# The Great Recession and the Public-Private Wage Gap: Distributional Decomposition Evidence from Croatia 2008-2011

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# The Great Recession and the Public-Private Wage Gap: Distributional Decomposition Evidence from Croatia 2008-2011

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ABSTRACT: We study the pay gap between the public and the private sectors in Croatia just before and in the wake of the recent Great Recession. Using the Labor Force Survey data, we decompose the real hourly wage gap of full-time workers in 2008 and 2011 into the contributions of differences in workers' characteristics and differences in marginal returns to these characteristics. Besides decomposing the gaps in the two years, we analyze the main drivers of changes in the 2008-2011 period. The decompositions are performed at the mean, as well as at a number of quantiles along the distribution. In addition to quantifying the aggregate effects of characteristics and their marginal returns, we further decompose each of the two effects into the contributions of specific characteristics or groups of them. For the decomposition of the mean gap, the standard Oaxaca-Blinder framework is used, while in the case of quantile decompositions, this framework is combined with the recently developed unconditional quantile regressions. The results show that in both 2008 and 2011 there was a notable wage premium in favor of the public sector workers along the entire distribution, with both the differences in characteristics and marginal returns playing a role. The premium in favor of the public sector increased in the period considered, driven almost exclusively by changes in marginal returns.

KEYWORDS: wage gap, decomposition, Oaxaca-Blinder, recentered influence function, unconditional quantile regression, public, private, Great Recession, Croatia
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## 1. Introduction

Differences in wages between workers in the public and those in the private sector have been found to exist in many countries around the world. The public-private wage differential is a phenomenon which has different microeconomic and macroeconomic implications. For example, as regards microeconomic effects, the existence and nature of the public-private wage gap may have implications for labor market dynamics. In principle, the two sectors face different types of constraints in the wage setting process. While in the private sector various political constraints are dominant or sometimes the only ones that matter, the chief constraint that the private sector faces is that of profit maximization.

Different constraints in the wage setting process usually have consequences for the outcome of this process, that is, the employee's wages. Motivated partly or exclusively by the prospects for their reelection, incumbent government administrations may use public wage policy as an instrument for maximizing the number of votes in elections. Part of this may involve paying higher wages in the public sector than they are in the private sector; that is, providing a public sector premium, unjustified on productivity grounds. As a consequence of the wage gap thus created, people may well prefer public sector jobs, which may then put upward pressure on private sector wages which also may not be justified on productivity grounds. A result on macroeconomic level may be higher inflation. In addition, due to greater financing needs, fiscal deficit may widen, asking for cuts in other components of public expenditure, tax increases, or more borrowing.

This latter, public finance aspect of the public-private wage gap has been and continues to be especially important in the recent crisis, the Great Recession. Many governments around the world, and notably in Europe, struggle with excessive fiscal deficits, and Croatia is not an exception. In recent years, the media are cluttered with emphasizing that

employees in the public sector have been hit by the recession stronger than those in the private sector, primarily in terms of earnings and the possibility of job loss.

In this paper, we explore empirically the public-private wage gap in Croatia. We consider two years: 2008, which is taken as the last pre-crisis year, and 2011, the latest year of recession for which we have available data. The chief aims of the paper are to measure the public-private wage gap separately for the two mentioned years, to uncover the drivers of the gap and to see if any changes took place during the three-year period that we consider. More specifically, we measure the gaps at the mean and at a number of quantiles along the distribution and decompose them, within the Oaxaca-Blinder decomposition framework (Oaxaca 1973, Blinder 1973) into two components. The first component is the "composition" effect: it is that part of the raw gap which can be attributed to differences in observed individual characteristics of workers between the two sectors. The second one is the "wage structure" effect which is due to differences in marginal returns or rewards to these characteristics. In addition to quantifying these aggregate composition and wage structure effects, we also decompose each of them into the effects of specific characteristics. In the case of decompositions at different quantiles, we combine the Oaxaca-Blinder framework with recently proposed procedure for estimating the so-called unconditional quantile regressions (Firpo, Fortin, and Lemieux 2009). Unlike the standard (conditional) quantile regressions (Koenker and Basset 1978), unconditional quantile regressions can be interpreted both conditionally and unconditionally, just like it is the case with OLS mean regressions, and it is this property that allows one to perform detailed, rather than only aggregate, decompositions of quantile wage gaps. The micro-data we use come from the Labor Force Surveys for 2008 and 2011.

The contribution of this paper is threefold. First, to the best of our knowledge, this is the first paper to deal with the relationship between the recent Great Recession and the public-

private wage gap. Other papers on the topic of public-private wage gap are focused on years before the recent economic downturn. By analyzing the gap just before the crisis, in 2008, and in the wake of it, in 2011, and by comparing the results, we are able to see if there were any changes in terms of the size of the gap and its components. Second, the unconditional quantile regressions of Firpo, Fortin, and Lemieux (2009) allow us to perform detailed, and not just aggregate, quantile decompositions of the public-private wage gap. In the public-private wage gap literature, this has so far been done only by Depalo, Giordano, and Papapetrou (2012), so that our paper contributes to the literature in this respect as well. Finally, to the best of our knowledge the public-private wage gap in Croatia has not been analyzed so far at all. This paper thus represents the first attempt to deal with the topic in a systematic way.

The remainder of the paper is organized in the following way. Section 2 describes the Labor Force Survey data and the sample selected for use in our analysis, and provides some simple descriptive evidence. Section 3 presents the methodological framework that we utilize. In section 4, we present the results of our analysis. Finally, section 5 contains a summary of the paper and some concluding remarks.

## 2. Data, sample selection, and descriptive evidence

We use the data from the Labor Force Survey (LFS) for the years 2008 and 2011. The survey is conducted by the Croatian Bureau of Statistics via face-to-face interviews on a random sample of households that is representative of the Croatian population. For each member of an interviewed household older than 14, the data contain information on a number of demographic and socio-economic characteristics such as age, gender, education, activity status, occupation, work experience and tenure. Interviewed individuals are also asked about the usual net monthly wage on their main job and the usual number of hours they work per week.

The data for both 2008 and 2011 were collected on a quarterly basis as a rotating panel, following the so-called "2-(2)-2" survey design. Precisely, each sampled household is interviewed for two consecutive quarters, then it is left out for the next two consecutive quarters, and then it is interviewed again for two consecutive quarters. Therefore, in a given year, the observations from the first and third quarters do not overlap, and the same holds for the observations from the second and fourth quarters. To ensure that our samples do not contain overlapping observations, for each of the two years, we took all observations from the first and third quarters and pooled them with those from the second and the fourth quarter that were present in neither the first not the third quarter.

For this study's purpose, we restricted the full 2008 and 2011 samples in the following way. We focus those in paid employment who work fulltime (40 or more hours per week). We exclude self-employed, farmers, and all individuals working as helping workers in family firms and on family farms. The reason for excluding them is that their wage structure may be different due to the fact that the self-employed determine their wages themselves or, in the case of helping workers in family firms and farms, the wages are determined by close family members. Individuals older than 65, which is the official retirement age, but still work, may also have quite different wage structure than other workers, and for this reason we also exclude all individuals older than 65. Finally, we exclude those with a military occupation. The reason is that in both the 2008 and 2010 samples each person with a military occupation is employed in the public sector, which causes that the indicator for military occupation has no variability whatsoever in either the public or the private sector, and therefore cannot be used as a covariate in the wage regressions we run as part of the decomposition methodology. Applying all these restrictions, we are left with 5,956 observations in the 2008 sample and 4,389 observations in the 2011 sample.

Regarding the definition of the public and private sectors that we use to delineate them, we consider as public sector employees all those who work in a state-owned firm, public organization or institution, or in a firm which is in the process of privatization. All other workers are then considered as working in the private sector. According to this classification of workers between the two sectors, public sector workers comprised about 37 percent of the 2008 sample and about 38 percent of the 2011 sample.

The wage variable used in this paper is defined as the usual net hourly wage. We compute it using the answers to the questions about the usual net monthly wage and about the usual number of work hours per week. The number of work hours per week is multiplied by four to obtain the number of work hours per month. To obtain real wages, nominal wages are divided by the consumer price index whose base is the year 2010. Finally, as usual in the literature, in our analysis we use the natural logarithm of the hourly wage, rather than its absolute level.[2]

The set of explanatory individual characteristics consists of: gender, age and age squared, experience and experience squared, tenure, six indicators for the educational level, and nine occupational indicators. Summary statistics of these variables for both sectors are given in table 1 (2008) and table 2 (2011). We first observe that there are significant differences in the means of characteristics between the public and private sectors in each of the two years. In both years, the genders are virtually equally represented in the public sector, whereas in the private sector there are notably more males, whose share is about 56-57 percent. In comparison to workers from the private sector, those in the public sector are on average about 7 years older, have about 6 years more experience, and their tenure is about 8 years longer. Public sector workers are also on average better educated. For example, while the share of workers with tertiary education (college, university graduate, postgraduate) in the

[2] For simplicity of exposition, in the remainder of the paper we do not refer to "log net hourly real wage", but rather to "log wage" or just "wage".

public sector is about one third, the corresponding share is less than 15 percent in the case of the private sector. As far as occupational structure is concerned, most of the public sector employees are professionals, technicians, or clerks, whereas in the private sector most are craftsmen, plant/machine operators, or deal with services and sales.

Another thing we note is that with the exception of characteristics measured in years (age, experience, and tenure), the differences in means over the period considered are for both sectors quite small. This should not come as a surprise, given that the time span is only three years long, and one can hardly expect any sizeable changes to the distribution of individual characteristics. The only exceptions, as we said, are the characteristics measured in years. Note that for both sectors the mean age increased by roughly two years, and the mean experience increased by roughly one year and a half. We speculate that these differences might be due to possibly asymmetric effect of the Great Recession with respect to age and experience: those who lost their jobs during the 2008-2011 period may be on average younger and have fewer years of experience than those who managed to remain employed. However, it is puzzling that during the same period the average tenure fell by roughly two years.

Before we proceed, we here give some descriptive evidence on the wage gaps at the mean and along the distribution. On panels A and B of figure 1, we see that in both years the wage density for the public sector is to the right of that for the private sector, indicating generally that wages are higher in the public sector. This can also be seen by comparing the mean wages in the two sectors: the one in the public sector is higher for both 2008 and 2011, with the gap in 2011 being a bit bigger. Panels C and D depict how the density for each of the two sectors changed in the period 2008-2011. Concerning the public sector, we observe that in the period considered there was a rightward shift, but very small; this can be best seen by comparing the means. On the contrary, there was hardly any notable change in the case of private sector: the two means virtually coincide to each other. Figure 2 displays the public-

private wage gaps at 99 percentiles along the distribution for 2008 and 2011. The gaps are computed by subtracting the private sector wage from the public sector wage. First, one can observe that for both years the gap is positive, that is, there is a public sector premium, along the entire distribution. And second, the gaps are generally bigger in 2011 than in 2008. This is a consequence of what we have seen on panels C and D of figure 2, namely that the real net wages increased somewhat in the public sector during the period 2008-2011, while those in the private sector remained virtually unchanged.

In the remainder of the paper, for each of the two years we decompose the raw wage gaps at the mean and at a number of quantiles along the distribution into the contributions attributable to differences in individual characteristics and to differences in the returns to these characteristics between the two sectors.

## 3. Methodological framework

### *3.1. Mean decomposition*

For the decomposition of the mean wage gap between the public and private sectors into components attributable to different individual characteristics and different returns to these characteristics, we use the standard Oaxaca-Blinder decomposition framework (Oaxaca 1973, Blinder 1973). Let the structural wage setting equation $m_g(X_i, \varepsilon_i)$ for a worker *i* be linear and separable in observable ($X$) and unobservable ($\varepsilon$) explanatory characteristics:

(1) $$Y_{g,i} = m_g(X_i, \varepsilon_i) = X_i \beta_g + \varepsilon_g ,$$

where $E\left[\varepsilon_g \mid X\right] = 0$ and where the subscript $g$ indicates whether the worker works in the public sector, *g=pub*, or in the private sector *g=pri*. Let also $D_{g,i}$ be an indicator variable equal to 1 if the individual *i* belongs to the group $g$, and 0 otherwise. Denoting by $\mu_g$ the

mean wage in group *g*, the overall mean wage gap, $\Delta^{\mu}$, in the population can then be expressed as:

$$
\begin{aligned}
\Delta^{\mu} &= \mu_{pub} - \mu_{pri} \\
&= E\left[Y_{pub} \mid D_{pub} = 1\right] - E\left[Y_{pri} \mid D_{pri} = 1\right] \\
&= E\left[X\beta_{pub} + \varepsilon_{pub} \mid D_{pub} = 1\right] - E\left[X\beta_{pri} + \varepsilon_{pri} \mid D_{pri} = 1\right] \\
&= E\left[X \mid D_{pub} = 1\right]\beta_{pub} - E\left[X \mid D_{pri} = 1\right]\beta_{pri}.
\end{aligned} \tag{2}
$$

The sample counterpart of the above expression is obtained by replacing the expectations of the explanatory variables by their sample averages and the beta parameters by their OLS estimates:

$$\hat{\Delta}^{\mu} = \bar{X}_{pub}\hat{\beta}_{pub} - \bar{X}_{pri}\hat{\beta}_{pri}\,. \tag{3}$$

Finally, adding and subtracting $\bar{X}_{pub}\hat{\beta}_{pri}$, the mean wage that public sector workers would have earned if they had the wage structure (i.e., returns to characteristics) equal to those of workers in the private sector, the following decomposition is obtained:

$$
\begin{aligned}
\hat{\Delta}^{\mu} &= \bar{X}_{pub}\left(\hat{\beta}_{pub} - \hat{\beta}_{pri}\right) + \left(\bar{X}_{pub} - \bar{X}_{pri}\right)\hat{\beta}_{pri} \\
&= \hat{\Delta}^{\mu}_{\beta} + \hat{\Delta}^{\mu}_{X}
\end{aligned}\,. \tag{4}
$$

The first term on the right-hand side of (4) is the *wage structure effect*, the part of the overall mean wage gap that is due to different wage structures between public and private sector workers, for fixed characteristics (those in the public sector). The other term is the *composition effect*, representing the effect of differing characteristics between the two groups of workers, under fixed wage structure (from the private sector). The composition effect is also called the "explained" part of the overall gap, while the wage structure effect is accordingly termed "unexplained".

