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Changes in the Gender Wage Gap in Germany during a Period of Rising Wage Inequality 1999 – 2006: Was it Discrimination in the Returns to Human Capital?

Usamah Fayez Al-Farhan[1]

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ABSTRACT:

In this article I analyze the changes in the gender wage gap in the western region, eastern region and in reunified Germany during the period 1999 – 2006. I use data from the German Socio-Economic Panel and implement two alternative decomposition methodologies; the Juhn, Murphy and Pierce (1991) decomposition, and a methodology that totally differences the Oaxaca-Blinder (1973) decomposition, found in Smith and Welch (1989). I conclude that most of the increase in the gender wage gap occurred during a period of remarkably rising wage inequality and argue that both trends are caused simultaneously by the same set of factors. Furthermore, German women were, on average, treated favorably in the returns to their educational attainment, potential experience and tenure compared men, and that the increasing gender wage gap was mainly due to changes in the gender differentials in human capital endowments, particularly worker's potential experience, changes in the gender distribution across industries, company sizes and occupational positions and to changes in discrimination in the returns to job-specific training.

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INTRODUCTION:

Wage gaps have been intensively studied in the literature, yet they attract today no less attention than they did any time before. Gender wage gaps are of particular interest for they persist almost in every market oriented economy with varying degrees.

Do women have fewer skills to sell in the labor market than men? Is a unit of female human capital of less worth than that of men? Are women discriminated against? These questions and others are important questions to be answered whenever gender wage gaps exist, for reasons that reach beyond efficiency considerations into the arena of equity and social welfare.

In this article I use data from the German Socio-Economic Panel to analyze changes in the gender wage gap in the western region, eastern region and reunified Germany during the period 1999 – 2006. The reason why this period is of special interest is that, as shown in Al-farhan (2010), wage inequality has increased remarkably, especially during the first three years of this time interval.

Therefore, this article contributes to the existing literature in that it explores the coexistence of rising levels of inequality and widening gender wage gaps. Blau and Kahn have pioneered the analysis of international differences in gender wage gaps, and concluded in various occasions that countries with relatively higher levels of wage inequality also exhibit wider gender wage differentials. Hence this article comes to explore this positive association between inequality and gender wage gaps using the same data and sample period that have been employed in Al-farhan (2010) to verify the existence of such a relationship across time. In other words, I intend to answer the question whether gender wage gaps would increase simultaneously as wage inequality rises using data from the same population instead of conducting an international comparison. The wage equations that underlie the analysis of changes in the gender wage gaps in this article include the same variables that were included in the wage equations in Al-farhan (2010). Therefore, I will be able to explore whether the variables that mainly caused the rising wage inequality would also be important in explaining changes in the

gender wage gap. This will shed more light on the relationship between the two trends, which cannot be found in any of the previous international comparisons.

Another contribution of this article shall be that it addresses changes in the gender wage gap during a fairly recent period in both the eastern and western regions of Germany, as well as in the sample that combines both regions together, using two decomposition methodologies, namely the Juhn, Murphy and Pierce (1991) method, and another methodology that can be found in Smith and Welch (1989), which is in essence the difference of the wage gap as decomposed by Oaxaca (1973).

The advantage of conducting the two decompositions is mainly twofold. First, together they provide more robustness to the empirical results, since they are constructed using different sets of assumptions. The Juhn, Murphy and Pierce method assumes the equality of coefficients and the standard errors of the residuals in the wage equations of men and women in any particular period, whereas the Smith and Welch method is free of these two restrictions. Second, the fact that the Smith and Welch methodology allows for gender differences in the returns to any particular characteristic, it allows for the identification of changes in discrimination in the returns to observable characteristics whenever present, whereas the Juhn, Murphy and Pierce method portrays the effect of changes in discrimination, among other things, in the so called "gap effect".

During 1999 – 2001 estimated by the Juhn, Murphy and Pierce methodology, the wage gap increased in the western region by 0.029 log points, in the eastern region by 0.142 log points, and increased in the sample of reunified Germany by 0.047 log points. According to Smith and Welch's methodology, the estimated increases in the gender wage gap in the western region, eastern region and reunified Germany where 0.033, 0.140 and 0.052 log points respectively. During the period 2001 – 2006, the Juhn, Murphy and Pierce methodology estimated the increase in the gender wage gap as 0.012 log point in the western region, 0.014 log points in the eastern region and 0.010 log points in the sample of reunified Germany. Alternatively, the Smith and Welch methodology estimated those increases in the gender wage gap as 0.011, 0.019 and 0.008 log points respectively.

Clearly, the majority of the increase in the gender wage gap in all three samples has occurred during the period 1999 – 2001, which was also a period of increasing levels of wage inequality all over Germany. Therefore, this article shows that it is not only true that countries with relatively higher levels of wage inequality experience larger gender wage gaps, but also periods of rising levels of wage inequality in a particular country are marked with simultaneously widening gender wage gaps. In particular, it will be shown that the variables that mainly explained the rising levels of wage inequality in Al-farhan (2010) are also crucial in explaining the increases in the gender wage gap. These variables were mainly potential experience, worker's company sizes and worker's occupational position and their occupation/training match.

Furthermore, Juhn, Murphy and Pierce's gap effect has estimated the gender wage gap during the period 1999 – 2006 to have increased by 0.027 log points in the western region, 0.185 log points in the eastern region and by 0.040 log points in the sample of reunified Germany, whereas Smith and Welch's methodology estimated that changes in discrimination have caused the wage gap to increase by 0.018 log points in the western region, 0.133 log points in the eastern region and by 0.038 log points in the sample of reunified Germany. These results show that Juhn, Murphy and Pierce's gap effect might have overestimated the effect of changes in discrimination due to potential biases.

In this article I will show that changes in discrimination had a positive influence on the gender wage gap. Moreover, I will show that the gender differential in the returns to educational attainment and experience and tenure in Germany during 1999 – 2006 where causing the wage gap to decrease, indicating that during that period, women actually received a favorable treatment in rewarding their human capital (other than job-specific training) compared to men.

This article continues with a literature review in section I, then it proceeds by presenting the data and descriptive statistics in section II, explaining the implemented methodologies in section III and discussing the empirical results in section IV. Section V concludes.

I.   LITERATURE REVIEW:

In this section I review a sample of papers that describe the evolution of the literature on the quantitative assessment of gender wage differentials and discrimination in Germany and changes therein across space and/or time. First, I briefly present the main papers that introduced the methodologies utilized in the empirical section of this article. Second, I review the main papers that analyze international comparisons in gender wage differentials, which include Germany in their sample of countries compared. Finally, I review the latest literature on gender wage differentials in Germany.

Ronald Oaxaca (1973) provided a methodology that made it possible to estimate the average extent of wage discrimination and quantitatively assess the sources of gender wage differentials. His estimation procedure relied on ordinary least squares estimations of semi-log wage equations for each gender. These equations are then used as inputs in a decomposition process that allows for identifying the gender wage gap into two components. The first of those components represents the estimated effects of differences in individual characteristics, and the second represents the estimated effects of discrimination. Oaxaca used data from the 1967 Survey of Economic Opportunity on white and black men and women. He finds that the gender wage gap is quite large and that a substantial proportion of that differential is attributable to the effects of discrimination.

Oaxaca was aware of the fact that the participation decisions of men are different from those of their women counterparts. Also, his results show that on average one child caused white women a longer period of absenteeism from the labor market as compared to black women. Therefore, he tried to control for women participation decision by including a variable on the number of children born to a women in his wage equations. Nevertheless, there was still a great chance that his coefficients suffered from selection bias. Later, Heckman (1979) introduced his well-known two step procedure that enables the econometrician to control for the participation decisions of individuals.

Yun (2007) formally proposed an extension of the Oaxaca decomposition equation using generalized residuals. That extension, he argued, is so general by nature that it enables

researchers to study wage differentials whatever complicated econometric issues exist, for example selection, simultaneity and endogeneity, and whatever econometric techniques are used in order to obtain consistent estimates in the wage equations.

In his paper, Yun employed the 2001 wave of the Panel Study of Income Dynamics and decomposes the wage gap between black and white women in the U.S. The consistent estimates were obtained by jointly estimating the participation and wage equations using maximum likelihood estimation (MLE). He showed that the racial wage differential of 0.246 log points decomposes into a characteristics effect of 0.112 log points, a coefficients effect of 0.188 log points and a generalized residuals effect of -0.054 log points. Further decomposition of the residuals effect reveals that the characteristics effect accounts for -0.063 log points and that the coefficients effect accounts for 0.008 log points.

Smith and Welch (1989) investigated American black men's economic progress using data from the 1940 to the 1980 censuses. Their regressions where estimated separately within five-year experience intervals, ranging between 1 to 5 and 36 t0 40 years of work experience. Their wage equations use the logarithm of the weekly wage as the dependent variable. The set of independent variables were years of schooling, dummy variables indicating residence in the South, standard metropolitan statistical areas (SMSAs), the central citied of those SMSAs and a set of single year experience dummies within each experience interval. Their idea was to quantify the extent to which the narrowing between white men wages and black men wages was due to black gains in education, and how much was due to migration and the growth in the Southern economy. For that purpose, they introduced the decomposition methodology that will be implemented in this article. Their results indicated that blacks where able to increase their relative position in education compares to whites and translate it into higher incomes, which led to the wage gap to decline. Given that in 1940 three quarters of black men were born in the South, the great northern migration had a profound impact on black men's wages relative to men. With respect to the influence of economic growth, Smith and Welch reported that 45% of the reduction in black poverty during 1940 and 1980 was due to economic growth.

Juhn, Murphy and Pierce (1991), hereafter the JMP, provided a methodology for analyzing changes in wage differentials between different groups (e.g. blacks and whites) in which the change in the differential is decomposed into a characteristics effect, coefficient effect and residual effect. Unlike the methodology of Oaxaca (1973), the JMP methodology is a difference in the difference kind of analysis, which was later on used in conducting international comparisons of gender wage gaps and analyzing changes in wage differentials across time. In their article they analyzed the slowdown in black-white wage convergence during the period 1963-1979 using data from the U.S. Current Population Surveys (CPS). They concluded that a significant portion of the slowdown in black-white wage convergence is attributable to changes in occupational prices and to shifts in relative wages across occupations, as well as changes in skill prices within education levels.

Analyzing international comparisons in gender wage differentials was initially pioneered by Blau and Kahn (1992), (1996) and (2003). Blau and Kahn (1992) compare the gender earnings gap in the USA to those of West Germany, U.K., Austria, Switzerland, Sweden, Norway and Australia. They used micro data from different surveys referring to each of those countries and apply the JMP decomposition methodology to decompose cross-country differences in the earnings gap between men and women. Data on Germany cover the period from 1985 – 1988. They showed that the gender earnings ratio (women – men earnings) was the highest in Sweden (76.7%), followed by Australia (74.9%), Norway (73.1%), Austria (72.6%), Germany (68.8%), USA (68.5%), UK (63.4%) and Switzerland respectively (61.7%). That indicates that Germany ranked fairly in the middle with respect to the gender wag differential. According to Blau and Kahn, international differences in gender wage gaps could be caused by differences in the relative supplies of skills, technology, by differences in the composition of demand for skills and by collective bargaining and different wage setting institutions. Also, the authors indicated that the level of wage inequality increases the gender differential. They showed that wage inequality in the U.S. fully accounted for the lower gender earnings ratio as compared to Scandinavian countries and Australia (the countries with the smallest gaps). This positive correlation between wage inequality and gender wage

differentials will be further examined in this article, since the gender wage gap is analyzed during a period of rising wage inequality in Germany.

Blau and Kahn (1996) extended their previous paper and increased their sample of countries to include in addition to those mentioned before, Hungary and Italy. Their results with respect to West Germany's position between those countries in terms of the women men earnings ration did not change from their previous findings. Germany ranked sixth, where women earned 70.2% as much as men did.

Blau and Kahn (2003) yet confirmed their previous results regarding the fact that more compressed men wage structures and lower women net supply are both associated with a lower gender pay gap. They employed microdata for 22 countries over the period from 1985 – 1994, and found that West Germany ranked 17th in terms of the gender wage gap, whereas East Germany ranked second. Data on West Germany covered the period from 1985 – 1993, whereas data for East Germany covered the period from 1990 – 1993. Although wage inequality has risen in East Germany after reunification, inequality levels remained well below their West German counterparts as indicated by Gang et al. (2006) and Gang and Yun (2003). That observation confirms that lower gender pay gaps are likely to be associated with lower levels of inequality as mentioned before. Hence, it would be interesting to see what happened to the gender wage gap in Germany during the period 1999 – 2006 where wage inequality in both regions of the country increased significantly.

Although there is a fair amount of literature on gender wage differentials in Germany, to my knowledge, none of them has explored in detail the change in the wage gap between men and women during the period of rising inequality after 1999. Gernandt and Pfeiffer (2008) highlighted the observation that wage inequality among East Germans has converged to the levels prevailing among West Germans at some time between 1994 and 2000, a result that was confirmed by the discussion in Al-farhan (2010). However, Gernandt and Pfeiffer did not specify exactly when such a convergence took place, nor did they provide a detailed explanation for the interchange in the levels of wage inequality between the east and the west before and after 1999. Furthermore, neither did Gernandt and Pfeiffer, nor did anyone else yet attempted to verify the linkage between

wage inequality and the gender wage differential in Germany during a period of noticeably rising levels of inequality. Blau and Kahn (1996), (1997), (2003) and (2006) indicated that increasing wage inequality could have adverse effects on women relative wages, such that rising inequality could significantly contribute to a widening wage gap between men and women.

Hence, one of this article's purposes, in addition to a detailed decomposition of the change in the gender wage differentials in eastern and western Germany during the period 1999 - 2006, to find out whether the changes in the gender wage gap were associated with the increases in the wage inequality analyzed in Al-farhan (2010).

Gang and Yun (2001) analyzed the gender wage gap and discrimination in East Germany during the period 1990-1997. Using data from the German Socio-Economic Panel they estimated wage equations via maximum likelihood, and applied a generalized Tobit model that accounts for participation selection. Interestingly their results showed that the gender wage differential decreased during the period of interest. However, while wage discrimination first decreased between 1990 and 1992, it increased remarkable to almost 20 log points in 1997.

Hunt (2002) found to some extent similar results for the period 1990 to 1994, also using data for the German Socio-Economic Panel. During that period, East German women wages rose by 10 percentage points relative to men wages, which contributed to a narrowing gender wage differential. However, Hunt argued that although this result is seemingly good news for women, almost half of that decrease in the gender wage differential was caused by disproportionate exits from employment of less-skilled workers, who were mainly less educated women. Furthermore, these exits were not caused by women voluntarily choosing more leisure, rather by reductions in the demand for low skilled labor. Hence, whether women became better or worse off during the period of 1990 – 1994, remains a question of the net influence of a declined gender wage differential and an increased employment gap on women welfare, holding everything else constant.

Beblo and Wolf (2003) used data from the "IAB – Beschäftigtenstichprobe" and the "IAB – Ergänzungsstichprobe" to estimate the wages of men and women taking into account the worker's entire employment biography, including the type and duration of each past employment interruption. Therefore, they were able to differentiate between the short-term and the long-term wage effects of unemployment, formal parental leave as well as other interruptions. Their analysis shows that the negative effects of interruptions, such as maternal leaves, on women wages were larger than on men wages. Hence, they argued that job market interruptions play an important role in the overall gender wage differential in Germany.

On the firm level, Gartner and Stephan (2004) provided evidence that collective contracts and work councils reduced gender wage differentials. Using data from the IAB-establishment panel and the Employment Statistical Register of the IAB they decomposed the change in the gender wage differential between firms that were covered by collective contracts or work councils and other firms, usually smaller, that were not. Gartner and Stephan extended the JMP methodology by including fixed firm effects in their wage equations. They found that the change in the gender wage differential between firms with and without collective contracts and work councils was mostly explained by the different positions of women workers in the men residual distribution (the gap effect), and the within firm unobserved price effect.

