	
R^2	0.38	0.39	0.38	0.38	0.37	0.36	0.34	0.29	0.2	
Panel B.	**2011-2013**									
Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.113	0.153	0.428***	0.396***	0.517***	0.422***	0.463***	0.296***	0.349***	0.233**
	(0.263)	(0.15)	(0.138)	(0.113)	(0.11)	(0.098)	(0.109)	(0.097)	(0.088)	(0.11)
R^2	0.13	0.21	0.26	0.28	0.31	0.33	0.34	0.35	0.36	0.37
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.236**	0.245**	0.09	0.133	0.082	0.048	-0.07	0.139	0.302*	
	(0.11)	(0.116)	(0.114)	(0.128)	(0.125)	(0.125)	(0.152)	(0.171)	(0.154)	
R^2	0.37	0.38	0.38	0.38	0.37	0.34	0.33	0.27	0.18	

Note: The summary table reports the point estimates of log hourly minimum wage on the RIF transformation of log hourly wage for a specific percentile *q*. Data: Panel A pooled quarterly LFS 2002-2013, Panel B for years 2011-2013. The sample represents male private sector workers (including agricultural workers). Robust standard errors (parenthesis) are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (7 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 14: The effect of the minimum wage on the provincial wage distribution for all private sector workers (excluding agriculture), 2002-2013; 2011-2013.

Panel A. 2002-2013

Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.090	0.135	0.189***	0.230***	0.249***	0.232***	0.294***	0.307***	0.306***	0.308***
	(0.164)	(0.103)	(0.068)	(0.063)	(0.062)	(0.050)	(0.054)	(0.056)	(0.054)	(0.048)
R^2	0.12	0.20	0.25	0.28	0.31	0.33	0.35	0.37	0.38	0.39
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.169***	0.181***	0.089	0.100*	0.119**	0.238***	0.275***	0.208***	0.239*	
	(0.059)	(0.042)	(0.092)	(0.054)	(0.046)	(0.053)	(0.082)	(0.069)	(0.123)	
R^2	0.40	0.40	0.40	0.40	0.39	0.37	0.34	0.29	0.20	

Panel B. 2011-2013

Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	-0.255	0.140	0.486***	0.554***	0.547***	0.471***	0.418***	0.483***	0.400***	0.389***
	(0.330)	(0.161)	(0.134)	(0.143)	(0.098)	(0.090)	(0.092)	(0.125)	(0.097)	(0.108)
R^2	0.12	0.19	0.25	0.29	0.32	0.35	0.36	0.38	0.39	0.40
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.105	0.269**	0.135	0.189	0.205	0.208	0.200	0.005	0.026	
	(0.134)	(0.118)	(0.135)	(0.152)	(0.137)	(0.140)	(0.144)	(0.136)	(0.192)	
R^2	0.40	0.40	0.40	0.39	0.39	0.36	0.33	0.28	0.19	

Note: The summary table reports the point estimates of log hourly minimum wage on the RIF transformation of log hourly wage for a specific percentile *q*. Data: Panel A pooled quarterly LFS 2002-2013, Panel B for years 2011-2013. The sample represents male and female private sector workers (excluding agricultural workers). Robust standard errors in parenthesis are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls: individual-level variables (female binary, years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 15: The effect of the minimum wage on the provincial wage distribution for female private sector workers (excluding agriculture), 2011-2013.

Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	-0.020	-0.086	0.233	0.511***	0.445***	0.585***	0.457***	0.495***	0.460***	0.445***
	(0.326)	(0.214)	(0.150)	(0.139)	(0.110)	(0.100)	(0.104)	(0.098)	(0.097)	(0.104)
R^2	0.13	0.23	0.29	0.32	0.36	0.38	0.40	0.42	0.44	0.44
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.225*	0.309**	0.340**	0.266*	0.281*	0.092	-0.085	-0.273*	-0.276	
	(0.123)	(0.136)	(0.146)	(0.155)	(0.168)	(0.145)	(0.131)	(0.148)	(0.170)	
R^2	0.45	0.44	0.43	0.43	0.41	0.39	0.35	0.29	0.19	

Note: The summary table reports the point estimates of log hourly minimum wage on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2011-2013. The sample represents female private sector workers (excluding agricultural workers). Standard errors in parenthesis are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 16: RIF regression of male provincial wages: Investigating performance of non-pilot provinces, 2002-2013.

MW effect	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
MW* No pilot	0.207	0.012	-0.06	-0.062	-0.043	-0.006	-0.02	0.016	-0.012	-0.056
	(0.127)	(0.083)	(0.079)	(0.065)	(0.055)	(0.056)	(0.050)	(0.058)	(0.053)	(0.055)
No pilot(d)	-	-	-	-	-	-	-0.435**	-	-0.34	-0.097
	2.830***	1.524***	0.592**	0.463**	0.592***	0.584***		0.590**		
	(0.420)	(0.291)	(0.247)	(0.209)	(0.192)	(0.204)	(0.197)	(0.249)	(0.211)	(0.232)

Ln MW	-0.266	0.064	0.304*	0.285**	0.291***	0.271**	0.278***	0.223**	0.268***	0.279***
	(0.252)	(0.176)	(0.157)	(0.130)	(0.102)	(0.112)	(0.105)	(0.090)	(0.096)	(0.085)
Wald Test	29.40	22.09	7.61	7.52	11.31	6.87	4.87	5.59	2.56	1.20
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.08	0.31
MW effect	55th	60th	65th	70th	75th	80th	85th	90th	95th	
MW* No pilot	-0.056	-0.091	-0.077	-0.088	-0.055	-0.044	0.005	-0.105	-0.103	
	(0.050)	(0.058)	(0.048)	(0.055)	(0.073)	(0.081)	(0.081)	(0.096)	(0.140)	
No pilot(d)	-0.27	0.013	-0.221	0.137	0.075	0.293	0.572	0.656	-0.001	
	(0.246)	(0.221)	(0.234)	(0.251)	(0.272)	(0.343)	(0.436)	(0.567)	(0.622)	
Ln MW	0.260***	0.277***	0.166	0.213**	0.123	0.163	0.081	0.272	0.424*	
	(0.081)	(0.097)	(0.106)	(0.103)	(0.122)	(0.151)	(0.168)	(0.165)	(0.225)	
Wald Test	2.73	1.62	3.88	1.28	0.33	0.36	1.08	1.22	0.28	
P-value	0.07	0.20	0.02	0.29	0.72	0.70	0.34	0.30	0.76	

Note: The summary table reports the point estimates of log hourly minimum wage (MW) and its interaction with a binary variable (No pilot) for not being a pilot province in the 2012 policy change (base category formed of 7 pilot provinces) on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2002-2013 (791,542 obs.). The sample represents male private sector workers (excluding agricultural workers). Robust standard errors in parenthesis clustered at province level (* p<.10 ** p<.05 *** p<.01). We report a Wald test statistic for joint equality of the binary variable and the interaction term. All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Other controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 17: RIF regression with sample break by firm size: Micro-SME versus Large firms, 2002-2013.