The two effects can be further decomposed into the contributions of each of the characteristics contained in vector *X*. If there are *K* characteristics, the wage structure effect can be written as

$$(5) \qquad \hat{\Delta}_{\beta}^{\mu} = \left(\hat{\beta}_{pub,0} - \hat{\beta}_{pri,0}\right) + \sum_{k=1}^{K} \overline{X}_{pub,k}\left(\hat{\beta}_{pub,k} - \hat{\beta}_{pri,k}\right),$$

where $\left(\hat{\beta}_{pub,0} - \hat{\beta}_{pri,0}\right)$ is the effect of the omitted group, and $\overline{X}_{pub,k}\left(\hat{\beta}_{pub,k} - \hat{\beta}_{pri,k}\right)$ is the contribution of characteristic $k$ to the aggregate wage structure effect. Similarly, the composition effects can be decomposed as follows:

$$(6) \qquad \hat{\Delta}_{X}^{\mu} = \sum_{k=1}^{K}\left(\overline{X}_{pub,k} - \overline{X}_{pri,k}\right)\hat{\beta}_{pri,k},$$

where $\left(\overline{X}_{pub,k} - \overline{X}_{pri,k}\right)\hat{\beta}_{pri,k}$ represents the contribution of characteristics $k$ to the aggregate composition effect.

A well-known and still unsolved issue with OB decompositions is that the results of detailed decompositions in the case of categorical variables depend on the choice of the omitted category (to avoid perfect collinearity), which is basically arbitrary (see, e.g., Jones 1983, Oaxaca and Ransom 1999, Gardeazabal and Ugidos 2004, and Yun 2005).[3] When one changes the omitted category, not only do the contributions of the other, non-omitted categories change; so does their combined contribution as well. The problem arises from the fact that a part of the wage structure effect associated with a particular category is always attributed to the intercept.[4] This makes the true wage structure effect of the covariate in question essentially unidentified.

What first comes so one's mind is to perform decompositions for all possible choices of omitted category, and to average the results so obtained. Doing this literally would hardly be convenient, especially when there is more than one characteristic, each represented by a number of dummies (say education with six categories and occupation with nine categories as in our application). In terms of results, an identical way is to follow the procedures proposed by Gardeazabal and Ugidos (2004) and Yun (2005). The procedures effectively rely on

[3] For a general discussion, see chapter 3.2. in Firpo, Fortin, and Lemieux (2011).
[4] See illustrative examples in Jann (2008) and in Firpo, Fortin, and Lemieux (2011)

restricting the coefficients on the dummies by which a categorical characteristic of interest is represented.

Suppose, for the sake of illustration,[5] that we have just one characteristic, that it is categorical, and that we represent it through $H$ dummies. To avoid perfect collinearity, only $H$-1 of them may be included in the wage equation. We thus have the model

(7) $$y = \beta_0 + \beta_1 D_1 + ... + \beta_{H-1} D_{H-1} + \beta_H D_H + \upsilon,$$

where one of the dummies, say $D_H$, is restricted to zero. A fully equivalent alternative is the following one:

(8) $$y = \widetilde{\beta}_0 + \widetilde{\beta}_1 D_1 + ... + \widetilde{\beta}_{H-1} D_{H-1} + \widetilde{\beta}_H D_H + \upsilon, \text{ subject to } \sum_{h=1}^{H} \widetilde{\beta}_h = 0,$$

where $\widetilde{\beta}_0 = \beta_0 + c$, $\widetilde{\beta}_h = \beta_h - c$ for $h$ = 1, …, $H$, and $c = \frac{1}{H}\sum_{h=1}^{H} \beta_h$. Yun (2005) showed that a detailed decomposition involving coefficients estimated in this way yields results identical to results that one would obtain by performing decompositions sequentially with different omitted categories and then averaging those results. In our empirical analysis we follow Yun's (2005) approach.[6]

### *3.2. Quantile decomposition*

When one wants to perform an OB-type decomposition of wage gaps at different quantiles along the distribution, one unfortunately cannot just run the quantile wage regressions of Koenker and Basset (1978) at the quantiles of interest and use the estimated coefficients in the OB framework. The reason lies in the fact that unlike the OLS coefficients, which have both the conditional and unconditional interpretation, the coefficients estimated by quantile regressions have only the conditional interpretation.

As is well known, the OLS is a linear approximation to the true conditional expectation function, $E[Y \mid X] = X\beta$, which allows one to interpret $\beta$ as the effect of changes

[5] The illustration is based on Jann (2008).
[6] It is easily implemented as an option in Ben Jann's Stata procedure "oaxaca" (Jann 2008).

in $X$ on the conditional expectation of $Y$ given $X$. Taking expectations of the last expression over the distribution of $X$ and invoking the law of iterated expectations gives

(9) $$E_X[E[Y \mid X]] = E[Y] = E[X]\beta,$$

which makes clear that $\beta$ can also be interpreted as the effect of changes in the mean of $X$ on the unconditional mean of $Y$. It is this property that is used in OB decompositions of the mean wage gap (see equation (2)). Unfortunately, the law of iterated expectations does not hold for quantiles, that is, taking expectations of a conditional $\tau^{\text{th}}$ quantile, $Q_\tau(X)$, does not yield the unconditional quantile: $E_X[Q_\tau(X)] \neq Q_\tau$. Consequently, the beta coefficients in the linear quantile regression $Q_\tau(X) = X\beta_\tau$ have only the conditional interpretation, so that one cannot interpret it as the effect of changes in the mean of $X$ on the marginal (i.e., unconditional) $\tau^{\text{th}}$ quantile.

While in the case of the mean it is enough to estimate the conditional mean wage, in the case of quantiles the entire counterfactual unconditional cumulative distribution $F_{Y_{pub}^{pri}}(Y)$ must be estimated, where $F(.)$ denotes cumulative distribution function and $Y_{pub}^{pri}$ denotes wages that would have prevailed in the public sector had public sector workers been paid according to the wage structure from the private sector. Once one has it, a counterfactual unconditional quantile of interest can be recovered by inversion: $Q_{\tau,pub}^{pri} = F_{Y_{pub}^{pri}}^{-1}(\tau)$.

A number of procedures for obtaining the counterfactual distribution $F_{Y_{pub}^{pri}}(Y)$ have been suggested in the literature during the last two decades. Juhn, Murphy, and Pierce (1993), Machado and Mata (2005) and Melly (2005) seek to replace each public sector wage $Y_{pub}$ with a counterfactual wage $Y_{pub}^{pri}$. Juhn, Murphy, and Pierce (1993) do that using a residual imputation approach, while Machado and Mata's (2005) method is based on conditional quantile regressions and simulations. DiNardo, Fortin, and Lemieux (1996) proposed a semi-

parametric reweighting approach, which uses an estimated reweighting factor to "impose" public sector workers' characteristics on workers in the private sector. There are also methods that first estimate the conditional distribution $F_{Y_{pri}|X_{pri}}(Y \mid X)$ and then integrate it over the public sector workers' distribution of characteristics, $F_{X_{pub}}(X)$ to obtain the counterfactual distribution $F_{Y^{pri}_{pub}}(Y)$. These include the parametric methods of Donald, Green, and Paarsch (2000) and Fortin and Lemieux (1998), as well as a less restrictive approach of Chernozukov, Fernandez-Val, and Melly (2012).[7]

If one's aim is to perform just an aggregate decomposition of quantile wage gaps, that is, to estimate the wage structure and composition effects without the wish to do a detailed decomposition by further decomposing both of them into the contributions of each of the observable characteristics, any of these methods can do the job. If one is, however, interested in a detailed decomposition, the methods mentioned so far in this section are limited. Although some of them allow for detailed decompositions, they are either not easy to implement or path dependent in the sense that a detailed composition must be done sequentially, introducing the characteristics sequentially one at a time, and the results depend on the order in which the characteristics are introduced.

Firpo, Fortin, and Lemieux (2010) have recently proposed a simple procedure which allows one to do a detailed decomposition of quantile wage gaps. It is easy to implement and the results are not path dependent since there is no need for a sequential decomposition. The method is based on the so-called recentered influence function (RIF) regressions or unconditional quantile regressions of Firpo, Fortin, and Lemieux (2009). The idea is to run a standard OLS regression in which the dependent variable is replaced by the recentered

[7] Fortin, Lemieux and Firpo (2010) provide a comprehensive overview of these methods, discussing their limitations and advantages. It should be said that the mentioned papers do not deal with decompositions of the mean or quantile public-private wage gaps, but with differences/changes in various other statistics (functionals) of wage distributions, such as scalar inequality measures (e.g., the Gini coeffeicient, the variance); and the applications are not necessarily related to differences between the public and private sectors.

influence function of the distributional statistic of interest. Unlike in a standard quantile regression of Koenker and Basset (1978) where the estimated coefficients have only the conditional interpretation, in a RIF regression of a particular quantile the coefficients have the unconditional interpretation, as in standard OLS regressions.

The key concept underlying RIF regressions is the influence function (IF) of a distributional statistic, a function that shows the effect of a small perturbation in the distribution of the outcome variable (wage in our case) on the distributional statistic of interest (a quantile in our case). For a quantile $Q_\tau$ of a distribution of wages, the IF has been shown to be:

$$(10) \qquad IF(Y;Q_\tau) = \frac{\tau - \mathbf{1}[Y \le Q_\tau]}{f_Y(Q_\tau)} ,$$

where **1**[.] is an indicator function that is equal to 1 if income is less than or equal to the unconditional quantile $Q_\tau$ and 0 otherwise, and $f_Y(Q_\tau)$ is the density of wages at $Y = Q_\tau$. The recentred influence function (RIF) is defined as the sum of the statistic of interest and its IF, so that the RIF of a quantile $Q_\tau$ is given as:

$$(11) \qquad RIF(Y;Q_\tau) = Q_\tau + \frac{\tau - \mathbf{1}[Y \le Q_\tau]}{f_Y(Q_\tau)} .$$

Since the expected value of the IF of any distributional statistic is by definition equal to zero, the expectation of the corresponding RIF is equal to the distributional statistic itself, the unconditional quantile in our case: $E[RIF(Y;Q_\tau)] = Q_\tau$. Firpo, Fortin, and Lemieux (2009) assume that the conditional expectation of the $RIF(Y;Q_\tau)$ given $X$ can be approximated by a linear function,

$$(12) \qquad E[RIF(Y;Q_\tau) \mid X] = X\beta_\tau^{RIF} .$$

Taking expectations of this equation over $X$ and invoking the law of iterated expectations yields

(13) $E[RIF(Y;Q_\tau)] = E[X]\beta_\tau^{RIF}$.

Equations (12) and (13) make clear that the estimated coefficients in a RIF regression of a quantile $Q_\tau$ have both the conditional (in (12)) and unconditional (in (13)) interpretations. This property is a consequence of using $RIF(Y;Q_\tau)$ instead of $Q_\tau$ as the dependent variable. To be more precise, since the true $RIF(Y;Q_\tau)$ is unknown, the estimate of it is used, which is obtained by first estimating the sample quantile of interest, $\hat{Q}_\tau$, and the density of wages at this point, $\hat{f}_Y(\hat{Q}_\tau)$. Using these estimates in formula (11), one obtains the estimate of $RIF(Y;Q_\tau)$ to be used as the dependent variable.

Once the RIF regression for a quantile of interest is estimated[8] separately for females and males, the resulting coefficient estimates $\hat{\beta}_{\tau,pub}^{RIF}$ and $\hat{\beta}_{\tau,pri}^{RIF}$, respectively, can be used to perform a standard OB decomposition of the wage gap at the $\tau^{th}$ quantile ($\hat{\Delta}^\tau$) into the wage structure ($\hat{\Delta}_\beta^\tau$) and composition ($\hat{\Delta}_X^\tau$) effects in the same way it is done for the mean gap in equation (4):

(14)
$$\begin{aligned}\hat{\Delta}^\tau &= \bar{X}_{pub}(\hat{\beta}_{\tau,pub}^{RIF} - \hat{\beta}_{\tau,pri}^{RIF}) + (\bar{X}_{pub} - \bar{X}_{pri})\hat{\beta}_{\tau,pri}^{RIF} \\ &= \hat{\Delta}_\beta^\tau + \hat{\Delta}_X^\tau.\end{aligned}$$

A detailed decomposition is possible as well, in the way it is done in equations (5) and (6). Finally, the issue with the choice of the omitted categories is present here as well. For that reason, here we follow Yun's (2005) proposal for making detailed decompositions invariant to the choice of the omitted categories that we discussed in the subsection on mean decomposition.