Unfortunately, information on workers' union membership status and trade councils are not available in all waves during the period 1999 – 2006 in the German Socio-Economic Panel. Therefore, I will not control for workers' associations with unions or work councils, and consequently would expect that the effect of such memberships to be captured by the constants and the residuals in my wage equations. The absence of union membership might result in biased estimates. Nevertheless, since changes in the gender wage differential will be decomposed on a year-to-year basis (i.e. from 1999 to 2000, from 2000 to 2001, …, and from 2005 to 2006), the bias in each one-year period due to the absence of a union membership variable and, in fact any other omitted variable, will be differenced out as long as it is time invariant during that particular period. Union

membership of individual workers is likely to be time invariant during a period of one year.

Ziegler (2005) calculated the gender wage gap by applying the Oaxaca-Blinder methodology to three different major data sources. Using data from 2003, the Gehalts und Lohnstrukturerhebung (GLS) he showed that about 40% of the wage gap for salaried employees in the western region in Germany was explained by differences mainly in the educational attainment, occupational position and sector. Using the IAB Beschäftigtenstichprobe (IABS) on the other hand, these variables mainly explained 37% of the gender wage gap. However, using the German Socio-Economic Panel, the aforementioned variables explained only 18% of the gender wage gap. For the eastern region of Germany, educational attainment, occupational position and sector explained 33.8%, 9% and 11% of the gender wage gap, using the GLS data set, the IABS data set and the German Socio-Economic Panel respectively. Generally, Ziegler concluded that the gender wage gap in the eastern region was smaller as compared to the western region, and that the explained part of that wage gap was more relevant than the unexplained part.

Gartner and Rässler (2005) analyzed the changing gender wage gap in West Germany during 1991 – 2001, using the JMP methodology. Their data come from the IAB – employment register which, although a rich dataset, lacks the information on individuals' wages if the wage lies above the social security contribution limit. Any wage that is above that limit is missing. Gartner and Rässler before implementing their decomposition solved the problem of censored wages as a missing data problem. They did so by multiple imputations based on the Markov chain Monte Carlo (MCMC) technique. They found that the gender wage gap declined over the decade of the nineties. That decline was due to the negative impacts of the observable characteristics and the gap effects in the JMP decomposition. That can be interpreted by that both women endowments of human capital and their relative position in the men wage distribution have improved. The wage structure, on the other hand, contributed to a widening wage gap since both the observed and unobserved prices effects were positive. This improvement in women relative endowments and positions in the men wage distribution, accompanied by changes in the wage structure that widened the wage gap resembled the observation that Blau and Kahn

(1997) described by "swimming upstream" while analyzing the gender wage differentials in the U.S. during the period 1979 – 1988.

Holst and Busch (2009) used data from the wave of 2006 form the German Socio-Economic Panel and analyzed the gender wage gap in leadership positions in the private sector. They defined an individual worker to be in a leadership position if he or she was older than 18 years old, employed in the private sector and carries out leadership tasks such as being a director, a manager, or performs as a highly qualified professional, such as being head of a department, scientist or an engineer. Using the Oaxaca-Blinder methodology, they show that the decomposition results differ significantly between controlling for the possibility of women being selected into a leadership position and not controlling for this type of selection. They employed the Heckman two-step procedure, in which they used the educational attainment of the father as the main instrument. Holst and Busch find that despite the fact that women and men in leadership positions enjoyed relatively similar human capital characteristics, without controlling for selection, two thirds of the gender wage gap could mainly be explained by allocative discrimination. Once they controlled for selection, the effect of allocative discrimination in the gender pay gap amongst leadership positions fell down to one third.

A cautionary note is however due when interpreting Holst and Busch's results. Their estimates might still be biased due to the likely presence of double selection. More specifically, it is not only women selection into leadership positions that must be controlled for in this case, but also women participation decisions (i.e. the traditional participation selection). For a more detailed discussion on double selection, see Yun (1999) and Wetzels and Zorlu (2003) and Hamermesh and Donald (2004).

II.   DATA AND DESCRIPTIVE STATISTICS

II.1. Data:

This section describes the data from the German Socio-Economic Panel for the period 1999 -2006. This data set is a longitudinal panel of the population in Germany. It is a household based study which started in 1984 and in which adult household members are interviewed annually. Additional samples have been taken of households in East Germany since 1990 and immigrants in 1994, 1998, 2000, 2002 and 2006. As of 2007, there were about 12,000 households, and more than 20,000 adult persons sampled. The annual surveys are conducted by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung (DIW) Berlin). For a more detailed description of the panel see Wagner G., Frick J., and Schupp J. (2007) and Frick J., Jenkins S., Lillard D., Lipps O., and Wooden M. (2007).

The sample is restricted to men and women, 18 to 64 years of age, who are full time workers and have completed their education. It excludes employees who are on maternity leaves since they earn reduced wages, and those in the military and community service. Also, the sample excludes men and women who work in the agricultural sector due to the seasonal nature in that sector, and workers who are self-employed. Furthermore, to control for outliers and to maintain comparability with the data set employed in Al-farhan (2010), individuals who earn more than Euro 50 per hour and work more than 100 hours per week are also excluded from the sample. Finally, the lowest 2% of the wage distribution was truncated in order to eliminate the effect of outliers on the wage gap.

II.2. Descriptive Statistics:

The size of the gender wage gap in the eastern region of Germany during the period 1999 – 2006 was negligible, confirming the findings of Ziegler (2005) who reported that the gender wage gap in the east in 2003 was relatively small. This can clearly be seen in figures (1), (2) and (3), which show the cumulative distribution of women wages relative to the men wage distribution in 1999, 2001 and 2006 respectively. The reason for

choosing these years as benchmarks is that; given the discussion in Al-farhan (2010), it was in 1999 when the levels of wage inequality in the east caught up with the levels in the west. Also, the two-year period 1999 – 2001 was a period where the level of wage inequality has increased. Finally, 2006 is the end of the period of interest.

A close look at those figures leads to two main observations. First, it is obvious that the cumulative distribution function of women wages in the eastern region was remarkably closer to the main diagonal[2] than that of the western region in all three figures. This indicates that the level of the gender wage gap in the eastern region was considerably low as compared to that in the western region, and that the gender wage gap in reunified Germany was mainly explained by the wage gap in the western region. In fact, the mean of the gender wage gap in the eastern region during the entire period 1999- 2006 was as low as 0.062 log points, compared to 0.268 in Germany as a whole.

Second, all three cumulative distribution functions shift to the left in 2001 compared to the initial location in 1999, and then shift back to the right in 2006 by a smaller horizontal distance as compared with the initial shift to the left. This indicates that the level of the gender wage gap in the western region, eastern region and reunified Germany might have increased during the period 1999 – 2001 and then decreased during 2001 – 2006, however ending up at a higher level in 2006 than what it was in 1999 in all three samples.

Consequently, although the level of the gender wage gap in the eastern region might seemingly be negligible compared to the western region, the pattern of change in the wage gap seems to be similar in both regions. Furthermore, in a scenario where the gender wage gap persistently increases in the eastern region by larger amounts than in the west, it might be that after a while the levels of the gender wage gap in the east could catch up with the levels in the west, just as the overall levels of wage inequality did.

Therefore, this article focuses on three main dimensions. First, I verify whether or not empirical evidence can be found concerning the positive relationship between rising wage inequality and gender wage gaps, as mentioned by Blau and Kahn in numerous occasions. Second I compare the relative sizes of changes in the gender wage gap in the

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[2] The main diagonal represents the benchmark situation of no wage gap.

western region, eastern region and reunified Germany, and decompose those into their respective explained and unexplained terms annually during the period 1999 – 2006, and verify whether the changes in the gender wage gap are explained by the same individual factors in both regions of Germany as well as in the combined sample of the reunified country. Third, I implement a decomposition methodology that relaxes the JMP assumptions of the equality of coefficients and variances of the wage residuals, and see whether by doing so more insights into the causes of the changes in gender wage gaps could be found.
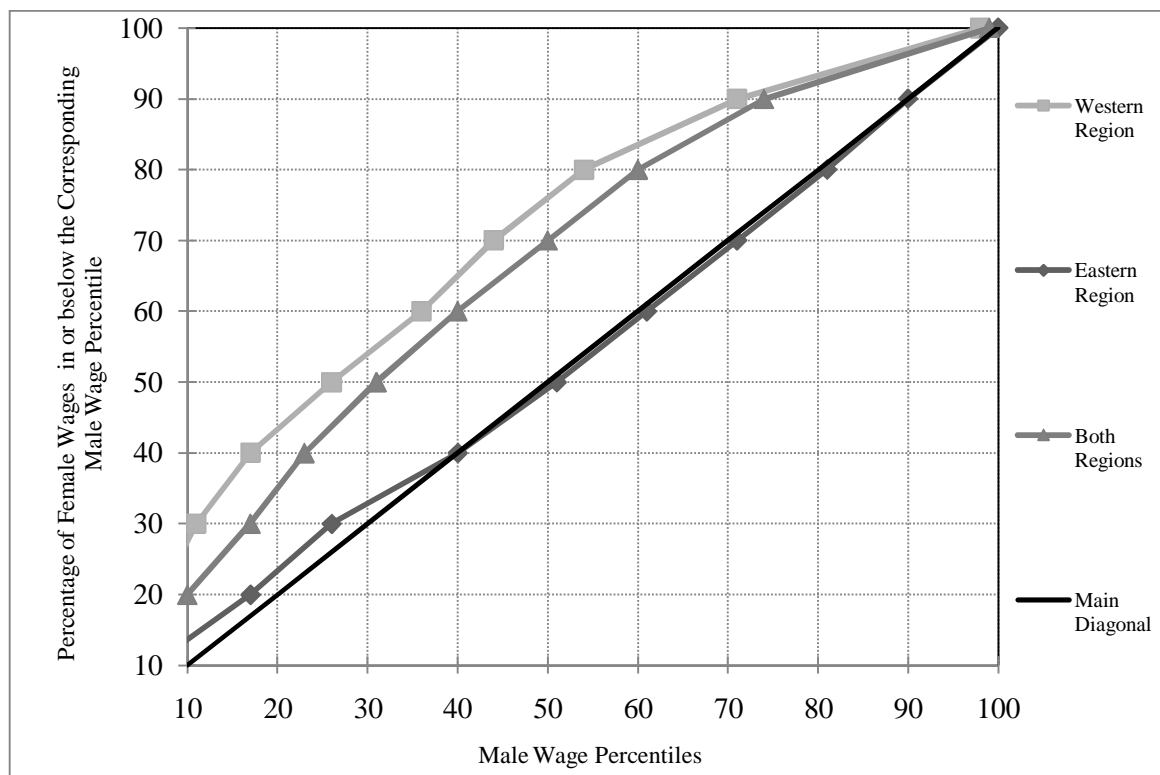
Source: Author

Figure 1: The Cumulative Distribution Function of Women Wages Relative to the Male
　　　　Wage Distribution in the Respective Region in 1999
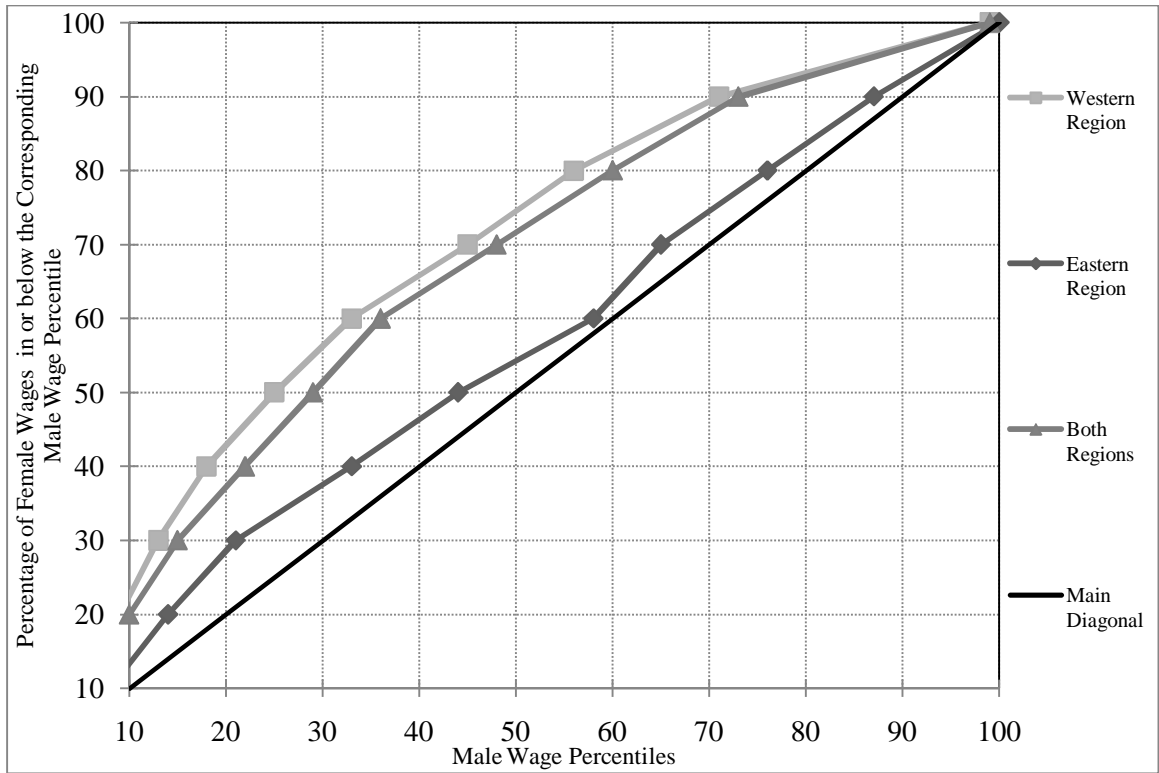
Source: Author

Figure 2: The Cumulative Distribution Function of Women Wages Relative to the Male
   Wage Distribution in the Region in 2001
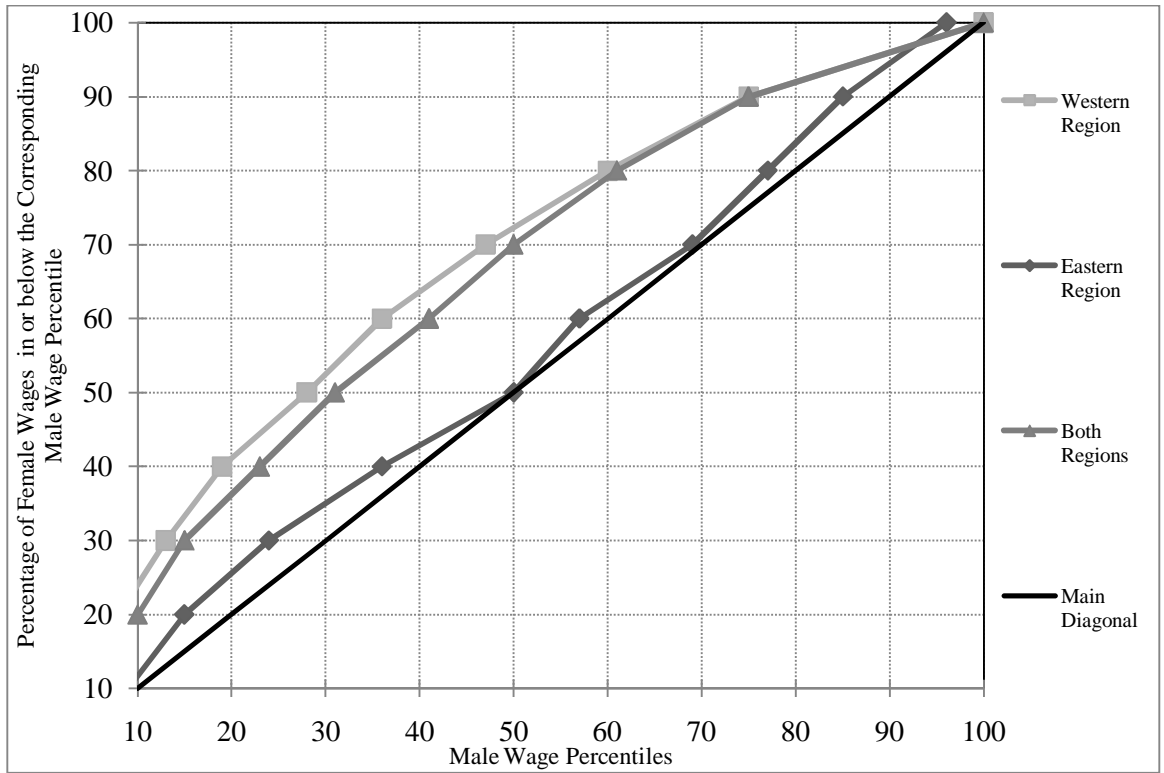
Source: Author

Figure 3: The Cumulative Distribution Function of Women Wages Relative to the Male
Wage Distribution in the Respective Region in 2006

II.2.1 Wage Distributions in the Western and Eastern Regions:

In light of the objectives of this article, among which is to verify the association of increasing gender wage gaps with rising levels of wage inequality, it is useful to look closer at the picture of the relative positions of the wage distributions in the western region and eastern region with respect to the distribution of wages in the country as a whole.

