The Czech Wage Distribution and the Minimum Wage Impacts: an Empirical Analysis[1]

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Abstract

A well-fitting wage distribution is a crucial precondition for economic modeling of the labour market processes. In the first part, this paper provides the evidence that – as for wages in the Czech Republic – the most often used log-normal distribution failed and the best-fitting one is the Dagum distribution. Then we investigate the role of wage distribution in the process of the economic modeling. By way of an example of the minimum wage impacts on the Czech labour market, we examine the response of Meyer and Wise's (1983) model to the Dagum and log-normal distributions. The results suggest that the wage distribution has important implications for the effects of the minimum wage on the shape of the lower tail of the measured wage distribution and is thus an important feature for interpreting the effects of minimum wages.

Keywords	**JEL code**
Wage distribution, wage, minimum wage, employment	*J31, E24*

INTRODUCTION

During economic crises, we usually notice a higher demand for economic models which analyse and describe the economic situation and are able to identify the point of the economic cycle that the economy is approaching. Regardless their assumptions, the economic models represent always a simplified relationship among relevant variables. As for individual models, a set of appropriate and reliable variables is needed. The most often inputs are variables directly measured (e.g. an average wage), but in some cases we need – roughly said – hypothetical variables, i.e. those which cannot be measured under current conditions.

As for labour market models, one can encounter problems concerning lack of information needed although there are many results from labour market surveys available in the Czech Republic. The most likely disadvantage concerning labour market indicators is the fact that each of the key aspects of the labour market (i.e. employment as well as remuneration) has been so far surveyed and evaluated sepa-

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rately (Duspivová, Spáčil, 2011). Another problem, one can encounter quantifying individual effects on the labour market, are insufficiently comprehensive and accurate inputs that implied distorted conclusions. To this end, we pay our attention to the wage distribution in the Czech Republic, because no doubt a well-fitting wage distribution is a crucial precondition for an economic modeling of the labour market processes. As far as wages are concerned, we suppose that – in the Czech Republic usually used – the log-normal distribution is not the best-fitting one and this distribution is used because of its convenient theoretical qualities. Thanks to advanced technologies, there is no need to use simpler methods neither for the modeling nor as a teaching tool anymore.

The main aim of this paper is to find the best-fitting wage distribution in the wage sphere in the Czech Republic with respect to its further use in the process of economic modeling. As for wage distributions, we will fit generally known income and wages distributions (lognormal, Dagum, Singh-Maddala, etc.) to the microdata from the Average Earnings Information System (the Structure of Earnings Survey family) using the maximum-likelihood estimation to estimate the parameters of individual models. To illustrate the role of the wage distribution in economic models, we will focus on the results of the Meyer & Wise's (1983a, 1983b) model which is used to estimate the impact of the minimum wage on employment and wages comparing market wage rates that individuals would receive in the absence of the minimum wage (i.e. the above mentioned hypothetical variable) with an actual wage distribution. Meyer & Wise's model was chosen because of two reasons – on the one hand the empirical as well as hypothetical distributions are considered, on the other hand the quantification of the minimum wage effects is not in the forefront of the public interest in the Czech Republic, although the minimum wage is an important state intervention on the labour market.

The structure of the paper is as follows: section 1 describes the dataset and methods used, section 2 presents the main empirical results concerning wage distributions in the Czech Republic and in section 3 there are presented important implications of different wage distributions used in the Meyer & Wise's (1983a, 1983b) model. The last section concludes the paper.

1 METHODOLOGY

In this part, we will briefly introduce the data (namely the Average Earnings Information System) and the methodology that will be used. Methodological issues, we will deal with, will concern the sample for our analysis, the estimation of wage distributions and the model proposed by Meyer & Wise (1983a, 1983b).

Data Sources

As far as wages are concerned, there are two different data sources available, namely surveys concerning Labour Statistics conducted by the Czech Statistical Office (CZSO) and the *Average Earnings Information System (ISPV)* conducted by the MoLSA. Within the Labour Statistics of the CZSO, there are surveyed the number of employees and sum of earnings in the enterprise, so an average gross monthly wage can be calculated. On the contrary, the ISPV gathered data on individual employees in the enterprise, so – in addition to the average wage – the wage distribution is known (Malenovský, Duspivová, 2012). Considering the aims of this paper, the only one possible data source is the ISPV.

The ISPV is a quarterly employer survey carried out by a private agency (TREXIMA, spol. s r.o.) on behalf of the Ministry of Labour and Social Affairs (MoLSA) since 1992. The ISPV is based on the stratified random sampling which has been fully in accordance with the European Structure of Earnings Survey (SES) guidelines since 2006.

Since 2011, the ISPV population has been extended by the employees of economic subjects previously not surveyed, above all by employees of economic subjects with less than 10 employees (for more detailed information see Malenovský, Duspivová, 2012). The sample in the wage sphere contained c. 4 900 economic subjects with total employment about 1.5 million workers in 2011 (ISPV, 2012). In addition to the improvements made in the ISPV survey in 2011, the 2011 data are the latest available ones, so all the figures presented in the next parts will be the *measures concerning the year 2011*.

Estimations of individual wage distributions and Meyer & Wise's model will represent only the *wage sphere*[4] *in the Czech Republic*. The salary sphere[5] will not be considered because there is a minimum of employees remunerated at the minimum wage, so the further use of the wage distribution in the Meyer & Wise's model does not make sense.

Wage Distribution

As for wage distributions, we will consider the following seven most frequently used distributions in wage statistics: the Dagum, Singh-Maddala, log-logistic, log-normal (2 and 3 parameter), Gamma and Weibull distribution. A brief description of each distribution (including its probability density function) will be in the following section concerning fitted wage distributions, for more detailed information on individual distributions see e.g. Kleiber, Kotz (2003) or Yee, Wild (1996).

In our case, a random variable is defined as the nominal average gross monthly wage in the wage sector in the Czech Republic in 2011.

The distributions mentioned above are fitted to our data using an iterative procedure of the maximum likelihood estimation method in statistical software R (version 2.14.2). The only exception is the estimation of parameters of the 3-parameter log-normal distribution, where the parameters were estimated in MS Excel according to Cohen & Whitten (1980) for the following reason: the probability density function includes the logarithm of the difference between an observed wage and the parameter lambda, see (4). Because of very low wages in the sample, a calculation of the probability density function is impossible. Cohen & Whitten (1980) provide an iterative process algorithm, which allows to include the information on the lowest wages in the initial values of the estimated parameters.

