MINIMUM WAGES AND UNEMPLOYMENT:
EMPIRICAL EVIDENCE FROM PANEL DATA ON RUSSIAN REGIONS

By

TEN, Gi Khan

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

2015

MINIMUM WAGES AND UNEMPLOYMENT:
EMPIRICAL EVIDENCE FROM PANEL DATA ON RUSSIAN REGIONS

By

TEN, Gi Khan

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

2015

Professor Shun Wang

MINIMUM WAGES AND UNEMPLOYMENT:

EMPIRICAL EVIDENCE FROM PANEL DATA ON RUSSIAN REGIONS

By

TEN, Gi Khan

THESIS

Submitted to
KDI School of Public Policy and Management
in partial fulfillment of the requirements
for the degree of

MASTER OF DEVELOPMENT POLICY

Committee in charge:

Professor Shun WANG, Supervisor

Professor Lisa LIM

Professor Ju Ho LEE

Approval as of December, 2015

MINIMUM WAGES AND UNEMPLOYMENT: EMPIRICAL EVIDENCE FROM PANEL DATA ON RUSSIAN REGIONS

By

TEN, Gi Khan

ABSTRACT

The relationship between minimum wages and unemployment is a widely debated topic among economists and policy makers. However, only a few attempts to study this issue on Russian labor market have been done. By using one of the most effective empirical tools, which is Instrumental Variables approach, it was determined that minimum wages policies do have an adverse impact on unemployment rates in Russian regions. After exploiting an exogenous variation in minimum wages across regions and time, the results are expected to be unbiased and consistent. The results are robust to alternative model specifications.

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION AND LITERATURE OVERVIEW.

Unemployment is the macroeconomic problem that severely affects state's performance. It's no surprise that unemployment is a common topic of debates among policy makers, that often claim that their proposed policies would help to improve labor market's condition. While some policies, such as job-training programs, did prove to be effective, minimum wages policies indeed remain one of the most controversial issues among academic circles and policy makers. Proponents of minimum wages hikes highlight that such policies can be used as a tool to reduce inequality by shrinking the bottom tail of a state's income distribution (Almeida and Terrell, 2008). However, opponents argue that wage rigidity, or, in other words, the failure of wages to adjust to a level at which labor supply interacts with labor demand, is a cause of a disemployment effect of such policies and hence they harm, rather than protect the state's labor market stability.

1.1 Developed Countries.

A review of recent studies will be started from observing the evidences from the US labor markets. The earliest generations of studies tend to rely on time-series techniques and show an adverse effect of minimum wages' raises on teenagers and non-whites (Adams, 1987; Brown, Gilroy and Cohen, 1982). Further researches relied predominantly on survey-based longitudinal and/or cross-sectional micro data and demonstrated contradictory evidences of disemployment effects: in some cases the estimated employment elasticities were either statistically insignificant, or even positive (Card and Krueger, 1994; Neumark and Wascher, 1994, 2004). These findings are partially consistent with a well-known monopsony model first introduced by Joan Robinson (1933)[1]:

[1] It's important to emphasize a *partial* consistency of empirical findings with theoretical predictions. For example, difference-in-difference estimation of the US low-wage segment of labor market conducted by Card and Krueger (1994) shows a significant positive effect of minimum wages' hikes on employment in the fast-food industry. However, Card and Kruger emphasize that much of the burden of increased production costs were passed on by companies to their consumers by establishing higher prices, so that it is hard to attribute fully a positive employment effect to monopsony model's theory.

Suppose a static, partial equilibrium in a "company town" labor market, where there are little options for low-wage workers and hence they have to either accept the monopsonist's wage offer or leave the labor force. Hence, the company's profit (P) is a function of revenue (R) and labor cost (wage (w) multiplied by number of workers (L)):

$$P(L) = R(L) - w(L)x\ L$$

Thus, the profit maximization may be determined as following:

$$P'(L) = R'L - \left(w(L)\ x\ L\right)'$$

$$P'(L) = R'(L) - w(L)'\ x\ L - w(L),$$

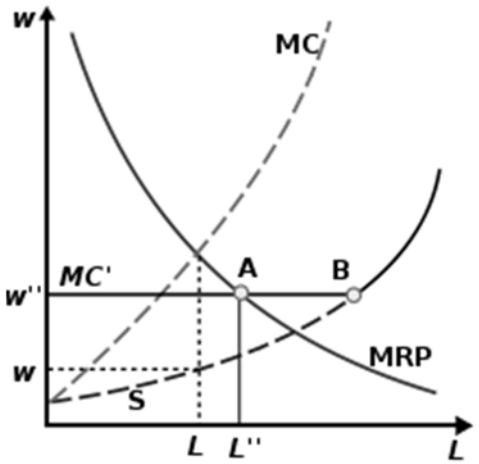
where maximum profit P^{max} occurs when $P'(L) = 0$. Consequently,

$$0 = R'(L) - w(L)'\ x\ L - w(L)$$

$$R'(L) = w(L)'\ x\ L + w(L),$$

where $R'(L)$ is the *marginal revenue product* of labor (MRP), while the right-hand side of the equation is the *marginal cost* of labor (MC).

Figure 1. Minimum Wages' effect on employment, a static monopsony model.



Note: The company maximizes its profit at point A, where MC =MRP. However, in this example minimum wages' level is established higher than competitive level and therefore leads to unemployment (AB).

Hence, if minimum wages increase still leads to profit gain, the company benefits on hiring additional workers. In the opposite case minimum wage hikes make the company fire workers (since the production cost exceeds revenue).

This model, however, has not grounded lots of researches. Perhaps, this is because a monopsony model ignores some "shock" effects, such as raising the productivity of company's operation to offset the increase in production cost. What is more important, some labor economists argue that only few labor markets have employers with monopsony power (Brown, Gilroy & Koshen, 1982; West & McKee, 1980). Finally, there are lots of other theoretical arguments why minimum wage hikes sometimes do lead to higher employment levels.

As in the case of the US labor market, evidences of minimum wage's impact on unemployment in other developed countries are mixed. Swidinsky (1980) claims that the estimated negative elasticity of teenage employment (defined as the most vulnerable segment of labor force) with respect to the minimum wages in Canada is sufficiently low. Thus, Swidinsky assures that the state's economic costs of a moderate increase in the minimum wage distribution would not be unduly severe. Similar results have been observed in the Spanish labor market, where higher employment in all industries was associated with higher minimum wages, while a totally opposite effect was peculiar to young workers (Garcia, Goerlich and Orts, 1994).