MW effect	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
For M-SME	0.193	0.067	0.239***	0.192***	0.209**	0.231***	0.230**	0.268***	0.275***	0.222***
	(0.188)	(0.127)	(0.087)	(0.067)	(0.079)	(0.084)	(0.091)	(0.090)	(0.087)	(0.053)
R2	0.08	0.14	0.19	0.21	0.24	0.26	0.28	0.29	0.30	0.31
Obs.	557,641	557,641	557,641	557,641	557,641	557,641	557,641	557,641	557,641	557,641
For LE	0.002	0.258***	0.313***	0.372***	0.493***	0.574***	0.500***	0.429***	0.371***	0.259***
	(0.160)	(0.089)	(0.073)	(0.066)	(0.074)	(0.069)	(0.066)	(0.074)	(0.070)	(0.096)
R2	0.15	0.20	0.22	0.23	0.26	0.28	0.30	0.32	0.34	0.36
Obs.	233,901	233,901	233,901	233,901	233,901	233,901	233,901	233,901	233,901	233,901
Chi2 p-value	0.38	0.24	0.55	0.07	0.00	0.00	0.03	0.24	0.45	0.78
Wald Test	57.83	54.01	45.05	32.87	27.91	22.44	17.62	17.66	20.94	32.25
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

MW effect	55th	60th	65th	70th	75th	80th	85th	90th	95th
For M-SME	0.196***	0.159***	0.061	0.112**	0.076	0.151**	0.142	0.125	0.261**
	(0.050)	(0.044)	(0.070)	(0.053)	(0.055)	(0.065)	(0.097)	(0.095)	(0.122)
R2	0.32	0.32	0.32	0.32	0.32	0.31	0.29	0.26	0.19
Obs.	557,641	557,641	557,641	557,641	557,641	557,641	557,641	557,641	557,641
For LE	0.235***	0.185**	0.109	0.121	0.074	0.091	0.024	0.020	0.178
	(0.083)	(0.082)	(0.099)	(0.123)	(0.136)	(0.165)	(0.171)	(0.200)	(0.283)
R2	0.38	0.39	0.40	0.40	0.40	0.39	0.36	0.31	0.22
Obs.	233,901	233,901	233,901	233,901	233,901	233,901	233,901	233,901	233,901
Chi2 p-value	0.71	0.78	0.65	0.95	0.99	0.74	0.51	0.63	0.80
Wald Test	52.41	71.60	86.78	117.29	142.08	149.33	157.46	119.12	80.55
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: The summary table reports the point estimates of log hourly minimum wage (MW) on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2002-2013 split by firm size (either Micro or SME, 1-99 employees, or Large enterprises with 100 or more). The sample represents male private sector workers (excluding agricultural workers). Robust standard errors in parenthesis clustered at province level (* p<.10 ** p<.05 *** p<.01). We report a χ^2 test p-value for joint equality of the minimum wage variable on the two samples. All monetary variables are deflated by quarterly CPI (base year

2013 Q3). Other controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 18: RIF regression with sample break for Micro and S-M Enterprise, 2002-13.

Panel A. Micro-enterprise RIF										
MW effect	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.208	-0.187	0.148	0.116	0.127	0.223*	0.218	0.269*	0.289*	0.250**
	(0.290)	(0.189)	(0.122)	(0.097)	(0.092)	(0.127)	(0.144)	(0.142)	(0.153)	(0.108)
R^2	0.07	0.11	0.14	0.16	0.18	0.19	0.21	0.21	0.22	0.22
Obs.	313756	313756	313756	313756	313756	313756	313756	313756	313756	313756
MW effect	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.210**	0.161***	0.047	0.063	0.017	0.096	0.090	0.038	0.013	
	(0.081)	(0.057)	(0.075)	(0.073)	(0.064)	(0.062)	(0.092)	(0.097)	(0.157)	
R^2	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.20	
Obs.	313756	313756	313756	313756	313756	313756	313756	313756	313756	
Panel B. Small-Medium enterprise RIF										
MW effect	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.166	0.245**	0.332***	0.295***	0.320***	0.303***	0.298***	0.336***	0.327***	0.247***
	(0.288)	(0.112)	(0.080)	(0.077)	(0.084)	(0.070)	(0.069)	(0.071)	(0.066)	(0.050)
R^2	0.09	0.18	0.22	0.25	0.27	0.29	0.31	0.33	0.34	0.36
Obs.	243885	243885	243885	243885	243885	243885	243885	243885	243885	243885
Chi2 p-value	0.35	0.44	0.26	0.11	0.01	0.00	0.06	0.16	0.32	0.55
MW effect	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.227***	0.182**	0.078	0.135**	0.118	0.177**	0.163	0.159	0.393**	
	(0.057)	(0.072)	(0.090)	(0.062)	(0.087)	(0.085)	(0.115)	(0.121)	(0.159)	
R^2	0.36	0.37	0.37	0.36	0.35	0.34	0.32	0.27	0.19	
Obs.	243885	243885	243885	243885	243885	243885	243885	243885	243885	
Chi2 p-value	0.84	0.86	0.29	0.03	0.51	0.22	0.06	0.45	0.54	

Note: The summary table reports the point estimates of log hourly minimum wage (MW) on the RIF transformation of log hourly wage for a specific percentile *q*. Data: pooled quarterly LFS 2002-2013 split by firm size (either Micro, less than 10 employees, or SME, 10-99). The sample represents male private sector workers (excluding large firms and agricultural workers). Robust standard errors in parenthesis clustered at province level (* p<.10 ** p<.05 *** p<.01). We report a χ^2 test p-value for joint equality of the minimum wage variable on the two samples. All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Other controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

Table 19: RIF regression with sample break by poverty ranking, 2002-2013.