The maximum likelihood estimates and the related fits are evaluated by the Akaike information criterion (AIC) according to Yee and Wild (1996) (1).

$$AIC = -ln(L) + 2p, \tag{1}$$

where *ln(L)* is the logarithm of the likelihood and p is the number of estimated parameters in the maximum likelihood estimation method.

Minimum Wage Effects (Meyer & Wise's model)

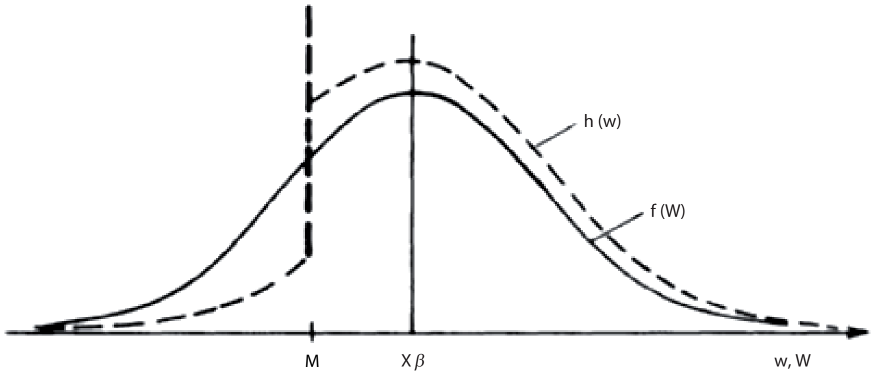
To illustrate the role of wage distribution estimations in some models, we use the Meyer & Wise's (1983a, 1983b) model. As was mentioned above, Meyer & Wise's model is used to estimate the impact of the minimum wage on employment and wages comparing market wage rates that individuals would receive in the absence of the minimum wage with an actual wage distribution. The basic idea of this model is shown in Figure 1.

In the Figure 1, there are two density functions – f(W) and h(W). The density function *f(W)* represents the *distribution of wages* in a given population *in the absence of the minimum wage* (the solid line in the Figure 1). *After introducing the minimum wage* at level M, we switch to the density function *h(W)*,

[4] The wage sphere includes economic subjects who provide remuneration in the form of wages pursuant to Section 109 (2) of Act No. 262/2006 Coll., the Labour Code, as amended. For more detailed information see Malenovský, Duspivová (2012).

[5] Economic subjects belonging to the salary sphere provide remuneration in the form of salaries pursuant to Section 109 (3) of Act No. 262/2006 Coll., the Labour Code, as amended. For more detailed information see Malenovský, Duspivová (2012).

Figure 1 Basic principles of the Meyer & Wise's model



Source: Meyer, Wise (1983a)

that is distorted compared to f(W) due to several effects caused as a consequence of the minimum wage introduction. Suppose the whole economy, some employees continue to be paid below the minimum, because they are employed in a non-covered sector (i.e. sector not covered by the minimum wage law) or their employers do not comply with the law. The spike represents employees whose wage rose up to the minimum because of compliance with the law. Most of the employees with wages above the minimum are unaffected but we can see a spillover effect[6] (i.e. shift to the right). There may be other effects caused by the minimum wage in the economy, too, but an in-depth analysis of this issue is not a subject matter of this paper. Minimum wage effects are analysed in more detail e.g. in Stigler (1946), Mankiw (1998) or Dolado et al (1996).

As for the Czech Republic, the distribution of wages in a given population (to be more specific in the wage sphere) in the existence of the minimum wage is well-known. To be able to quantify the effects of the minimum wage using the Meyer & Wise's model, we need to know the distribution of wages in the absence of the minimum wage. The minimum wage legislation has been in force since the early 1990's, so the only option how to get the density function f(W) is to estimate hypothetical density function. In accord with Meyer & Wise (1983), we suppose that employees paid above the minimum are unaffected by the minimum, so we use the likelihood function for estimating the distribution of wages from a sample of employees where the wages are *truncated at 8 800 CZK*. Contrary to Dickens et al (1994), the ideal level of truncation is hardly to estimate in the Czech Republic, because an in-depth analysis of quantile differences is biased due to the process of the transformation of the Czech economy (Milanovic, 1998). The level of 8 800 CZK represents those employees who are definitely not paid at the minimum on neither monthly nor hourly basis.

2 WAGE DISTRIBUTION

A theoretical wage distribution is essential for probabilistic considerations. There are many applications of wage distributions and detailed information can be obtained from the modelling of the entire distribution of wages, which is the main purpose of this paper also.

A frequent assumption is that the wage distribution is described by the log-normal distribution. We are aware of its strengths concerning above all academic purposes (where exponential transformation of a normally distributed random variable results subsequently in the log-normal distribution), but we

[6] Roughly said, a spillover effect balances the differences in productivity of individual employees.

are aware of its weaknesses lying in simplifying assumptions, too. Contrary to Marek (2010) and others, we question an assumption of the usefulness of the log-normal distribution and will answer the question which wage distribution is the most appropriate one as far as the Czech data are concerned.

As was mentioned above, close attention will be given to seven most frequently used distributions in wage statistics: the Dagum, Singh-Maddala, log-logistic, log-normal (2 and 3 parameter), Gamma and Weibull distribution.

2.1 Dagum distribution

In the 1970s, C. Dagum proposed several variants of a new model for the size distribution of personal income. Dagum (1977) motivates his model from the empirical observation and his approach was further developed in a series of papers on generating systems for income in 1980's and 1990's (for more detailed information see Kleiber, 2007).