So far, most of the evidences from developed countries converge on the following point: minimum wages hikes lead to substitution of skilled labor for the most vulnerable (low-skilled and low-productive) labor segments (mostly presented by teenagers) with low marginal productivity.

1.2 Developing Countries.

A large fraction of the labor force in developing countries remains outside the regulatory framework, being employed in the informal economy with low income, low job security and no

social protection (Bachetta, Ernst and Bustamante, 2009). For example, the empirical evidence from the Indonesian market, where informal employment accounts for almost 70% of urban employment, shows that raises in state's minimum wages' level do lead to job losses (Comola and Mello, 2011). However, an interesting finding is that it doesn't result in higher overall state's unemployment and even increases a net increase in total (formal and informal) employment, since job losses in the formal sector are offset by job gains in informality.

Two significant economists, John R. Harris and Michael Todaro presented a general equilibrium model of dual economy, explaining some issues regarding rural-urban migration. One aspect of the model, which is minimum wages set institutionally in the urban, had been ignored by most of economists, however. Thus, Vassilis Paranos (2005) has given a very detailed discussion of the effects of minimum wages on sectoral unemployment based on original Harris-Todaro model.

Paranos claims, that if the elasticity of demand for labor with respect to minimum wages' level is lower than one, then, employment in the urban and rural sectors will fall and urban unemployment will be increased. This change may be grounded by simple logical explanation: displaced workers either shift to the rural (informal) sector, as it has been demonstrated by Comola and Mello, since the probability of finding job in urban area goes down, or stay in the urban sector "queuing" for a formal-sector job.

Similar impacts of minimum wages' increase may be observed in the Russian labor market where a significant evidence of its adverse effect has been found. More precisely, higher minimum wages were found to yield an increased youth unemployment and informality (Muravyev and Oschepkov, 2013). These findings are not without weaknesses, however (to be discussed in the further chapters).

Based on the empirical evidences presented above, one important caution should be emphasized. The one should be careful in equalizing such impacts as "job losses" and "increased

unemployment" in an attempt to study the labor market with high informality, since the "transition effect" draws a clear distinction between these terms (although they might be synonyms in developed countries). No negative impact of minimum wages' hikes on a state employment doesn't imply no disemployment effect, since displaced workers might simply shift to the informal sector and hence "hide" the magnitude of a minimum wages' impact on a state's job losses.

For the rest of the developing countries the literature on how minimum wages affect employment and informality are rather limited and hence more researches are required for better comprehension of this issue. In most countries, however, teenagers and ethnic minorities remain to be the most vulnerable group to minimum wages' hikes, while a high-skilled labor force keeps being unaffected

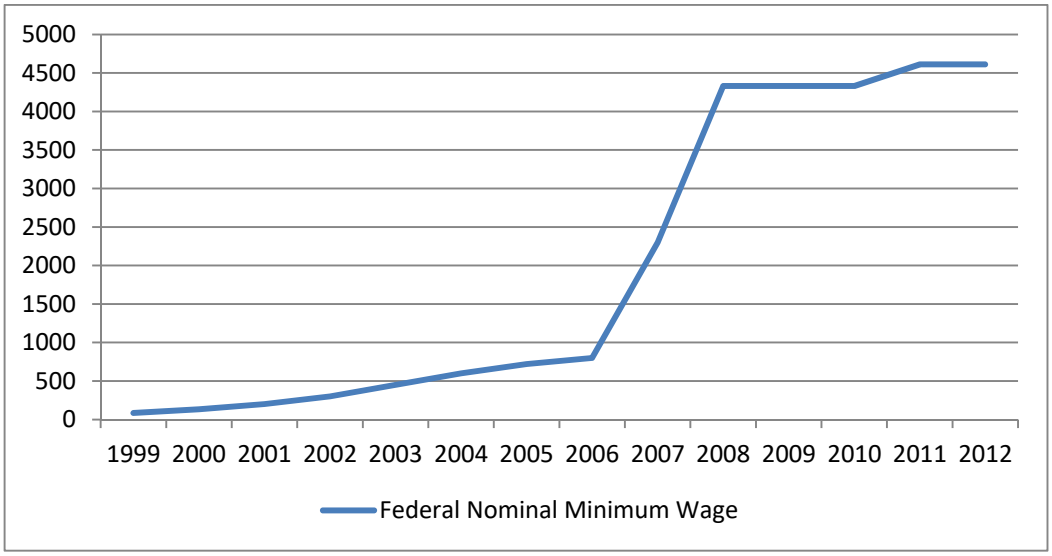
1.3 Institutional background.

The term "Minimum wage" in Russia implies a statutory minimum wages' level being used for determining salaries, unemployment benefits, taxes, premiums and other dues. Employers then are obliged to pay salary no lower than established minimum wage unless the employee works part-time (less than 40 hours per week).

The country has State minimum wage's level being regulated by relevant Federal Law, while Federal Subjects (since 2007) are allowed to establish their own level of minimum wages that must not exceed the nationwide one. Thus, in some Federal Subjects nominal minimum wage's level may exceed federal one twice or even more.

Unlike many other countries, Russian legislative system obliges employers to pay minimum wages to all full-time workers, regardless of age, sex or industry. The figure below shows the dynamics of federal nominal minimum wages' level.

Figure 2. Dynamics of nominal Federal Minimum Wage, 1999-2012.



Source: Federal law on the minimum wages of The Russian Federation

Four main questions are to be addressed in this research. First, what is the impact of regional minimum wages' adjustments on the Russian Labor market in general? Second, which subgroups of the economically active population are the most sensitive to the adverse effect of such policies? Third, will the result be consistent with previous findings in the Russian labor market after applying an exogenous source of regional minimum wages' variation to the model of estimation? And finally, what are the potential policy implications of the findings?

CHAPTER 2. AN EMPIRICAL EVIDENCE FROM PANEL DATA ON RUSSIAN REGIONS.

2.1 Data

My sample covers 80 out of 83 federal subjects from 2009 to 2012. The key data source of the main regional macro indicators is Russian Federal State Statistics service and National Labor Force Survey. No cumulative dataset on regional minimum wages exists, however. Hence, the data was obtained from respective Federal Laws and Labor Unions' agreements that establish regional minimum wages' levels.

Additionally, the data on average winter temperature and wind speed had been collected from Russian Hydrometeorological Center in order to compute a Winter Severity Index, also known as Bodman Index, which is one of the instruments for Minimum Wage variable. Further discussion of the validity of the instruments would be given in further chapters.