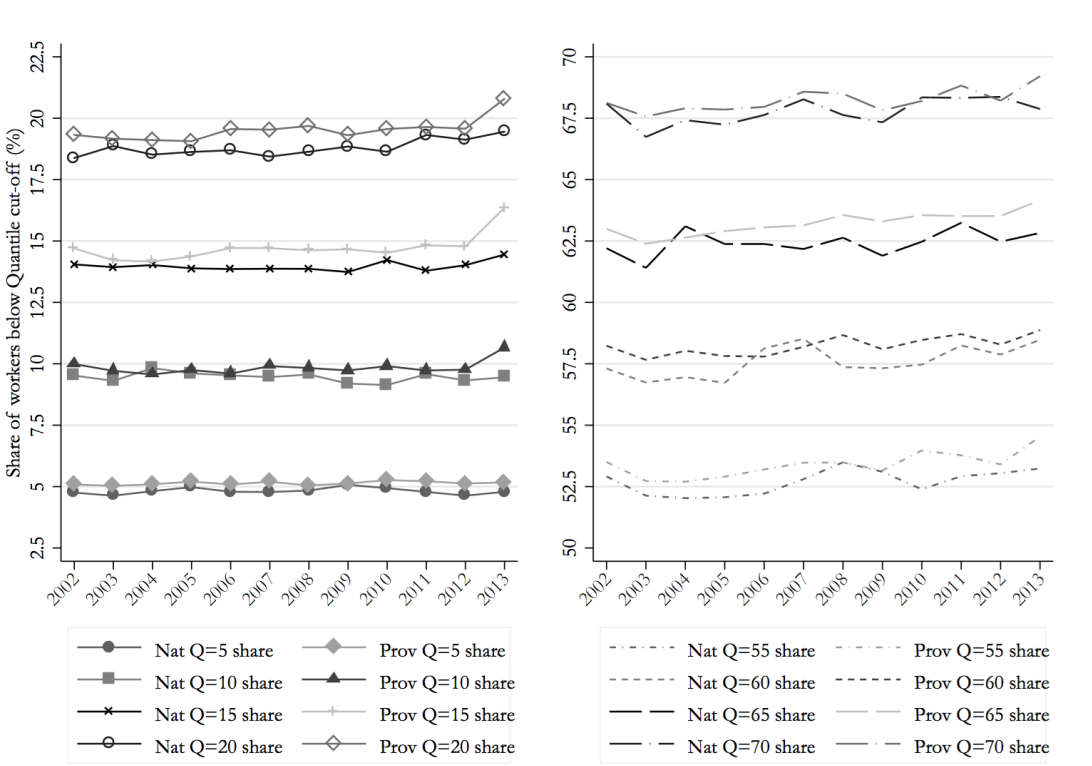
MW effect	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
For poor prov	0.131	0.114	0.408	0.168	-0.071	-0.203	-0.165	-0.143	-0.036	0.144
	(0.598)	(0.396)	(0.273)	(0.265)	(0.232)	(0.205)	(0.169)	(0.162)	(0.145)	(0.163)
R2	0.06	0.09	0.12	0.14	0.16	0.17	0.18	0.19	0.19	0.20
Obs	283417	283417	283417	283417	283417	283417	283417	283417	283417	283417
Non poor prov	0.191	0.140*	0.236***	0.220***	0.285***	0.345***	0.296***	0.286***	0.292***	0.205***
	(0.158)	(0.077)	(0.061)	(0.056)	(0.076)	(0.080)	(0.079)	(0.079)	(0.081)	(0.062)
R2	0.11	0.19	0.23	0.25	0.27	0.29	0.31	0.33	0.35	0.36
Obs	508125	508125	508125	508125	508125	508125	508125	508125	508125	508125
Chi2-pval	0.92	0.94	0.52	0.84	0.13	0.01	0.01	0.01	0.04	0.72

MW effect	55th	60th	65th	70th	75th	80th	85th	90th	95th
For poor prov	0.029	0.128	0.148	0.289*	0.292*	0.406*	0.248	-0.184	-0.294
	(0.154)	(0.141)	(0.136)	(0.148)	(0.167)	(0.201)	(0.202)	(0.280)	(0.339)
R2	0.20	0.21	0.22	0.22	0.22	0.22	0.21	0.19	0.13
Obs	283417	283417	283417	283417	283417	283417	283417	283417	283417
Non poor prov	0.191***	0.144*	0.028	0.043	-0.013	0.017	0.008	-0.029	0.266*
	(0.067)	(0.073)	(0.082)	(0.067)	(0.068)	(0.081)	(0.112)	(0.125)	(0.152)
R2	0.37	0.38	0.38	0.38	0.37	0.36	0.33	0.28	0.19
Obs	508125	508125	508125	508125	508125	508125	508125	508125	508125
Chi2-pval	0.31	0.91	0.44	0.12	0.08	0.06	0.28	0.60	0.12

Note: The summary table reports the point estimates of log hourly minimum wage (MW) on the RIF transformation of log hourly wage for a specific percentile q. Data: pooled quarterly LFS 2002-2013 arbitrarily split by poverty ranking into equally sized groups (38 provinces). Poverty ranking is based on poverty headcount per province in year 2011 (using household level data from SES 2011) and national poverty line. "Non poor" provinces have an average headcount ratio of 6.4 percent, "poor" provinces 20.3 percent. Poor provinces are located in Northeast (14), North (12), Centre (10) and South (2). The sample represents male private sector workers (excluding agricultural workers). Robust standard errors in parenthesis clustered at province level (* p<.10 ** p<.05 *** p<.01). We report a χ^2 test p-value for joint equality of the minimum wage variable on the two samples. All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Other controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work, all interacted with quarter-year dummies), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects, province-specific time trends.

A.4. Differences between national and provincial RIF

Figure 12: Annual share of workers below the quantile cut-offs of National and Provincial log wage distributions, 2002-2013.



Note: LFS quarterly data 2002-2013. The figure above reports the share of male private employees over total number (excluding agricultural workers) with log wage below a quantile cut-off (for selected quantile cut-offs at percentiles 5, 10, 15, 20, 55, 60, 65, 70) of either quarter-year distribution at national level (labeled "Nat") or quarter-year distribution at provincial level (labeled "Prov"). In other words, we look for each RIF

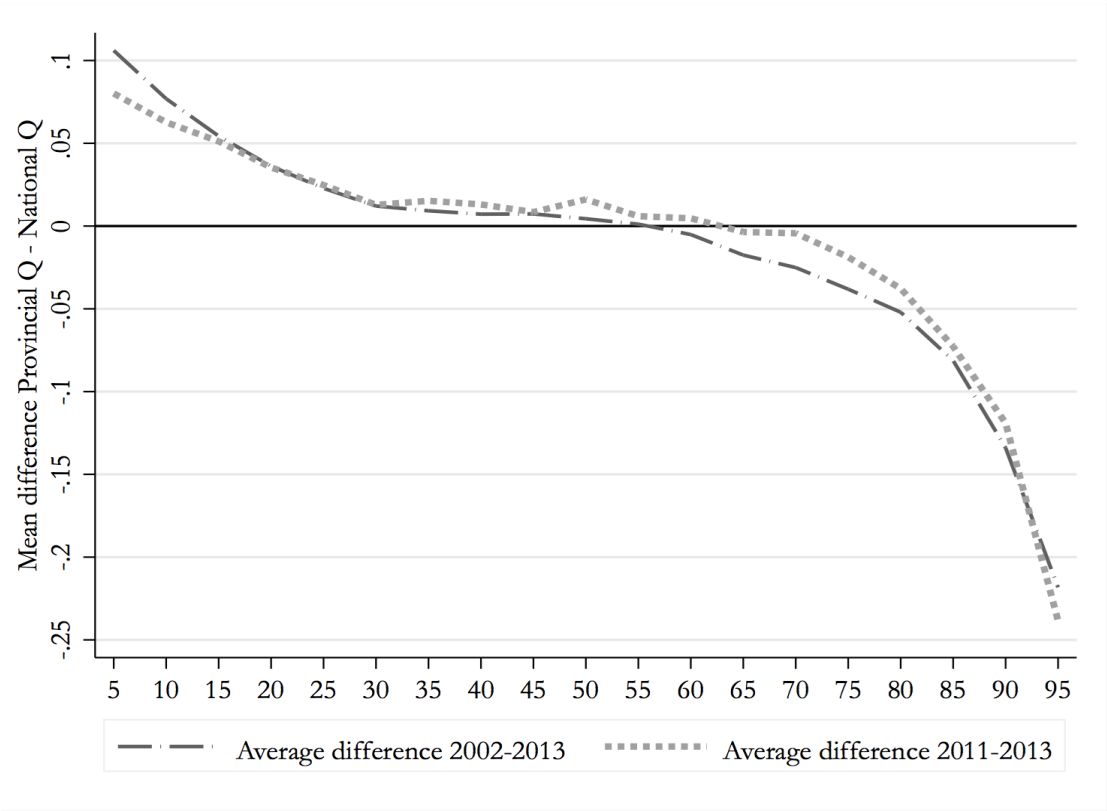
transformation of quantile q_τ, what is the share of individuals with identity measure $\boldsymbol{I}(Y \leq q_\tau)$. The shares are cumulative (i.e. the 15th percentile cut-off will include the share of workers of the 5th and 10th cut-offs). The visual comparison of the population in both distributions suggests that with the provincial RIF transformation the private workers are more spread across the distribution, in example a greater number of individuals compose the bottom 5 and 15 of the provincial wage distribution.