Figures (4) to (6) show the cumulative distributions of real hourly wages in the western region and eastern region relative to the overall distribution of wages in reunified Germany in 1999, 2001 and 2006 respectively.
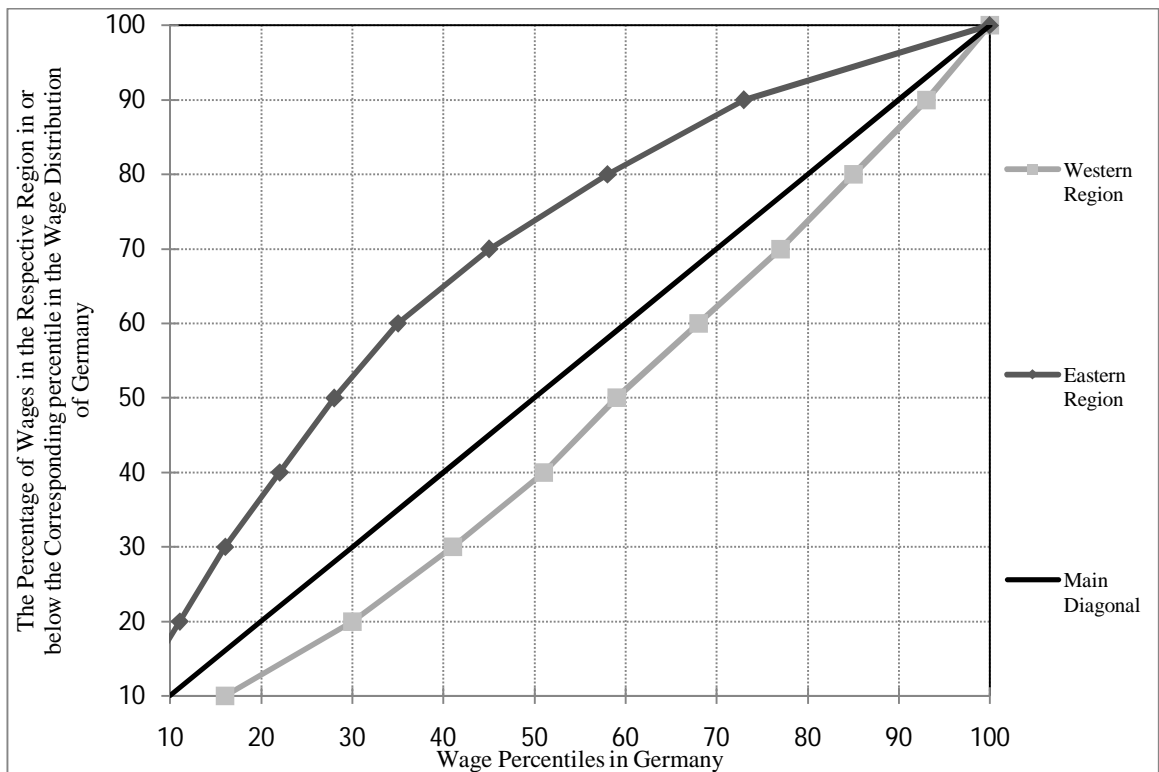
Source: Author

Figure 4: The Cumulative Distribution Function of Wages in the Western and Eastern Regions of Germany Relative to the Wage Distribution in the Country in 1999
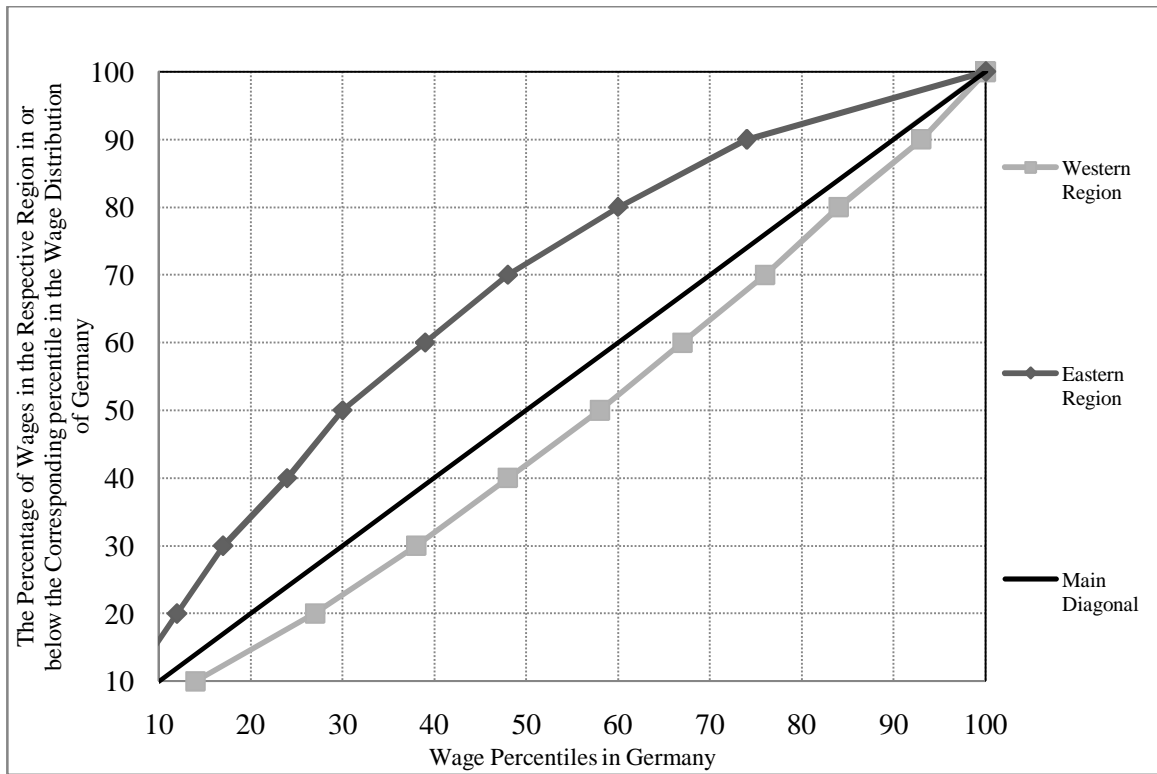
Source: Author

Figure 5: The Cumulative Distribution Function of Wages in the Western and Eastern Regions of Germany Relative to the Wage Distribution in the Country in 2001
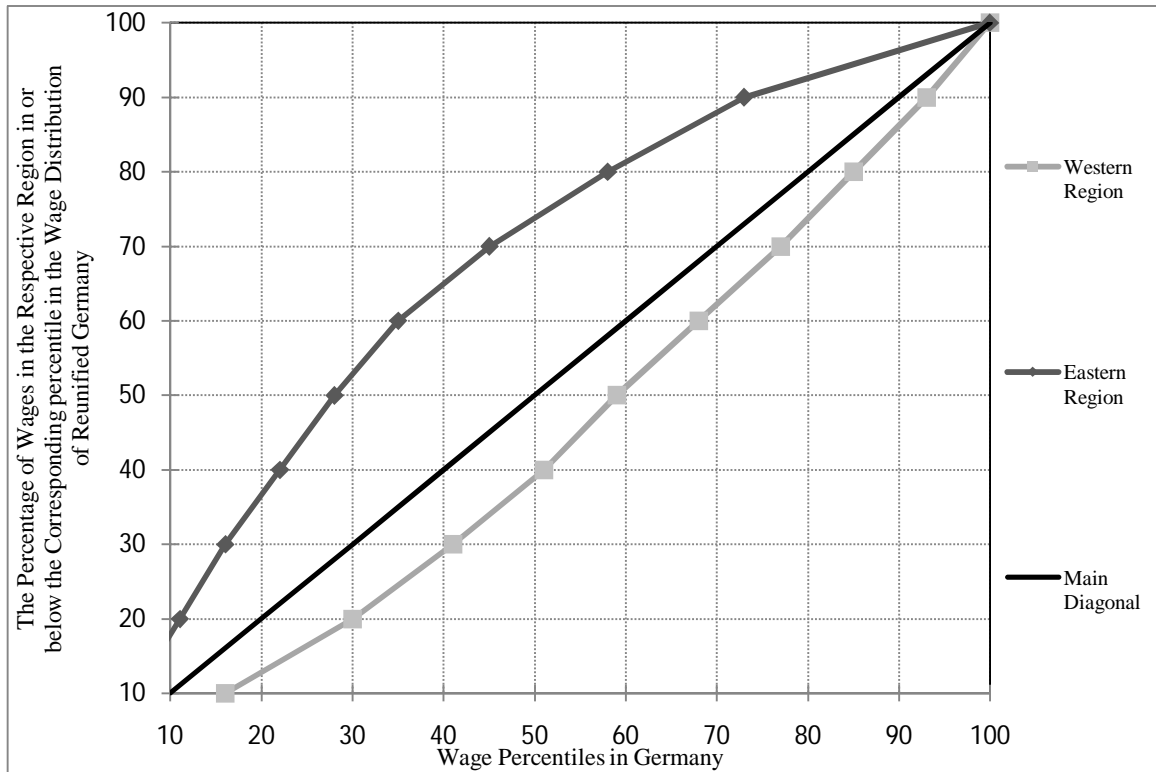
Source: Author

Figure 6: The Cumulative Distribution Function of Wages in the Western and Eastern
Regions of Germany Relative to the Wage Distribution in the Country in 2006

All figures show that the distribution of wages in the western region lied to the right of
the main diagonal whereas the distribution in the eastern region lies to the left. In fact, it
is clear that the distribution of wages in the eastern region was located further to the left
of the main diagonal than the distribution of wages in the western region was located to
the right. Therefore, it is obvious that eastern wages were more concentrated in the lower
tail of the wage distribution in Germany whereas wages in the western region were more
concentrated in the upper tail of the distribution.

This is a very convenient input to the analysis of this article. It enables me to actually test
for the presence of a positive relationship, or lack of, between rising levels of wage
inequality that, given the results Al-farhan (2010), were prevalent in both regions

particularly during the period 1999 – 2002, and increases in the gender wage gap using two separable wage distributions, i.e. the western region and the eastern region, with relatively different means, that are ultimately belonging to the greater wage distribution of reunified Germany.

Hence, if we want to draw meaningful conclusions about the relationship between changes in wage inequality and changes in gender wage gap in Germany, it is useful to analyze each region separately, and see whether the differences in the wage distributions between the west and the east had any impact on that relationship, if at all existent.

II.2.2. Real Hourly Wages and the Gender Wage Ratio in Germany:

Mean real hourly wages have increased for both genders in Germany during 1999 – 2006. As shown in figure (7) to (9) below, men wages remained higher than women wages during the entire period in the western region, eastern region and reunified Germany alike, whereas wages in the western region were considerably higher. Men wages in the western region increased during the period 1999 - 2002 by 10.47% and slightly decreased by 0.31% during the period 2002 – 2006. For women on the other hand, wages increased in the first period by 8.18% and continued to increase rather mildly by 1.09% during the period that followed. In the eastern region, men wages increased by 13.70% during he period 1999 – 2002, and by as low as 0.86% during the period 2002 – 2006. Wages of women in the eastern region of Germany increased during the first period by 3.26%, and by 3.41% during the second. These trends combined caused real hourly wages of men in the combined sample to rise by 12.97% between 1999 and 2002, and then to decrease slightly by 0.47% between 2002 and 2006. For women on the other hand, wages increased by 8.95% between 1999 and 2002, and then increased moderately by 1.19% during 2002 and 2006.
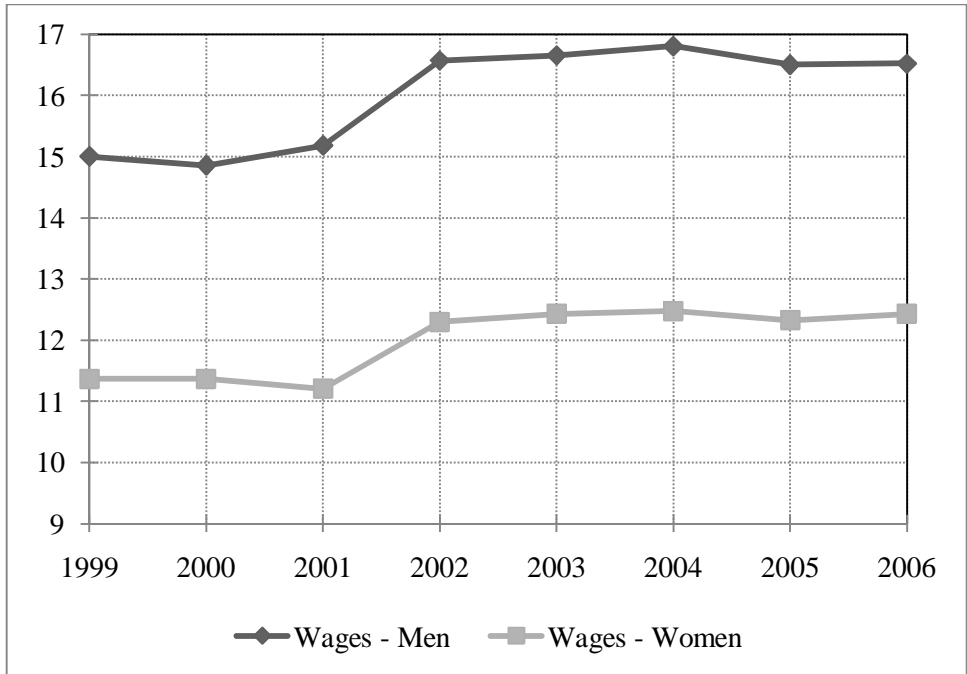
Figure 7: Mean Real Hourly Wages for Men and Women in the Western
Region (Constant 2001 Euros)
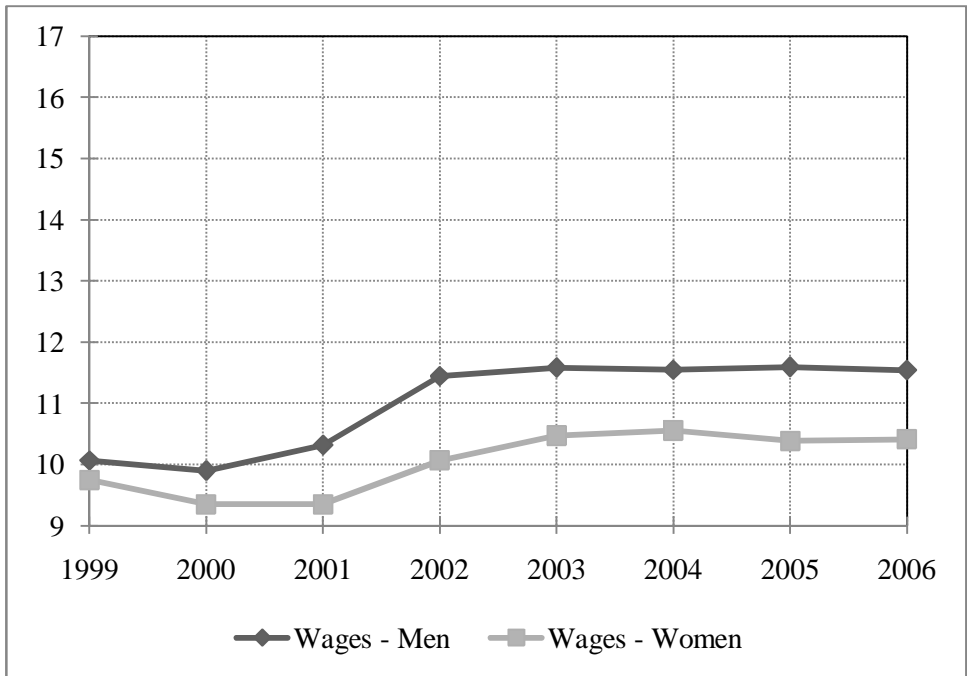
Figure 8: Mean Real Hourly Wages for Men and Women in the Eastern
Region (Constant 2001 Euros)
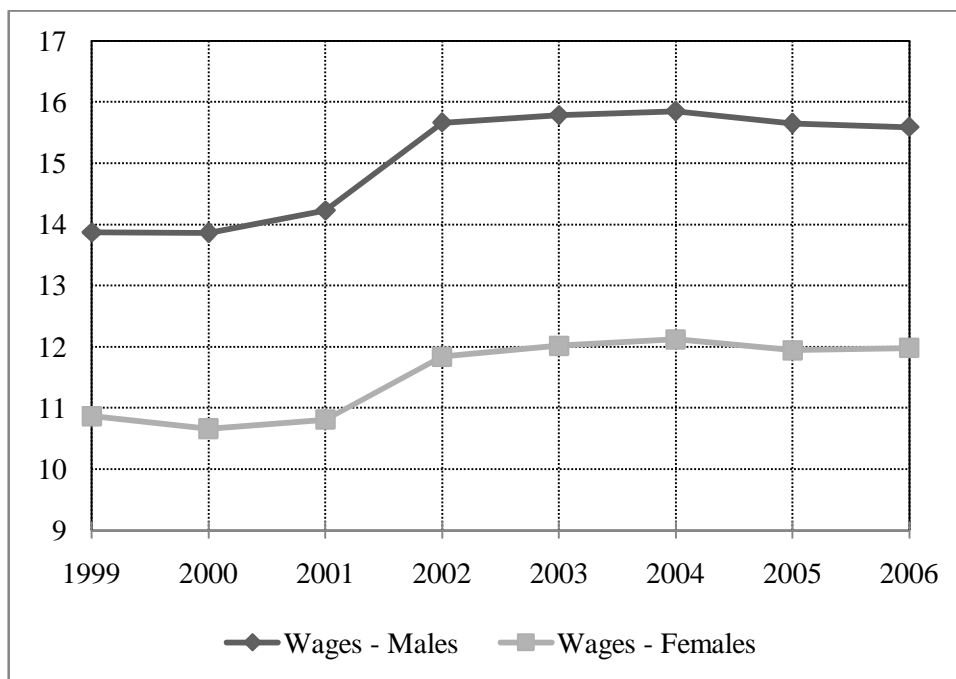
Source: Author