A descriptive statistics of all variables is given at Annex-I.

2.2 The Empirical Setting.

Let's consider the following equation, based on a standard neoclassical model of unemployment as a function of minimum wages and inflation:

$$\log unemployment_{it} = \beta_1 log\, rMW_{it} + \beta_2 log\, Inflation_{it} + X'_{it}\beta + A'_i\gamma + u_{it} \quad (1)$$

where $unemployment_{it}$ denotes U, T, Y, A, LE, HE or INF; rMW_{it} is real minimum wage (in 2008 prices), $Inflation_{it}$ is a regional inflation, A'_i is a set of unobserved time-invariant covariates, X'_{it} denotes a vector of regional-level covariates and ε_{it} is the error term.

It's worth to emphasize at this point that researches all around the world use different minimum wages variables in their attempts to identify their causal effect on unemployment. For

example, one of the most popular variables, which also grounded the most recent study of Russian labor market (Muravyev and Oschepkov, 2013), is so-called Kaitz index, defined as a minimum wage over mean wages ratio adjusted for coverage (Kaitz, 1970).This ratio has its pros and cons, however. While, to certain extent, it does make sense to attribute different labor market outcomes to this ratio (that has a greater variation in its definition), the one should clearly understand, that an estimated elasticity is also being driven by the denominator of Kaitz index (regional mean wages). Keeping in mind the existence of other minimum wage variables (fraction affected, the fraction at, the fraction below and so forth), it's almost impossible to compare the results of different studies. The estimation strategy of my research is then to exploit an ordinary variation of real minimum wages across different regions in different years (since, as it's mentioned in previous chapters, the same amount minimum wage is applied to all segments of workers in a given region) and consequently come up with a direct interpretation of an estimated causal effect.

Another problem that, so far, has been generally ignored by many researchers, is a reverse casualty that inevitably leads to biased estimation. Card and Krueger (1994) say, "Politicians from states in which an increase in the minimum wages is expected to have a strong effect on ... employment opportunities might oppose the increase, whereas those from states in which an expected effect is smaller might support it. In order to shed some light on this issue, following Baskaya and Rubinstein (2012), let's assume that local policy makers in a given region decide whether to keep local wage floors above federal one or not, following standard economic utility maximization theory:

$$\omega_{fs} = 1 \ (U^*_{fs} = f(\bullet) \geq 0),$$

where ω_{fs} is policy makers' propensity to keep minimum wages in federal subject equal to federal level and U^*_{fs} is a latent index of "utility" from such decision that, in turns, depends on a function $f(\bullet)$ of observable and unobservable factors. The traditional propensity is then a probability that $\omega_{fs} = 1$ conditional on $f(\bullet)$. However, even if a perfect data set of all factors

affecting legislators' decision regarding the magnitude of local minimum wage's level had been available, it would have barely eliminated the endogeneity problem. The reason is that the policy makers, being aware of an ambiguity of the consequences of their decision, are unlikely to push wages up in federal subjects, where unemployment is severe. If this assumption is true, then equation (1) actually implies:

$$\log unemployment_{it} = \beta_1 f(y)_{it} + X'_{it}\beta + A'_i\gamma + u_{it},$$

where, higher unemployment rate means higher probability that ω_{fs} would be equal to 1(since federal subjects, again, can't hold local minimum wage's level lower than federal) and hence the covariance of rMW and Unemployment is negative. Thus, as n→ ∞, the bias of Least Square Estimator would be the following:

$$\text{plim}(\widehat{\beta_1}) = \beta_1 - \frac{cov(rMW, Unemployment)}{var(rMW)}$$

$$\beta_1 = \text{plim}(\widehat{\beta_1}) + \frac{cov(rMW, Unemployment)}{var(rMW)},$$

which means that OLS estimator $\widehat{\beta_1}$ has a downward bias. A possible solution of the problem is an instrumental variable approach that is expected to produce unbiased and consistent estimators.

By definition, good instruments must be correlated with regional minimum wages but uncorrelated with any characteristics of labor market that may affect unemployment. Following Neumark and Wascher (1992), I include mean of the minimum wage level in geographically bordering federal subjects as my first instrument. The logic behind is the following: local policy makers are likely to observe the effect of minimum wages' hikes in neighboring federal subjects' labor markets. Higher minimum wages in neighboring federal subjects are then expected to affect positively the likelihood of pushing minimum wages' level up in a local labor market. Minimum wages in neighboring federal subjects, however, may be suspected to affect local labor market by attracting labor force to the regions with higher minimum wages, in which case the so-

called instrument should be included as an independent variable in the unemployment equation. This suspicion, however, has no ground to be valid, since the benefits from the migration in such a big country as The Russian Federation are likely to be offset by costs of moving in other regions for the sake of earning higher minimum wage.

The second instrument requires a more detailed discussion. If to review Russian labor market from the historical prospective, the one may notice, that in some regions, though unemployment rates were high, minimum wages were kept higher than federal floor. This phenomenon is explained by the existence of so-called Northern Multiplier: in the North and Far East, where the winter is much colder than in other regions, workers were paid higher minimum wages regardless of the labor market's condition. This was, according to the Labor Code of the Russian Federation, one of the forms of social benefits for workers living in regions with tough northern climate. The computation of minimum wages in federal subjects where Northern Multiplier existed, was straightforward:

$$\text{Regional MW} = \text{Federal MW} \times \text{Northern Multiplier},$$

where Northern Multiplier (depending on the closeness to the North) was varying from 1.1 to 2. For example, in 2006, while federal minimum wage's level was 1100, the workers in Chukotsky Autonomous Okrug (where Northern Multiplies was 2) were receiving 2200, although local unemployment rate was up to 3 higher than in regions that had no Northern Multiplier and hence kept wages equal to federal level.

Although the Northern Multiplier did explain the variation of minimum wages across regions, it may not be considered as a good instrument. First, the Northern Multiplier is a time-invariant index that would have been eliminated by fixed-effect regression. Second, the concept of Northern Multiplier existed only until the middle of 2007 and hence is not able to explain the variation of minimum wages in subsequent years. Finally, the value of different indices across the regions is not purely exogenous and therefore doesn't satisfy the assumption of exclusion

restriction. After 2007, however, some regions did keep regional minimum wages higher than federal despite the unemployment rates. Coincidently, most of those federal subjects, where Northern Multiplier existed, remained to be unrestricted by federal minimum wages, which pushes towards the following question: what determines the variation of minimum wages in those regions?