Table 20: Comparison of selected distributional cut-offs for provincial RIF means, their distance to the national RIF and test statistics (2002-2013)

	5th percentile			45th percentile			90th percentile			Mean
Year	P	P-N	t	P	P-N	t	P	P-N	t	Y gap
2002	2.63	0.13	0.00	3.36	-0.01	0.00	4.23	-0.14	0.00	-0.01
2003	2.65	0.12	0.00	3.37	0.00	0.26	4.29	-0.14	0.00	-0.01
2004	2.64	0.12	0.00	3.35	0.00	0.49	4.27	-0.12	0.00	-0.01
2005	2.66	0.09	0.00	3.37	0.00	0.28	4.28	-0.13	0.00	-0.01
2006	2.70	0.10	0.00	3.37	0.01	0.00	4.24	-0.12	0.00	-0.01
2007	2.74	0.12	0.00	3.39	0.01	0.00	4.24	-0.15	0.00	-0.01
2008	2.75	0.12	0.00	3.39	0.02	0.00	4.21	-0.16	0.00	-0.02
2009	2.78	0.13	0.00	3.42	0.02	0.00	4.26	-0.16	0.00	-0.01
2010	2.79	0.11	0.00	3.43	0.01	0.00	4.24	-0.13	0.00	-0.01
2011	2.83	0.07	0.00	3.45	0.02	0.00	4.23	-0.11	0.00	-0.01
2012	2.95	0.09	0.00	3.55	-0.01	0.00	4.33	-0.12	0.00	-0.01
2013	3.12	0.08	0.00	3.69	0.02	0.00	4.41	-0.12	0.00	-0.01

Note: The table above aims to compare how the average provincial quantiles (mean of 76) differ in size to the national quantiles over time. Here we report statistics for log real hourly wages of male private sector workers excluding agriculture, evaluated at 5th, 45th and 90th percentile means for provincial (P) or national (N) distributions. The first column ("P") reports the mean value for provincial quantile, the second ("P-N") reports the difference in means between provincial and national means at the specific percentile and column "t" reports the t-test (with equal or unequal variance). The 5th percentile column shows that there is a statistically greater value for the provincial quantile mean over time, but this gets reversed around the 45th percentile (with no statististically significant difference between the distribution means, with this event changing over the years with lowest switching at the 35th and highest at 65th). After the 45th percentile greater magnitude is seen in the national means over time. This is suggestive of greater nuances (weights) captured by the provincial quantiles for the lower tail of wage distribution and higher nuances (weights) for the national around and after the median quantile and especially at the top tail. The last column ("Mean Y gap") reports the average yearly gap among 19 percentiles (taking the average of percentile mean gaps from the 5th to 95th with 5 percentiles intervals), showing that overall average provincial wages are only slightly smaller than the national one.

Figure 13: Average mean quantile differences between provincial and national wage distributions, years 2002-2013 and 2011-2013.



Note: The figure aims to compare how the average provincial quantiles (mean of 76) differ in size to the national quantiles over time. The point estimates plotted on the graph refer to the average gap between the average value at provincial level and the national value. The first line (darker, in dash-dot) refers to the average difference per quantile between 2002-2013, the second line (lighter, in dot) refers to years 2011-2013. The figure shows that provincial distributions have higher mean quantile levels on average than national quantile means. However, passed the median the provincial mean tends to be twice as smaller then the national one. This difference is persistent by applying the comparison to different time periods.

Table 21: National RIF regression (excluding agriculture), 2002-2013; 2011-2013.

Panel A	2002-2013									
National	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	-0.005	0.104	-0.115	-0.146	-0.013	0.170**	0.348***	0.386***	0.378***	0.476***
	(0.122)	(0.082)	(0.095)	(0.096)	(0.080)	(0.073)	(0.049)	(0.045)	(0.035)	(0.053)
R2	0.10	0.16	0.21	0.25	0.28	0.31	0.34	0.35	0.35	0.36
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.408***	0.366***	0.192***	-0.135***	0.011	-0.320***	0.444***	0.437***	0.513***	
	(0.056)	(0.063)	(0.056)	(0.041)	(0.055)	(0.076)	(0.082)	(0.099)	(0.191)	
R2	0.37	0.37	0.38	0.38	0.37	0.35	0.33	0.29	0.21	
Panel B	2011-2013									
National	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Log MW	0.068	-0.010	-0.186	0.121	0.382***	0.594***	0.931***	1.023***	0.852***	0.486***
	(0.274)	(0.192)	(0.133)	(0.130)	(0.111)	(0.104)	(0.117)	(0.125)	(0.146)	(0.097)
R2	0.10	0.16	0.20	0.25	0.29	0.32	0.34	0.36	0.36	0.37
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Log MW	0.276**	0.383***	0.217**	0.057	0.351***	-0.398***	0.470***	0.156	-0.994***	
	(0.113)	(0.107)	(0.103)	(0.081)	(0.111)	(0.121)	(0.143)	(0.191)	(0.187)	
R2	0.38	0.39	0.39	0.38	0.37	0.36	0.33	0.28	0.19	

Note: The summary table reports the point estimates of log hourly minimum wage on the National RIF transformation of log hourly wage for a specific percentile *q*. Data: Panel A pooled quarterly LFS 2002-2013, Panel B for years 2011-2013. The sample represents male private sector workers (excluding agricultural workers). Robust standard errors (parenthesis) are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). Controls applied come from the most saturated model.

A.5. Robustness for distributional analysis

A.5.1. Comparison with Two-step prediction

To address the concern that by pooling individual observations for different provincial percentiles together we may capture some "aggregation bias" in different wage structures we report a two-step procedure to evaluate the effect of the minimum wage on the provincial wage structure. Note that the "aggregation bias" that we refer to is the potential bias represented by aggregation of different provincial wage structures in the reduced form equation, allowing the error structure to contain the noise within each labour market. This is different in spirit to what is typically referred in the wage literature as aggregation bias of skill-level and job complexity for employees, as explained in the minimum wage paradox by Teulings (2000). The two-step procedure, in a fashion similar to a selection model (Oaxaca Blinder), first models the RIF transformation and then regresses the yearly provincial binary predicted value on the policy variable and controls.