Figure 9: Mean Real Hourly Wages for Men and Women in Reunified
Germany (Constant 2001 Euros)

As a result of these trends in wage growth for men and women, the gender wage ratio, as shown in figures (10) to (12) has declined in the western region from 75.78% in 1999 to 74.20% in 2002 and then increased to 75.25% in 2006. Likewise, the gender wage ratio in the eastern region decreased from 96.88% in 1999 to 87.99% in 2002, and then increased to 90.21% in 2006. The gender wage ratio confirms the previously mentioned observation that the gender wage gap in the eastern region was relatively small. In the combined sample for reunified Germany, the gender wage ratio decreased from 78.37% in 1999 to 75.59% in 2002 and then improved to 76.85% in 2006.

These figures signal that the gender wage gap may have first increased during the period of interest in this article, and then declined. In fact, the period of decrease in the gender wage ratio coincides with the period of rising inequality, which leads to the prediction that a positive association between wage inequality and gender wage gaps might indeed be confirmed by this article.

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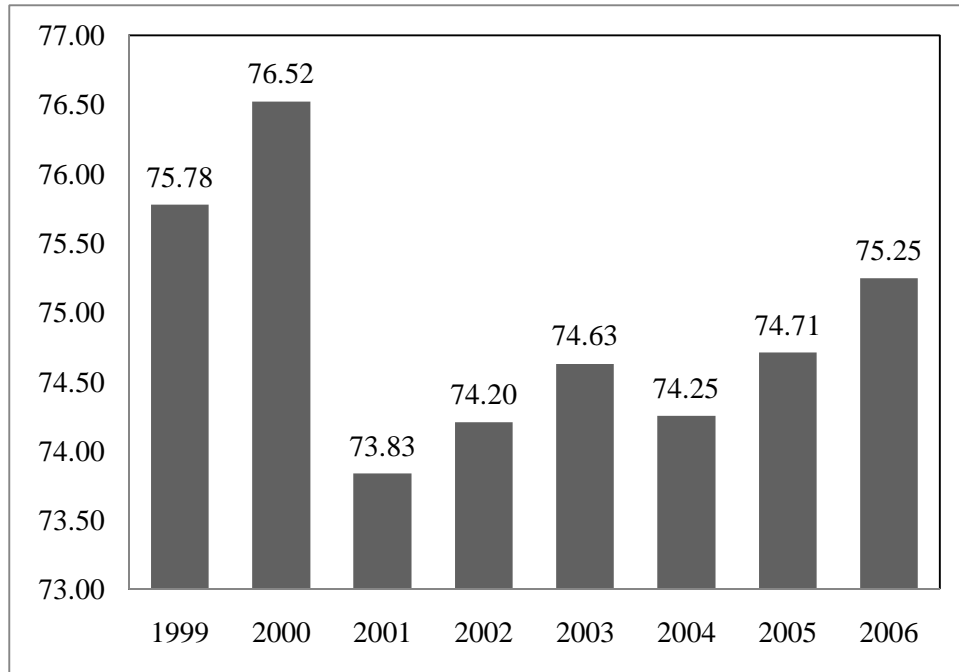
Figure 10: Mean Women to Men Real Hourly Wage Ratio in the Western
Region
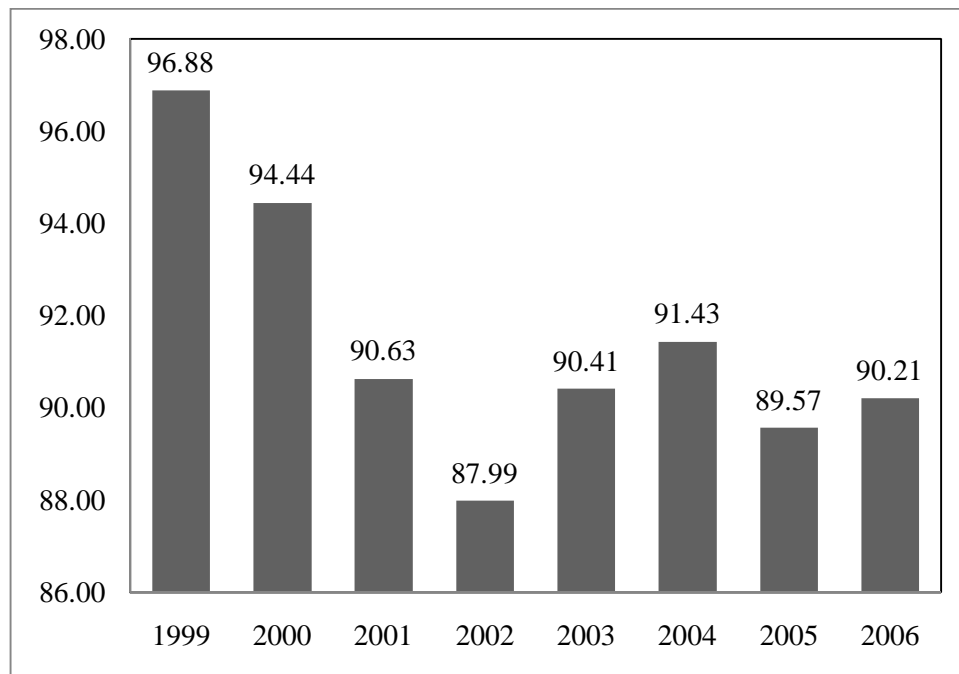
Figure 11: Mean Women to Men Real Hourly Wage Ratio in the Eastern
Region
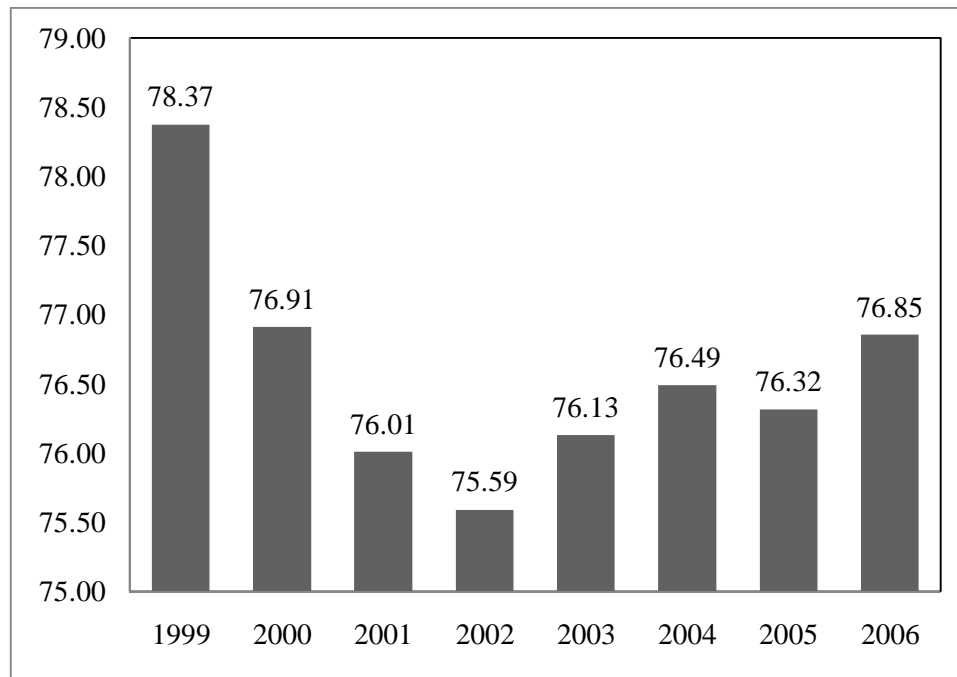
Source: Author

Figure 12: Mean Women to Men Real Hourly Wage Ratio in Reunified
Germany

One ought to be careful however, when reading the gender wage ratio since it is the ratio of the mean women real hourly wages to the mean men real hourly wages at any particular time. Gender wage gaps are measured in the literature that is based on the decompositions of Oaxaca (1973) and Juhn et al. (1991) by the gender difference in the means of the log real hourly wages, which does not exactly correspond to the former[3].

II.2.3. The Gender Wage Gap and Wage Inequality in Germany during 1999 – 2006:

As shown in figures (13) to (15) which show the gender means of log wages differentials along with the variance of log wages during the period 1999 – 2006, the gender wage gap

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[3] $\ln\left(\frac{\overline{W}_m}{\overline{W}_f}\right) = \ln \overline{W}_m - \ln \overline{W}_f \neq \overline{\ln W_m} - \overline{\ln W_f}$

increased in the western region from 0.283 log points in 1999 to 0.330 log points in 2001, and then declined to 0.305 log points in 2006. In the eastern region, the gender wage gap increased from 0.061 log points in 1999 to 0.129 log points in 2001, and then decreased to 0.107 log points in 2006. Notice that the gender wage gap is significantly lower in the eastern region. These trends caused the gender wage gap in the combined sample to increase from 0.243 log points in 1999 to 0.281 log points in 2001, and then to fall to 0.265 log points in 2006.
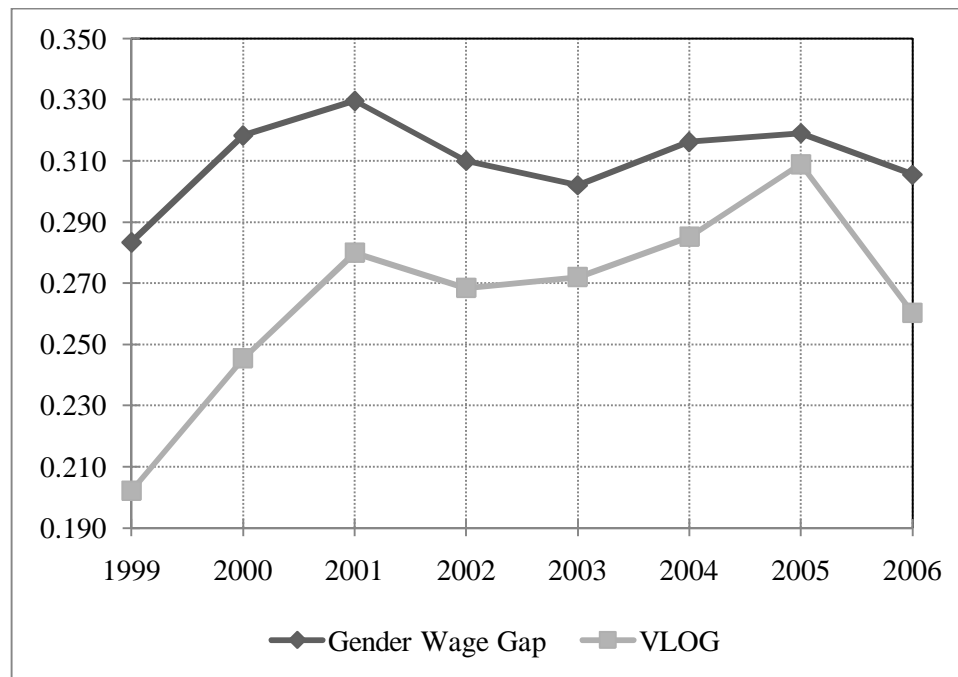
Source: Author

Figure 13: The Mean Log-Wage Gender Differential and the Variance of
Log-Wages in the Western Region
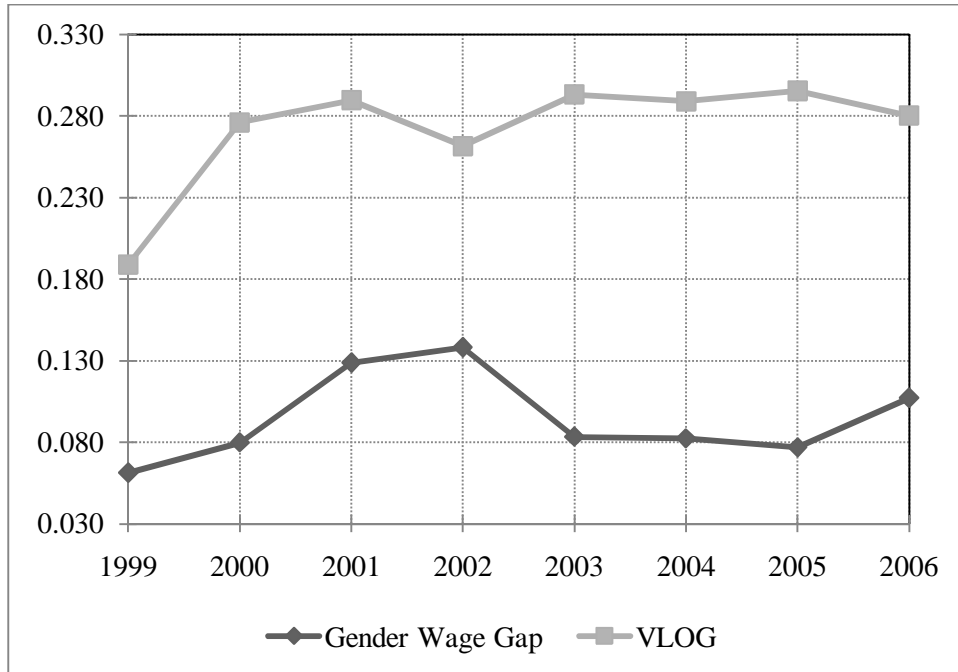
Source: Author

Figure 14: The Mean Log-Wage Gender Differential and the Variance of
Log-Wages in the Eastern Region
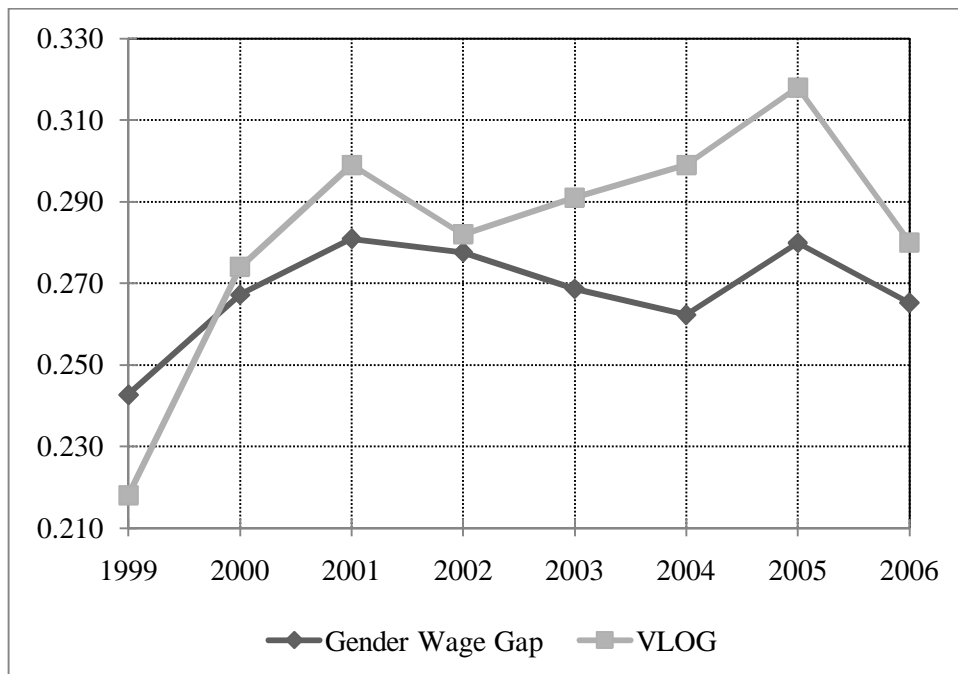
Source: Author

Figure 15: The Mean Log-Wage Gender Differential and the Variance of
Log-Wages in Reunified Germany

The three figures (13) to (15) reveal a very interesting observation. That is, with a small exception for the eastern region during the period 2002 – 2004, the remarkable similarities in the trends of the gender wage gap and the overall wage inequality. Particularly the period of 1999 – 2001[4] was a period which witnessed a surge in the level of inequality, and it is this period precisely in which the increase in the gender wage gap was the most obvious in both the western region, eastern region and in the sample that combines both regions together.