Lemos (2004) used political variables as instruments for endogenous minimum wages. The primary strategy was the following: first, the data on votes in favor and against minimum wages' hikes were collected under assumption that larger number of politicians standing for workers' rights increases the likeliness of establishment a higher wages' level; second, the election data was collected following Sobel's (1999) observation, that historically minimum wages, being a tool of political propaganda, have been increasing few days before the elections over the entire history of US, starting from the establishment of Fair Labor Standards Act.

In line with the evidence given above, let's assume that the likelihood of enactment higher minimum wages is determined by the political power of labor union bargaining for them in a particular federal subject in the Russian Federation. If this assumption is correct, then, regional policy makers are likely to observe the labor market outcomes of minimum wages' increases in the past. If past unemployment held at the acceptable level, then, regional policy makers would be more likely to agree to push minimum wage above federal standards.

Political power of labor union is just one part of the story, however, since a good argument for minimum wages' increase should be provided for the sake of reaching the agreement with regional politicians. Keeping in mind the concept of Northern Multiplier, it is logically to assume, that labor unions, being representatives or workers' rights, may consider a winter severity as an argument for pushing wages up for the sake of improving living conditions of low-income population. If the winter becomes more severe in a particular region, then labor unions obtain a stronger ground to bargain for higher minimum wages.

The most obvious measurement of winter severity is an average temperature. This measurement is not without disadvantages, however. First, the temperature itself is likely to correlate with many factors left in residual and hence may not be considered as a truly exclusive instrument. Second, it fails to take into account other factors affecting human's perception of winter severity, such as precipitation intensity, wind speed and atmospheric humidity.

One of winter severity's measurements was developed in 1910 by Swedish scientist Goesta Bodman. In his summary of the research expedition to the South Pole in 1901-1903, the researcher gave an attempt to objectively quantify the subjective human perception of winter severity. The scientist argues, that human's body is far more sensitive to the strength of the wind rather than to the low temperature. The formula of Bodman Index looks as follows:

$$S = (1 - 0.04 \times t) \times (1 + 0.27 \times v),$$

where t is the temperature (measured in °C) and v is the wind speed (measured in meters per second). The higher is the value of S, the worse is the human's perception of the winter. Indeed, the equation clearly reflects Bodman's opinion: the wind is given higher weight in the formula of winter perception. If the temperature is -25 °C and the wind speed is 1 meters per second, then, the Bodman Index is equal to 2.54, while if the temperature is -8 °C and the wind speed is 17 meters per second, the Index is then equal to 7.38. This fact is explained by the harmful effect of the wind expressed in ensuing breathing difficulty, mechanical pressure on the body and debilitated insulating properties of winter cloth (Bodman, 1916).

The paradox of an objective measurement of a subjective winter severity's perception distinguishes Bodman Index, as a potential candidate for inclusion in the first-stage regression, from Northern Multiplier and average winter temperature. First of all, it varies over time and, as it will be shown in subsequent chapters, does drive the variance of minimum wages across Russian regions. Second, although the temperature is a part of the formula, it doesn't correlate

with Bodman Index across regions, since the value of the Index is mostly driven by the wind speed and hence may be totally different even in those parts of Russia, where the temperature level is totally identical. This, in turns, means, that Bodman Index may be considered as a truly exclusive instrument for the endogenous regressor.

The first stage then exhibits the following structure:

$$log\ rMW_{it} = \alpha_1 \log Bodman_{it} + \alpha_2 MeanMW_{it} + X'_{it}\alpha + A'_i\rho + \epsilon_{it} \quad (2)$$

The reduced-form unemployment equation is[2]:

$$\log unemployment_{it} = \pi_1 log\ \widehat{rMW}_{it} + \pi_2 log\ Inflation_{it} + X'_{it}\pi + A'_i\theta + \nu_{it}, \quad (3)$$

where $\widehat{rMW}_{it}$ is the part of initially endogenous rMW_{it} that is left after removal of ϵ_{it} that was correlating with the error term u_{it} in the initial model (1).

An important issue regarding the model (3) is whether year effects should be included in the equation. Some researchers do control for year dummies assuming the existence of cohort-size effects that are not captured by regressors, which are usually used in minimum wages studies. The present research, however, studies the period of relatively stable post-crisis Russian economy that covers only four years. Additionally, after inclusion of regional inflation (following Phillips' (1958) theory) and regional GDP per capita (as an indicator of regional development), no reasons to believe in the existence of unexplained year effect are left.

[2] An error term ν_{it} is allowed to be correlated in the same cluster (federal subjects) over time, but not across different clusters. Since the sample covers 80 out of 83 federal subjects, but short period (4 years), the resulting standard errors are completely robust to serial correlation and heteroskedasticity (Liang and Zeger, 1986; Angrist and Pischke , 2008)

2.3 Empirical results.

A. OLS Estimates.

Estimates of equation (1) ,with unemployment measured by dividing total number of unemployed workers that are actively seeking for a job by total number of labor force in the region i and transforming this ratio in a logarithmic form . Table 2 reports OLS estimates.

Table 1. OLS Estimates and the Determinant of Unemployment rates in Russian regions

VARIABLES	Log Unemployment (1)	Log Unemployment (2)	Log Unemployment (3)	Log Unemployment (4)
Log (Real Minimum Wage)	-0.901***	-0.403***	-0.344***	-0.256**
	(0.106)	(0.109)	(0.106)	(0.109)
Log (Inflation)	3.080***	-0.042	-0.009	-1.424**
	(0.660)	(0.646)	(0.638)	(0.710)
Log (GDP per capita)		-0.507***	-0.195***	-0.223*
		(0.053)	(0.075)	(0.131)
Log (University Graduates)		-0.083**	-0.125***	0.124
		(0.037)	(0.035)	(0.143)
Log (Working Age Population)		0.399***	0.345**	4.380***
		(0.151)	(0.141)	(1.171)
Log (Real Living Cost)			-0.712***	-0.490**
			(0.143)	(0.195)
Log (Army)			-0.009	0.014
			(0.038)	(0.041)
Regional fixed effects	NO	NO	NO	YES
Observations	325	318	313	313
R-squared	0.43	0.64	0.66	0.69
Number of regions	83	81	80	80

Standard errors clustered at regional level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

Surprisingly, the estimates of the equation (1) reported in column 4 show a significant negative minimum wages elasticity of unemployment. As it will be discussed in further chapters, consistently with past evidences, this coefficient reflects workers' decision to move out from "queueing" unemployment to either inactive population and/or the informal sector (Comola and Mello, 2011; Muravyev and Oschepkov, 2013). Following this logic, the effect of minimum wages on informality regional rates is to be tested in further parts of the present research.