[8] Firpo, Fortin and Lemieux provide a Stata procedure "rifreg" to estimate RIF regressions. The codes are available on Nicole Fortin's web site (http://faculty.arts.ubc.ca/nfortin/datahead.html).

## 4. Results

In this section we present the results of our decomposition exercises. First the results of the mean decompositions are given, and then those at selected quantiles along the distribution. In detailed decompositions, we do not report the effect of each and every covariate. For example, the effects of experience, its square, and tenure are summed up and reported as a composite effect "experience and tenure". The same is done in the case of education and occupation.

### *4.1. Mean decompositions*

The results of the mean decomposition for both 2008 and 2011 are given in table 4, and the estimates of wage equations on which the decompositions are based are in table 3.[9] In 2008, the total gap between the mean wages in the public and private sectors was 0.280 log points,[10] indicating a premium for public sector workers. The aggregate decomposition for 2008, given in the first column, reveals that both the composition and wage structure effects are positive, that is, both operated in the same, gap-increasing direction. The composition effect was 0.163, indicating that about 63 percent of the total mean wage gap in 2008 can be accounted for by the mean differences in workers' characteristics between the two sectors. The rest, 0.0948 or about 37 percent, is due to differences in marginal returns to these characteristics, that is, due to the difference between the wage structures.

The detailed decomposition of the composition effect shows that the set of characteristics which can be considered as representing human capital – experience and tenure, education, occupation – dominate over gender and age. The effects of these human capital factors are all positive (gap-increasing), whereas the effects of gender and age are negative (gap-reducing). The same findings arise from the detailed decomposition of the wage structure effect. The effects of gender and age are again gap-reducing and by an order of

[9] We do not discuss the estimates of wage equations. We only note that in all the four wage equations most of the estimated coefficients have expected signs and are statistically significant, indeed highly so.
[10] Hereafter, we drop "log points" for the sake of expositional simplicity.

magnitude smaller in absolute value than the effects of experience and tenure, education, and occupation, which are all gap-increasing.

The total mean wage gap in 2011 was 0.289, meaning that the premium in favor of public sector workers increased in comparison to 2008 by 0.031. As in the case of 2008, the aggregate decomposition shows that both the composition and wage structure effects are gap-increasing. The composition effect amounts to 0.165, which is only slightly (0.002) more than in 2008. Although the composition effect increased in absolute value in the 2008-2011 period, its relative contribution to the total mean gap declined from 63 percent to 57 percent. This is a consequence of the change in the wage structure effect, which rose in the same period by 0.0292, an increase both absolutely and relatively bigger than in the case of the composition effect. That the wage structure effect increased more than the composition effect should come as no surprise, given that in three years one can hardly expect the differences in distributions of characteristics to change much. That is, indeed, what we observe by comparing tables 1 and 2. On the other hand, the marginal returns to those characteristics are easier to change, especially so in the time of an economic crisis. As we can see from the estimates of the wage regressions in table 3, the changes in marginal rewards were for most of the characteristics positive in the public sector, whereas in the private sector the changes in coefficients were in most cases negative. As a consequence, the total mean wage gap increased from 2008 to 2011 primarily due to the rise in the gap-increasing wage structure effect.

Splitting up the composition effect into detailed composition effects reveals that, as it was the case in 2008, the effects of gender and age are gap-reducing, the effects of the human capital-related factors are gap-increasing, and the latter effects dominate in absolute value the former ones, but only marginally. Comparing these detailed composition effects to those in 2008, we note that the absolute changes that give rise to near zero change (0.002) in the overall composition effect are those associated with age and experience and tenure. The

former is gap-reducing, and the latter is gap-increasing, while their absolute values are quite similar. As regards the detailed decomposition of the wage structure effect, the results show that, when all other detailed effects cancel each other out, the overall wage structure effect arises as roughly equal to the effect of experience and tenure. In particular: the negative effect of age cancels the positive effect of the intercept; the negative effect of education cancels the positive effect of occupation; and the effect of gender almost negligibly small. Comparison the 2011 detailed effects with those for 2008 shows that the effects of age and the intercept are substantial, yet the two cancel one another since they are of about the same absolute value. Basically, since the difference in the effect of gender is negligible, the rise in the overall wage structure effect (0.0292) comes about as the net result of the sum of positive effects of experience and tenure and occupation on the one hand, and the negative effect of education on the other hand.

In sum, the results of the decomposition of the mean public-private wage gap show that: first, there was a premium in favor of the public sector in both 2008 and 2011; second, the premium increased in the 2008-2011 period; third, the premium increased mainly because the wage structure effect increased.

### *4.2. Quantile decompositions*

We perform quantile decompositions at 19 equally distanced percentiles, from the 5$^{th}$ to the 95$^{th}$. To save space, we report neither the results of the 19 unconditional quantile regressions, nor the standard errors for the estimates of the decomposition terms.[11]

For 2008, the total public-private wage gaps, along with the associated composition and wage structure effects for the 19 selected percentiles are depicted in figure 3. For the sake of comparison, the mean wage gap is shown as well. We first note that from the bottom of the distribution up to the 65$^{th}$ percentile, the quantile gap is above the mean gap which in 2008

[11] All these results are available on request.

equals 0.258. The gap by no means varies monotonically. At the very bottom, it is just slightly above the mean gap. Then it rises, but only on average, up to the 40$^{th}$ percentile, where it reaches its maximum of 0.364, and falls, but again only on average, up to the 65$^{th}$ percentile. It is only from the latter percentile all the way to the 95$^{th}$ percentile, that the gap declines monotonically. Yet it stays positive along for the whole range of percentiles we consider; its smallest value it takes on, reached at the very top of the distribution, is 0.036. Generally, one can say that on average the gap is decreasing as one moves from the bottom towards the top, meaning that on average the public sector premium is bigger for those earning lower wages.

The overall composition effect is also positive along the whole distribution, ranging from somewhat below 0.1 to somewhat below 0.2. It reaches its maximum of 0.327 at the 20$^{th}$ percentile, and it only marginally smaller (0.189) at the 95$^{th}$ percentile. There is, however, hardly any systematic pattern in how the composition effect varies along the distribution; it just oscillates around the mean composition effect which we have seen in the previous section to be 0.163.

On the contrary, the overall wage structure effect is notably more variable. It is above the mean wage structure effect (0.0948) up to the 65$^{th}$ percentile, oscillating more or less within the same range as the composition effect. From the 65$^{th}$ percentile to the top, the wage structure effect is declining monotonically, just like the total gap. It also reaches the maximum and minimum at the same percentiles as the total gap, namely at the 40$^{th}$ and the 95$^{th}$ percentile, respectively. In fact, the overall wage structure effect varies along the distribution almost perfectly in line with the total gap; this is clearly observed by looking at the patterns of the lines representing the wage structure effect and the total gap. As regards the sign of the wage structure effect, it is not positive (gap-increasing) at all of the selected points of the distribution, as it turns negative (gap-reducing) at the top of the distribution, after the 85$^{th}$ percentile.

The two effects can be further divided up into the detailed effects. The detailed quantile decomposition of the composition effect is depicted in figure 4. The first thing to note in figure 4 is that the detailed composition effects of experience and tenure, education, and occupation are all positive (gap-increasing), whereas the effects of gender and age are all negative (or, at some percentiles, only marginally positive, virtually zero), along the entire distribution. Second, the dominance in absolute size of the former three effects is clearly seen to hold over a great part of the distribution. These three positive effects are pretty close to one another at percentiles over the middle of the distribution, whereas at the extremes, and especially at the bottom, the differences between them are more sizeable. While the effect of experience and tenure is dominant at the bottom, and only slightly in the middle, the effect of education seems more dominant in the upper part of the distribution. As regards the two negative (gap-reducing) effects, the effect of gender is quite small and stable along the entire distribution. The effect of age is absolutely bigger than the effect of gender at the bottom and at the top of the distribution (the only exception being the $95^{th}$ percentile), while in the middle it oscillates around the effect of gender. By and large, the signs and relative contributions of different detailed composition effects in the quantile decomposition seem to be pretty much in line with those indicated by the results of the mean decomposition.

In figure 5, the results of the detailed decomposition of the wage structure effect are displayed. At first glance, one observes that the only sizeable detailed components of the overall wage structure effect are the effects of age and the intercept. In the mean decomposition, we saw that these effects were very small. Now that we have their values along the whole distribution, we see that they are not quite so small at all. Indeed, they are the only sizeable detailed components of the overall wage structure effect. They are relatively small and close to each other only at around the middle of the distribution. Over the bottom and top portions of the distribution these two effects are of opposite signs: except at the very

bottom and the very top (i.e., at the 5th and the 95th percentile), when one is gap-increasing, the other is gap-reducing. The effect of age is gap-increasing over the bottom portion, while the effect of the intercept is gap-increasing over the upper portion of the distribution. Since the effect of age dominates in absolute value over the effect of the intercept across the bottom portion of the distribution, and since roughly the opposite holds for the upper portion, the net effect is that the overall wage structure effect for 2008 is declining on average, as we saw when we discussed the aggregate decomposition. Of the other components, which are generally small, only the effect of experience and tenure contributes significantly to the overall wage structure effect, being gap-increasing virtually along the entire distribution, while the other effects are almost negligible.

We turn now to the results for the year 2011. The aggregate decomposition is depicted in figure 6. The pattern of variation of the total gap and its two components looks pretty much the same as in 2008. The total gap is again positive, that is, there exists a public sector premium, along the entire distribution. Comparing the quantile gaps to the mean gap, we observe that the total gap at percentiles up to the 60th (except the 5th) is higher than the mean gap, and lower than it thereafter. The maximum of 0.402 is reached at the 40th percentile, as in 2008. Again, variation of the total gap along the distribution is far from monotonic. One can see, however, that looking at the whole range of selected quantiles, the pattern is declining on average from the bottom to the top of the distribution. In figure 9, we compare the total gaps for the two years, by subtracting the 2008 gap from the 2011 gap. We notice that at all the selected percentiles, except the 35th, the total gap is higher in 2011 than in 2008. However, the difference does not seem to follow a recognizable pattern along the distribution.

The aggregate composition effect is quite stable across the 19 percentiles: it moves in the range from 0.1 to 0.2 up to the 90th percentile, rising then to its maximal value of 0.3 at the very top. It is gap-increasing at all the percentiles considered. As shown in figure 10, the

composition effects for 2008 and 2011 are quite close to each other, with sizeable differences being observed only at the very bottom and the very top of the distribution. One cannot say that the effect for either of the years is generally above or below the effect for the other year.

Concerning the overall wage structure effect, in the bottom part of the distribution, except at the very bottom, it is more or less above the composition effect, while starting from the 65$^{th}$ percentile it falls below it. It is gap-increasing from the bottom to the 85$^{th}$ percentile, turning negative thereafter and reaching the minimum of -0.187 at the very top. Figure 11 compares the wage structure effects for 2008 and 2011. Here the differences are mostly positive, meaning that the wage structure effects for 2011 is mostly above that for 2008. And in comparison to the differences between the composition effects for the two years, the differences here are generally bigger. A particular pattern along the distribution cannot be recognized, however. Depicting in figure 12 all three differences between 2008 and 2011 together, we notice that the differences in the total gap are over the greatest part of the distribution driven mainly by the differences in the wage structure effect. This does not seem to hold only at the very top and at the very bottom of the distribution.

Finally, we do the detailed decompositions of the overall composition and wage structure effects. The detailed composition effects are displayed in figure 7. We first note that, as in 2008, along the whole distribution the effects of human capital-related characteristics – experience and tenure, education, occupation – are all gap-increasing, whereas the remaining two effects, those of age and gender, are gap-reducing (with only two exceptions of positive, but very small, effects of age). Among the gap-increasing effects, the one associated with experience and tenure dominates over the other two over the first half of the distribution, and it is generally declining. The effect of occupation is quite flat, whereas the effect of education is generally increasing and dominates above the 65$^{th}$ percentile. As regards the two gap-reducing effects, that of gender is almost perfectly flat and smallest in absolute value among

all effects, just as it was the case in 2008. The effect of age is declining in absolute value almost monotonically from the bottom toward the top of the distribution.

Regarding the detailed decomposition of the aggregate wage structure effect, figure 8 shows that, as in 2008, the two principal effects are those of age and of the intercept. However, there are some notable differences in comparison to 2008. First, in 2008 the effect of age was generally gap-increasing in the bottom part of the distribution and gap-reducing in the upper part, while the opposite was true for the effects of the intercept. Here the former effect is gap-reducing, and the effect of the intercept gap-increasing, along the whole distribution. Another important difference is that the absolute values of these two effects, as well as of the remaining ones, are in 2011 generally bigger than in 2008, especially at the bottom part of the distribution. However, with the exception of the effect of experience and tenure up to the $25^{th}$ percentile and the effect of education above the $80^{th}$ percentile, all other effects are relatively small in comparison with the effects of age and the intercept at all percentiles considered.

## 5. Summary and concluding remarks

In this paper, we examined the wage gap between workers in the public sector and those in the private sector just before the recent economic crisis and in the wake of it. For the years 2008 and 2011, we decomposed the gap in the real hourly net wage into the contribution of differing individual characteristics and the contribution of differing marginal returns to these characteristics. The decompositions are performed at the mean, as well as at a number of quantiles along the entire wage distribution. In addition to analyzing the wage gaps in 2008 and 2011, we also look at the factors that contributed to the change in the gap during the three-year period considered.