In this paper, we apply the three parametric version of the Dagum distribution with the following probability density function defined for all positive values of y (2):

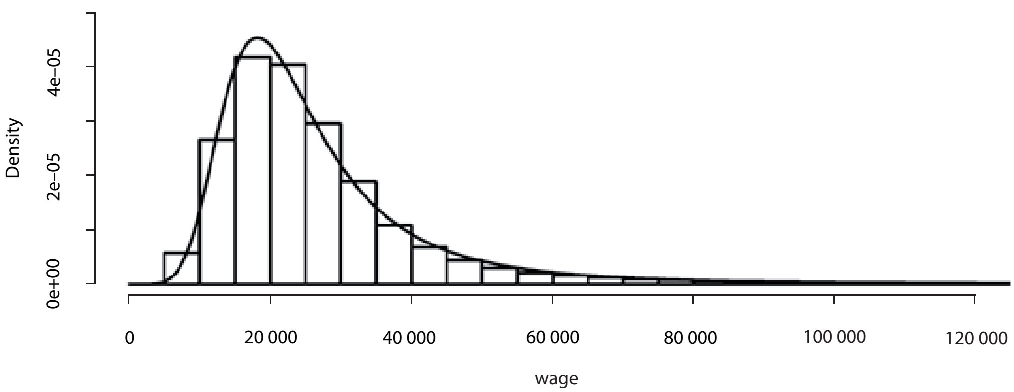
$$f(y) = apy^{ap-1} / \left[b^{ap} \left\{ 1 + (y/b)^{a} \right\}^{p+1} \right], \tag{2}$$

where $a, b, p, y > 0$. Parameters a and p determine a shape of the distribution and b is a scale parameter.

Kleiber & Kotz (2003) point out that the maximum likelihood estimates are very sensitive to outlier observations. Nevertheless, the sample size of the ISPV meets required numerical estimate conditions (the recommended sample size should be at least 7 000 observations, but the size from 2 000 up to 3 000 provides unbiased estimators of parameters a and p.) Thus, this recommendation is irrelevant due to the size of our sample.

Figure 2 shows the observed wages (the histogram) and probability density function of the Dagum distribution (the solid line). Parameters obtained by maximum likelihood estimation are a = 2.9300, b = 15 974.43, p = 2.3043.

Figure 2 The probability density function of the Dagum distribution and the histogram of observed wages



Source: ISPV, own calculations

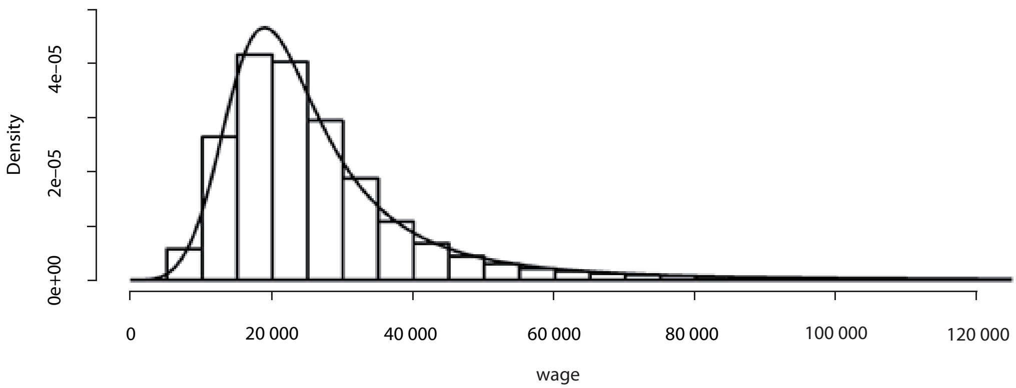
2.2 Singh-Maddala distribution

Similar to the Dagum distribution, the Singh-Maddala distribution (Singh, Maddala, 1976, and following papers) comes from a generalization of the Beta distribution of the second order (more information see in Kleiber, Kotz, 2003). The Singh-Maddala distribution (often known as the generalized log-logistic distribution) is very widely used in the modeling of the household income particularly in the USA. Probability density function for this distribution has the form of (3).

$$f(y) = aqy^{a-1} / \left[b^{aq} \left\{ 1 + (y/b)^a \right\}^{1+q} \right], \tag{3}$$

where *a, b, q, y* > 0. Parameters *a* and *b* determine the shape of the distribution and *q* is the scale parameter.

Figure 3 The probability density function of the Singh-Maddala distribution and the histogram of observed wages



Source: ISPV, own calculations

In the Figure 3, you can see the observed wages (the histogram) and the probability density function of the Singh-Maddala distribution (the solid line). Parameters estimated by maximum likelihood method are $a = 4.6021$, $b = 18\,940.34$, $q = 0.5725$.

2.3 Log-logistic distribution

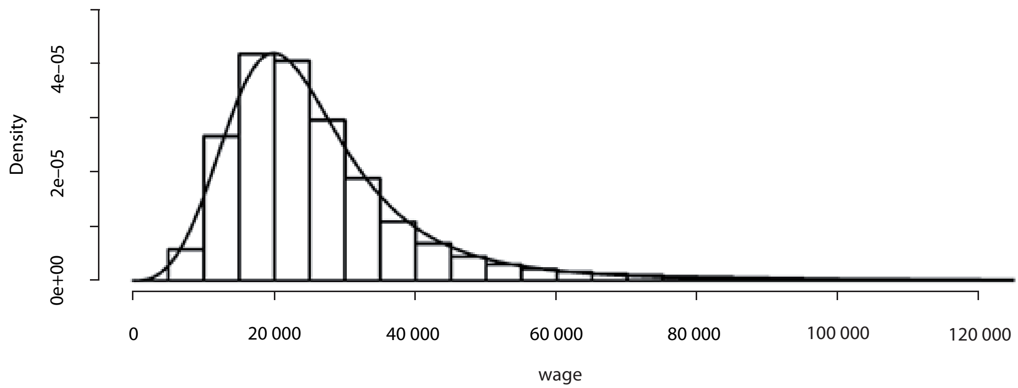
The Log-logistic distribution (in the economic theory also known as the Fisk distribution) is a simplification of the Sing-Maddala distribution (where the parameter q = 1), or of the Dagum distribution (where the parameter p = 1). It is mostly used in survival analyses as a model for rapidly rising events which afterwards fall more slowly (for example the mortality of people diagnosed with cancer). The relevant probability density function has the form of (4).

$$f(y) = ay^{a-1} / \left[b^{a} \left\{ 1 + (y/b)^a \right\}^{2} \right], \tag{4}$$

where *a, b, y* > 0. The parameter a determines the shape of the distribution and the parameter *b* specifies the scale of the distribution.