Meanwhile, all other significant coefficients have expected sign in line with previous findings and basic economic theory. Inflation, as it had been predicted by many economists (Phillips, 1958; Fisher, 1973; Chang, 1997), on average reduces regional unemployment by 1.4%, while GDP per capita, as an indicator of regional development, has much weaker, though significant effect (-0.2%).

B. IV Estimates.

Following past studies, the primary focus of the research was a heterogeneity of minimum wages' effect. Table 2 reports estimated elasticity of unemployment rates among different age groups of economically active population: total (people aged from 15 to 72), teenagers (15-19), youth (20-29), adults and elderly (29-72). In these specifications teenagers and youth are proxies for unskilled and inexperienced workers, which allow testing a potential diemployment effect of minimum wages' increase on those subgroups of population, that had been found in past studies.

Panel A of table reports 2SLS estimates of the parameters π from the equation (3), while Panel B shows the corresponding first stages. Consistently with previous studies, columns (2) and (3) show a strong disemployment effect of minimum wages hikes on teenagers and youth: the estimated elasticity are 0.68% and 0.84% respectively.

At this stage it is particularly important to point out, that 3 statistics proving the validity of instruments chosen are also reported in Panel B:

1. F-statistic of excluded instrument: after Staiger, Douglas and Stock (1997) had formalized the definition of "weak instruments", some researchers concluded, that F-stat higher than 10 is a valid indicator of statistically "strong" instruments. Otherwise, the instruments are considered to be weak and thus may yield biased estimator (Stock and Yogo, 2005). While some researchers[3]

[3] For more detailed discussion on this issue, read James H Stock, Jonathan H Wright and Motohiro Yogo "A survey

argue on the reasonability of this "rule of thumb", it's still important to report this statistic. The value of F-statistic of excluded instrument is far higher than 10 under each specification, which gives a ground to believe that the reported coefficient of the endogenous covariate is unbiased and consistent.

2. Hansen J test of overidentifying restrictions with corresponding p-values. The null hypothesis is that instruments are not correlated with the residual and that instruments are correctly excluded from the estimated equation.

Table 2. IV Estimates of minimum wages' effect on unemployment rate among different subgroups of population (segmented by age)

VARIABLES	Total (log) (1)	Teenagers (log) (2)	Youth (log) (3)	Adults and elderly(log) (4)
Panel A: Two-Stage Least Squares				
Log (Real Minimum Wage)	-0.418**	0.686***	0.838***	-0.624**
	(0.189)	(0.175)	(0.157)	(0.315)
Log (Inflation)	-1.595***	1.354	1.033	-2.589***
	(0.543)	(0.953)	(0.695)	(0.762)
Log (GDP per capita)	-0.230	-0.023	0.183	-0.480**
	(0.152)	(0.172)	(0.121)	(0.222)
Log (University Graduates)	0.281	0.012	0.161	0.496**
	(0.181)	(0.268)	(0.193)	(0.231)
Log (Working Age Population)	4.045***	-9.260***	0.047	3.696**
	(1.482)	(3.377)	(0.955)	(1.739)
Log (Real Living Cost)	-0.457**	-0.069	-0.072	-0.862***
	(0.226)	(0.308)	(0.183)	(0.303)
Log (Army)	0.003	0.011	0.022	0.033
	(0.034)	(0.067)	(0.046)	(0.044)
Regional Fixed Effects	YES	YES	YES	YES
Panel B: First Stage for Minimum Wage				
Log (Bodman Index)	0.985***	0.987***	0.988***	0.988**
	(0.067)	(0.068)	(0.067)	(0.067)
Log (Mean Wages of Neighboring Regions)	0.143	0.152	0.144	0.144
	(0.105)	(0.115)	(0.106)	(0.106)
Log (Inflation)	-0.236	-2.33	-0.215	-0.215
	(0.254)	(0.256)	(0.258)	(0.258)
Log (GDP per capita)	0.020	0.018	0.027	0.027
	(0.039)	(0.039)	(0.040)	(0.258)
Log (University Graduates)	0.122	0.121	0.129	0.129
	(0.089)	(0.089)	(0.095)	(0.095)
Log (Working Age Population)	0.168	0.177	0.156	0.156
	(0.509)	(0.512)	(0.522)	(0.523)
Log (Real Living Cost)	0.017	0.017	0.001	0.002

of weak instruments and weak identification in Generalized Method of Moments", Journal of Business & Economic Statistics; Oct 2002.

	(0.064)	(0.063)	(0.071)	(0.072)
Log (Army)	0.031	0.031	0.034	0.034
	(0.043)	(0.043)	(0.045)	(0.045)
Regional Fixed Effects	YES	YES	YES	YES
F-stat of excl. instruments	136.6	125.7	135.7	135.4
Hansen J statistic	0.33	0.48	2.17	1.46
(Chi-sq (1) P-value)	(0.56)	(0.49)	(0.14)	(0.23)
Observations	295	293	291	292
Number of regions	75	75	74	75
Adjusted R-squared	0.581	0.361	0.192	0.698

Standard errors clustered at regional level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

As it is discussed in previous chapters, IV estimator of unemployment elasticity with respect to minimum wages is lower than OLS's one. However, this result is valid under the assumption that minimum wage is the only channel through which instruments affect regional unemployment. If this is correct, then, the instruments suggested in this research, shouldn't affect unemployment rates in those countries, where minimum wages don't exist.

In order to test this assumption, a so-called falsification test was undertaken: I use one additional sample (a 8 years panel data set, from 2005 to 2012) that consists of 19 countries[4] that have no minimum wages regulation. Those countries are: Namibia, Qatar ,Denmark, Finland, Tonga, Italy, Sweden, Yemen, Brunei Darussalam, Cambodia, Singapore, Iceland, United Arab Emirates, Liechtenstein, Zimbabwe, Kiribati, Burundi, Djibouti. Following the above logic, it's expected that Bodman Index[5] (after controlling for other covariates) would have no significant impact on unemployment across the sample.

Column 1 in Table 4 shows the reduced-form estimates of the interactions between unemployment and Bodman Index in Russian regions. As it is shown, Bodman Index has a strong negative impact on regional unemployment rates. Column 2 reports reduced-form estimates within a new sample of 19 countries with no minimum wages policies[6]. The column

[4] 26 countries have no regulations of minimum wages. However, the sample covers only 19 countries since it's almost impossible to collect data for computing Bodman Index in some areas. The list of countries with no minimum wages policies was found in "Country reports for Human Rights practices".