This triggers the question whether the factors that were mainly responsible for explaining the changes in wage inequality, namely individuals' potential experience, education, tenure, company size and occupation/training match did also cause the gender wage gap. This question will be answered throughout the remainder of this article. Before continuing with explaining the methodology and presenting the empirical results, I briefly discuss the main characteristics of the sample used.

II.2.4. Sample Characteristics:

Tables (1) to (3) show the means and standard deviations of the socio-economic characteristics of men and women in the sample, as well as the women relative endowments (positions) compared to men, given that the overall women to men number of observations was around 51% and constant across time.

By comparing the fifth column in each of the three tables, we can see that women were on average slightly younger than men. The mean women age during the period from 1999 – 2006 was in the late thirties and the mean men age was the beginning of the forties.

Regarding the mean years of education, men and women had almost the same average number years, ranging between 12 – 13 years, with women having a slight upper hand. It

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[4] Other measures of wage inequality, namely the Gini coefficient, the Theil entropy index, the coefficient of variation and the difference between the 90th and 10th percentiles of the wage distribution showed that the level of wage inequality has increased further until 2002. Therefore, in Al-farhan (2010) I considered the period 1999 – 2002 as the period of rising inequality in Germany.

is also worth noticing however, that women's relative endowment of university degrees decreased from 1999 - 2001 and then increased from 2001 – 2006.

Also, women had on average 90.9% of men's potential experience in 1999, which slightly increased to 91.5% in 2001 and then decreased to 91.3%.

Regarding tenure, women's endowment relative to men was 82.8% in 1999, slightly falling to 81.8% in 2001 and then rising to 88.8% in 2006. The fact that women have relatively less tenure than they have potential experience compared to men, might be explained by lower women participation rates and more frequent job market interruptions as indicated by Beblo and Wolf (2003).

In general, gender differences in human capital characteristics, namely education, potential experience and tenure were minor in Germany. With respect to the distribution of women relative to men across industries however, there were clear differences. In the energy sector the percentage of mean women to men was around 40% during 1999 – 2006, whereas that percentage was only as low as around 10% in the mining sector. These low women to men ratios were however quite understandable, given the rough nature of the working environment in those sectors. Such an environment might for both genders be perceived as a disamenity, for which men on average have greater tolerance.

On the other hand, in other sectors, the women-men ratio was clearly in favor of women. The percentage of mean women to men in the trade sector increased from 157.4% in 1999 to 164.9% in 2001 and decreased to 142.2% in 2006. This percentage in the banking and insurance sector decreased from 174.8% in 1999 to 142.9% and to 131% in 2001 and 2006 respectively. In the services sector, the percentage of mean women to men decreased from 196.9% in 1999 to 191.6% in 2001 and to 180.4% in 2006.

The extent to which these percentages and the changes therein affected the gender wage gap depends on the values of those ratios, the amounts of change in those ratios across time, and the average wages paid in each respective sector, assuming the absence of discrimination. Table (4) below shows the degree of gender segregation in each industry and the mean real hourly wage paid in each industry. It is obvious that the men dominated sectors paid on average higher wages than the women dominated sectors, with

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the exception of banking and insurance. This might indicate that the way women and men were distributed across industries has increased the gender wage gap, especially during 1999 – 2001, where the percentage of women in the lowest paying industry (i.e. trade) increased and in the highest paying industry (i.e. banking and insurance) decreased.

Regarding the gender distribution of workers by the company size, the percentage of mean women to men employed by companies with less than 20 workers was 111.3% in 1999, 127.9% in 2001 and 132.3% in 2006. This is expected to have influenced the gender wage gap positively, given that the mean wage in small business was relatively lower as compared to larger businesses, and that workers in small businesses had less access to collective contracts. Likewise, in companies employing between 200 and 2000 workers, the percentage of mean women to men decreased from 126.4% in 1999 to 105.6% and 98% in 2001 and 2006 respectively. This again did not speak in favor of women. Also companies which employ more than 2000 workers hired more men than women, since the average percentage of mean women to men during 1999 – 2006 was approximately 78%.

On the other hand, the percentage of mean women to men working in occupations they have been trained for decreased from 107.1% in 1999 to 105% in 2001 and then increased to 108.8% in 2006. This percentage for workers in training or with no training at all increased from 146.8% in 1999 to 160.4% in 2001, and then decreased to 144.1% in 2006. These percentages signal that the occupation/training match might indeed have influenced the gender wage gap positively, given the relatively high gender ratio in the category of workers in training or those who did not have training at all.

Moreover, the percentage of mean blue collar women to men was around 42% during the period 1999 – 2006, whereas the percentage of mean white collar women to men decreased from 501.5% in 1999 to 342.6% in 2001 and to 320.5% in 2006. Given that the white collar occupational position was the lowest paying among all other positions, this high relative percentage of women is expected to have caused higher gender wage gaps. An offsetting effect was the relatively high percentage of mean women to men working as qualified and highly qualified professionals. That percentage decreased however from 171.3% in 1999 to 158.3% in 2001 and to 146.1% in 2006. In higher administrative,

hence higher paying occupational positions, namely foremen and managers the percentage of mean women to men was relative low, averaging at 9% for foremen, and 43.6% for managers during the period 1999 – 2006.

Table (4) again shows the segregation of men and women in occupational positions. It is obvious that higher degrees of segregation were found in higher paying occupational positions, which in other terms means that women were generally more concentrated in lower paying occupational position. And this in turn generally explains the persistence of gender wage gaps.

Finally the percentage of mean women to men working in the western region increased from 84.7% in 1999 to 87.6% in 2001 and to 89.4% in 2006. This indicates that, despite the presence of much lower wage gaps in the eastern region, more women moved to the western region where the average real wage was higher.

Table 1: Sample Means and Standard Deviations, and the Mean Women to Mean Men Ratio in 1999

Variable	1999				
	Men		Women		Women/Men Ratio (%)
Number of Observations	2790		1413		50.645
	Mean	S. D.	Mean	S. D.	
Real Hourly Wage (2001 Euros)	13.866	5.991	10.867	4.270	78.374
Age	40.603	10.248	38.648	10.642	95.184
Native (German = 1)	0.874	0.332	0.905	0.293	103.585
Education (Years)	12.116	2.655	12.210	2.521	100.779
Highest Educational Degree					
Elementary School	0.026	0.159	0.033	0.179	128.892
Secondary School 1	0.080	0.272	0.075	0.264	93.437
Secondary School 2	0.623	0.485	0.557	0.497	89.410
High school	0.037	0.188	0.103	0.304	280.692
University (Reference Group)	0.234	0.424	0.232	0.422	99.028
Potential Experience	22.487	10.393	20.437	10.965	90.885
Tenure	11.300	9.963	9.361	8.373	82.839
Industry					
Energy	0.019	0.137	0.008	0.088	40.981
Mining	0.012	0.110	0.001	0.038	11.615
Manufacturing	0.314	0.464	0.180	0.384	57.318
Construction	0.191	0.393	0.046	0.210	24.125
Trade	0.103	0.303	0.161	0.368	157.409
Transportation	0.072	0.259	0.041	0.198	56.694
Banking and Insurance	0.034	0.182	0.060	0.238	174.828
Service (Reference Group)	0.255	0.436	0.502	0.500	196.898
Company Size					
Less than 20 (Reference Group)	0.191	0.393	0.212	0.409	111.345
Between 20 and 200	0.304	0.460	0.285	0.452	93.836
Between 200 and 2000	0.237	0.425	0.299	0.458	126.357
More than 2000	0.268	0.443	0.203	0.402	75.659
Occupation/Training Match					
Works in occupation trained for (Reference Group)	0.597	0.491	0.640	0.480	107.141
Doesn't work in occupation trained for	0.347	0.476	0.278	0.448	80.164
In training or no training	0.056	0.230	0.082	0.275	146.823
Occupational Position					
Blue collar (Reference Group)	0.438	0.496	0.183	0.386	41.722
White collar	0.036	0.186	0.180	0.384	501.529
Civil service	0.091	0.288	0.062	0.242	68.409
Qualified & highly qualified professional	0.324	0.468	0.556	0.497	171.271
Forman	0.080	0.272	0.005	0.070	6.170
Managerial	0.022	0.146	0.011	0.106	51.791
Region	0.759	0.428	0.643	0.479	84.742

Source: Author

Table 2: Sample Means and Standard Deviations, and the Mean Women to Mean Men
Ratio in 2001

Variable	2001				
	Men		Women		Women/Men Ratio (%)
Number of Observations	4449		2232		50.169
	Mean	S. D.	Mean	S. D.	
Real Hourly Wage (2001 Euros)	14.224	6.561	10.811	4.992	76.008
Age	40.795	10.627	38.991	11.199	95.578
Native (German = 1)	0.903	0.296	0.925	0.263	102.442
Education (Years)	12.196	2.617	12.314	2.489	100.970
Highest Educational Degree					
Elementary School	0.015	0.123	0.015	0.123	99.664
Secondary School 1	0.070	0.256	0.072	0.259	102.530
Secondary School 2	0.634	0.482	0.594	0.491	93.660
High school	0.033	0.179	0.082	0.274	245.119
University (Reference Group)	0.247	0.431	0.237	0.425	96.033
Potential Experience	22.599	10.642	20.677	11.381	91.495
Tenure	11.559	10.033	9.453	8.702	81.779
Industry					
Energy	0.015	0.121	0.006	0.079	42.282
Mining	0.008	0.091	0.001	0.030	10.775
Manufacturing	0.263	0.440	0.161	0.368	61.279
Construction	0.232	0.422	0.052	0.222	22.362
Trade	0.108	0.311	0.178	0.383	164.932
Transportation	0.070	0.255	0.038	0.191	54.654
Banking and Insurance	0.037	0.190	0.053	0.225	142.892
Service (Reference Group)	0.266	0.442	0.510	0.500	191.584
Company Size					
Less than 20 (Reference Group)	0.185	0.388	0.236	0.425	127.949
Between 20 and 200	0.318	0.466	0.314	0.464	98.888
Between 200 and 2000	0.238	0.426	0.251	0.434	105.593
More than 2000	0.260	0.439	0.198	0.399	76.386
Occupation/Training Match					
Works in occupation trained for (Reference Group)	0.574	0.495	0.603	0.489	104.971
Doesn't work in occupation trained for	0.347	0.476	0.270	0.444	77.947
In training or no training	0.079	0.270	0.127	0.333	160.366
Occupational Position					
Blue collar (Reference Group)	0.384	0.486	0.171	0.376	44.412
White collar	0.045	0.207	0.153	0.360	342.563
Civil service	0.097	0.296	0.053	0.224	54.699
Qualified & highly qualified professional	0.343	0.475	0.543	0.498	158.340
Forman	0.067	0.249	0.007	0.082	10.101
Managerial	0.020	0.141	0.009	0.092	42.080
Region	0.782	0.413	0.685	0.465	87.629

Source: Author

Table 3: Sample Means and Standard Deviations, and the Mean Women to Mean Men
Ratio in 2006

Variable	2006				
	Men		Women		Women/Men Ratio (%)
Number of Observations	3769		1972		52.322
	Mean	S. D.	Mean	S. D.	
Real Hourly Wage (2001 Euros)	15.589	7.387	11.981	5.589	76.854
Age	43.178	10.346	41.246	11.041	95.527
Native (German = 1)	0.946	0.227	0.949	0.219	100.389
Education (Years)	12.785	2.800	12.980	2.682	101.525
Highest Educational Degree					
Elementary School	0.008	0.087	0.007	0.081	85.678
Secondary School 1	0.043	0.203	0.041	0.197	94.383
Secondary School 2	0.586	0.493	0.541	0.498	92.402
High school	0.036	0.187	0.068	0.252	188.315
University (Reference Group)	0.328	0.469	0.344	0.475	104.926
Potential Experience	24.393	10.383	22.267	11.221	91.283
Tenure	13.137	10.353	11.665	9.591	88.795
Industry					
Energy	0.018	0.131	0.007	0.084	40.542
Mining	0.006	0.074	0.001	0.023	9.101
Manufacturing	0.262	0.440	0.132	0.338	50.398
Construction	0.184	0.387	0.054	0.226	29.234
Trade	0.098	0.298	0.140	0.347	142.185
Transportation	0.073	0.261	0.042	0.200	56.579
Banking and Insurance	0.047	0.212	0.062	0.241	130.996
Service (Reference Group)	0.312	0.463	0.563	0.496	180.408
Company Size					
Less than 20 (Reference Group)	0.167	0.373	0.221	0.415	132.271
Between 20 and 200	0.300	0.458	0.302	0.459	100.459
Between 200 and 2000	0.255	0.436	0.250	0.433	98.049
More than 2000	0.278	0.448	0.227	0.419	81.859
Occupation/Training Match					
Works in occupation trained for (Reference Group)	0.616	0.486	0.670	0.470	108.768
Doesn't work in occupation trained for	0.330	0.470	0.252	0.434	76.420
In training or no training	0.054	0.226	0.078	0.268	144.051
Occupational Position					
Blue collar (Reference Group)	0.312	0.463	0.130	0.336	41.606
White collar	0.043	0.202	0.137	0.344	320.521
Civil service	0.114	0.318	0.091	0.288	80.193
Qualified & highly qualified professional	0.400	0.490	0.584	0.493	146.073
Forman	0.061	0.240	0.007	0.081	10.756
Managerial	0.037	0.189	0.014	0.116	36.860
Region	0.797	0.402	0.713	0.452	89.425

Source: Author

Table 4: Gender Segregation Indices* and Mean Real Hourly Wages per Industry and
　　　　Occupational Position

	1999		2001		2006	
	Segregation Index	Wage	Segregation Index	Wage	Segregation Index	Wage
Industries						
Energy	0.328	15.866	0.325	15.234	0.325	17.873
Mining	0.444	13.592	0.449	15.198	0.455	15.414
Manufacturing	0.275	13.041	0.265	13.600	0.291	14.808
Construction	0.391	13.715	0.399	13.025	0.367	14.705
Trade	0.056	10.135	0.047	9.994	0.073	10.655
Transport	0.277	11.808	0.285	12.319	0.272	13.792
Bank and Insurance	0.030	14.931	0.082	16.399	0.093	18.380
Services	0.001	13.107	0.010	13.515	0.014	14.462
Occupation						
Blue Collar	0.326	10.837	0.318	11.045	0.321	11.169
White Collar	0.218	9.215	0.132	9.896	0.126	9.604
Civil Service	0.243	15.009	0.285	15.549	0.204	17.023
Qualified and Highly Qualified	0.036	14.655	0.057	15.179	0.067	16.264
Foreman	0.470	13.252	0.452	13.546	0.447	13.806
Manager	0.292	19.836	0.326	22.939	0.338	24.476

Source: Author

$* Segregation\ Index = \frac{1}{2}|p_{im} - p_{if}|$, where p_{im} and p_{if} are the proportions of males and women's in the labor force employed in each industry (or occupational position) i. It indicates the proportion of women (or men) who would have to change their industry (or occupational position), for the industrial (or occupational) distributions of males and women's to become identical. See Duncan and Duncan (1955).