The Figure 4 shows the observed wages (the histogram) and the probability density function of the log-logistic distribution (the solid line). Parameters obtained by maximum likelihood estimation are $a = 3.6103$ and $b = 23\,283.94$.

Figure 4 The probability density function of the log-logistic distribution and the histogram of observed wages



Source: ISPV, own calculations

2.4 3-parameter log-normal distribution

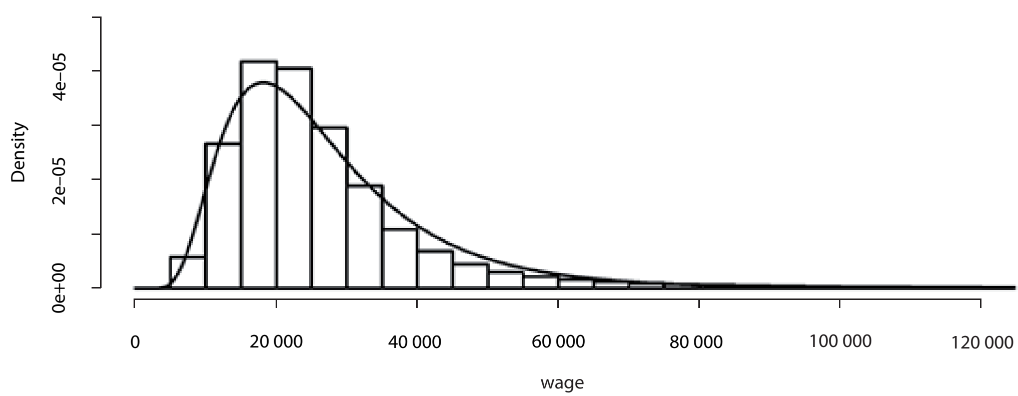
As was mentioned above, the log-normal distribution is often used above all for its convenient theoretical qualities. This distribution is used for example in economics, financial applications, hydrology and other scientific areas. The probability density function of the 3-parameter log-normal distribution is calculated according to the formula (5).

$$f(y) = \frac{1}{(y-\lambda)\sigma\sqrt{2\pi}} \exp\left\{-\frac{[\ln(y-\lambda-\mu]^2}{2\sigma^2}\right\}, \tag{5}$$

where $0 \le \lambda \le y,\ -\infty < \mu < \infty,\ \sigma > 0$ are parameters of the probability density function, specifically μ is the expectation value, σ is the standard deviation and λ is the shift parameter. Density function (5) is defined for $y > 0$.

The Figure 5 shows the observed wages (the histogram) and the probability density function of the 3-parameter log-normal distribution (the solid line). Parameters obtained by the maximum likelihood estimation are $\mu = 10.0331$, $\sigma = 0.5326$, $\lambda = 1\ 004.13$.

Figure 5 The probability density function of the 3-parameter log-normal distribution and the histogram of observed wages



Source: ISPV, own calculations

2.5 2-parameter log-normal distribution

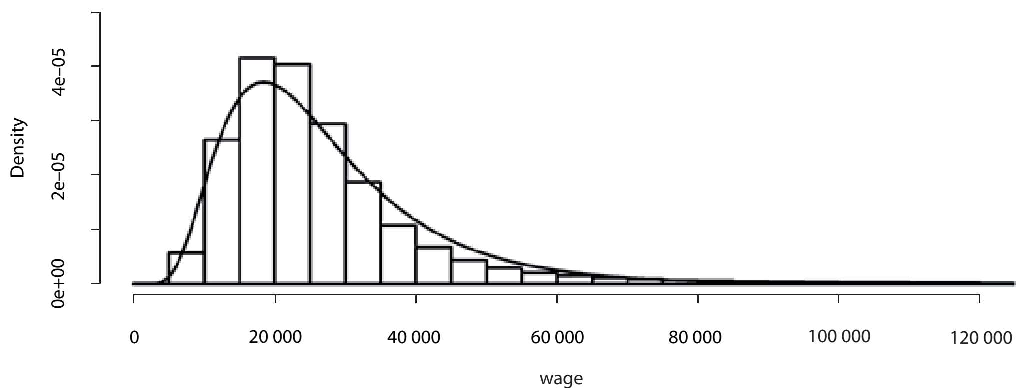
The 2-parameter log-normal distribution is used more frequently than its 3-parameter extension. It is obvious that – if the shift parameter of the 3-parameter log-normal distribution (λ) equals zero – the probability density function of the 2-parameter log-normal distribution is given by the formula (6).

$$f(y) = \frac{1}{y\sigma\sqrt{2\pi}} \exp\left\{-\frac{[\ln(y-\mu]^2}{2\sigma^2}\right\}, \tag{6}$$

where $-\infty < \mu < \infty,\ \sigma > 0$, are parameters of the density function, μ is the expected value and σ is the standard deviation. The density function is defined for values of $y > 0$.

The Figure 6 shows the observed wages (the histogram) and the probability density function of the 2-parameter log-normal distribution (the solid line). Parameters obtained by the maximum likelihood estimation are $\mu = 10.0818$, $\sigma = 0.5106$.

Figure 6 The probability density function of the 2-parameter log-normal distribution and the histogram of observed wages



Source: ISPV, own calculations

2.6 2-parameter Gamma distribution

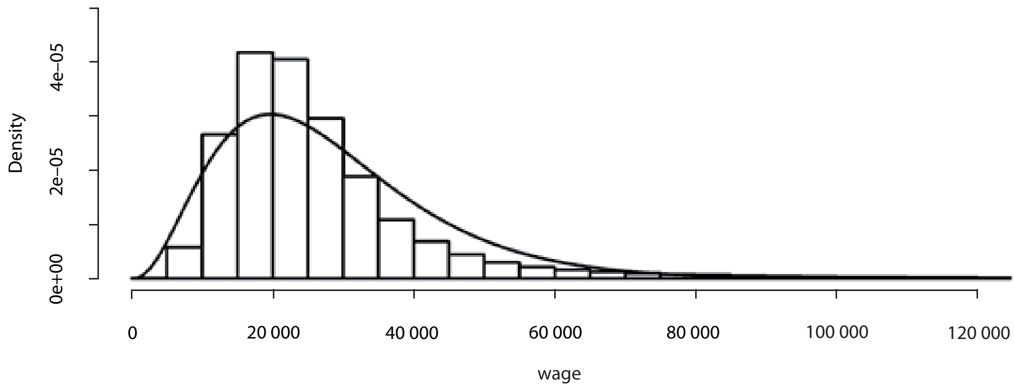
The Gamma distribution has expanded parameterization according to the purpose of its modeling. As for the probability density function, there are many modifications available. In this paper we use the following form (7).

$$f(y) = \exp(-\beta y) \times y^{\alpha - 1} \frac{\beta^{\alpha}}{\Gamma(\alpha)}, \tag{7}$$

where the parameter α determines the shape of the distribution and β is the parameter determining the scale (also known as the inverse scale parameter, because it is calculated as an inversion of the original scale parameter in the basic definition of the distribution) and Γ is the gamma function.