[5] Bodman Index was computed as a weighted average winter temperature in critically Northern and Southern parts of the countries. In tropical countries Bodman Index has a negative value.

[6] Column 2 reports the estimator of an absolute value of Bodman Index (not logarithmic form), since in the countries with tropical climate Bodman Index takes a negative value. Other covariates, such as inflation, GDP per capita (in 2000 prices), working age population and primary school enrollment rates are also included in the

displays no systematic relationship between Bodman Index and states' unemployment rates[7].

After testing the assumptions quantitatively, no doubts regarding the validity of the instruments should be left.

Table 3. Reduced Form Relationship between Bodman Index and Unemployment Rate

VARIABLES	Russian Regions (1)	Other Countries (2)
Bodman Index, log	-0.38***	
	(0.141)	
Bodman Index		-0.19
		(0.392)
CONTROLS	YES	YES
FIXED EFFECTS	YES	YES
Observations	313	87
N	80	19
R-squared	0.695	0.289

Standard errors clustered at regional/country level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

Moving back to the issue of heterogeneity of impact of minimum wages increase, It's also important whether such polices affect workers differently depending on their level of education. It's also important to identify the causal effect of minimum wages on the size of informal sector, since, as it had been noted before, an estimated negative elasticity π_1 may be a result of the transition effect between two sectors.

The unemployment rate among low-educated is defined as an amount of unemployed workers, with no higher education, divided by working age population ratio. The unemployment rate among high-educated workers is then defined as a total number of unemployed workers with higher education divided by the reference population. Finally, informality rate is defined as a share of informal-sector employees in the working age population.

In line with expectations, column 2 reports a 0.99% increase of unemployment rates

model. Data source: World Bank.

[7] Unfortunately, the falsification test for the second instrument, mean value of minimum wages in geographically neighboring regions, can't be proceeded for obvious reasons.

among low-educated as a response to higher minimum wages' enactment. Surprisingly, column 3 shows a significant negative estimator. In an ideal case, the adverse effect of minimum wages increase should be studied by inclusion official *employment* rates among different segments of population on the left-hand side of the equation (3), which would have produced a more reliable inference regarding to the effect of such policies. Unfortunately, the absence of such data doesn't allow producing such estimation and hence the inference should be guided by existing literature.

Table 4. IV Estimates of minimum wages' effect on unemployment rate among different subgroups of population (segmented by the level of education)

VARIABLES	Log Total Unemployment (1)	Log(un) among Low-Educated (2)	Log(un) among High-Educated (3)	Informality Rate (log) (4)
Panel A: Two-Stage Least Squares				
Log (Real Minimum Wage)	-0.418**	0.920***	-0.582**	1.157***
	(0.189)	(0.085)	(0.232)	(0.055)
Log (Inflation)	-1.595***	-0.371	-0.926	0.510
	(0.543)	(0.416)	(0.943)	(0.336)
Log (GDP per capita)	-0.230	0.025	-0.207	0.092*
	(0.152)	(0.083)	(0.222)	(0.050)
Log (University Graduates)	0.281	-0.060	0.190	-0.091
	(0.181)	(0.099)	(0.273)	(0.078)
Log (Working Age Population)	4.045***	-0.952	4.033**	-0.387
	(1.482)	(0.728)	(1.896)	(0.453)
Log (Real Living Cost)	-0.457**	-0.134	-0.140	-0.231***
	(0.226)	(0.114)	(0.283)	(0.069)
Log (Army)	0.003	-0.032	-0.025	-0.007
	(0.034)	(0.022)	(0.058)	(0.019)
Regional Fixed Effects	YES	YES	YES	YES
Panel B: First Stage for Minimum Wage				
Log (Bodman Index)	0.985***	0.987***	0.988***	0.988**
	(0.067)	(0.068)	(0.067)	(0.067)
Log (Mean Wages of	0.143	0.152	0.144	0.144
Neighboring Regions)	(0.105)	(0.115)	(0.106)	(0.106)
Log (Inflation)	-0.236	-2.33	-0.215	-0.215
	(0.254)	(0.256)	(0.258)	(0.258)
Log (GDP per capita)	0.020	0.018	0.027	0.027
	(0.039)	(0.039)	(0.040)	(0.258)
Log (University Graduates)	0.122	0.121	0.129	0.129
	(0.089)	(0.089)	(0.095)	(0.095)
Log (Working Age Population)	0.168	0.177	0.156	0.156
	(0.509)	(0.512)	(0.522)	(0.523)
Log (Real Living Cost)	0.017	0.017	0.001	0.002
	(0.064)	(0.063)	(0.071)	(0.072)
Log (Army)	0.031	0.031	0.034	0.034
	(0.043)	(0.043)	(0.045)	(0.045)
Regional Fixed Effects	YES	YES	YES	YES
F-stat of excl. instruments	136.6	136.6	152.7	151.6

Hansen J statistic	0.33	0.07	1.90	0.34
(Chi-sq (1) P-value)	(0.57)	(0.79)	(0.17)	(0.56)
Number of regions	75	75	75	75
Adjusted R-squared	0.581	0.589	0.229	0.742

Standard errors clustered at regional level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

Therefore, following (Comola and Mello, 2011; Muravyev and Oschepkov, 2013), the only rationale explanation of joint observation of the results in columns (3) and (4) is that discouraged workers simply give up seeking for a job in a formal sector and hence the magnitude of unemployment rates decreases when minimum wages raise up, while the size of uncovered sector increases.

2.4 Robustness checks.

The baseline results rely on the assumption that two instruments are valid and hence estimated coefficient of minimum wages are unbiased and consistent in the presence of reverse causality problem. If this is true, then, the results must be robust to alternative minimum wages' variables largely exploited by different researchers all around the world.