We simplify the notation of the first-stage equation below to imply that each individual i in each time period t (year) has a wage (transformed) falling in a specific percentile τ. For each quantile in each year t the RIF transformation is regressed on a set of individual characteristics, quarter t and province p dummies:

$$RIF_{w_{i\,p\,t},q_{\tau pt}} = \alpha_0 + \alpha_1 X_{i\,p\,t} + \psi_p + \psi_t + \mu_{i\,p\,t}$$

$$\widehat{\psi_{pT,q_{\tau pT}}} = \beta_0 + \beta_1 ln(MW_{p\,T}) + \beta_2 X_{p\,T} + \xi_{p\,T}$$

In the second stage we take the predicted value of the provincial binary variables ($\widehat{\psi_{pT,q_{\tau pT}}}$) and we pool them together over time and regress them on our policy of interest and a set of geographic-specific controls using weighted least squares (WLS), where the weights are provided by the inverse of the standard error for the corresponding provincial fixed effect.

Table 22: Two-step procedure: Second stage of the effect of minimum wage on the predicted provincial binary variables, 2002-2013.

	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
ln MW	0.215***	0.132***	0.120***	0.128***	0.164***	0.195***	0.181***	0.148***	0.151***	0.058***
	(0.047)	(0.034)	(0.030)	(0.028)	(0.025)	(0.023)	(0.021)	(0.022)	(0.020)	(0.021)
R^2	0.83	0.86	0.88	0.89	0.90	0.90	0.91	0.92	0.92	0.93
	55th	60th	65th	70th	75th	80th	85th	90th	95th	
ln MW	0.047**	0.007	-0.030	0.013	0.011	-0.018	-0.030	-0.075***	0.004	
	(0.019)	(0.019)	(0.018)	(0.019)	(0.019)	(0.020)	(0.022)	(0.027)	(0.042)	
R^2	0.93	0.93	0.94	0.93	0.94	0.92	0.90	0.86	0.80	

Note: LFS 2002-13, second step regression of predicted provincial dummies on log real minimum wage, using weighted least squares (WLS) where the weights are provided by the inverse of the standard error for the corresponding provincial fixed effect, robust standard errors clustered in parenthesis. Controls 1st stage: provincial dummies, individual level variables interacted with quarter dummies (schooling, married, experience and its squared, full-time), rural, industry dummies, firm dummies, round dummies. Controls 2nd stage: log real hourly MW, share of youth, share of elderly, share of high skilled, log per capita GPP, province-specific trends. Note that (1) the main difference between the estimation proposed here and the single provincial RIF estimation is that here we predict the provincial wage structure year by year rather than in each quarter-year (2) the exclusion of the trends does not alter the significance reported here, but slightly increases the magnitude of the point estimates.

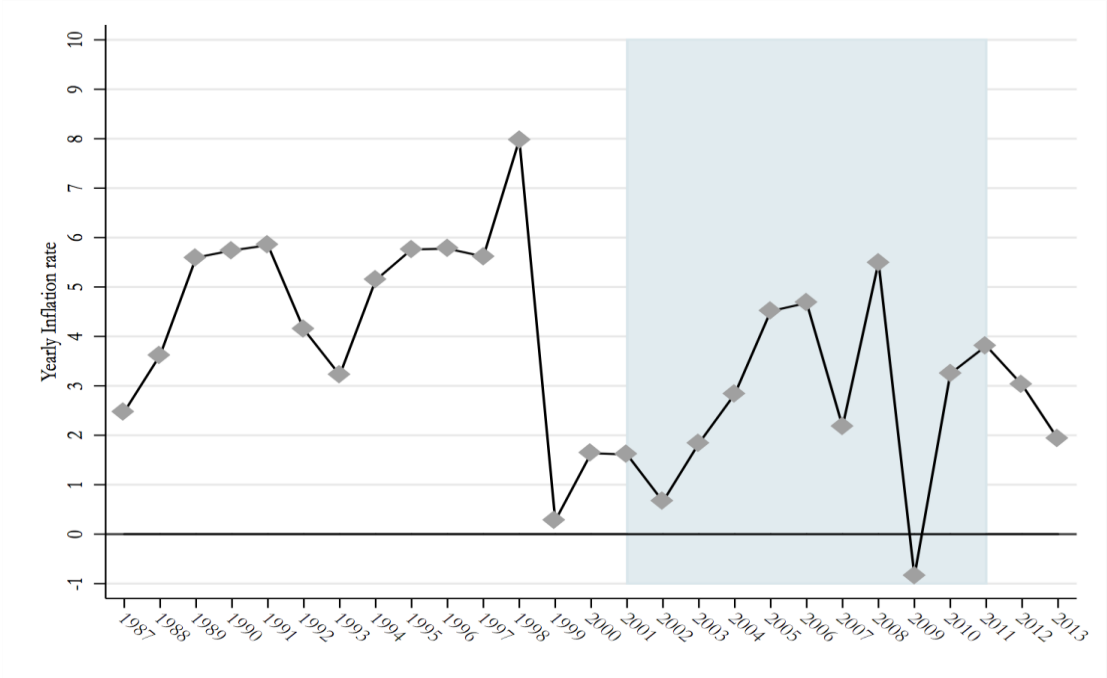
A.5.2. Inflationary effects, spatial and national CPI comparisons

To address the reliability of our estimation results we proceed to change the type of deflator used for constructing the wage distribution. In our main results we proposed a deflator which reflects the quarterly variations (quarterly national CPI with base year 2013 Q3). However, we acknowledge that for the full time period under analysis, Thailand experienced an economic recovery from the Asian financial crisis, partially reflected in price changes. Additionally, both the 2007-2008 world food price crisis, the oil price hikes and the 2008 global financial crisis may have affected (in)directly domestic price movements with different strength and variation across areas. Thus, a national CPI may be underestimating the wage effects if some areas have recovered rapidly or if purchasing power has grown with different trends between rural and urban areas.