Figure 7 shows the observed wages (the histogram) and the probability density function of the 2-parameter Gamma distribution (the solid line). Parameters obtained by the maximum likelihood estimation are $\alpha = 0.00012197$, $\beta = 3.4015398$.

Figure 7 The probability density function of the 2-parameter Gamma distribution and the histogram of observed wages



Source: ISPV, own calculations

2.7 Weibull distribution

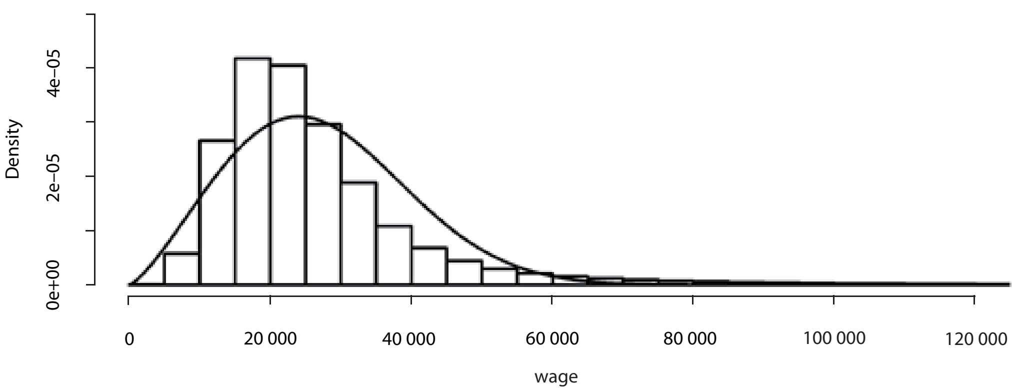
The Weibull distribution (Weibull, 1951) is often used in the reliability theory for the random variable, which represents a lifetime (especially of a technical equipment). Another use of this distribution is particularly in situations where the log-normal distribution does not meet the research requirements. The probability density function of the Weibull distribution is defined by the formula (8).

$$f(y) = ay^{a-1}\exp\left[-(y/b)^{a}\right]/(b^{a}), \tag{8}$$

where $y > 0$, $a > 0$ is the parameter, which determines the shape of the distribution, $b > 0$ is the scale parameter.

The Figure 8 shows the observed wages (the histogram) and the probability density function of the 2-parameter Weibull distribution (the solid line). Parameters obtained by the maximum likelihood estimation are $a = 2.3172$, $b = 30\ 660$.

Figure 8 The probability density function of the Weibull distribution and the histogram of observed wages



Source: ISPV, own calculations

2.8 Results

The Figure 9 compares the results mentioned above and shows the fitting of all selected theoretical distributions to observed wages. Observed wages are represented by histograms and the probabilistic distributions are illustrated by the probability density functions (solid lines). Individual graphs are sorted by the best fit according to the AIC (1).

The fit between theoretical and empirical wage distributions is more clearly shown in the Table 1, which contains estimated parameters, the logarithm of the likelihood and values of the AIC (1).

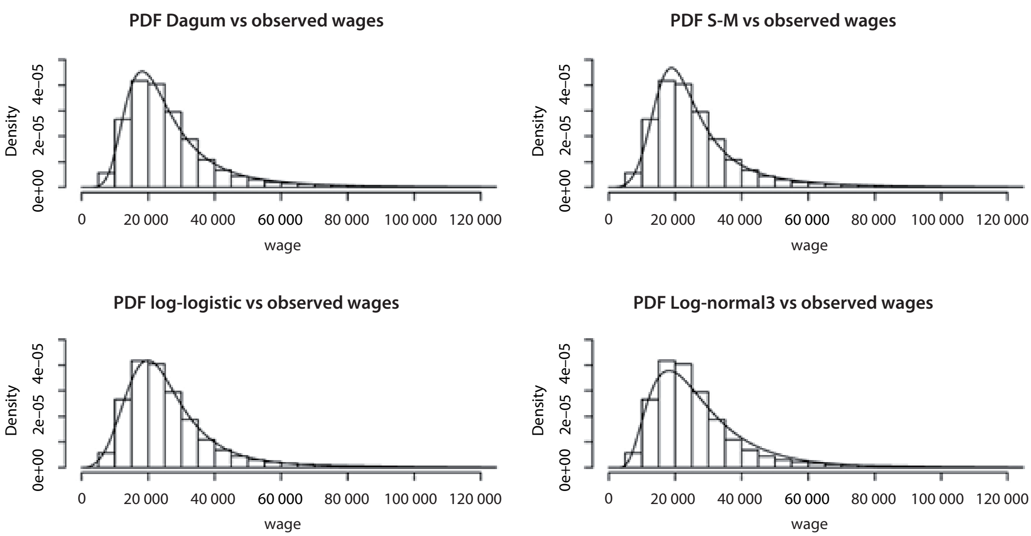
Table 1 Fits between empirical and theoretical wage distributions

Distribution	Parameter estimates			log-likelihood	AIC
Dagum	$a = 2.930$	$b = 15\,974.43$	$p = 2.3042$	–16 448 865	32 897 736
Singh-Maddala	$a = 4.602$	$b = 18\,940.34$	$q = 0.5725$	–16 450 507	32 901 020
Log-logistic	$a = 3.610$	$b = 23\,283.94$		–16 472 863	32 945 730
3-param. log-normal	$\mu = 10.033$	$\sigma = 0.5326$	$\lambda = 1\,004.13$	–16 473 337	32 946 680
2-param. log-normal	$\mu = 10.081$	$\sigma = 0.5106$		–16 512 126	33 024 256
2-parameter Gamma	$\alpha = 0.000121$	$\beta = 3.4015$		–16 677 991	33 355 986
Weibull	$a = 2.3172$	$b = 30\,660$		–16 865 534	33 731 072

Source: ISPV, own calculations

It is obvious, that the best fitting wage distribution is the Dagum distribution and the log-normal distribution does not by far suit the data well.