Our results show that in both years there was a significant wage gap in favor of the public sector; that is, there was a premium for working in the public sector. This holds at the mean, as well as at different points along the distribution. Mean decomposition results show that, in both 2008 and 2011, both the composition and wage structure effects are gap-increasing. This holds as well at different quantiles, the only exception being that the wage structure effect is gap-reducing at the very top of the distribution. The wage structure effect generally dominates, but not by much, over roughly the bottom half of the distribution, while in the upper part it weakens, getting even negative (gap-reducing) at the very top.

Concerning the detailed decompositions of the two effects, the results indicate that, in the case of the composition effect, the effects human capital-related characteristics, namely experience and tenure, education, and occupation, are gap-increasing and dominate in absolute value the gap-reducing effects of innate characteristics, namely gender and age. These results hold roughly for both years. As regards the detailed wage structure effects, in both years the effects of age and the intercept are the strongest and of opposite signs virtually everywhere along the distribution. The other detailed wage structure effects are small compared to these two.

The mean gap increased in the analyzed three-year period, as did the gaps at almost all quantiles that we consider. The changes in the total gaps were mostly due to changes in the wage structure than due to changes in the composition. This should come as no surprise, given that one can hardly expect the distribution of individual characteristics to change much in only three years. On the contrary, the returns to these characteristics are easier to change even in a relatively short period, especially if this period was characterized with a general economic downturn.

The main objectives of this paper were to quantify the public-private wage gap and its determinants prior to and in the wake of the Great Recession, and in addition to whether and

why the gap changed in the period 2008-2011. Many related questions remain, however, unanswered and thus warrant further research. Departing from the results of this paper, one should pursue more detailed analyses of the public-private wage gap. An avenue worth pursuing is to analyze more carefully the changes in the marginal returns to different individual characteristics that took place under the influence of the economic downturn. Another direction for further research would be to check the robustness of the results to different definitions of the public sector, for instance by dividing the public sector as it is defined in this paper into the budgetary public sector and the part comprising publically-owned enterprises. Such an analysis may reveal that the wage gap is different and possibly driven by different factors when alternative definitions of the public sector are considered.

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## Tables and figures

*Table 1: Summary statistics, 2008*

| | Public sector | | | | | Private sector | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max |
| Log hourly wage | 2214 | 3.32 | 0.34 | 0.95 | 4.54 | 3742 | 3.06 | 0.41 | 1.64 | 5.22 |
| Female | 2214 | 0.50 | 0.50 | 0.00 | 1.00 | 3742 | 0.43 | 0.50 | 0.00 | 1.00 |
| Male | 2214 | 0.50 | 0.50 | 0.00 | 1.00 | 3742 | 0.57 | 0.50 | 0.00 | 1.00 |
| Age | 2214 | 44.36 | 10.20 | 16.00 | 65.00 | 3742 | 37.82 | 11.26 | 17.00 | 65.00 |
| $Age^2/100$ | 2214 | 20.72 | 8.78 | 2.56 | 42.25 | 3742 | 15.57 | 8.70 | 2.89 | 42.25 |
| Experience | 2214 | 21.52 | 10.64 | 0.00 | 46.00 | 3742 | 15.27 | 11.08 | 0.00 | 45.00 |
| $Experience^2/100$ | 2214 | 5.76 | 4.45 | 0.00 | 21.16 | 3742 | 3.56 | 3.96 | 0.00 | 20.25 |
| Tenure | 2214 | 16.73 | 10.93 | 0.00 | 45.00 | 3742 | 8.57 | 9.42 | 0.00 | 46.00 |
| *Education* | | | | | | | | | | |
| Primary or less | 2214 | 0.10 | 0.30 | 0.00 | 1.00 | 3742 | 0.14 | 0.35 | 0.00 | 1.00 |
| 3-year high school | 2214 | 0.23 | 0.42 | 0.00 | 1.00 | 3742 | 0.43 | 0.49 | 0.00 | 1.00 |
| 4-year high school | 2214 | 0.33 | 0.47 | 0.00 | 1.00 | 3742 | 0.31 | 0.46 | 0.00 | 1.00 |
| College | 2214 | 0.14 | 0.35 | 0.00 | 1.00 | 3742 | 0.05 | 0.21 | 0.00 | 1.00 |
| University graduate | 2214 | 0.17 | 0.38 | 0.00 | 1.00 | 3742 | 0.06 | 0.25 | 0.00 | 1.00 |
| Postgraduate | 2214 | 0.02 | 0.14 | 0.00 | 1.00 | 3742 | 0.00 | 0.06 | 0.00 | 1.00 |
| *Occupation* | | | | | | | | | | |
| Manager | 2214 | 0.02 | 0.15 | 0.00 | 1.00 | 3742 | 0.01 | 0.10 | 0.00 | 1.00 |
| Professional | 2214 | 0.17 | 0.38 | 0.00 | 1.00 | 3742 | 0.05 | 0.23 | 0.00 | 1.00 |
| Technician | 2214 | 0.27 | 0.44 | 0.00 | 1.00 | 3742 | 0.13 | 0.34 | 0.00 | 1.00 |
| Clerk | 2214 | 0.16 | 0.37 | 0.00 | 1.00 | 3742 | 0.13 | 0.34 | 0.00 | 1.00 |
| Service and sales | 2214 | 0.09 | 0.29 | 0.00 | 1.00 | 3742 | 0.22 | 0.41 | 0.00 | 1.00 |
| Agriculture | 2214 | 0.01 | 0.10 | 0.00 | 1.00 | 3742 | 0.01 | 0.10 | 0.00 | 1.00 |
| Craftsman | 2214 | 0.10 | 0.30 | 0.00 | 1.00 | 3742 | 0.19 | 0.39 | 0.00 | 1.00 |
| Plant/machine operator | 2214 | 0.08 | 0.26 | 0.00 | 1.00 | 3742 | 0.17 | 0.38 | 0.00 | 1.00 |
| Elementary | 2214 | 0.10 | 0.30 | 0.00 | 1.00 | 3742 | 0.08 | 0.27 | 0.00 | 1.00 |

*Table 2. Summary statistics, 2011*

| Variable | Public sector | | | | | Private sector | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | Mean | Std. Dev. | Min | Max | Obs | Mean | Std. Dev. | Min | Max |
| Log hourly wage | 1655 | 3.36 | 0.34 | 1.81 | 4.64 | 2734 | 3.07 | 0.41 | 1.59 | 5.14 |
| Female | 1655 | 0.51 | 0.50 | 0.00 | 1.00 | 2734 | 0.44 | 0.50 | 0.00 | 1.00 |
| Male | 1655 | 0.49 | 0.50 | 0.00 | 1.00 | 2734 | 0.56 | 0.50 | 0.00 | 1.00 |
| Age | 1655 | 46.44 | 10.27 | 19.00 | 65.00 | 2734 | 39.70 | 11.59 | 17.00 | 65.00 |
| $Age^2/100$ | 1655 | 22.62 | 9.13 | 3.61 | 42.25 | 2734 | 17.10 | 9.27 | 2.89 | 42.25 |
| Experience | 1655 | 23.15 | 10.98 | 0.00 | 46.00 | 2734 | 16.55 | 11.55 | 0.00 | 44.00 |
| $Experience^2/100$ | 1655 | 6.56 | 4.85 | 0.00 | 21.16 | 2734 | 4.07 | 4.35 | 0.00 | 19.36 |
| Tenure | 1655 | 15.00 | 11.36 | 0.00 | 43.00 | 2734 | 6.54 | 9.74 | 0.00 | 40.00 |
| *Education* | | | | | | | | | | |
| Primary or less | 1655 | 0.11 | 0.31 | 0.00 | 1.00 | 2734 | 0.12 | 0.32 | 0.00 | 1.00 |
| 3-year high school | 1655 | 0.18 | 0.38 | 0.00 | 1.00 | 2734 | 0.37 | 0.48 | 0.00 | 1.00 |
| 4-year high school | 1655 | 0.36 | 0.48 | 0.00 | 1.00 | 2734 | 0.38 | 0.49 | 0.00 | 1.00 |
| College | 1655 | 0.13 | 0.34 | 0.00 | 1.00 | 2734 | 0.06 | 0.23 | 0.00 | 1.00 |
| University graduate | 1655 | 0.19 | 0.39 | 0.00 | 1.00 | 2734 | 0.07 | 0.26 | 0.00 | 1.00 |
| Postgraduate | 1655 | 0.03 | 0.16 | 0.00 | 1.00 | 2734 | 0.01 | 0.08 | 0.00 | 1.00 |
| *Occupation* | | | | | | | | | | |
| Manager | 1655 | 0.02 | 0.13 | 0.00 | 1.00 | 2734 | 0.01 | 0.11 | 0.00 | 1.00 |
| Professional | 1655 | 0.26 | 0.44 | 0.00 | 1.00 | 2734 | 0.07 | 0.25 | 0.00 | 1.00 |
| Technician | 1655 | 0.19 | 0.40 | 0.00 | 1.00 | 2734 | 0.12 | 0.33 | 0.00 | 1.00 |
| Clerk | 1655 | 0.15 | 0.36 | 0.00 | 1.00 | 2734 | 0.11 | 0.31 | 0.00 | 1.00 |
| Service and sales | 1655 | 0.10 | 0.31 | 0.00 | 1.00 | 2734 | 0.27 | 0.44 | 0.00 | 1.00 |
| Agriculture | 1655 | 0.01 | 0.11 | 0.00 | 1.00 | 2734 | 0.01 | 0.08 | 0.00 | 1.00 |
| Craftsman | 1655 | 0.08 | 0.27 | 0.00 | 1.00 | 2734 | 0.17 | 0.38 | 0.00 | 1.00 |
| Plant/machine operator | 1655 | 0.07 | 0.26 | 0.00 | 1.00 | 2734 | 0.16 | 0.37 | 0.00 | 1.00 |
| Elementary | 1655 | 0.10 | 0.30 | 0.00 | 1.00 | 2734 | 0.08 | 0.27 | 0.00 | 1.00 |

*Table 3. OLS estimates of the wage regressions*

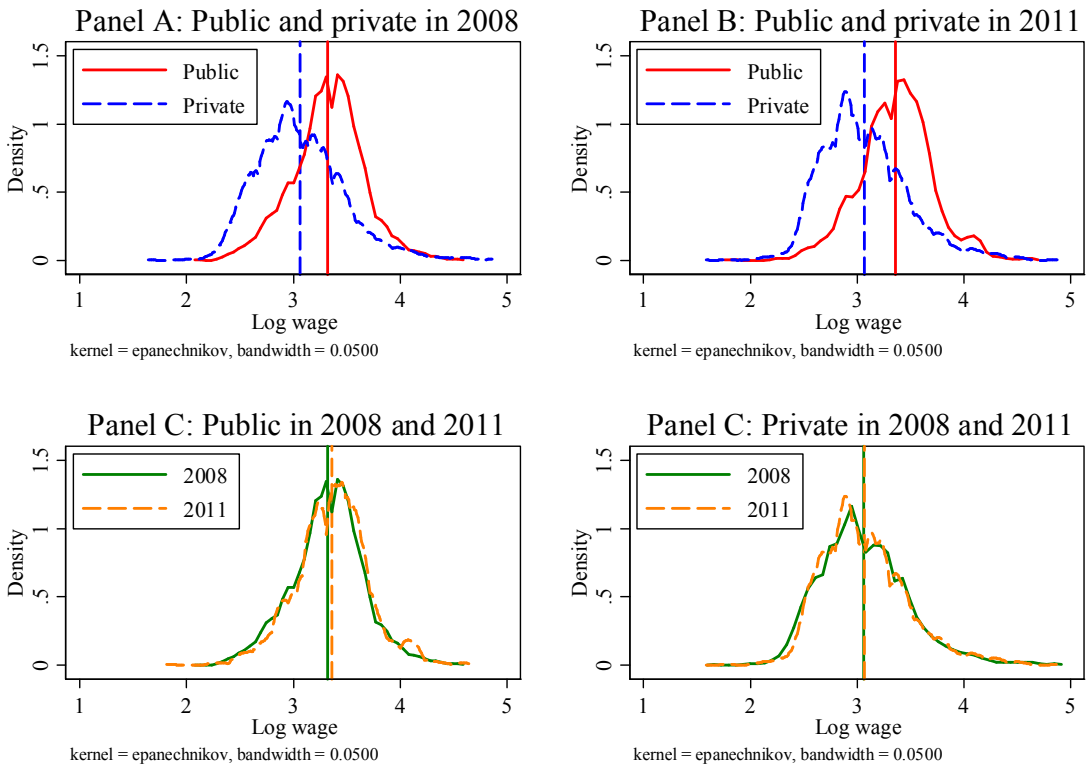
| Dependent variable: log hourly wage | 2008 | | 2011 | |
|---|---|---|---|---|
| | Public | Private | Public | Private |
| | (1) | (2) | (3) | (4) |
| Female | -0.121*** | -0.186*** | -0.137*** | -0.187*** |
| | (0.011) | (0.012) | (0.013) | (0.014) |
| Age | 0.006 | 0.005 | -0.011 | 0.004 |
| | (0.006) | (0.005) | (0.007) | (0.006) |
| $Age^2/100$ | -0.008 | -0.006 | 0.005 | -0.005 |
| | (0.007) | (0.007) | (0.008) | (0.008) |
| Experience | 0.013*** | 0.011*** | 0.021*** | 0.009** |
| | (0.003) | (0.003) | (0.004) | (0.003) |
| $Experience^2/100$ | -0.022** | -0.017* | -0.029*** | -0.012 |
| | (0.007) | (0.008) | (0.008) | (0.008) |
| Tenure | 0.003*** | 0.000 | 0.004 *** | 0.004*** |
| | (0.001) | (0.001) | (0.001) | (0.001) |
| 3-year high school | 0.130*** | 0.083*** | 0.049* | 0.089*** |
| | (0.021) | (0.017) | (0.023) | (0.021) |
| 4-year high school | 0.211*** | 0.138*** | 0.125*** | 0.156*** |
| | (0.023) | (0.019) | (0.024) | (0.022) |
| College | 0.339*** | 0.298*** | 0.201*** | 0.252*** |
| | (0.028) | (0.032) | (0.032) | (0.034) |
| University graduate | 0.410*** | 0.358*** | 0.357*** | 0.344*** |
| | (0.037) | (0.039) | (0.038) | (0.042) |
| Postgraduate | 0.607*** | 0.736*** | 0.626*** | 0.260** |
| | (0.051) | (0.100) | (0.049) | (0.087) |
| Professional | -0.225*** | -0.329*** | -0.126** | -0.371*** |
| | (0.037) | (0.059) | (0.046) | (0.062) |
| Technician | -0.287*** | -0.514*** | -0.218*** | -0.576*** |
| | (0.040) | (0.060) | (0.049) | (0.062) |
| Clerk | -0.428*** | -0.631*** | -0.309*** | -0.700*** |
| | (0.042) | (0.060) | (0.051) | (0.063) |
| Service & sales | -0.466*** | -0.809*** | -0.405*** | -0.860*** |
| | (0.044) | (0.059) | (0.052) | (0.063) |
| Agriculture | -0.502*** | -1.054*** | -0.490*** | -0.883*** |
| | (0.063) | (0.077) | (0.073) | (0.094) |
| Craftsman | -0.435*** | -0.781*** | -0.374*** | -0.815*** |
| | (0.044) | (0.060) | (0.054) | (0.064) |
| Plant/machine operator | -0.451*** | -0.843*** | -0.353*** | -0.876*** |
| | (0.045) | (0.061) | (0.054) | (0.064) |
| Elementary | -0.607*** | -0.911*** | -0.523*** | -0.927*** |
| | (0.046) | (0.062) | (0.055) | (0.066) |
| Constant | 3.229*** | 3.545*** | 3.599*** | 3.574*** |
| | (0.118) | (0.107) | (0.143) | (0.120) |
| Adjusted $R^2$ | 0.527 | 0.407 | 0.557 | 0.417 |
| F | 130.8 | 136.3 | 110.5 | 103.9 |
| Observations | 2214 | 3742 | 1655 | 2734 |