To account for this, we assess whether there have been highs or lows in inflation. Figure 14 shows that after the Asian financial crisis, the inflation staid fairly stable until 2001, followed by a hike until year 2008, then returning to more stability afterwards. Following, we apply the SCPI to the monetary variables of our main specification. Noting that a yearly CPI does not fully capture the seasonality in prices if applied to quarterly data, we interpret the SCPI estimations with caution. The estimates for the full time period under analysis (2002-2013) in Figure 15 suggest that the minimum wage effect to be larger than the ones using quarterly CPI by approximately 0.21 percent (0.17 between the 5-50 percentiles and 0.25 between the 55-95 on average). Looking at a shorter time period of more stability in inflation (2011-2013, 12 quarters), the two specifications (Figure 16) display almost similar results (with an average of 0.04 greater beta coefficient for the

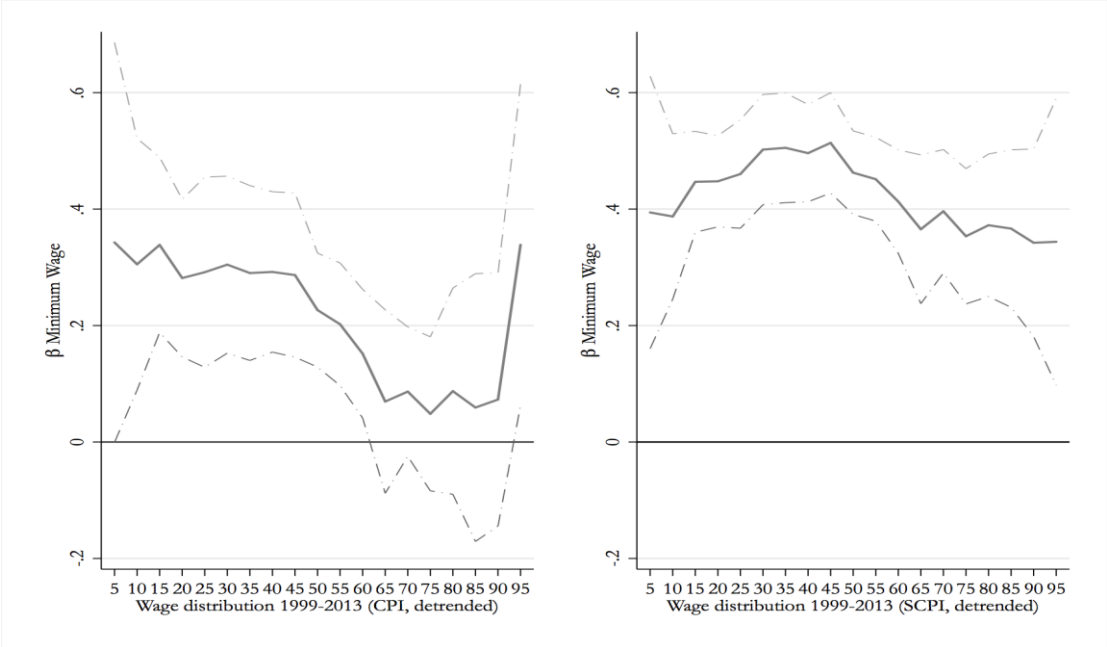
minimum wage in the estimation using national CPI). Thus, although the long-run analysis might be over-inflated, we assert that the estimates go in similar direction of magnitude.

Figure 14: National yearly inflation rate, 1987-2013.



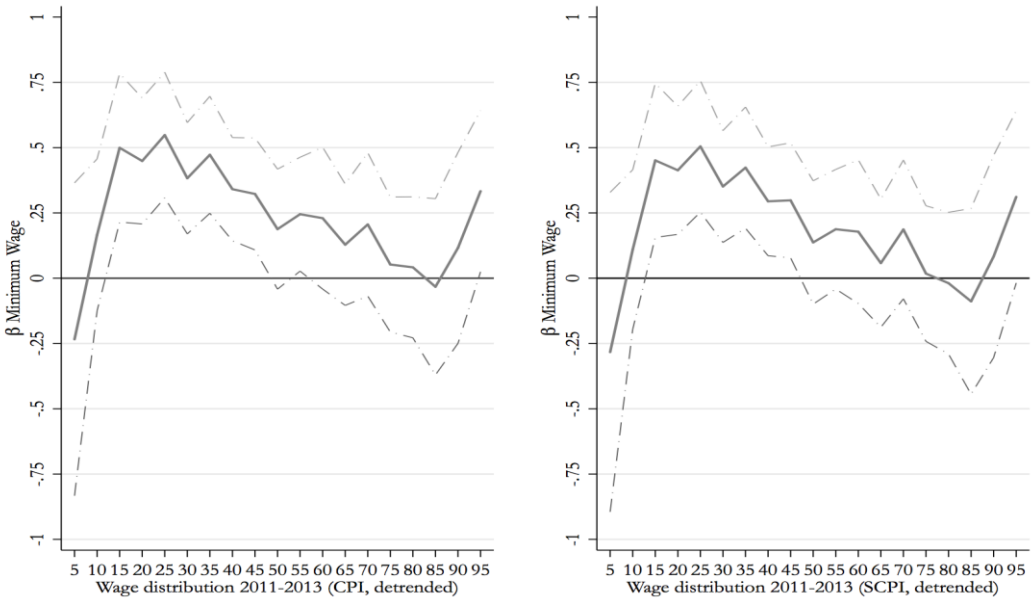
Note: Authors calculation using 1986-2013 yearly Consumer Price Index data for all commodities (TDRI). Inflation as captured by the CPI represents the annual percentage change in the cost to a representative consumer of acquiring a basket of goods and services. Change (in %, reported on y-axis) for consumer prices is calculated for the whole Kingdom. The figure displays the average yearly inflation rate to be high till the financial crisis (1997), then low in the recovery phase (till 2002), high again till 2008 and reducing after 2011. The shaded area in the graph represents the period of provincial minima being in vigour (prior introduction of the National Minimum between 2012 and 2013).

Figure 15: Comparison of the effect of Minimum wage on CPI-deflated versus SCPI-deflated distributions, 1999-2013.



Note: LFS quarterly data (1999-2013) for male private sector workers (excluding agriculture). The wage distributions are reported on the x-axis, and the regression coefficient from log real minimum wage is reported on the y-axis. The left panel reports the estimation for all monetary variables deflated by quarterly CPI (base 2013Q3). The right panel reports the estimation for all monetary variables deflated by yearly spatial CPI (SCPI, base 2011)

Figure 16: Comparison of the effect of Minimum wage on CPI-deflated versus SCPI-deflated distributions, 2011-2013.



Note: LFS quarterly data (2011-2013) for male private sector workers (excluding agriculture). The wage distributions are reported on the x-axis, and the regression coefficient from log real minimum wage is reported on the y-axis. The left panel reports the estimation for all monetary variables deflated by quarterly CPI (base 2013Q3). The right panel reports the estimation for all monetary variables deflated by yearly spatial CPI (SCPI, base 2011).

A.6. Multi-way clustering

In this section we report the construction of multi-way clustering proposed by Cameron et al. (2011). Note that the variance estimator proposed by Cameron et al. (2011) in principle is similar to the estimator proposed by Conley (1999) for spatial data in which weights are specified to decay towards zero as distance between objects widens. We choose to apply the two-way clustering for two reasons: first it allows the correlation in the error being driven by common shocks, which have a factor structure rather than a decaying dependence as in spatial analysis; second, even if less relevant to the main geographic interaction we are seeking to isolate in the data, the approach allows the clusters to be non-nested. Note that using this error structure we rely on a weak distributional assumption of independence of observations that share no clusters in common (Cameron et al., 2011).

Table 23: One versus two-way clustering comparison of minimum wage effect, RIF regression, saturated model 2002-2013.