Figure 9 Probability density functions of common wage distributions



Source: ISPV, own calculations

Figure 9 Probability density functions of common wage distributions

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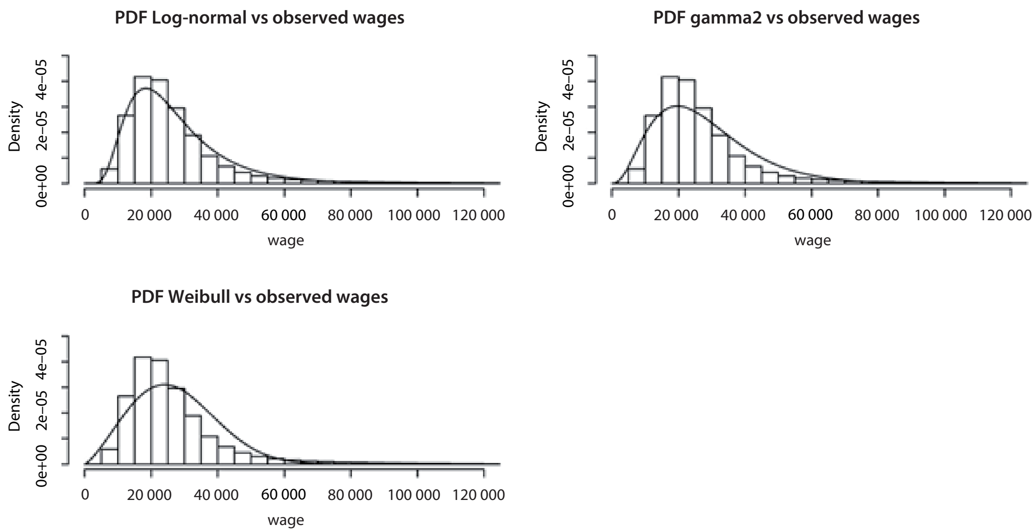
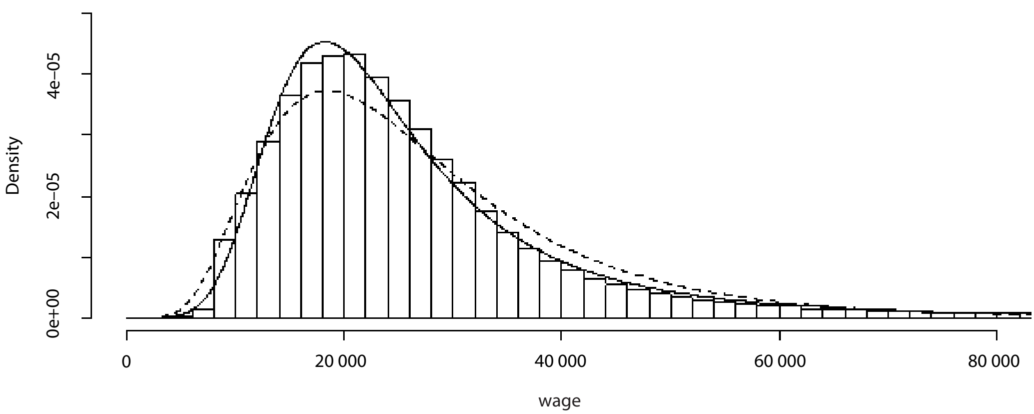


Source: ISPV, own calculations

3 WAGE DISTRIBUTION AND MINIMUM WAGE EFFECTS MODELING

To illustrate the role of the wage distribution in economic models, we will focus on the results of the Meyer & Wise's (1983a, 1983b) model which presents the method how to estimate the effect of the minimum wage on wages and employment using data based only on the observed distribution of wages. As for wage distributions, there is no doubt about using the Dagum distribution which seems to be the best-fitting one. By way of illustration, we will quantify the Meyer & Wise's model using not only the Dagum distribution, but also the 2-parameter log-normal distribution which is on one hand often used but on the other hand is not the well-fitting one as far as wages are concerned (see Table 1 and Figure 10).

Figure 10 The probability density function of the Dagum (the solid line) and 2-parameter log-normal (the dashed line) distributions and the histogram of observed wages

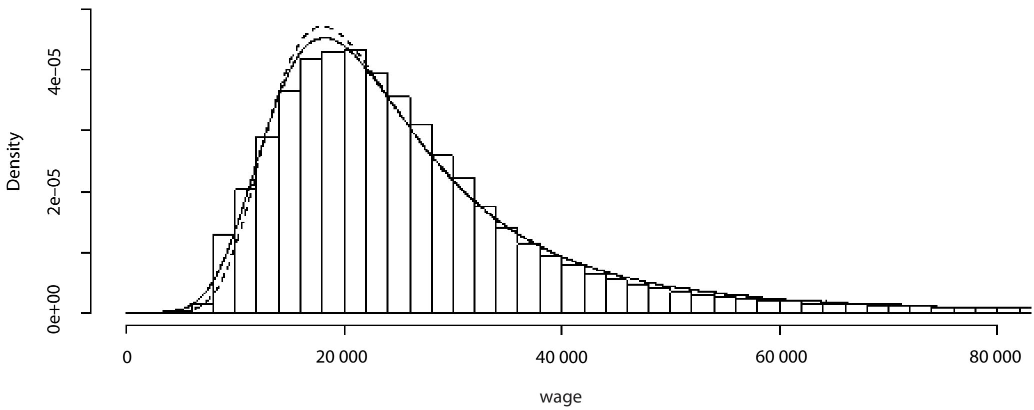


Source: ISPV, own calculations

As was mentioned above, the Meyer & Wise's model compares the distribution of market wage rates that individuals would receive in the absence of the minimum and the observed distribution with the minimum. As for observed wages, the distribution in the wage sphere is well-known (see the section 2) but it is very difficult to find the theoretical distribution in the absence of the minimum. In practice, truncated distributions are used to substitute the missing distribution.