III.   METHODOLOGY:

In this article, I implement two methods of decomposing changes in the gender wage gap in the western region, eastern region and reunified Germany. First I use the JMP decomposition methodology. In their decomposition, they assume the equality of returns to the same observable characteristic across genders in any particular time or place. The assumption of the equality of the returns to the same observable characteristics, as we shall see, allows for isolating the effects of changes in the difference of mean observable characteristics between genders across time or space, and the changes in the returns to those characteristics across time or space. Also, they assume the equality of the variances of the residuals in both genders wage regressions in any particular time or place. To capture the effect of changes in discrimination on the gender wage gap however, they use the gender wage regressions' residuals to define the relative position of one group (e.g. women) in the distribution of unobservable characteristics of the other group (e.g. men). That will permit them to isolate the effect of changes in the difference in unobservable characteristics, the gap effect, and the effect of changes in the returns to those unobservable characteristics respectively. This procedure is explained in further detail below.

Although widely accepted and implemented in the empirical literature on changes in wage gaps across different demographic groups, the JMP method should be interpreted with caution. That is because it is relying on a strong set of assumptions; the equality of coefficients and variances of the wage regressions, which is completely arbitrary. Furthermore, the JMP method is constructed in such a way that assumes the absence of discrimination in all observable characteristics, and shifts back the effect of the actual existence of such discrimination to the gap effect, along with all other possible sources of bias. This in turn makes it impossible for the JMP methodology to separate out the estimated amount of change in gender wage discrimination in observable characteristics across time or space, and makes it difficult to draw any conclusions about changes in discrimination in general, especially if the underlying wage regressions suffer any kind of bias.

Alternatively, I will also implement a decomposition methodology found in Smith and Welch (1989). This methodology is fairly simple. It is basically the total difference of the Oaxaca decomposition. In that sense, it is a difference in the difference type of analysis on the means level, using the results of the wage regressions for any two demographic groups; in our case men and women across time. This methodology, as explained below, does not rely on the assumptions of equality of coefficients and equality of the variances of the regressions' residuals. Hence it will result in four terms, all of which are observable. The first term captures the effect of changes in the gender differences in mean observable characteristics, ceteris paribus, given a certain level of returns. The second term captures the effect of the difference in the returns to observable characteristics between two periods, ceteris paribus, given a certain gender differential in mean characteristics. Both the first and second terms assume that there is no gender difference in the returns at any particular point in time. The third term captures the effect of the change in the mean observable characteristics between two periods, ceteris paribus, given a certain level of differences in the returns. Finally, the fourth term captures the change in the gender difference in the returns to characteristics between two periods, ceteris paribus, given a certain level of mean characteristics. Both the third and fourth terms assume no gender differences in the mean characteristics. Simply, this decomposition is the total difference of the gender wage gap, differenced between two periods. As for the factors that are unobservable to the econometrician, their effect either differences out on the mean level, or is captured by the third and fourth terms of this decomposition, see Cahuc and Zylberberg (2004).

Despite that this method is seemingly free of any arbitrary assumptions, caution is recommended in two places. First, the decomposition relies on ordinary least squares regressions, for which the mean of residuals are all equal to zero. In the presence of any source of bias (i.e. selection, endogeneity...etc), the mean residuals will not be zero. Consequently, blind implementation of such kind of a decomposition leads to the effect of non-zero mean residuals to be simply left out and the estimated coefficients to be biased. This in turn will overestimate or underestimate the wage gap and the changes therein over time. Unless all sources of bias are then constant over time, the analysis of changes in the gender wage gap could be very misleading. In contrast, the JMP

methodology captures the bias in its term "the gap". Second, it is highly likely that at least some of the average characteristics and estimated coefficients to have different computed values, which however, are statistically equal to each other. For example, the coefficient for the firm size category of working in a firm with number of employees between 20 and 200 might in a particular year be 0.112 for men and 0.053 for women. The raw gender difference in this case is 0.059. However, it might be the case that this raw difference in statistically not different from zero. The way this decomposition is constructed does not recognize this possibility and the decomposition is computed by using those raw differences, regardless of whether they are statistically different from zero or not. That being the case, the computed changes in the wage gap using this decomposition might very likely include nonzero components that are statistically not different from zero. And hence, this way of decomposition might overestimate or underestimate the changes in the gender wage gap.

In order to check for the robustness of the two decomposition methodologies, I will show how they compare in terms of the deviation of the estimated change in the gender wage gap from the actual change in the gender wage gap at the end of section designated to the empirical results.

In what follows, I explain each of the two decomposition methodologies in further detail.

III.1 The JMP Decomposition Methodology:

Define two groups $g = (A, B)$. Group A includes N_A individuals and group B includes N_B individuals. Also define two time periods $t = (1, 2)$ where period 2 follows period 1. Hence, four semi-log wage equations for individuals belonging to each group, A and B for each time period 1 and 2 could simply be estimated via ordinary least squares, which could then be represented by the following general expression:

$$Y_{gt} = X_{gt}\hat{\beta}_{gt} + \theta_{gt}\sigma_{gt} \qquad \dots (1)$$

Y_{gt} is the natural logarithm of the real hourly wage of each individual belonging to group A and B at time periods 1 and 2. X_{gt} is a $1 \times K$ vector of socio-economic characteristics

of each individual belonging to group A and B at time periods 1 and 2. $\hat{\beta}_{gt}$ is a $K \times 1$ vector of estimated coefficients for each group A and B at time periods 1 and 2. Finally, σ_{gt} and θ_{gt} are the standard deviation of the residuals in each wage equation and the corresponding standardized residual with a mean equal to zero and a standard deviation equal to one respectively, such that $\sigma_{gt}\theta_{gt} = e_{gt}$.

If A represents the group of men and B represents the group of women in our sample, then the gender wage gap at time t is given by:

$$D_t = Y_{At} - Y_{Bt} = X_{At}\hat{\beta}_{At} - X_{Bt}\hat{\beta}_{Bt} + \theta_{At}\sigma_{At} - \theta_{Bt}\sigma_{Bt} \quad \text{... (2)}$$

As mentioned before however, the procedure introduced by Juhn et al. (1991) is based on the coefficients obtained from the estimated men wage equations. That is, for period 1 it is assumed that $\hat{\beta}_{At} = \hat{\beta}_{Bt} = \hat{\beta}_t$ and $\sigma_{At} = \sigma_{Bt} = \sigma_t$, implying that women returns would be the same in absence of discrimination. Hence, the gender mean wage gap can be rewritten as follows:

$$D_t = \overline{Y}_{At} - \overline{Y}_{Bt} = (\overline{X}_{At} - \overline{X}_{Bt})\hat{\beta}_t + (\overline{\theta}_{At} - \overline{\theta}_{Bt})\sigma_t \text{ ... (3)}$$

or

$$D_t = \Delta\overline{X}_t \hat{\beta}_t + \Delta\overline{\theta}_t\sigma_t \text{ ... (4)}$$

In equation (4), the first term measures the difference in average observable characteristics between men and women at time t evaluated using the returns to characteristics obtained from the men wage equation. The second term measures the difference in the standardized residuals, the unexplained differential, evaluated using the money value per unit difference in the standardized residual between men and women.

The change in the gender wage gap between time period 1 and 2 can therefore easily be shown to be:

$$\Delta D = \Delta\overline{X}_2 \hat{\beta}_2 - \Delta\overline{X}_1 \hat{\beta}_1 + \Delta\overline{\theta}_2\sigma_2 - \Delta\overline{\theta}_1\sigma_1 \text{ ... (5)}$$

By adding and subtracting the terms $\Delta\overline{X}_1 \hat{\beta}_2$ and $\Delta\overline{\theta}_1\sigma_2$, equation (5) becomes:

$$\Delta D = (\Delta\bar{X}_2 - \Delta\bar{X}_1)\hat{\beta}_2 + \Delta\bar{X}_1(\hat{\beta}_2 - \hat{\beta}_1) + (\Delta\bar{\theta}_2 - \Delta\bar{\theta}_1)\sigma_2 + \Delta\bar{\theta}_1(\sigma_2 - \sigma_1) \,\ldots(6)$$

The first term on the right-hand side of equation (6) represents the effect of changes in the average observable socio-economic characteristics from period 1 to period 2, valued by the coefficients of period 2, or simply the observable characteristics effect. The second term represents the effect of the changes in the returns to the observable characteristics between period 1 and period 2, weighted by the difference in the characteristics in period 1, or simply the observable prices effect[5]. The third term represents the relative position of women residuals in the distribution of men residuals assuming that both periods have the same men wage inequality. For instance, in order to compute $(\Delta\bar{\theta}_2 - \Delta\bar{\theta}_1)\sigma_1$ one first needs to assign each woman in period 2 a percentile number based on the ranking of her wage residual in period 2's distribution of the men wage residuals. Then one ought to impute each woman's wage residual in period 2, given her percentile ranking in period 2's men wage residuals and the men wage residuals in period 1. This imputed residual is then multiplied by -1, since the mean men residual is always zero, and that will be the estimate for $\Delta\theta_2\sigma_1$. Furthermore, the actual mean women wage residual from period 1's men distribution of residuals multiplied by -1, will be the estimate for $\Delta\theta_1\sigma_1$. The difference between the means of those two terms will then constitute the desired term $(\Delta\bar{\theta}_2 - \Delta\bar{\theta}_1)\sigma_1$. This term, which literature refers to as "the gap" reflects the gender differences in unmeasured characteristics and/ or the impact of changes in labor market discrimination against women. Finally, the fourth term represents the change in residual inequality and measures the contribution to the change in the gender wage gap across time that results if the two periods had the same percentile rankings of men and women wage residuals and differed in the extent of men wage inequality only. The computation of this term is analogous to the computation of the third term described above.

The empirical literature on analyzing changes in wage gaps between two different groups across time or space is largely dominated by the use of the JMP methodology. Despite its wide use in literature however, the JMP methodology has not been free of criticism, see Suen (1997) and Yun (2007). Mainly Suen's argues that the decomposition of wage residuals into standard deviation and percentile rankings might be misleading.

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[5] The coefficients used as references are from the male regression.

Furthermore, it assumes the equality of the wage inequality for men and women at each particular point in time or in each particular place, which is a fairly strong assumption, given that gender differences contributed negatively to the increasing level wage inequality in Germany during the period 1999 – 2006 al-farhan (2006).

III.2 The Smith and Welch Decomposition:

As mentioned before, the idea of differencing the Oaxaca decomposition can be found in Smith and Welch (1989). This method relies on the OLS regressions for groups $g = (A, B)$ in each of the time periods $t = (1, 2)$ as follows:

$$Y_{gt} = X_{gt}\hat{\beta}_{gt} + e_{gt} \qquad \dots (7)$$

where Y_{gt} is again the natural logarithm of the real hourly wage of each individual belonging to group A and B at time periods 1 and 2. X_{gt} is a $1 \times K$ vector of socio-economic characteristics of each individual belonging to group A and B at time periods 1 and 2. $\hat{\beta}_{gt}$ is a $K \times 1$ vector of estimated coefficients for each group A and B at time periods 1 and 2, and $e_{gt} \sim N(0, \sigma_{gt}^2)$.

Therefore, the mean wage gap between groups A and B at time $t = 1$ can simply be written as:

$$D_1 = \overline{X}_{A1}\hat{\beta}_{A1} - \overline{X}_{B1}\hat{\beta}_{B1} + (\overline{e}_{A1} - \overline{e}_{B1}) = \overline{X}_{A1}\hat{\beta}_{A1} - \overline{X}_{B1}\hat{\beta}_{B1} \qquad \dots (8)$$

Adding and subtracting $\overline{X}_{B1}\hat{\beta}_{A1}$ results in:

$$D_1 = (\overline{X}_{A1} - \overline{X}_{B1})\hat{\beta}_{A1} + \overline{X}_{B1}(\hat{\beta}_{A1} - \hat{\beta}_{B1}) = \Delta\overline{X}_1\hat{\beta}_{A1} + \overline{X}_{B1}\Delta\hat{\beta}_1 \qquad \dots (9)$$

Expression (9) is nothing but the traditional Oaxaca decomposition, where the first term represents the explained component of the wage gap (i.e. the characteristics effect), and the second term represents the unexplained component of the wage gap (i.e. the coefficient effect).

Analogously for period $t = 2$, the gender wage gap is:

$$D_2 = (\overline{X}_{A2} - \overline{X}_{B2})\hat{\beta}_{A2} + \overline{X}_{B2}(\hat{\beta}_{A2} - \hat{\beta}_{B2}) = \Delta\overline{X}_2\hat{\beta}_{A2} + \overline{X}_{B2}\Delta\hat{\beta}_2 \quad \text{... (10)}$$

Hence, the change in the gender wage gap from period 1 to period 2 is given by:

$$\Delta D = \Delta\overline{X}_1\hat{\beta}_{A1} - \Delta\overline{X}_2\hat{\beta}_{A2} + \overline{X}_{B1}\Delta\hat{\beta}_1 - \overline{X}_{B2}\Delta\hat{\beta}_2 \quad \text{... (11)}$$

By subtracting $\Delta\overline{X}_1\hat{\beta}_{A2}$ from the first term and adding it to the second term, and similarly by subtracting $\overline{X}_{B1}\Delta\hat{\beta}_2$ from the third term and adding it to the fourth term of expression (11), we will arrive at the final form of this decomposition, given by:

$$\Delta D = (\Delta\overline{X}_2 - \Delta\overline{X}_1)\hat{\beta}_{A2} + \Delta\overline{X}_1(\hat{\beta}_{A2} - \hat{\beta}_{A1}) + (\overline{X}_{B2} - \overline{X}_{B1})\Delta\hat{\beta}_2 + \overline{X}_{B1}(\Delta\hat{\beta}_2 - \Delta\hat{\beta}_1) \quad \text{... (12)}$$

The first term in expression (12) represents the component of the change in the gender wage gap that is attributable to change in the gender differential in mean observable characteristics from period 1 to period 2, weighted by the returns to characteristics for group A in period 2.

The second term represents the component of the change in the gender wage gap that is attributable to the change in the returns to observable characteristics of group A from period 1 to period 2, weighted by the mean gender differential in characteristics in period 1.

Notice that both the first and second terms are allowing for gender differentials in observable characteristics in each period, and hold constant the gender differentials in returns to those characteristics. These two terms are analogous to the first and second terms in the JMP decomposition described by equation (6). They are interpreted as the explained characteristics and explained coefficient effects respectively.

The third term in expression (12) represents the component of the change in the gender wage gap that is attributable to the change in the average characteristics of group B from period 1 to period 2, weighted by the gender differential in the returns to characteristics in period 2.

Finally, the fourth term represents the component of the change in the gender wage gap that is attributable to the change in the gender differential in returns to observable characteristics, weighted by the average characteristics of group B in period 1. In other words, this term captures the effect of changes in discrimination.

Notice that, unlike the terms in the JMP decomposition, the third and fourth terms of expression (12) allow for gender differences in the returns to characteristics in any particular time, and hold constant the gender differences in observable characteristics. They represent the unexplained characteristics and unexplained coefficient effects respectively.

IV.   EMPIRICAL RESULTS:

In this section I will first present the decomposition results obtained by implementing the JMP methodology. Second, I will implement and report the results of the Smith and Welch (1989) methodology. Finally I will compare the results of the two alternatives[6].