Cluster (mat size)	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
No cluster	0.052	0.034**	0.027***	0.024***	0.022***	0.021***	0.020***	0.020***	0.020***	0.021***
Province (76)	0.141	0.083	0.063***	0.052***	0.066***	0.065***	0.062***	0.058***	0.059***	0.038***
Region (5)	0.158	0.067	0.023***	0.026***	0.051***	0.059***	0.064***	0.062***	0.066***	0.043***
Prov-Year (76x12)	0.179	0.091	0.064***	0.059***	0.063***	0.058***	0.053***	0.039***	0.041***	0.039***
Reg-Year (5x12)	0.181	0.080	0.049***	0.052***	0.060***	0.057***	0.061***	0.051***	0.059***	0.042***
Prov-Regyr (76x60)	0.168	0.098	0.071***	0.055***	0.068***	0.072***	0.072***	0.069***	0.074***	0.055***
Cluster (mat size)	55th	60th	65th	70th	75th	80th	85th	90th	95th	
No cluster	0.022***	0.023***	0.024	0.027**	0.030	0.035**	0.041**	0.051*	0.073***	
Province (76)	0.041***	0.044***	0.068	0.047	0.059	0.073	0.090	0.099	0.127*	
Region (5)	0.051**	0.065	0.102	0.069	0.086	0.101	0.135	0.118	0.083**	
Prov-Year (76x12)	0.044***	0.059**	0.067	0.057	0.054	0.088	0.146	0.099	0.126**	
Reg-Year (5x12)	0.050***	0.065*	0.091	0.065	0.072	0.098	0.209	0.166	0.100**	
Prov-Regyr (76x60)	0.062***	0.069*	0.093	0.089	0.099	0.112	0.138	0.143	0.141*	

Note: The standard errors with significance level are reported. This table reports a comparison of standard errors for minimum wage variable (starting with no cluster) or clustered either at province or regional level (one-way cluster in the second and third rows of each sub-panel, but note that single region clustering suffers of too reduced number of cells created) against two-way clustering (Cameron et al., 2011) of the Province variable clustered with either a time control (Year), or a group variable of Region and Year (Regyr) or the Region variable clustered with Year. Estimations come from a RIF regression of log wages for male private sector workers (excluding agriculture) using pooled quarterly data from LFS 2002-2013 (791,542 observations, controls from the saturated model). The size of the joint matrix is reported into parenthesis. The two-way clustering appears to increase the standard error. The Reg-Year and Prov-Regyr cluster groups are the ones of most interest at they assume there could be a specific within-geographic clustering (i.e. due to shocks) affecting some grouped observations. Both clustering types increase the standard error and show significance of the estimator from the 15th to 60th quintile, thus strengthening the reliance of the estimates.

Table 24: One versus two-way clustering comparison of minimum wage effect, RIF regression, saturated model 2011-2013.

Cluster (mat size)	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
No cluster	0.127*	0.080**	0.058***	0.051***	0.046***	0.044***	0.043***	0.043***	0.044***	0.046***
Province (76)	0.301	0.146	0.143***	0.121***	0.121***	0.107***	0.112***	0.099***	0.108***	0.115
Region (5)	0.233	0.047**	0.087***	0.069***	0.086***	0.079***	0.080***	0.059***	0.059***	0.052**
Prov-Year (76x3)	0.223	0.115	0.093***	0.083***	0.052***	0.076***	0.065***	0.067***	0.047***	0.049***
Reg-Year (5x3)	0.214	0.087*	0.068***	0.063***	0.041***	0.066***	0.038***	0.042***	0.027***	0.035***
Prov-Regyr (76x15)	0.248	0.089*	0.109***	0.092***	0.105***	0.100***	0.118***	0.121***	0.131**	0.147
Cluster (mat size)	55th	60th	65th	70th	75th	80th	85th	90th	95th	
No cluster	0.048***	0.051***	0.054**	0.061***	0.068	0.078	0.089	0.105	0.154**	
Province (76)	0.109**	0.136*	0.117	0.138	0.130	0.136	0.169	0.184	0.155**	
Region (5)	0.069**	0.112	0.078	0.111	0.050	0.095	0.205	0.213	0.096**	
Prov-Year (76x3)	0.044***	0.059***	0.038***	0.043***	0.065	0.063	0.098	0.109	0.119***	
Reg-Year (5x3)	0.034***	0.043***	0.026***	0.040***	0.042	0.041	0.074	0.095	0.108***	
Prov-Regyr (76x15)	0.163	0.199	0.206	0.243	0.239	0.268	0.292	0.250	0.161**	

Note: The standard errors with significance level are reported. This table reports a comparison of standard errors for the minimum wage variable (starting with no cluster) or clustered either at province or regional level (one-way cluster in the second and third rows of each sub-panel) against two-way clustering (Cameron et al., 2011) of the Province variable clustered with either a time control (Year), or a group variable of Region and Year (Regyr) or the Region variable clustered with Year. Estimations come from a RIF regression of log wages for male private sector workers (excluding agriculture) using pooled quarterly data from LFS 2011-2013 (205,075 observations, controls from the saturated model). The size of the joint matrix is reported into

parenthesis. The two-way clustering appears not to improve the one-way clustering, with only a modest change in the standard errors created in the Province x Region-year clustering. This may be indicative of either no strong geographic clustering in the error structure (except for intrinsic province-specific noise accounted by the single clustering and the controls) or to too little number of clusters created. Thus, the results suggest that single clustering at province-level best captures the variance in the data.

Table 25: RIF regressions of log minimum wage with set of controls, 1999-2013.

Extended time period: β estimate of log minimum wage, 1999-2013										
Percentile	5th	10th	15th	20th	25th	30th	35th	40th	45th	50th
Simple	0.325**	0.310**	0.336**	0.307**	0.317**	0.334**	0.317**	0.313**	0.311**	0.251**
	(0.143)	(0.101)	(0.080)	(0.071)	(0.082)	(0.077)	(0.075)	(0.063)	(0.061)	(0.058)
Interactions	0.318**	0.280**	0.312**	0.276**	0.277**	0.301**	0.286**	0.292**	0.293**	0.240**
	(0.139)	(0.098)	(0.077)	(0.067)	(0.077)	(0.076)	(0.076)	(0.072)	(0.073)	(0.056)
P*T Trends	0.350**	0.334**	0.359**	0.310**	0.327**	0.332**	0.313**	0.303**	0.293**	0.223**
	(0.173)	(0.109)	(0.078)	(0.071)	(0.082)	(0.073)	(0.067)	(0.051)	(0.050)	(0.051)
Saturated	0.343*	0.305**	0.338**	0.282**	0.292**	0.305**	0.290**	0.292**	0.287**	0.227**
	(0.172)	(0.108)	(0.076)	(0.068)	(0.082)	(0.076)	(0.075)	(0.069)	(0.071)	(0.049)
Percentile	55th	60th	65th	70th	75th	80th	85th	90th	95th	
Simple	0.243**	0.221**	0.164**	0.180**	0.152**	0.161*	0.111	0.136	0.437**	
	(0.058)	(0.063)	(0.073)	(0.062)	(0.075)	(0.093)	(0.095)	(0.100)	(0.170)	
Interactions	0.222**	0.179**	0.110	0.107*	0.070	0.083	0.023	0.023	0.255**	
	(0.057)	(0.064)	(0.084)	(0.063)	(0.073)	(0.091)	(0.113)	(0.107)	(0.122)	
P*T Trends	0.208**	0.182**	0.116*	0.154**	0.128**	0.159*	0.143*	0.187*	0.512**	
	(0.055)	(0.056)	(0.066)	(0.051)	(0.062)	(0.082)	(0.085)	(0.104)	(0.178)	
Saturated	0.202**	0.152**	0.069	0.087	0.048	0.087	0.059	0.073	0.339**	
	(0.053)	(0.055)	(0.079)	(0.056)	(0.066)	(0.089)	(0.115)	(0.109)	(0.138)	