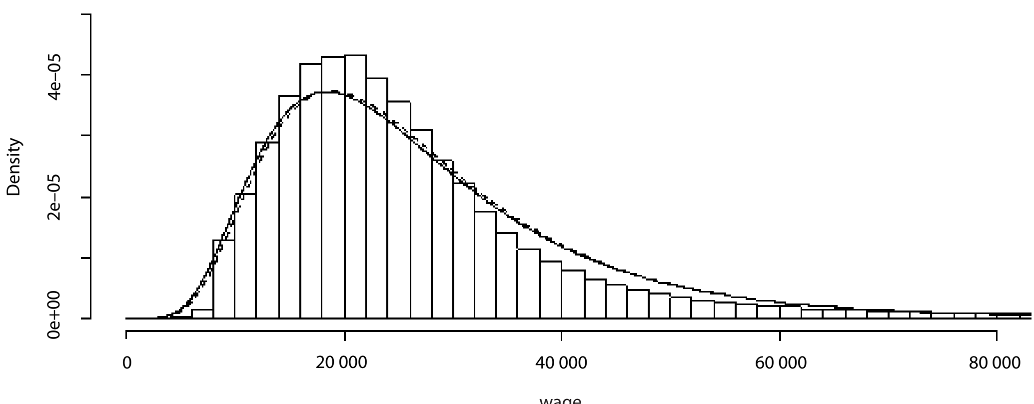
In Figures 11 and 12, there are shown the Dagum and 2-parameter log-normal distributions (solid lines) with the corresponding distributions truncated from the left at 8 800 CZK (dashed lines). Truncated distributions make use only of a part of the sample because objects with lower wages are excluded. In accord with the theory, a higher mean is typical of truncated distributions from the left (see the Table 2). As for the higher mean of the truncated distribution, it is important that individual means do not differ at too high levels because difference is „only" a half of the intervals used to quantify differences between the situations with and without minimum wage (the range of intervals equals to CZK 1 000).

Figure 11 The probability density function of the Dagum (the solid line) and Dagum distribution truncated from the left at 8 800 CZK (the dashed line) and the histogram of observed wages



Source: ISPV, own calculations

Figure 12 The probability density function of the 2-parameter log-normal (the solid line) and 2-parameter log-normal distribution truncated from the left at 8 800 CZK (the dashed line) and the histogram of observed wages



Source: ISPV, own calculations

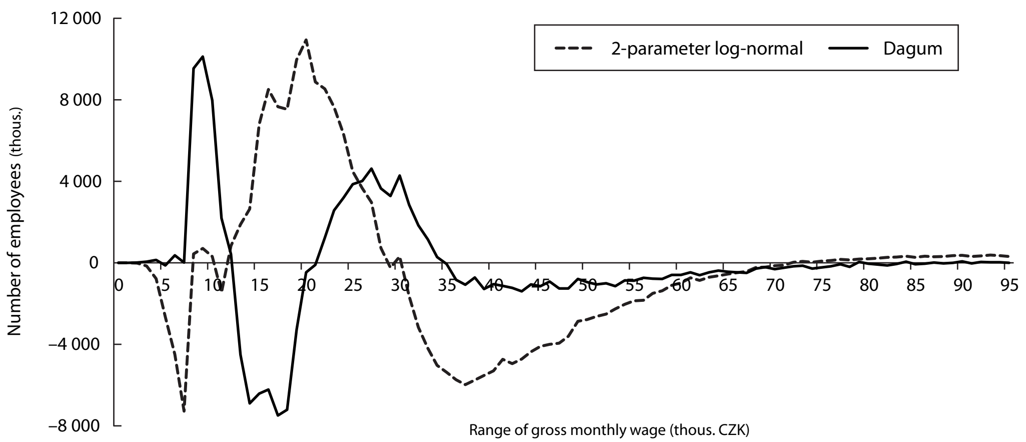
Table 2 Statistical characteristics of the Dagum and 2-parameter log-normal distributions and the Dagum and 2-parameter log-normal distributions truncated from the left at 8 800 CZK

Distribution	n	E(X)	Median	Variance
Dagum	1 524 860	27 663	22 836	450 201 178
Dagum truncated	1 507 392	28 060	22 876	511 571 849
2-parameter log-normal	1 524 860	27 233	23 904	220 908 895
2-parameter log-normal truncated	1 507 392	27 426	24 211	213 096 556

Source: ISPV, own calculations

If we compare the distribution of market wage rates that individuals would receive in the absence of the minimum (the distribution truncated from the left extrapolated up to the lower tail) and the observed distribution, the difference represents the effect of minimum wage on wages and employment in the wage sphere. Differences between observed values and truncated Dagum (or log-normal) distribution are shown in the Figure 13. The interpretation of results is obvious – the areas above the x axis represent the employment gains owing to the minimum wage (i.e. in the existence of the minimum wage, there are more employees remunerated at the wage ranging in the given interval), the areas under the axis represent employment losses (i.e. in the existence of the minimum wage, there are less employees remunerated at the wage ranging in the given interval).

Figure 13 Results of the Meyer & Wise's model using Dagum and 2-parameter log-normal distributions



Source: ISPV, own calculations

The diametrically opposite results showed in the Figure 13 for the Dagum and 2-parameter log-normal distribution imply that the distribution really matters. The only conclusion, we can draw for both distributions, is that the minimum wage distorts the wage distribution. The shift in an actual distribution differs between the Dagum and the 2-parameter log-normal distribution. As for the 2-parameter log-normal distribution, the spill-over effect is clearly evident even for highest wages (see employment losses in the intervals surrounding the 9th decile, roughly said 40 000 CZK) and what is more, there is no spike at the minimum representing the lowest wage workers clustering to the minimum wage after its introduction.