*Table 4: Mean decomposition*

| | 2008 | | 2011 | | Difference |
|---|---|---|---|---|---|
| | Estimate | Std. Err. | Estimate | Std. Err. | |
| | (1) | (2) | (3) | (4) | |
| Mean log wage, public | 3.3210 | 0.0073 | 3.3600 | 0.0085 | - |
| Mean log wage, private | 3.0630 | 0.0068 | 3.0700 | 0.0079 | - |
| **Total gap** | **0.2580** | 0.0099 | **0.2890** | 0.0115 | **0.0310** |
| | | | | | |
| **Composition effect** | **0.1630** | 0.0086 | **0.1650** | 0.0102 | **0.0020** |
| Gender | -0.0078 | 0.0018 | -0.0106 | 0.0024 | -0.0028 |
| Age | -0.0043 | 0.0096 | -0.0472 | 0.0109 | -0.0429 |
| Experience & tenure | 0.0584 | 0.0092 | 0.1000 | 0.0110 | 0.0416 |
| Education | 0.0642 | 0.0064 | 0.0585 | 0.0072 | -0.0057 |
| Occupation | 0.0527 | 0.0069 | 0.0643 | 0.0085 | 0.0116 |
| | | | | | |
| **Wage structure effect** | **0.0948** | 0.0095 | **0.1240** | 0.0109 | **0.0292** |
| Gender | -0.0043 | 0.0012 | -0.0032 | 0.0013 | 0.0011 |
| Age | -0.0095 | 0.1660 | -0.4420 | 0.1950 | -0.4325 |
| Experience & tenure | 0.0420 | 0.0372 | 0.1260 | 0.0438 | 0.0840 |
| Education | 0.0337 | 0.0212 | -0.0689 | 0.0193 | -0.1026 |
| Occupation | 0.0270 | 0.0116 | 0.0640 | 0.0133 | 0.0370 |
| Intercept | 0.0058 | 0.1440 | 0.4490 | 0.1690 | 0.4432 |

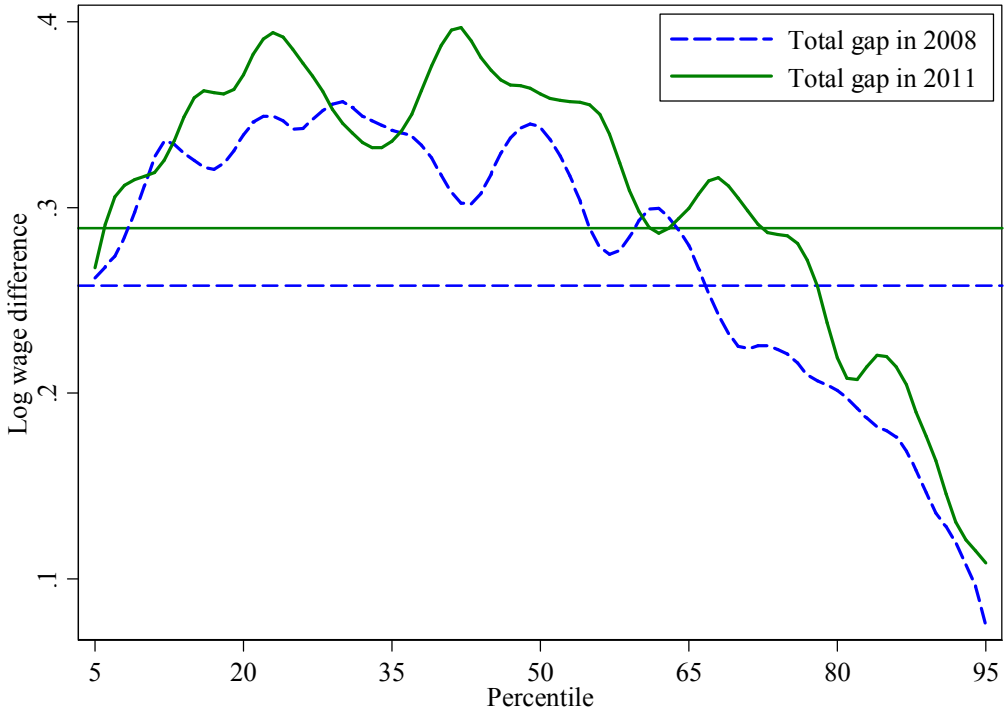
*Notes:* The differences are obtained by subtracting the column (1) from column (3). Characteristics are grouped as follows: age = (age, age$^2$/100); experience and tenure = (experience, experience$^2$/100, tenure); education = (primary or less, 3-year high school, 4-year high school, college, university graduate, postgraduate); occupation = (manager, professional, technician, clerk, service and sales, agriculture, craftsman, plant/machine operator, elementary).

Figure 1. Comparison of densities



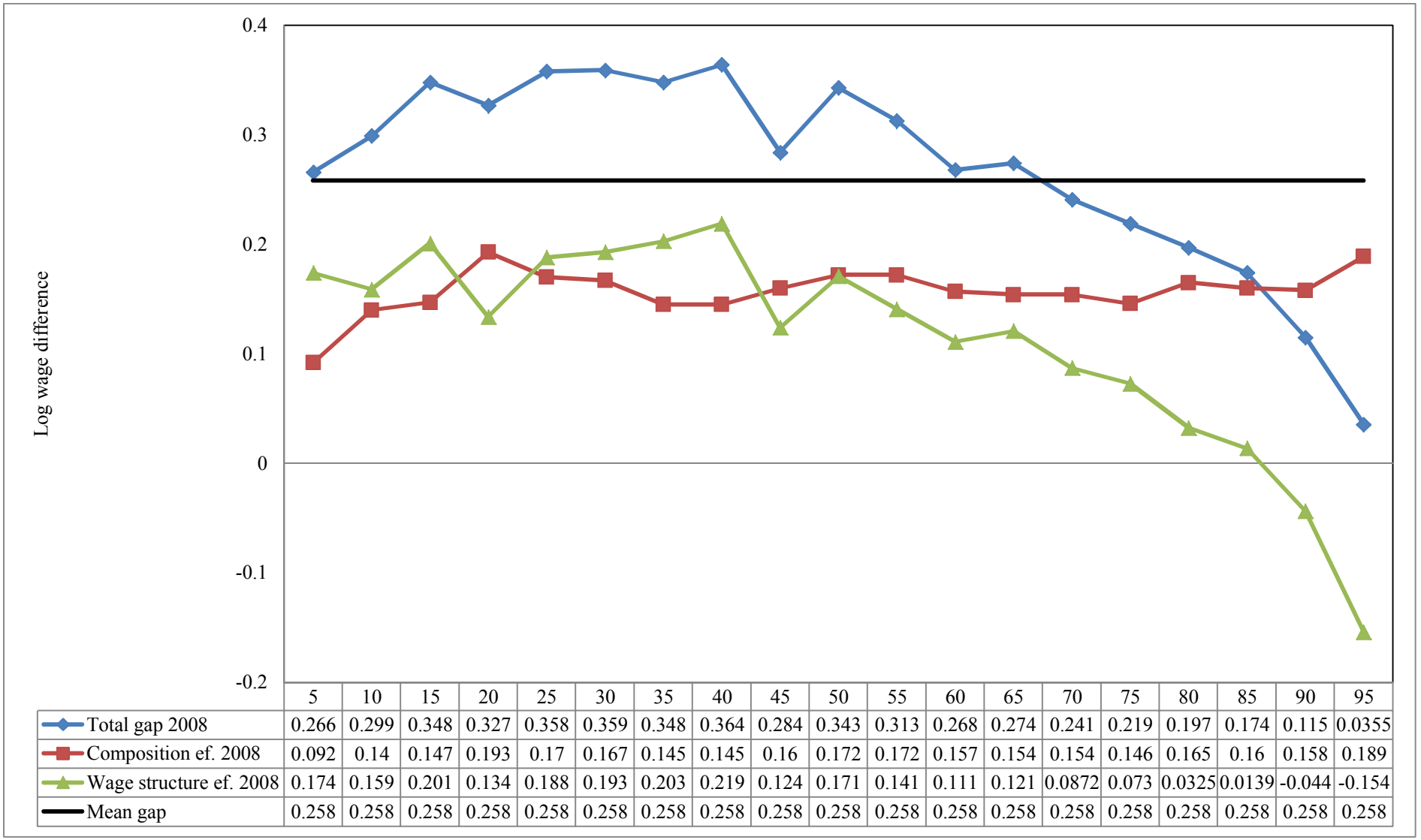

*Notes:* On each of the panels, the vertical lines represent the means of the corresponding distributions.

Figure 2. Public-private wage gap in 2008 and 2011



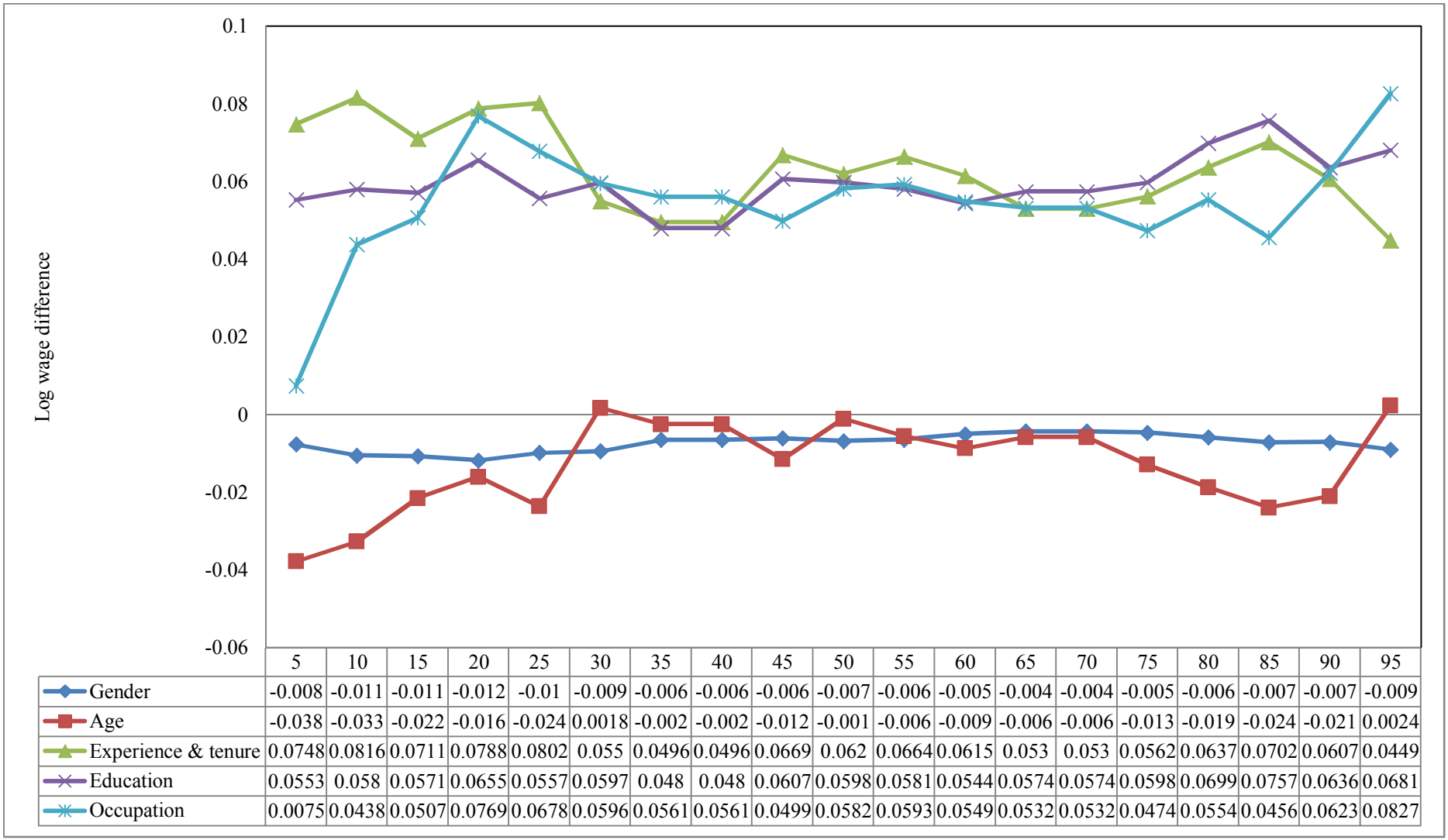

*Notes:* The horizontal straight lines represent the mean gaps. The curvy lines represent the gaps at all the percentiles between the 5th and the 95th, smoothed using locally weighted regression (lowess).