Note: The table reports the coefficient of log real hourly minimum wage on the RIF measure from a set of estimation with different controls from least to most saturated models using LFS 1999-2013 data, pooled quarterly data for male private sector workers excluding agriculture. Standard errors in parenthesis are clustered at province level (* p<.10 ** p<.05 *** p<.01). All monetary variables are deflated by quarterly CPI (base year 2013 Q3). In each sub-panel the first row ("Simple") uses as controls: individual-level variables (years of schooling, marital status, expected experience and its squared, whether in full-time work), industry dummies (6 groups), firm size dummies (5 groups), provincial-level variables (share of young population, share of elderly population, share of individuals in labour force with secondary education or greater, log per capita GPP), rural binary, time and province fixed effects. In the second row ("Interactions") the individual-level variables of the first specification are interacted with quarter-year dummies. In the third row ("P*T Trends) we add to the first specification the province-specific time trends. In the last row ("Saturated") we jointly add the individual-level variables interacted with time and the province-specific time trends.

B. Latest literature of minimum wage effects in Thailand

Del Carpio et al. (2014) applies a Difference-in-difference estimator to 1998-2010 data (thus prior the change to statutory wage) and show dis-employment effects on female, elderly, and less-educated workers, plus it shows evidence of large positive effects on the wages of prime-age male workers and consumption inequality.

Ariga (2015) compares the effect of minimum wage changes on a selected sample of daily-paid workers and monthly-paid workers and shows with descriptive statistics that daily wage-workers are the ones affected in their wage schedule post minimum-wage changes.

Looking at employment effect, Ariga (2015) finds that there is positive employment effect for workers paid daily wages, and it models competitive firms' cost of non-compliance, if firms put the wage below the minimum they would have to incur in higher costs for hiring (via public or private employment agencies), so they are incentivised to put it at the minimum (or higher). The model predicts that wages for complying firms are compressed and that there could be positive employment expansion for complying firms (assuming workers' heterogeneity). To test the model, it applies a switching regression: it creates a proxy measure for compliance and uses it as main explanatory variable in a participation probability model for being working "below or above the minimum" attached to wage equations for people below or above the minimum wage. Its findings suggest that minimum wage constrains the structure of daily-wage workers' pay, with larger negative treatment effects for small firms than for large ones. However, the article suffers of some inconsistencies in (1) data choice (2) no explanation on the use of sample size and time under analysis (3) use of a switching regression with one predicted variable for one year applied to multiple years backward-looking, with no explanation on its variation over time nor on representativeness. For the relevance of our analysis, Ariga (2015) gives some insights on the wage distribution across firm-size: it finds that for daily-wage earners the non-complying average wage level is higher (in relative terms) in big firms than in smaller, but for daily-wages above the minimum wage no such difference is marked. So it concludes that large firms tacitly "collude" to set the daily wage using the minimum wage as their anchor.

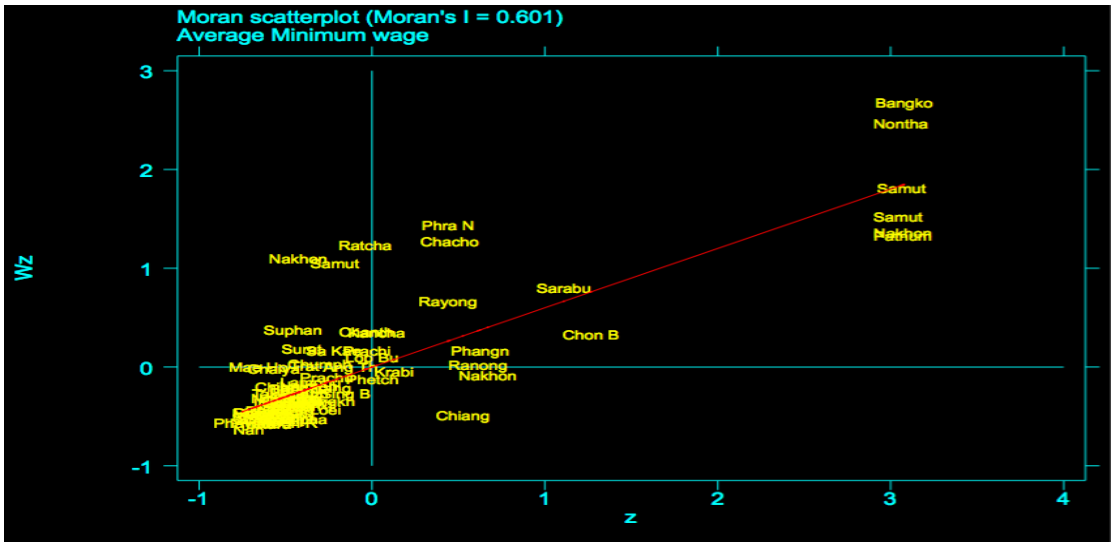
C. Spatial autocorrelation of minimum wages

Given the Thai context and the methods proposed in this article, there is interest to investigate the level of co-movement in minimum wages set at provincial level prior the national minimum was introduced. To do so, we apply a local spatial correlation test to assess the trends within provincial boundaries over time. In the construction of the contiguous weighting matrix, we are able to perform the analysis for 75 provinces out of 76 because the province of Phuket does not have continuous borders with the mainland. In addition to this restriction, we perform the indices by grouping the province of Bueng Kan to Nong Khai[27], and in future robustness we will also perform the spatial analysis by

[27] The province of Bueng Kan created in 2011 after partition of Nong Khai, is not present in the map coordinates available at time of writing so it is incorporated as part of Nong Khai.

(1) superimposing proximity of Phuket to the mainland (2) excluding information recoded under Bueng Kan province for the latest years of survey in which the province is recorded. The weighting matrix is a binary matrix equal to 1 if a province i has a contiguous border with province j and 0 otherwise (created with queen contiguity, that is two provinces are neighbours if they share a border). For the Moran' I test we row-standardize the weighting matrix, meaning that each element in a row is divided by the sum of elements in the row. The scatterplot below suggests some degree of clustering among some provinces (any group which diverts from the origin), with a Moran's I of 0.6 which is a not too pervasive measure, but it suggests necessity of testing for cross-sectional dependence in the econometric estimations (forthcoming).

Figure 17: Local Spatial Moran's I scatterplot for average minimum wage levels between 1998-2012.



Note: Authors' own calculations using LFS data 1998-2012. Year 2013 is excluded due to non-variation in the minimum wage (set at 300Baht).