These findings contradict both the minimum wage theory and empirical studies carried out in other countries. On the contrary, conclusions drawn from the Dagum distribution are in accordance with the economic theory as well as empirical studies, i.e. there is a spike at the minimum and the spill-over effect corresponds to the best knowledge as far as the minimum wage is concerned.

CONCLUSION

In this paper we present empirical work on the wage distribution in the Czech Republic and its further use in an economic model concerning the labour market consequences of the minimum wage.

Contrary to other authors, we assume that the log-normal distribution is not the best-fitting one as far as wages in the Czech Republic are concerned. We fit common income and wages distributions to the microdata from the Average Earnings Information System using the maximum-likelihood estimation to estimate the parameters of individual models. In our case, a random variable is defined as the nominal average gross monthly wage in the wage sphere in the Czech Republic in 2011. In accord with our assumption, the log-normal distribution does not by far suit the data well and the best- fitting distribution is the Dagum distribution.

To achieve the second aim, i.e. to illustrate the role of the wage distribution in economic models, we quantify the Meyer & Wise's (1983a, 1983b) model that estimates the employment consequences of minimum wages. According to the model, we compare the distribution of wages that individuals would receive in the absence of the minimum wage (i.e. an estimate based on the distribution truncated from the left and subsequently extrapolated up to the lower tail) and the observed distribution, so the difference represents the effect of the minimum wage on wages and employment in the wage sphere. By way of illustration, we quantify the Meyer & Wise's model using not only the Dagum distribution, but also the 2parameter log-normal distribution which is not the well-fitting one as far as wages are concerned.

In view of the fact, that more work concerning above all truncation points is needed to identify how robust are the results of the Meyer & Wise's model in the Czech Republic, we focus on conclusions resulting from alternative measures of wage distributions. The only conclusion, we can draw for both distributions, is that the minimum wage distorts the wage distribution. The shift in an actual distribution differs between the Dagum and the 2-parameter log-normal distribution. As for the 2-parameter log-normal distribution, there is no spike at the minimum wage representing the lowest wage workers clustering to the minimum wage which contradicts both the minimum wage theory and empirical studies carried out in other countries. On the contrary, conclusions drawn from the Dagum distribution are in accordance with the economic theory as well as empirical studies. In other words, we found the evidence that the distribution really matters.

Last but not least our analysis illustrates the fact that well-specified models are required to evaluate the impact of state interventions on social-economic development. Improperly used models result in distorted conclusions and if we think of the worst consequences, it might be misused in favour of preferred solution alternatives.

References

COHEN, A. C., WHITTEN, B. J. Estimation in the Three-Parameter Lognormal Distribution. *Journal of the American Statistical Association,* 1980, Vol. 75, No. 370, pp. 399–404.

DAGUM, C. Un nouveau modèle de répartition du revenu privé: spécification et estimation. *Économie Appliquée,* 1977, Vol. 30, No. 3, pp. 413–437. Reprinted in: CHOTIKAPANISCH, D. eds. *Modeling Income Distributions and Lorenz Curves.* New York: Springer Verlag, 2008, pp. 3–25.

DICKENS, R., MACHIN, S., MANNING, A. Estimating the Effect of Minimum Wages on Employment from the Distribution of Wages: A Critical Review. *Centre for Economic Performance LSE CEP Discussion Paper,* No. 203 (August 1994).

DOLADO, J., KRAMARZ, F., MACHIN, S., MANNING, A., MARGOLIS, D., TEULINGS, C. The Economic Impact of Minimum Wages in Europe. *Economic Policy,* 1996, Vol. 23, pp. 317–372.

DUSPIVOVÁ, K., SPÁČIL, P. The Czech Labour Market and the Current Economic Crisis: What Can the Linked Employer-Employee Data Tell Us? *Statistika*, 2011, 48, 4 (December), pp. 22–34.

ISPV. *Informační systém o průměrném výdělku: 2011, IV. čtvrtletí, Mzdová sféra* (Information System on Average Earnings: 2011, IV. Quarter, Wage Sphere). Prague: Ministry of Labour and Social Affairs, 2012.

KLEIBER, C. A Guide to the Dagum Distributions. *The Center of Business and Economics, University of Basel (WWZ) Working Paper* No. 23/07, 2007.

KLEIBER, C., KOTZ, S. *Statistical Size Distributions in Economics and Actuarial Sciences.* New Jersey: John Wiley & Sons Inc., 2003.

MALENOVSKÝ, L., DUSPIVOVÁ, K. Harmonisation of the Average Earnings Information System (MoLSA) with the Wage Statistics (CZSO). *Statistika: Statistics and Economy Journal,* 2012. Vol. 49, No. 2, pp. 76–89.

MANKIW, N. G. *Principles of Economics.* Fort Worth, TX [US]: Dryden Press, 1998.

MAREK, L. Analýza vývoje mezd v ČR v letech 1995–2008 (Analysis of the Wages in the Czech Republic in 1995–2008). *Politická ekonomie,* 2010, Vol. 58, No. 2, pp. 186–206.

MEYER, R. H., WISE, D. A. Discontinuous Distributions and Missing Persons: The Minimum Wage and Unemployed Youth. *Econometrica,* 1983a, Vol. 51, No. 6 (Nov.), pp. 1677–1698.

MEYER, R. H., WISE, D. A. The Effects of the Minimum Wage on the Employment and Earnings of Youth. *Journal of Labor Economics,* 1983b, Vol. 1, No. 1 (Jan.), pp. 66–100.

MILANOVIC, B. *Income, Inequality, and Poverty During the Transition from Planned to Market Economy.* Washington, D.C.: The World Bank. 1998.

SINGH, S. K., MADDALA, G. S. A Function for Size Distribution of Incomes. *Econometrica,* 1976, Vol. 44, No. 5 (Sep.), pp. 963–970.

STIGLER, G. J. The Economics of Minimum Wage Legislation. *The American Economic Review,* 1946, Vol. 36, No. 3 (Jun.), pp. 358–365.

THOMAS, W. Y., WILD, C. J. Vector Generalized Additive Models. *Journal of Royal Statistical Society,* 1996, Series B, Vol. 58, No. 3, pp. 481–493.

WEIBULL, W. A Statistical Distribution Function of Wide Applicability. *Journal of Applied Mechanics,* 1951, Vol. 18, No. 3, pp. 293–297.