Figure 3. Aggregate decomposition, 2008



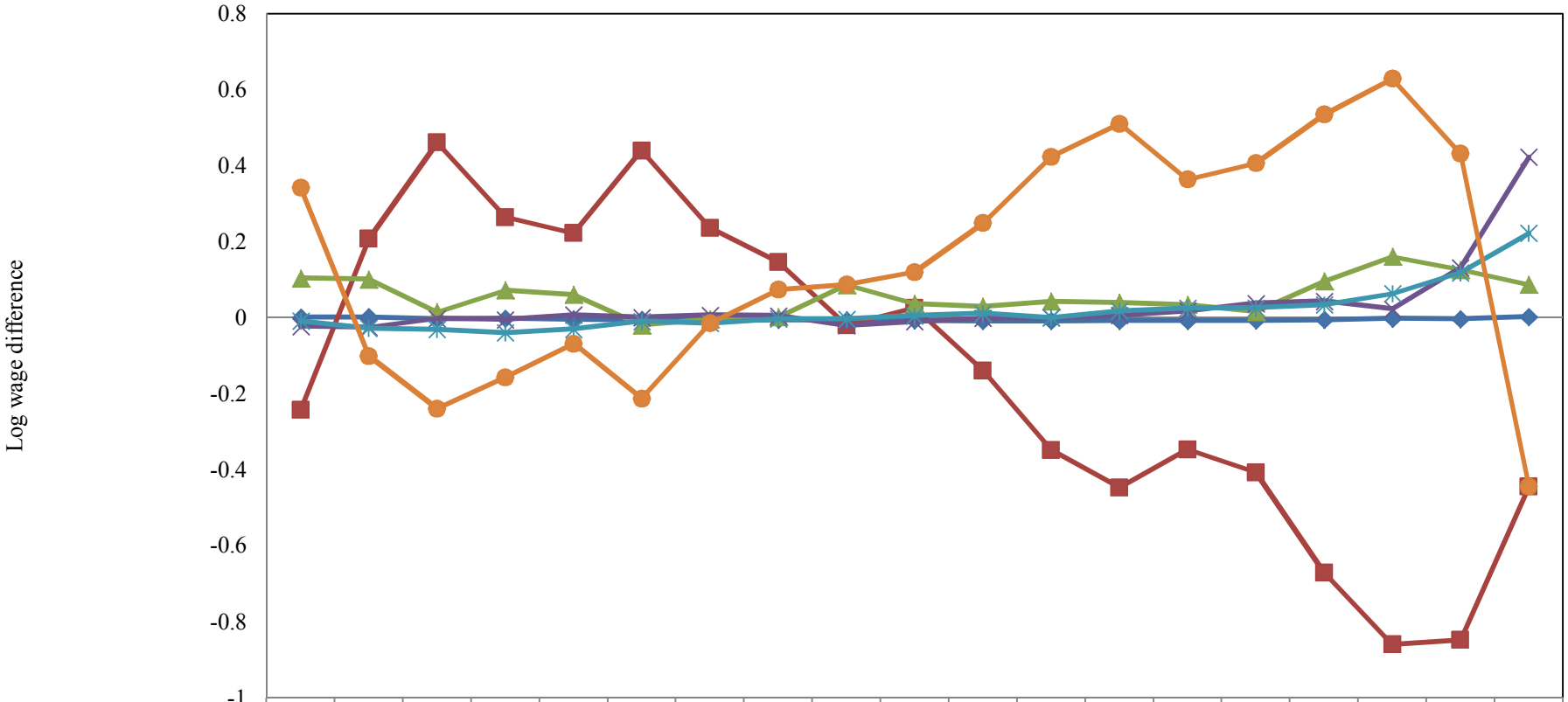

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total gap 2008 | 0.266 | 0.299 | 0.348 | 0.327 | 0.358 | 0.359 | 0.348 | 0.364 | 0.284 | 0.343 | 0.313 | 0.268 | 0.274 | 0.241 | 0.219 | 0.197 | 0.174 | 0.115 | 0.0355 |
| Composition ef. 2008 | 0.092 | 0.14 | 0.147 | 0.193 | 0.17 | 0.167 | 0.145 | 0.145 | 0.16 | 0.172 | 0.172 | 0.157 | 0.154 | 0.154 | 0.146 | 0.165 | 0.16 | 0.158 | 0.189 |
| Wage structure ef. 2008 | 0.174 | 0.159 | 0.201 | 0.134 | 0.188 | 0.193 | 0.203 | 0.219 | 0.124 | 0.171 | 0.141 | 0.111 | 0.121 | 0.0872 | 0.073 | 0.0325 | 0.0139 | -0.044 | -0.154 |
| Mean gap | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 | 0.258 |

Figure 4. Detailed decomposition of the composition effect, 2008



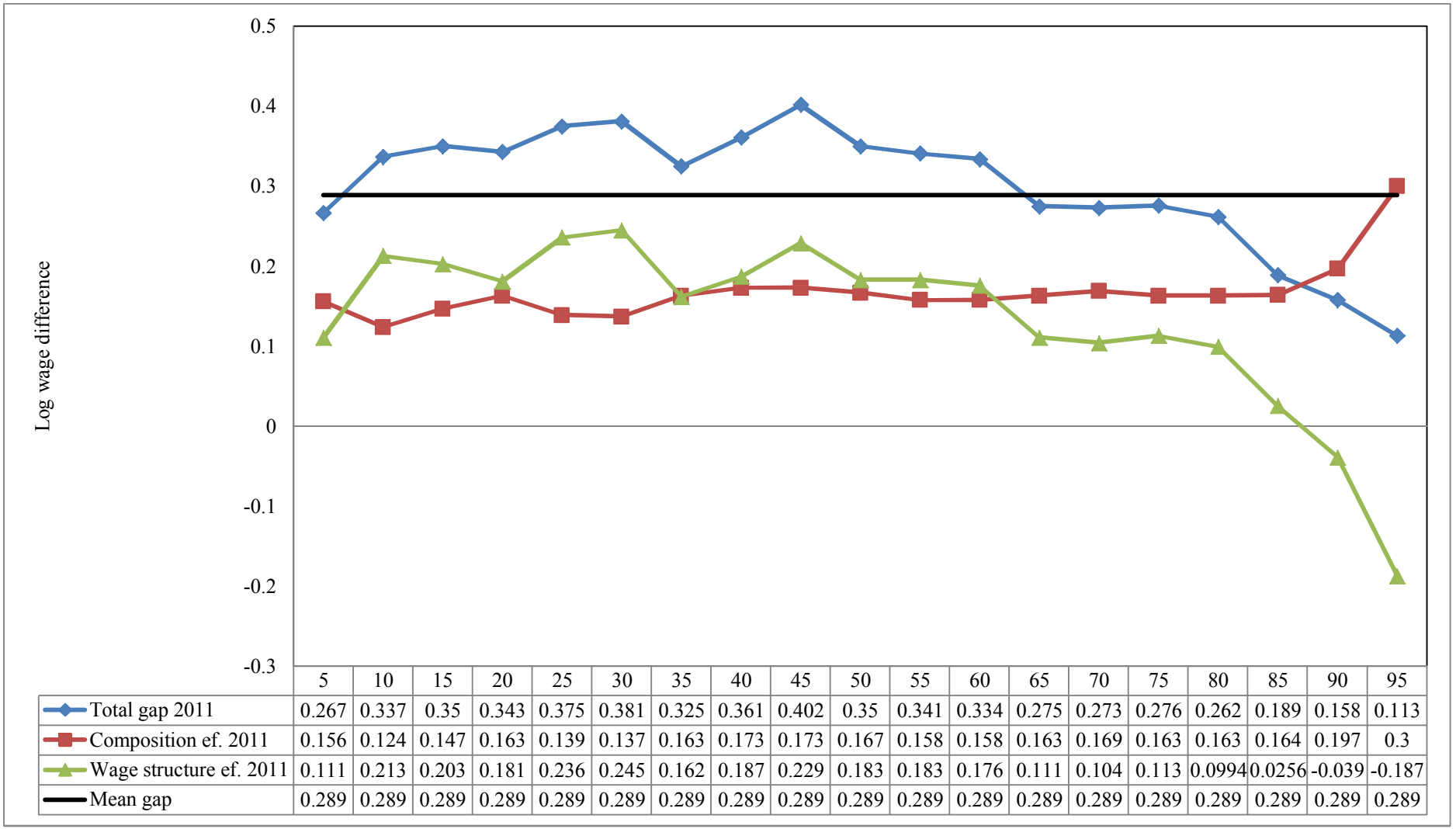

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | -0.008 | -0.011 | -0.011 | -0.012 | -0.01 | -0.009 | -0.006 | -0.006 | -0.006 | -0.007 | -0.006 | -0.005 | -0.004 | -0.004 | -0.005 | -0.006 | -0.007 | -0.007 | -0.009 |
| Age | -0.038 | -0.033 | -0.022 | -0.016 | -0.024 | 0.0018 | -0.002 | -0.002 | -0.012 | -0.001 | -0.006 | -0.009 | -0.006 | -0.006 | -0.013 | -0.019 | -0.024 | -0.021 | 0.0024 |
| Experience & tenure | 0.0748 | 0.0816 | 0.0711 | 0.0788 | 0.0802 | 0.055 | 0.0496 | 0.0496 | 0.0669 | 0.062 | 0.0664 | 0.0615 | 0.053 | 0.053 | 0.0562 | 0.0637 | 0.0702 | 0.0607 | 0.0449 |
| Education | 0.0553 | 0.058 | 0.0571 | 0.0655 | 0.0557 | 0.0597 | 0.048 | 0.048 | 0.0607 | 0.0598 | 0.0581 | 0.0544 | 0.0574 | 0.0574 | 0.0598 | 0.0699 | 0.0757 | 0.0636 | 0.0681 |
| Occupation | 0.0075 | 0.0438 | 0.0507 | 0.0769 | 0.0678 | 0.0596 | 0.0561 | 0.0561 | 0.0499 | 0.0582 | 0.0593 | 0.0549 | 0.0532 | 0.0532 | 0.0474 | 0.0554 | 0.0456 | 0.0623 | 0.0827 |