As it had been noted before, in the recent study of Russian labor market the relative variation of minimum wages or so-called Kaitz Index was used as the main regressor of the model of estimation (Muravyev and Oschepkov, 2013). The authors say, that the usage of lagged value of the denominator (regional mean wages) of Kaitz Index eliminates the impact of minimum wages increase on the average wage. Thus, following Muravyev and Oschepkov (2013), Kaitz index was computed following the formula given below[8]:

$$Kaitz_{it} = \frac{Minimum\ Wage_{it}}{Average\ Wage_{it-1}} \times 100$$

Thus, the new reduced- form unemployment equation with minimum wage variable substituted for Kaitz index looks like as follows:

[8] A detailed discussion of choosing optimal lags of the denominator of Kaitz index is given in a corresponding research.

$$\log unemployment_{it} = \varphi_1 \widehat{Kaitz_{it}} + \varphi_2 log\ Inflation_{it} + X'_{it}\varphi + A'_i\gamma + ħ_{it},$$

The first stage then exhibits the following structure:

$$Kaitz_{it} = \delta_1 \log Bodman_{it} + \delta_2 MeanMW_{it} + X'_{it}\delta + A'_i\tau + \upsilon_{it}$$

The baseline findings appeared to be robust to substitution minimum wages' variable for Kaitz Index. The results, reported in Tables 7,8 show that Kaitz Index's hikes leads to increased unemployment among teenagers, youth and low-educated workers. A negative impact of Kaitz index on total employment also pushes towards the suggestion that minimum wages hikes discourage workers shifting them away from a formal sector of the Russian economy.

Table 5. IV Estimates of minimum wages' effect on unemployment rate among different subgroups of population (segmented by age)

VARIABLES	Total Unemployment (log) (1)	Teenagers (log) (2)	Youth (log) (3)	Adults and elderly (log) (4)
Panel A: Two-Stage Least Squares				
Kaitz Index	-1.225**	2.015***	2.442***	-1.853*
	(0.554)	(0.510)	(0.433)	(0.949)
Controls	YES	YES	YES	YES
Regional Fixed Effects	YES	YES	YES	YES
Panel B: First Stage for Kaitz Index				
Log (Bodman Index)	0.334***	0.333***	0.333***	0.334***
	(0.025)	(0.026)	(0.025)	(0.025)
Log (Mean Wages of	0.061*	0.063*	0.06*	0.06*
Neighboring Regions)	(0.032)	(0.034)	(0.032)	(0.032)
Controls	YES	YES	YES	YES
Regional Fixed Effects	YES	YES	YES	YES
F-stat of excl. instruments	100.4	92.5	99.6	99.5
Hansen J statistic	0.28	0.39	2.43	1.46
(Chi-sq (1) P-value)	(0.6)	(0.54)	(0.12)	(0.23)
Observations	295	293	291	292
Number of regions	75	75	74	75
Adjusted R-squared	0.565	0.305	0.111	0.679

Standard errors clustered at regional level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

The finding that higher minimum wages lead to lower unemployment among different segments of workers may be also thought as a result of so-called "lighthouse effect", a term

employed if the minimum wages' hikes in formal sector positively affect wages in a shadow economy and hence, once again, moves " queuing " unemployed workers from covered into uncovered sector. Consistently with previous studies (Comola and Mello, 2011; Khamis 2008), this seems to be a valid suggestion regarding to Russian labor market: the estimated informality rate's elasticity for minimum wages is positive in both model specifications.

Table 6. IV Estimates of minimum wages' effect on unemployment rate among different subgroups of population (segmented by the level of education)

VARIABLES	Low-Educated (log) (1)	High-Educated (log) (2)	Informality (log) (3)
	Panel A: Two-Stage Least Squares		
Kaitz Index	2.677***	-1.674**	3.329***
	(0.318)	(0.656)	(0.221)
Controls	YES	YES	YES
Regional Fixed Effects	YES	YES	YES
	Panel B: First Stage for Kaitz Index		
Log (Bodman Index)	0.334***	-0.335**	0.334***
	(0.025)	(0.026)	(0.025)
Log (Mean Wages of	0.061*	0.06*	0.59*
Neighboring Regions)	(0.032)	(0.032)	(0.032)
Controls	YES	YES	YES
Regional Fixed Effects	YES	YES	YES
F-stat of excl. instruments	100.4	98.1	97.5
Hansen J statistic	0.25	1.99	0.2
(Chi-sq (1) P-value)	(0.62)	(0.16)	(0.64)
Observations	295	293	291
Number of regions	75	75	75
Adjusted R-squared	0.478	0.225	0.529

Standard errors clustered at regional level are reported in parentheses*** p<0.01, ** p<0.05, * p<0.1.

CHAPTER 3. CONCLUSION AND POLICY IMPLICATIONS.

The present study draws the connection between minimum wages and unemployment in Russian regions in both theoretical and empirical manner. The study also focuses on the heterogeneity of minimum wages' impact on regional labor markets, as it had been done by many researchers all around the world.

Neoclassic economic theory suggests, that a government's failure to adjust wages to the equilibrium level, at which labor supply equals to labor demand causes structural unemployment. This phenomenon occurs because of a mismatch between the number of people who want to work and the number of working places that economy can produce. Therefore, minimum wage policies, initially targeted at improving the living standards of the poorest, may in fact reduce the quantity of labor demanded and hence decrease the number of people employed in a formal sector of economy. Thus, this research is an attempt to make a contribution to the ongoing debate of opponents and proponents of minimum wage laws by showing empirical evidence from Russian labor market.

The research used an Instrumental Variables approach to produce an unbiased estimation of minimum wages impact on unemployment in the presence of endogeneity problem, which has not been considered in many of past studies. After inclusion of other covariates affecting unemployment in Russian regions, the IV estimators showed a strong and significant adverse

impact of minimum wages on unskilled workers with low productivity, defined, following the literature, as teenagers, youth and low-educated employees. The research also gives evidence that minimum wages increase excludes discouraged workers from the labor force and hence enlarges the size of an uncovered sector of state's economy.

The study offers several policy implications. First of all, more flexible approach regarding to the determination of the value of minimum wages should be considered. Both demand-side factors, such as firms' performance, industries' specifics, elasticity of substitution between labor and capital in different sectors of state economy, and labor supply-side factors, such as educational level, the composition of regional labor force, workers' productivity, should be considered in order to identify an optimal minimum wages for different segments of population, depending on industries and/or personal workers' characteristics, such as age, experience and so forth. Second, Russian Labor Code obliges employers to pay the same amount of minimum wages to all people regardless of their age, gender or industry unless their work less than 40 hours per week. Perhaps, this "All or Nothing" framework is what explains a very strong adverse effect of such policies on Russian labor market, since companies, facing increased production costs caused by increased minimum wages, are not given a halfway house between lowering the profit and firing employed workers. Hence, the enactment of minimum hourly wages, as it is done in the U.S, Canada, South Korea and many other countries, should be considered. Finally, while current minimum wages' policies are to be crafted more carefully, other tools of income redistribution and improving living standards also seem to require more attention. For example, regional policy makers might consider the provision of more incentives for new companies to locate in areas with high employment. An introduction of vocational programs in order to re-skill disemployed workers might also increase the likelihood of lowering the vulnerability of unskilled labor force, in those regions, where winter is particularly severe, local policy makers may consider an imposition of lower taxes as an alternative option for minimum wages increase.