The regressions that underlie each of the decomposition methodologies implemented in this section are estimated via ordinary least squares. These regressions include on the right hand side an education dummy (4 categories), tenure, potential experience and its square, being German or not with the value of 1 if the worker is German and 0 otherwise, the industry in which the worker is employed (7 categories), the worker's company size (4 categories), the occupation/training match of the worker (3 categories) and the worker's occupational position (7 categories). For the regressions with the sample that combines both regions together, a regional dummy is also included with a value of 1 for the western region and 0 otherwise.

It is well established in the empirical literature on the topic that the coefficients of wage equations estimated via ordinary least squares are likely to be biased and inconsistent, partly because ordinary least squares does not control for workers participation decisions. Therefore, one ought to be careful when determining the means of estimation. In the case of the data employed in this article, controlling for worker's participation via several alternative methods did not seem to alter the regression results. I have estimated the same wage equations using Heckit, the Heckman maximum likelihood estimation method and Breen's (1996) maximum likelihood estimation for regression models with endogenous selection. Given the Heckit estimation for instance, in many of those regressions the inverse Mill's ratio was insignificant, and in all cases the estimated coefficients in the aforementioned estimation methods where remarkably close (if not exactly equal) to the coefficients estimated via ordinary least squares. Furthermore, an informal test for the equality of the mean residuals from the ordinary least squares regressions revealed that in the majority of the regressions, the mean of the residuals was not significantly different

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[6] The sizes of the decomposition terms alter according to the choice regarding the reference group. For comparability, I chose the men's regressions coefficients and the women's average characteristics as references in both decompositions.

from zero. Hence, I conclude that selection bias does not impose a significant problem to the estimates, and is not worthwhile controlling for in this particular case.

Moreover, since this article analyses changes in the gender wage gap over time, it is very likely that the minor bias would cancel out if it is constant from one regression to the next. A similar conclusion about the choice between whether or not to control for participation using data from the German Socio-Economic Panel was arrived at by Lauer (2000) who finds that controlling for women's participation decision in West Germany during 1984 -1997 did not significantly alter the ordinary least squares estimates.

Figure (16) also shows that the labor force participation rate for German men and women did not change significantly over the period investigated by this article. Particularly, the period 1999 – 2002 during which most of the rise in wage inequality and the gender wage gap occurred, the labor force participation rate for both genders remained almost time invariant. This provides another support for the irrelevance of participation decisions.
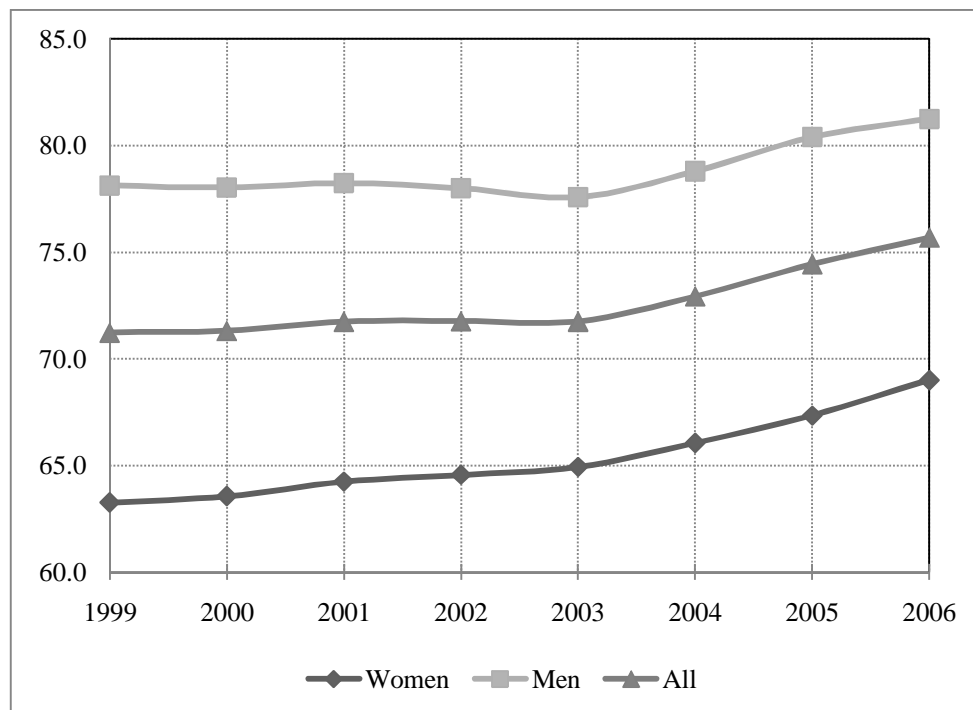
Source: Organization for Economic Co-operation and Development (OECD):
http://stats.oecd.org

Figure 16: Labor Force Participation Rate in Germany

IV.1 The Juhn, Murphy and Pierce Decomposition Results during the Period 1999 - 2006:

Table (5) reports the decomposition results for the change in the gender wage gap in the western region, eastern region and reunified Germany during the period 1999 – 2006, using the Juhn, Murphy and Pierce (1991) decomposition methodology.

The gender wage gap in Germany during the period 1999 - 2006 followed a generally similar pattern in both the western and eastern regions, as well as in the sample that considers both regions combined.

It is clear that most of the increase in the gender wage gap happened during the period 1999 – 2001, which happens to be the same period within which the majority of the increase in wage inequality occurred (Al-farhan 2010). Specifically, in the western region the gender wage gap increased by 0.029 log points during the first period, and then increased by 0.012 log points during 2001 - 2006. Similarly in the eastern region, the wage gap increased by 0.142 log points during the period 1999 – 2001, and then continued to increase moderately by 0.014 during 2001 – 2006. As for the sample of reunified Germany, the wage gap increased first by 0.047 log points and by 0.010 log points in the following period.

This confirms and adds to Blau and Kahn's notion of a positive relation between the changes in the wage inequality and changes in the gender wage gap that such a relationship seems to hold regardless of where we are in the overall wage distribution. Recall that wages in the eastern region were located towards the lower tail of the wage distribution of Germany, whereas the wages in the western region were located more towards the upper tail.

Also notice that, even though both the value of the gender wage gap and the average wage level for both genders was lower in the east as compared to the west at any particular point in time, the increase in the gender wage gap over time was higher in the eastern region than it was in the west.

Not only was the general trend of changes in the gender wage gap quite similar in the western region, eastern region and both regions combined, but also the way that change decomposed into its respective effects was remarkably close.

The bottom lines in each section of table (5) show that the explained characteristics effect in the for the period 1999 – 2006 caused the wage gap to increase by 0.039 log points in the western region, 0.067 log points in the eastern region and by 0.030 log points in the sample of reunified Germany. The explained coefficient effect was negative on the other hand, causing the wage gap to decrease by 0.017 log points in the western region, 0.037 log points in the eastern region and by 0.013 log points in reunified Germany. The gap effect was positive, causing the gender wage gap to rise by 0.027 log point in the western region, 0.0185 log points in the eastern region and by 0.040 log points in reunified Germany. Finally, the unexplained price effect caused the gender wage gap to decrease by 0.007 in the western region, 0.058 log points in the eastern region and did not affect the wage gap in the sample of reunified Germany.

Hence it is obvious that according to the JMP decomposition methodology, the characteristics effect caused the gender wage gap to increase, whereas the wage structure caused the wage gap to decline.

Changes in discrimination as measured by the gap effect had a seemingly positive influence on the wage gap. However, the relative contributions of each regressor and its returns to that effect are not clear at this point and will only become clear after I perform the Smith and Welch decomposition.

Table 5: JMP Decompositions of the Gender Wage Gap in the Western Region, Eastern Region and Reunified Germany during 1999 – 2006

Western Region					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	The Gap Effect	Coeff. Effect
1999 - 2000	-0.019	-0.001	0.018	-0.038	0.002
2000 - 2001	0.049	0.029	-0.014	0.023	0.010
Subtotal	**0.029**	**0.028**	**0.004**	**-0.015**	**0.013**
2001 - 2002	-0.039	-0.024	-0.001	-0.019	0.006
2002 - 2003	-0.005	-0.007	0.015	-0.012	-0.001
2003 - 2004	0.026	0.037	0.000	-0.010	-0.001
2004 - 2005	0.035	0.001	-0.019	0.064	-0.012
2005 - 2006	-0.005	0.004	-0.015	0.018	-0.012
Subtotal	**0.012**	**0.011**	**-0.021**	**0.042**	**-0.020**
Total	**0.041**	**0.039**	**-0.017**	**0.027**	**-0.007**
Eastern Region					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	The Gap Effect	Coeff. Effect
1999 - 2000	0.045	-0.010	0.013	0.014	0.028
2000 - 2001	0.097	0.086	-0.028	0.046	-0.007
Subtotal	**0.142**	**0.076**	**-0.015**	**0.060**	**0.021**
2001 - 2002	-0.082	-0.003	-0.059	-0.020	0.001
2002 - 2003	0.019	0.017	0.060	-0.059	0.002
2003 - 2004	0.010	-0.004	-0.072	0.107	-0.020
2004 - 2005	0.003	-0.018	0.001	0.026	-0.007
2005 - 2006	0.064	0.000	0.048	0.070	-0.054
Subtotal	**0.014**	**-0.009**	**-0.022**	**0.125**	**-0.079**
Total	**0.157**	**0.067**	**-0.037**	**0.185**	**-0.058**
Reunified Germany					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	The Gap Effect	Coeff. Effect
1999 - 2000	-0.011	-0.011	0.023	-0.032	0.009
2000 - 2001	0.058	0.034	-0.017	0.033	0.008
Subtotal	**0.047**	**0.023**	**0.006**	**0.001**	**0.017**
2001 - 2002	-0.047	-0.021	-0.004	-0.025	0.003
2002 - 2003	0.005	0.007	0.019	-0.024	0.003
2003 - 2004	0.016	0.021	-0.011	0.007	0.000
2004 - 2005	0.031	0.000	-0.011	0.048	-0.006
2005 - 2006	0.006	0.001	-0.012	0.034	-0.016
Subtotal	**0.010**	**0.006**	**-0.018**	**0.039**	**-0.017**
Total	**0.058**	**0.030**	**-0.013**	**0.040**	**0.000**

Source: Author

IV.1.1. JMP Decomposition of the Change in the Gender Wage Gap in the Western Region during the Period 1999 - 2006:

The first row and the last row of tables (6) to (11) show the explained component of the change in the gender wage gap and the unexplained component of the change in the gender wage gap in the western region, eastern region and reunified Germany during 1999 – 2006 respectively.

Table (6) analyses the period 1999 – 2001. It indicates that in the western region the explained change in the gender wage gap was more relevant than the unexplained change. The explained change caused the wage gap to increase by 0.032 log points, accounting for 108.1% of the total change in the gap, whereas the unexplained change caused the gap to decrease by 0.002 log points and hence accounting for -8.1%. This finding is consistent with Ziegler (2005).

The explained characteristics effect caused the gender wage gap to increase by 0.028 log points, accounting for 94.9% of the increase in the wage gap during this period. The main contributors of this effect were the change in the gender differential in workers' experience, which accounted for 0.011 log points, workers' occupational position, accounting for 0.009 log points and workers' occupation/training match, which accounted for 0.006 log points of the increase in the wage gap.

The reason why occupational position and the occupation/training match play such a major role in determining changes in the gender wage gap is the higher concentration of women in lower paying jobs, which require relatively lower skills and training compared to men. Similar results where found by Hunt (2002) considering a sample from East Germany. The quantity effect of the workers occupational position also captures the effect of any possible allocative discrimination as highlighted by Holst and Busch (2009).

The observed coefficient effect on the other hand caused the gender wage gap to increase slightly by 0.004 log points, accounting for as low as 13.2% of the total increase in the gender wage gap during 1999 – 2001. The main forces that caused this weak coefficient effect were the effects of changes the returns to education and experience, where each caused the wage gap to increase by 0.009 log points. These however were

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counterbalanced by the effect of changes in the returns to workers' occupational position and company size, which caused the wage gap to decrease by 0.009 and 0.005 log points respectively.

The unexplained characteristics effect, or simply the gap, effect caused the gender wage gap to decrease by 0.015 log points, accounting for -51% of the total change in the wage gap. This indicates that women's position in the men's wage distribution in the western region during 1999 – 2001 has improved and discrimination has actually decreased. The unexplained coefficient effect however, was positive and caused the wage gap to increase by 0.013 log points.

Table 6: JMP Decomposition of the Gender Wage Gap in the Western Region during the
Period 1999 – 2001

1999 - 2001						
CHANGE IN GENDER WAGE GAP			0.029			
Variable	**Total**	**%**	**Char. Eff.**	**%**	**Coeff. Eff.**	**%**
EXPLAINED CHANGE IN GENDER WAGE GAP	**0.032**	**108.1**	**0.028**	**94.9**	**0.004**	**13.2**
Education	**-0.001**	**-2.6**	**-0.002**	**-6.0**	**0.001**	**3.4**
Elementary and Secondary School 1	0.000	0.1	0.000	0.6	0.000	-0.6
Secondary School 2	-0.003	-8.6	-0.002	-6.9	-0.001	-1.8
High school	0.002	6.0	0.000	0.2	0.002	5.8
Experience	**0.020**	**66.9**	**0.011**	**38.0**	**0.009**	**29.0**
Potential Experience	0.025	83.9	0.002	7.5	0.022	76.4
Potential Experience^2/100	-0.005	-17.0	0.009	30.5	-0.014	-47.5
Tenure	**0.008**	**28.8**	**-0.001**	**-3.1**	**0.009**	**32.0**
Native (German = 1)	**-0.001**	**-2.0**	**0.001**	**1.8**	**-0.001**	**-3.8**
Industry	**0.001**	**2.4**	**0.003**	**9.8**	**-0.002**	**-7.4**
Energy and Mining	-0.004	-12.3	0.000	-0.8	-0.003	-11.4
Manufacturing	-0.001	-2.4	-0.001	-5.1	0.001	2.7
Construction	0.003	10.4	0.003	10.7	0.000	-0.2
Trade	0.001	2.7	0.001	3.4	0.000	-0.8
Transportation	0.000	1.1	0.000	-0.3	0.000	1.5
Banking and Insurance	0.001	2.8	0.001	1.9	0.000	0.8
Company Size	**-0.004**	**-14.8**	**0.000**	**0.8**	**-0.005**	**-15.6**
Between 20 and 200	-0.002	-6.7	0.000	0.1	-0.002	-6.8
Between 200 and 2000	0.007	25.1	0.006	21.9	0.001	3.1
More than 2000	-0.010	-33.2	-0.006	-21.2	-0.004	-11.9
Occupation/Training Match	**0.008**	**28.3**	**0.006**	**22.0**	**0.002**	**6.3**
Doesn't work in occupation trained for	0.000	-1.3	-0.001	-2.0	0.000	0.7
In training or no training	0.009	29.7	0.007	24.0	0.002	5.6
Occupational Position	**0.000**	**1.1**	**0.009**	**31.7**	**-0.009**	**-30.6**
White collar	-0.009	-30.7	-0.001	-2.7	-0.008	-28.0
Civil service	-0.003	-10.2	-0.001	-2.6	-0.002	-7.7
Qualified & highly qualified professional	0.010	33.3	0.010	33.2	0.000	0.1
Forman	-0.002	-7.0	-0.002	-8.2	0.000	1.2
Managerial	0.005	15.8	0.004	12.0	0.001	3.7
UNEXPL. CHANGE IN GENDER WAGE GAP	**-0.002**	**-8.1**	**-0.015**	**-51.0**	**0.013**	**42.9**

Source: Author

Table (7) reports the decomposition results of the gender wage gap in the western region of Germany during the period 2001 – 2006. During this period, the gender wage gap in the western region has continued to increase moderately by 0.012 log points. The explained component of the change in the gender wage gap caused the wage gap to decrease by 0.010 log points, accounting for -82.3% of the total change. On the other hand, the unexplained change caused the wage gap to increase by 0.022 log points, accounting for 182.3% of the total change in the gender wage gap.