Figure 5. Detailed decomposition of the wage structure effect, 2008



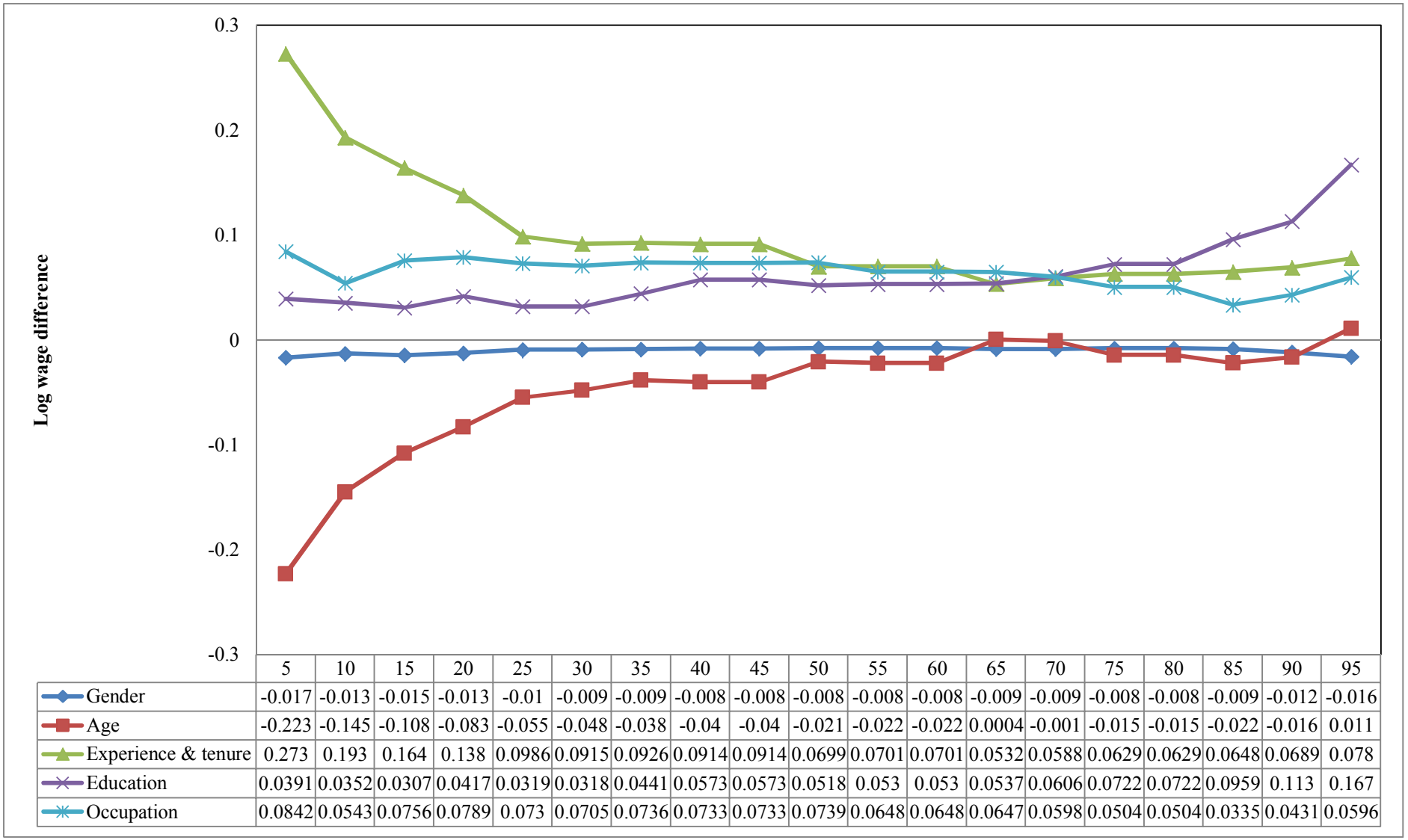

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | 0.0007 | 0.0017 | -0.003 | -0.002 | -0.004 | -0.006 | -0.007 | -0.006 | -0.006 | -0.007 | -0.009 | -0.009 | -0.008 | -0.008 | -0.007 | -0.006 | -0.002 | -0.004 | 0.0021 |
| Age | -0.243 | 0.208 | 0.461 | 0.265 | 0.223 | 0.44 | 0.237 | 0.147 | -0.019 | 0.0258 | -0.139 | -0.348 | -0.447 | -0.347 | -0.407 | -0.671 | -0.86 | -0.848 | -0.445 |
| Experience & tenure | 0.104 | 0.101 | 0.0148 | 0.0723 | 0.0604 | -0.02 | -0.004 | 0.0015 | 0.0863 | 0.037 | 0.0296 | 0.0433 | 0.0403 | 0.0344 | 0.0159 | 0.0962 | 0.161 | 0.126 | 0.0872 |
| Education | -0.023 | -0.025 | -0.002 | -0.005 | 0.0078 | 0.0013 | 0.0067 | 0.0051 | -0.02 | -0.01 | -0.001 | -2E-05 | 0.0063 | 0.0179 | 0.038 | 0.044 | 0.023 | 0.132 | 0.423 |
| Occupation | -0.008 | -0.028 | -0.031 | -0.04 | -0.03 | -0.009 | -0.015 | -0.003 | -0.003 | 0.0053 | 0.0115 | 0.0003 | 0.018 | 0.0256 | 0.0262 | 0.0338 | 0.0634 | 0.119 | 0.223 |
| Constant | 0.343 | -0.101 | -0.239 | -0.157 | -0.068 | -0.213 | -0.015 | 0.0738 | 0.0873 | 0.12 | 0.249 | 0.424 | 0.511 | 0.364 | 0.407 | 0.535 | 0.629 | 0.432 | -0.444 |

Figure 6. Aggregate decomposition, 2011



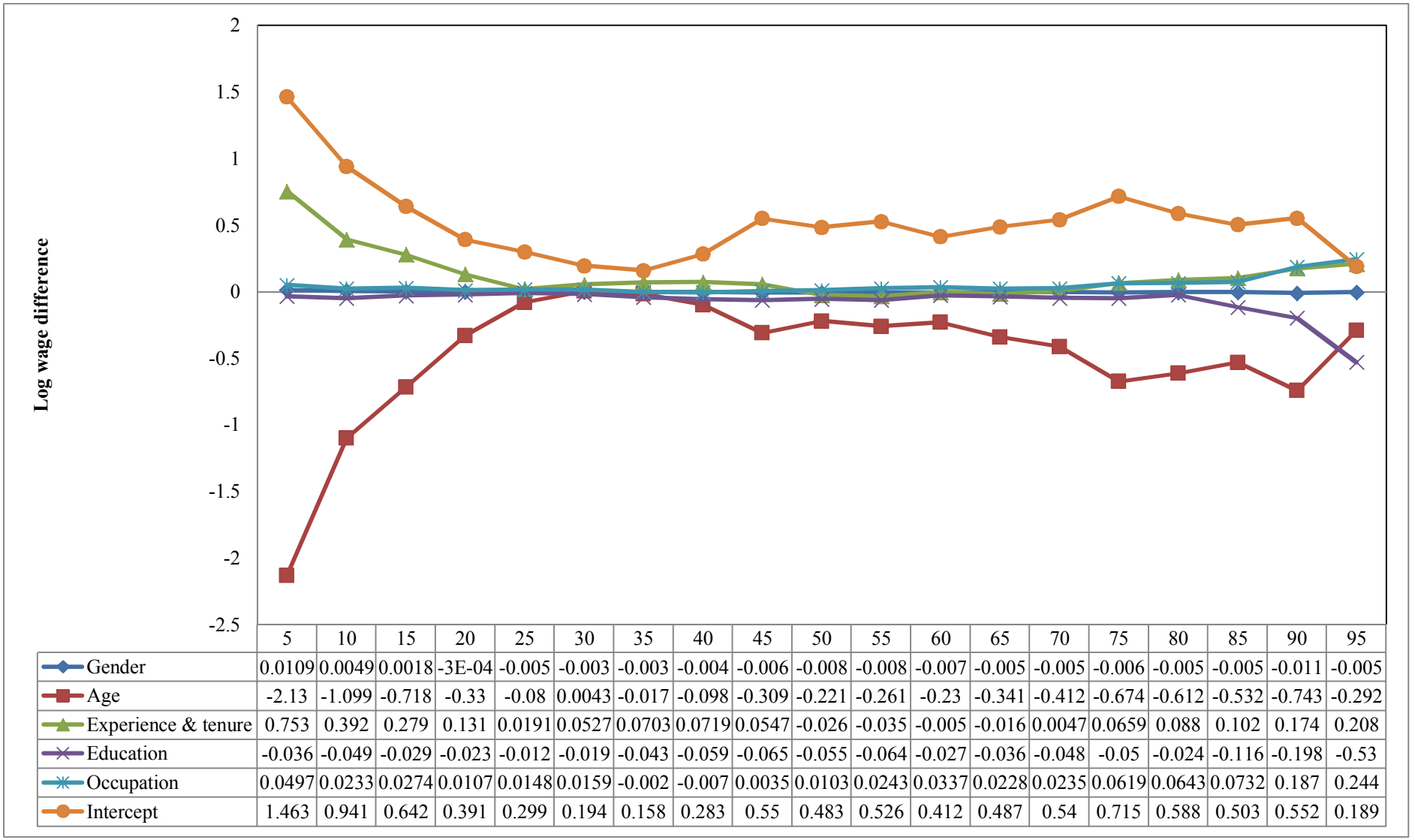

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total gap 2011 | 0.267 | 0.337 | 0.35 | 0.343 | 0.375 | 0.381 | 0.325 | 0.361 | 0.402 | 0.35 | 0.341 | 0.334 | 0.275 | 0.273 | 0.276 | 0.262 | 0.189 | 0.158 | 0.113 |
| Composition ef. 2011 | 0.156 | 0.124 | 0.147 | 0.163 | 0.139 | 0.137 | 0.163 | 0.173 | 0.173 | 0.167 | 0.158 | 0.158 | 0.163 | 0.169 | 0.163 | 0.163 | 0.164 | 0.197 | 0.3 |
| Wage structure ef. 2011 | 0.111 | 0.213 | 0.203 | 0.181 | 0.236 | 0.245 | 0.162 | 0.187 | 0.229 | 0.183 | 0.183 | 0.176 | 0.111 | 0.104 | 0.113 | 0.0994 | 0.0256 | -0.039 | -0.187 |
| Mean gap | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 | 0.289 |

Figure 7. Detailed decomposition of the composition effect, 2011



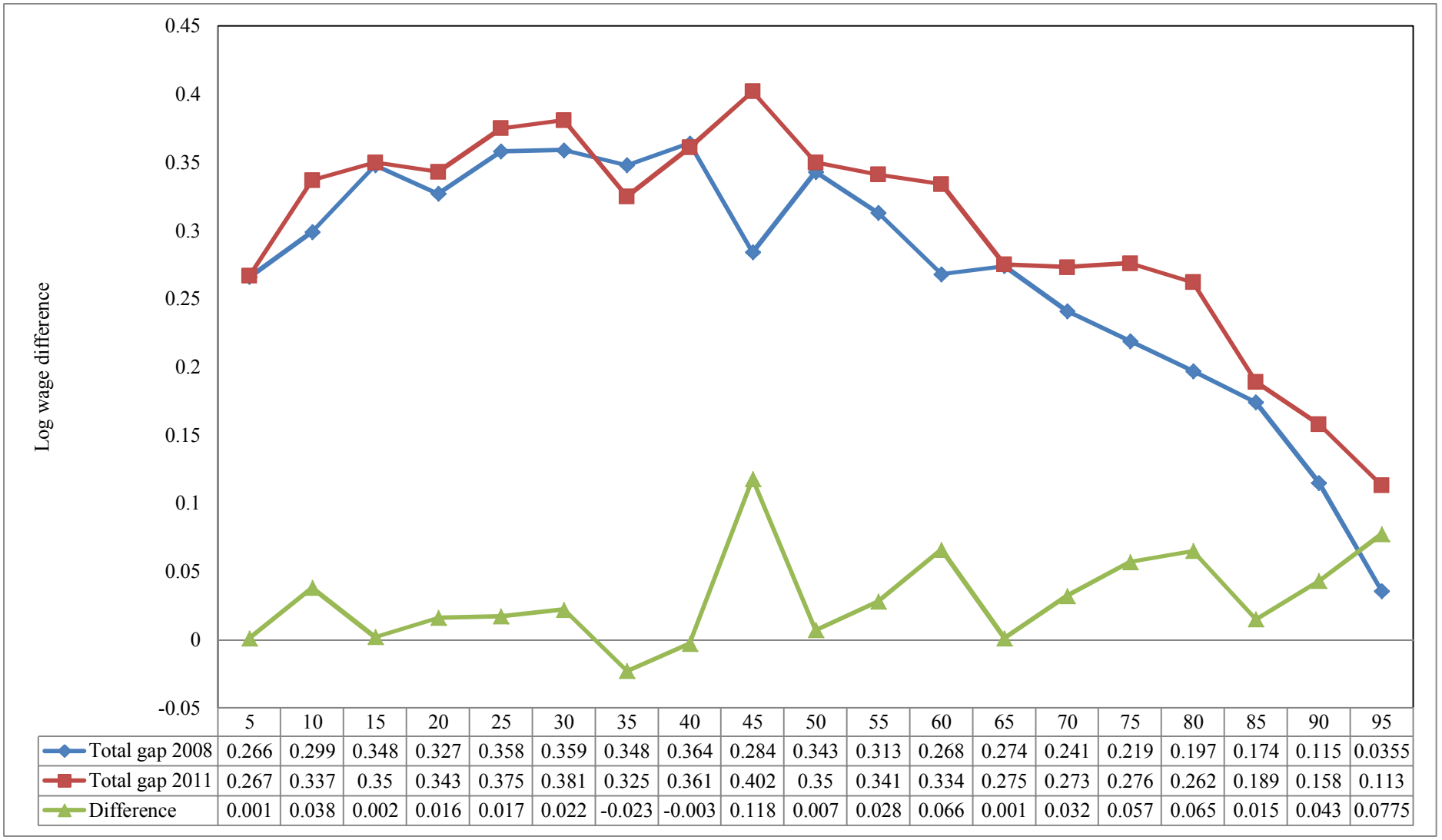

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | -0.017 | -0.013 | -0.015 | -0.013 | -0.01 | -0.009 | -0.009 | -0.008 | -0.008 | -0.008 | -0.008 | -0.008 | -0.009 | -0.009 | -0.008 | -0.008 | -0.009 | -0.012 | -0.016 |
| Age | -0.223 | -0.145 | -0.108 | -0.083 | -0.055 | -0.048 | -0.038 | -0.04 | -0.04 | -0.021 | -0.022 | -0.022 | 0.0004 | -0.001 | -0.015 | -0.015 | -0.022 | -0.016 | 0.011 |
| Experience & tenure | 0.273 | 0.193 | 0.164 | 0.138 | 0.0986 | 0.0915 | 0.0926 | 0.0914 | 0.0914 | 0.0699 | 0.0701 | 0.0701 | 0.0532 | 0.0588 | 0.0629 | 0.0629 | 0.0648 | 0.0689 | 0.078 |
| Education | 0.0391 | 0.0352 | 0.0307 | 0.0417 | 0.0319 | 0.0318 | 0.0441 | 0.0573 | 0.0573 | 0.0518 | 0.053 | 0.053 | 0.0537 | 0.0606 | 0.0722 | 0.0722 | 0.0959 | 0.113 | 0.167 |
| Occupation | 0.0842 | 0.0543 | 0.0756 | 0.0789 | 0.073 | 0.0705 | 0.0736 | 0.0733 | 0.0733 | 0.0739 | 0.0648 | 0.0648 | 0.0647 | 0.0598 | 0.0504 | 0.0504 | 0.0335 | 0.0431 | 0.0596 |