References

1. Adams, G. (1987). Increasing the Minimum Wage: The Macroeconomic Impacts, Brief Paper. *Economic Policy Institute, Washington DC,* p 22-25.
2. Angrist, J.D. & Pischke, J. (2008). Mostly Harmless Econometrics: An Empirist's Companion, p 221-236.
3. Bachetta,M., Ernst,E. & Bustamante,J.P. (2009).Globalization and informal jobs in developing countries. A joint study of the International Labour Office and the Secretariat of the World Trade Organization, p 21-37.
4. Baskaya, Y.S. & Rubinstein, Y. (2012). Using federal minimum wages to identify the impact of minimum wages on employment and earnings across the US states. p 9-21.
5. Bodman, G. (1916). Petrographische studien tiber engine antarktische gesteine, Wissens. Ergebnisse der Schwedischen Siidpolar-Exped. 1901-1903, Geologie *und Paloontologie, 3*, pt.15, p 58-59.
6. Brown, C., Gilroy, C. & Koshen, A. (1982). The effect of the minimum wages on employment and unemployment. *Journal of Economic Literature, 20, p 427-528.*
7. Card, D.& Krueger, A. B. (1994). Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania*. American Economic Review, 84*. p 772-792.
8. Chang, R. (1997). Is Low Unemployment Inflationary? *Federal Reserve Bank of Atlanta*

Economic Review, p 4-13.

9. Comola, M. & Mello, L. (2011). How Does Decentralized Minimum Wage Setting Affect Employment and Informality? The Case of Indonesia. *Review of Income and Wealth*, 7, p 79-99.
10. Fisher, I. (1973). A Statistical Relation between Unemployment and Price Changes. T*he Journal of Political Economy*, Vol. 81, No. 2, Part 1 (Mar. - Apr., 1973), p 496-502.
11. García, S., Goerlich, F.J.. & Orts, V. (1994). Macromagnitudes básicas a nivel sectorial de la industria española: series historicas. *Economía Industrial , 27.* p 299.
12. Harris, J.R., & Todaro, M. (1970). Migration, unemployment and development: A two-sector analysis. *American Economic Review, 60,* p 126-142.
13. Khamis, M. (2008). Does the Minimum Wage Have a Higher Impact on the Informal than on the Formal Labor Market? Evidence from Quasi-Experiments. IZA DP, 3911, p 5-26.
14. Liang, Kung-Yee and Scott L. Zeger. (1980) Longitudinal Data Analysis using Generalized Linear Models, *Biometrika*,, p 13-22.
15. Muravyev, A., & Oschepkov, A. (2013). Minimum wages, unemployment and informality: evidence from panel data on Russian regions. IZA DP, 7878, p 13-36.
16. Neumark, D. & Washer, W. (1994). Employment Effects of Minimum and Sub-minimum Wages: Reply to Card, Katz, and Krueger. *Industrial and Labour Relations Review, 46.* p 55-79.
17. Neumark, D., Schweitzer, M. & Wascher, W. (2004). Minimum Wage Effects throughout the Wage Distribution. *Journal of Human Resources, 3*. p 425-449.
18. Paranos, V. (2005). Minimum wage and income distribution in the Harris-Todaro Model. *Journal of Economic Development, 30.* p 2-11.
19. Phillips, A.W. (1958). The Relationship between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-195", *Economica*. p283-299.

20. Robinson, J. (1933). The Economics of Imperfect Competition London: Macmillan.
21. Staiger, D. & Stock, J.H. (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica*, 65, p 557-586.
22. Stock, J.H. & Yogo, M. (2001). Testing for Weak Instruments in Linear IV Regression. *NBER Technical Working paper №28,* p 21-54.
23. Stock, J.H., Wright, J.H. & Yogo, M. (2002) A survey of weak instruments and weak identification in Generalized Method of Moments". *Journal of Business & Economic Statistics*, Oct 2002, p 518-527.
24. Swidinsky, R. (1980). Minimum wages and Teenage Unemployment. *The Canadian Journal of Economics, 1.* p 158-171.
25. Terrell, K. & Almeida, K.A. (2008). Minimum wages in developing countries: helping or hurting people? *World Bank Employment Policy Primer, 10,* p 1-6.
26. West, E.G. and McKee, M. (1980). Minimum wages: The new issues in theory, evidence, policy, and politics. Economic Council of Canada, Institute for Research on Public Policy. p 50-72.

ANNEXURES

ANNEX-I

DESCRIPTIVE STATISTICS

Variable	N	Mean	Std. Dev.	Min	Max
1. Dependent Variables					
Average overall unemployment rate, log (U)	332	1.978581	0.43405	-0.22314	3.768153
Average teenage unemployment rate (15-19 years old), log (T)	318	-2.72162	0.632292	-7.38841	-1.33748
Average youth unemployment rate (20-29 years old), log (Y)	316	1.696239	0.431368	0.393231	3.508899
Average adults unemployment rate (older than 30), log (A)	328	1.561609	0.470331	-1.33181	3.298949
Average unemployment rate among low-educated workers, log (LE)	321	1.812497	0.430504	0.392042	3.639426
Average unemployment rate among high-educated workers, log (HE)	329	0.90505	0.384243	-0.75502	2.127041
Average informality rate, log (INF)	316	2.352149	0.476079	0.019573	3.475878
Kaitz Index	324	31.21137	7.764126	9.634953	62.27528
2. Independent Variables					
Real minimum wage at the beginning of the year, log	325	8.447458	0.21252	8.24326	9.297165
Inflation at the beginning of the year, log	332	0.07455	0.018447	0.013903	0.158882
Average gross Regional Product per capita, log	326	12.17554	0.658827	10.40507	15.13604
Proportion of university graduates, log	324	9.222901	1.032325	6.684612	12.52598
Average working age population, log	332	-0.51574	0.249491	-2.78447	-0.31708
Real living cost at the beginning of the year, log	332	8.627178	0.249717	8.159012	9.448243
Proportion of population serving in army, log	322	-7.64131	0.54128	-9.92416	-6.34962
Bodman Index, log	327	1.39417	0.362799	0.182322	2.104134
Mean nominal wage of geographically neighboring region, log	304	8.497533	0.113733	8.373322	9.10498