Figure 8. Detailed decomposition of the wage structure effect, 2011



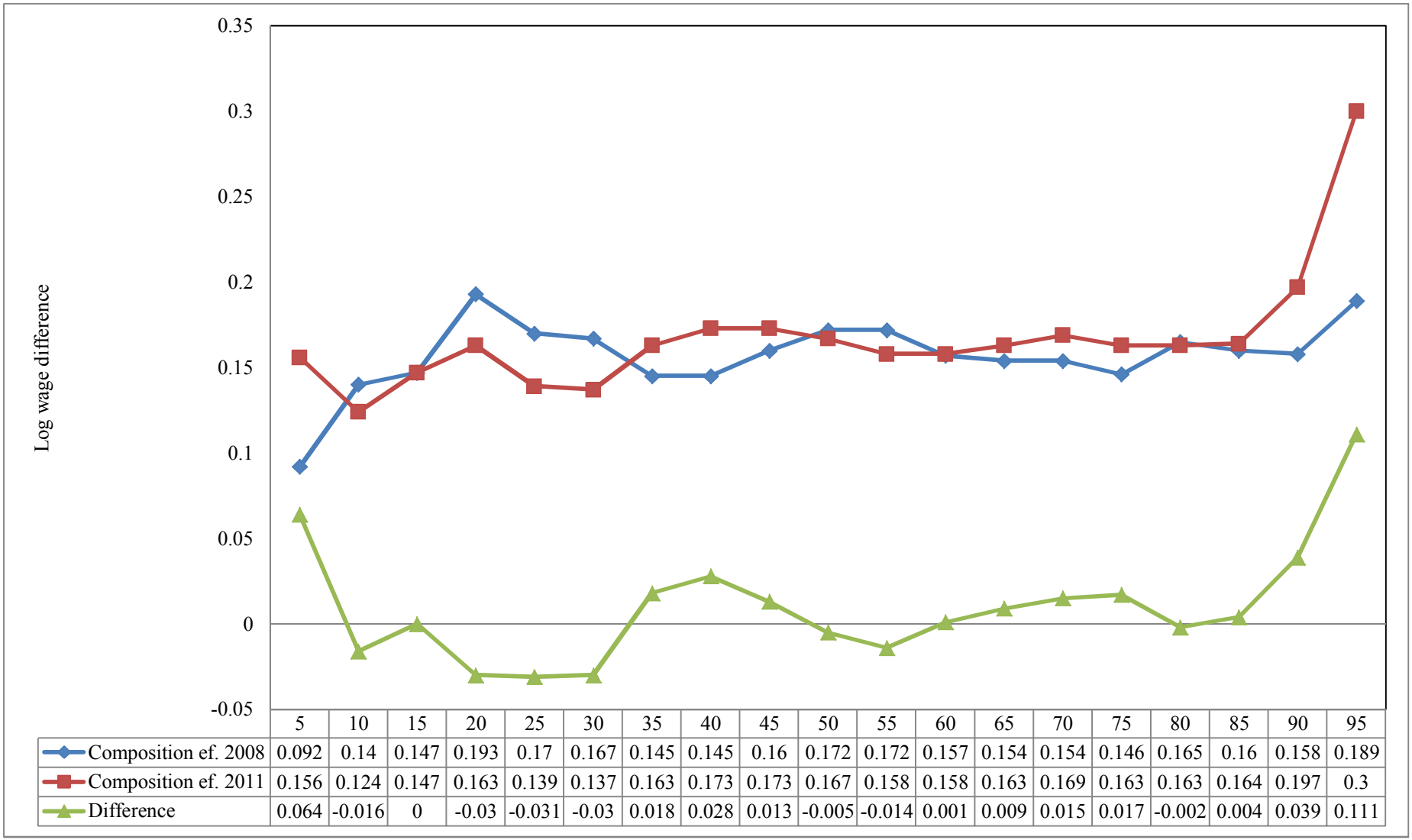

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gender | 0.0109 | 0.0049 | 0.0018 | -3E-04 | -0.005 | -0.003 | -0.003 | -0.004 | -0.006 | -0.008 | -0.008 | -0.007 | -0.005 | -0.005 | -0.006 | -0.005 | -0.005 | -0.011 | -0.005 |
| Age | -2.13 | -1.099 | -0.718 | -0.33 | -0.08 | 0.0043 | -0.017 | -0.098 | -0.309 | -0.221 | -0.261 | -0.23 | -0.341 | -0.412 | -0.674 | -0.612 | -0.532 | -0.743 | -0.292 |
| Experience & tenure | 0.753 | 0.392 | 0.279 | 0.131 | 0.0191 | 0.0527 | 0.0703 | 0.0719 | 0.0547 | -0.026 | -0.035 | -0.005 | -0.016 | 0.0047 | 0.0659 | 0.088 | 0.102 | 0.174 | 0.208 |
| Education | -0.036 | -0.049 | -0.029 | -0.023 | -0.012 | -0.019 | -0.043 | -0.059 | -0.065 | -0.055 | -0.064 | -0.027 | -0.036 | -0.048 | -0.05 | -0.024 | -0.116 | -0.198 | -0.53 |
| Occupation | 0.0497 | 0.0233 | 0.0274 | 0.0107 | 0.0148 | 0.0159 | -0.002 | -0.007 | 0.0035 | 0.0103 | 0.0243 | 0.0337 | 0.0228 | 0.0235 | 0.0619 | 0.0643 | 0.0732 | 0.187 | 0.244 |
| Intercept | 1.463 | 0.941 | 0.642 | 0.391 | 0.299 | 0.194 | 0.158 | 0.283 | 0.55 | 0.483 | 0.526 | 0.412 | 0.487 | 0.54 | 0.715 | 0.588 | 0.503 | 0.552 | 0.189 |

Figure 9. Comparison of the total gaps for 2008 and 2011



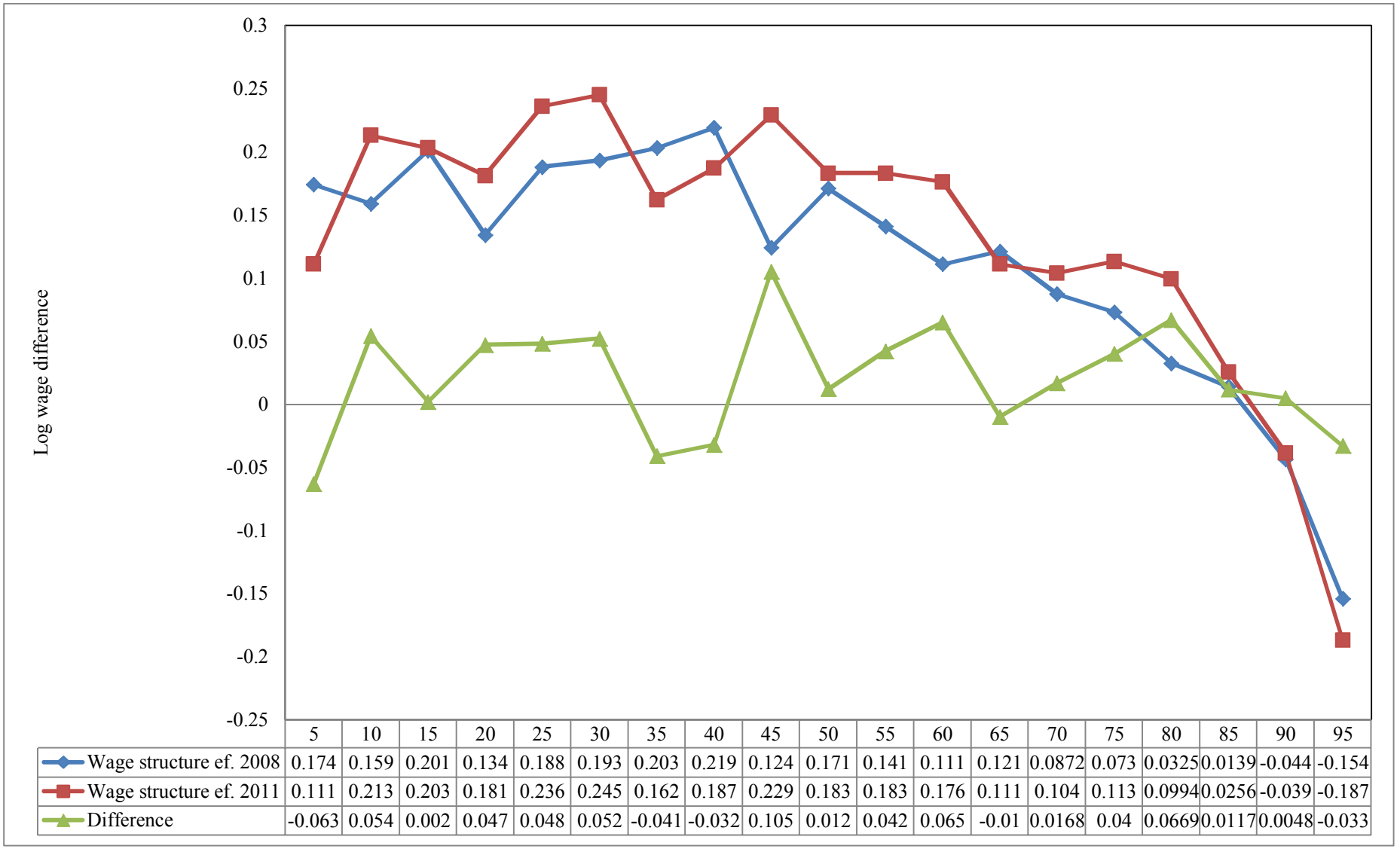

| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total gap 2008 | 0.266 | 0.299 | 0.348 | 0.327 | 0.358 | 0.359 | 0.348 | 0.364 | 0.284 | 0.343 | 0.313 | 0.268 | 0.274 | 0.241 | 0.219 | 0.197 | 0.174 | 0.115 | 0.0355 |
| Total gap 2011 | 0.267 | 0.337 | 0.35 | 0.343 | 0.375 | 0.381 | 0.325 | 0.361 | 0.402 | 0.35 | 0.341 | 0.334 | 0.275 | 0.273 | 0.276 | 0.262 | 0.189 | 0.158 | 0.113 |
| Difference | 0.001 | 0.038 | 0.002 | 0.016 | 0.017 | 0.022 | -0.023 | -0.003 | 0.118 | 0.007 | 0.028 | 0.066 | 0.001 | 0.032 | 0.057 | 0.065 | 0.015 | 0.043 | 0.0775 |

Figure 10. Comparison of the composition effects for 2008 and 2011




| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Composition ef. 2008 | 0.092 | 0.14 | 0.147 | 0.193 | 0.17 | 0.167 | 0.145 | 0.145 | 0.16 | 0.172 | 0.172 | 0.157 | 0.154 | 0.154 | 0.146 | 0.165 | 0.16 | 0.158 | 0.189 |
| Composition ef. 2011 | 0.156 | 0.124 | 0.147 | 0.163 | 0.139 | 0.137 | 0.163 | 0.173 | 0.173 | 0.167 | 0.158 | 0.158 | 0.163 | 0.169 | 0.163 | 0.163 | 0.164 | 0.197 | 0.3 |
| Difference | 0.064 | -0.016 | 0 | -0.03 | -0.031 | -0.03 | 0.018 | 0.028 | 0.013 | -0.005 | -0.014 | 0.001 | 0.009 | 0.015 | 0.017 | -0.002 | 0.004 | 0.039 | 0.111 |

Figure 11. Comparison of the wage structure effects for 2008 and 2011




| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wage structure ef. 2008 | 0.174 | 0.159 | 0.201 | 0.134 | 0.188 | 0.193 | 0.203 | 0.219 | 0.124 | 0.171 | 0.141 | 0.111 | 0.121 | 0.0872 | 0.073 | 0.0325 | 0.0139 | -0.044 | -0.154 |
| Wage structure ef. 2011 | 0.111 | 0.213 | 0.203 | 0.181 | 0.236 | 0.245 | 0.162 | 0.187 | 0.229 | 0.183 | 0.183 | 0.176 | 0.111 | 0.104 | 0.113 | 0.0994 | 0.0256 | -0.039 | -0.187 |
| Difference | -0.063 | 0.054 | 0.002 | 0.047 | 0.048 | 0.052 | -0.041 | -0.032 | 0.105 | 0.012 | 0.042 | 0.065 | -0.01 | 0.0168 | 0.04 | 0.0669 | 0.0117 | 0.0048 | -0.033 |