The observed characteristics effect caused the gender wage gap to increase by 0.011 log points. The main factors that contributed to this effect were the effect of changes in the gender differential in potential experience, which caused the wage gap to increase by 0.017 log points, and the effect of changes in the gender distribution amongst occupational positions, which caused the wage gap to increase by another 0.010 log points. One ought to be careful however, when interpreting the effect of potential experience, since it is a constructed measure calculated by the workers' age minus years of schooling minus 6. Therefore, the effect of potential experience is nothing but a composite effect of age and schooling. On the other hand, changes in the gender differential in education and worker's occupation/training match have caused the gender wage gap to decrease by 0.011 and 0.007 log points respectively.

The explained coefficient effect caused the gender wage gap to decrease by 0.021 log points. The majority of this negative effect came from changes in the returns to workers' distribution across industries, accounting for -0.021 log points and changes in the returns to experience, which accounted for -0.014 log points.

The gap effect during this period was positive and rather large, outweighing its negative effect in the previous period and causing the gender wage gap to increase by 0.042 log points, indicating that women's position in the men's wage distribution has worsened. Finally the influence of the unexplained coefficient effect on the gender wage gap was negative. It caused the gap to decrease by 0.020 log points.

Table 7: JMP Decomposition of the Gender Wage Gap in the Western Region during the Period 2001 – 2006

2001 - 2006						
CHANGE IN GENDER WAGE GAP			0.012			
Variable	Total	%	Char. Eff.	%	Coeff. Eff.	%
EXPLAINED CHANGE IN GENDER WAGE GAP	**-0.010**	**-82.3**	**0.011**	**95.2**	**-0.021**	**-177.5**
Education	**-0.010**	**-83.6**	**-0.011**	**-89.3**	**0.001**	**5.7**
Elementary and Secondary School 1	-0.004	-34.4	-0.005	-39.5	0.001	5.1
Secondary School 2	-0.004	-34.7	-0.003	-24.5	-0.001	-10.2
High school	-0.002	-14.5	-0.003	-25.3	0.001	10.8
Experience	**0.002**	**18.7**	**0.017**	**139.3**	**-0.014**	**-120.6**
Potential Experience	0.028	239.0	0.079	666.7	-0.051	-427.7
Potential Experience^2/100	-0.026	-220.3	-0.063	-527.4	0.036	307.1
Tenure	**0.004**	**33.6**	**0.002**	**18.0**	**0.002**	**15.6**
Native (German = 1)	**0.000**	**-1.6**	**-0.002**	**-15.1**	**0.002**	**13.5**
Industry	**-0.019**	**-160.7**	**0.002**	**16.6**	**-0.021**	**-177.3**
Energy and Mining	0.003	28.3	0.001	11.7	0.002	16.6
Manufacturing	-0.003	-24.5	0.003	28.5	-0.006	-53.0
Construction	-0.012	-97.8	-0.005	-40.1	-0.007	-57.8
Trade	-0.005	-43.0	-0.001	-10.1	-0.004	-32.9
Transportation	-0.003	-29.0	0.000	-1.7	-0.003	-27.3
Banking and Insurance	0.001	5.4	0.003	28.3	-0.003	-23.0
Company Size	**0.004**	**33.4**	**0.000**	**-1.6**	**0.004**	**35.0**
Between 20 and 200	0.001	9.3	0.001	10.1	0.000	-0.7
Between 200 and 2000	0.009	79.3	0.007	58.8	0.002	20.5
More than 2000	-0.007	-55.3	-0.008	-70.5	0.002	15.2
Occupation/Training Match	**-0.001**	**-11.9**	**-0.007**	**-56.1**	**0.005**	**44.1**
Doesn't work in occupation trained for	0.001	9.9	-0.002	-13.4	0.003	23.3
In training or no training	-0.003	-21.8	-0.005	-42.7	0.002	20.8
Occupational Position	**0.011**	**89.8**	**0.010**	**83.3**	**0.001**	**6.5**
White collar	0.004	36.6	0.000	2.3	0.004	34.4
Civil service	0.002	18.2	0.004	37.1	-0.002	-18.9
Qualified & highly qualified professional	-0.003	-27.3	0.004	30.1	-0.007	-57.4
Forman	0.008	70.7	0.002	12.7	0.007	58.0
Managerial	-0.001	-8.4	0.000	1.1	-0.001	-9.6
UNEXPL. CHANGE IN GENDER WAGE GAP	**0.022**	**182.3**	**0.042**	**351.1**	**-0.020**	**-168.8**

Source: Author

IV.1.2. JMP Decomposition of the Change in the Gender Wage Gap in the Eastern Region during the period 1999 - 2006:

Table (8) reports the decomposition results of the change in the gender wage gap in the eastern region of Germany during the period 1999 – 2001.

As demonstrated by the table, the explained change in the gender wage gap was 0.061 log points, accounting for 43.2% of the total change. The unexplained change in the gender wage gap was 0.081 log points, accounting for 56.8% of the total.

The explained characteristics effect caused the gender wage gap to increase by 0.076 log points. The main factors which lead to this effect were the changes in the gender distribution across occupational positions, industries and companies of different sizes, which accounted for 0.036, 0.021 and 0.019 log points respectively. This means that in the eastern region women became more densely distributed in lower paying industries and occupational positions, as well as in companies of smaller sizes which pay less.

The explained coefficient effect was nevertheless, negative. This effect caused the gender wage gap to decrease by 0.015 log points. Mainly, the coefficient effect of changes in the returns to education caused the wage gap to decline by 0.020 log points, followed by the effects of changes in the returns to working in a particular industry or company size, leading to a decline in the gender wage gap by 0.006 and 0.005 log points respectively. These negative forces were met by the still positive influence of the change in the returns to occupational position, which caused the gender wage gap to increase by 0.018 log points.

The gap effect on the other hand was positive, causing the gender wage gap to increase by 0.060 log points. This signals that changes in wage discrimination might have worsened women's position in the wage distribution of men in that region and period. Finally, the unexplained coefficient effect caused the gender wage gap to increase by 0.021 log points.

Table 8: JMP Decomposition of the Gender Wage Gap in the Eastern Region during the Period 1999 – 2001

1999 - 2001						
CHANGE IN GENDER WAGE GAP			0.142			
Variable	**Total**	**%**	**Char. Eff.**	**%**	**Coeff. Eff.**	**%**
EXPLAINED CHANGE IN GENDER WAGE GAP	**0.061**	**43.2**	**0.076**	**53.5**	**-0.015**	**-10.3**
Education	**-0.017**	**-11.7**	**0.004**	**2.5**	**-0.020**	**-14.2**
Elementary and Secondary School 1	-0.013	-9.3	-0.014	-10.1	0.001	0.9
Secondary School 2	-0.001	-0.9	0.020	14.0	-0.021	-14.9
High school	-0.002	-1.5	-0.002	-1.3	0.000	-0.2
Experience	**-0.004**	**-2.5**	**-0.002**	**-1.2**	**-0.002**	**-1.3**
Potential Experience	-0.003	-1.8	0.007	5.0	-0.010	-6.8
Potential Experience^2/100	-0.001	-0.7	-0.009	-6.2	0.008	5.5
Tenure	**0.000**	**-0.3**	**-0.002**	**-1.6**	**0.002**	**1.3**
Industry	**0.015**	**10.8**	**0.021**	**14.5**	**-0.005**	**-3.8**
Energy and Mining	0.000	-0.1	-0.001	-0.9	0.001	0.9
Manufacturing	0.018	12.3	0.005	3.8	0.012	8.6
Construction	-0.003	-1.8	-0.004	-2.7	0.001	1.0
Trade	0.000	-0.2	0.001	1.0	-0.002	-1.2
Transportation	0.004	2.9	0.006	4.0	-0.002	-1.1
Banking and Insurance	-0.003	-2.4	0.013	9.4	-0.017	-11.8
Company Size	**0.012**	**8.6**	**0.019**	**13.1**	**-0.006**	**-4.5**
Between 20 and 200	-0.012	-8.4	-0.004	-3.2	-0.007	-5.2
Between 200 and 2000	0.022	15.3	0.025	17.4	-0.003	-2.1
More than 2000	0.002	1.7	-0.002	-1.1	0.004	2.8
Occupation/Training Match	**0.000**	**0.0**	**0.001**	**0.6**	**-0.001**	**-0.6**
Doesn't work in occupation trained for	0.000	-0.1	-0.002	-1.3	0.002	1.2
In training or no training	0.000	0.0	0.003	1.9	-0.003	-1.9
Occupational Position	**0.054**	**38.3**	**0.036**	**25.5**	**0.018**	**12.8**
White collar	0.002	1.3	0.002	1.6	0.000	-0.3
Civil service	0.016	11.3	0.023	16.2	-0.007	-4.9
Qualified & highly qualified professional	0.030	21.3	0.011	8.0	0.019	13.3
Forman	0.009	6.3	0.002	1.1	0.007	5.1
Managerial	-0.003	-1.8	-0.002	-1.4	-0.001	-0.4
UNEXPL. CHANGE IN GENDER WAGE GAP	**0.081**	**56.8**	**0.060**	**42.1**	**0.021**	**14.7**

Source: Author

Table (9) reports the decomposition results of the change in the gender wage gap in the eastern region of Germany during the period 2001 – 2006. Here the explained change in the gender wage gap was -0.031 log points, accounting for 215% of the total change. The unexplained change on the other hand was 0.045 log points, accounting for 315% of the total change and leading to a net increase of 0.014 log points in the gender wage gap during that period in the eastern region.

The explained characteristics effect caused the gender wage gap to decrease by 0.009 log points. It were mainly the gender differential in occupation/training match and the differential in the gender distribution across industries, which lead the wage gap to decrease by 0.024 and 0.020 log points respectively. Additionally, the improvement of women's educational attainment relative to men caused the gender wage gap to fall further by 0.010 log points. On the other hand, the differential in the gender distribution amongst companies of different sized caused the gender wage gap to increase by 0.032 log points, and the change in the gender differential in potential experience caused the gap to increase by 0.012 log points.

The explained coefficient effect caused the gender wage gap to decrease by 0.022 log points. The main contributors to that negative impact were the change in the returns to education, change in the returns to employment in a given industry and the change in the returns the company size, which caused the wage gap to decrease by 0.026, 0.006 and 0.006 log points respectively. Changes in the returns to occupational positions on the other hand, caused the gender wage gap to increase by 0.015 log points.

The gap effect during this period was remarkably high. It was sufficiently large to outweigh the negative influence of all other three terms and caused the gender wage gap to increase. It had a positive impact of 0.125 log points, indicating that wage discrimination against women might have had a significant role in dictating the trend of the gender wage gap in the eastern region during this period. Finally, the unobserved coefficient effect caused the gender wage gap to decrease by 0.079 log points.

Table 9: JMP Decomposition of the Gender Wage Gap in the Eastern Region during the Period 2001 – 2006

	2001 - 2006					
CHANGE IN GENDER WAGE GAP			0.014			
Variable	**Total**	**%**	**Char. Eff.**	**%**	**Coeff. Eff.**	**%**
EXPLAINED CHANGE IN GENDER WAGE GAP	**-0.031**	**-215.0**	**-0.009**	**-60.7**	**-0.022**	**-154.3**
Education	**-0.036**	**-248.0**	**-0.010**	**-67.5**	**-0.026**	**-180.5**
Elementary and Secondary School 1	0.010	69.3	0.012	85.0	-0.002	-15.7
Secondary School 2	-0.058	-401.9	-0.022	-151.5	-0.036	-250.4
High school	0.012	84.7	0.000	-1.0	0.012	85.7
Experience	**0.015**	**102.6**	**0.012**	**86.6**	**0.002**	**16.0**
Potential Experience	-0.012	-80.9	-0.016	-107.6	0.004	26.7
Potential Experience^2/100	0.026	183.5	0.028	194.2	-0.002	-10.7
Tenure	**-0.001**	**-7.4**	**-0.002**	**-11.8**	**0.001**	**4.4**
Industry	**-0.003**	**-23.4**	**0.002**	**17.1**	**-0.006**	**-40.5**
Energy and Mining	0.002	10.5	0.003	19.5	-0.001	-8.9
Manufacturing	-0.009	-62.4	0.003	18.3	-0.012	-80.8
Construction	0.015	103.2	0.004	30.8	0.010	72.4
Trade	-0.006	-38.6	-0.003	-23.8	-0.002	-14.8
Transportation	-0.004	-28.0	-0.001	-8.3	-0.003	-19.7
Banking and Insurance	-0.001	-8.1	-0.003	-19.4	0.002	11.3
Company Size	**0.026**	**180.5**	**0.032**	**221.4**	**-0.006**	**-41.0**
Between 20 and 200	0.025	173.5	0.019	128.7	0.006	44.8
Between 200 and 2000	-0.003	-21.1	-0.003	-23.8	0.000	2.7
More than 2000	0.004	28.1	0.017	116.6	-0.013	-88.4
Occupation/Training Match	**-0.026**	**-180.7**	**-0.024**	**-164.6**	**-0.002**	**-16.1**
Doesn't work in occupation trained for	-0.012	-83.7	0.000	1.3	-0.012	-85.0
In training or no training	-0.014	-96.9	-0.024	-165.9	0.010	69.0
Occupational Position	**-0.006**	**-38.7**	**-0.020**	**-142.0**	**0.015**	**103.3**
White collar	0.001	4.2	0.002	16.0	-0.002	-11.8
Civil service	-0.011	-72.9	-0.004	-29.4	-0.006	-43.4
Qualified & highly qualified professional	0.027	184.6	0.001	7.2	0.026	177.4
Forman	-0.014	-95.4	-0.010	-66.3	-0.004	-29.1
Managerial	-0.009	-59.2	-0.010	-69.4	0.001	10.2
UNEXPL. CHANGE IN GENDER WAGE GAP	**0.045**	**315.0**	**0.125**	**865.6**	**-0.079**	**-550.6**

Source: Author

IV.1.3. JMP Decomposition of the Change in the Gender Wage Gap in Reunified Germany during the Period 1999 - 2006:

Table (10) reports the decomposition results of the gender wage gap in the sample that combines both the western and eastern region together under one reunified Germany during the period 1999 - 2001. Here the decomposition results look to a great extent like what could be found in the western region alone.

The explained change in the gender wage gap was 0.029 log points, accounting for 61.6% of the total change. The unexplained change on the other hand was 0.018 log points, accounting for 38.4%.

The explained characteristics effect accounted for the majority of the explained change, causing the wage gap to increase by 0.023 log points. Changes in the gender distribution amongst occupational positions caused the wage gap to increase by 0.010 log points. Changes in the gender differential in the occupation/training match and changes in the gender differential in potential experience each caused the wage gap to increase by 0.006 log points. Moreover, changes in the gender distribution across industries contributed to the increase in the gap by 0.004 log points.

The explained coefficient effect caused the gender wage gap to increase by 0.006 log points. Mainly, changes in the returns to education, tenure and occupation/training match contributed by 0.007, 0.006 and 0.004 log points respectively. These positive forces were partially counterbalanced by the negative impact of the changes in the returns to the company size and occupational position, which caused the gender wage gap to decrease by 0.005 and 0.003 log points respectively.

Interestingly, the regional dummy had both a negative characteristics effect and coefficient effect. The former caused the wage gap to decrease by 0.006 log points and the latter caused the gap to decrease by 0.002 log points. That indicates that women in the western region are better off compared to women in the eastern region with respect to their relative position in the wage distribution of men.

The gap effect during this period in the combined sample had a relatively small positive influence on the gender wage gap, causing it to increase by 0.001 log points. The unexplained coefficient effect on the other hand caused the gender wage gap to increase by 0.017 log points.

Table 10: JMP Decomposition of the Gender Wage Gap in Reunified Germany during the Period 1999 – 2001

1999 - 2001						
CHANGE IN GENDER WAGE GAP	0.047					
Variable	**Total**	**%**	**Char. Eff.**	**%**	**Coeff. Eff.**	**%**
EXPLAINED CHANGE IN GENDER WAGE GAP	**0.029**	**61.6**	**0.023**	**49.4**	**0.006**	**12.2**
Education	**0.001**	**1.2**	**0.002**	**4.1**	**-0.001**	**-3.0**
Elementary and Secondary School 1	-0.001	-1.5	0.000	-0.9	0.000	-0.6
Secondary School 2	0.000	0.4	0.003	5.6	-0.002	-5.1
High school	0.001	2.2	0.000	-0.5	0.001	2.7
Experience	**0.013**	**28.5**	**0.006**	**13.0**	**0.007**	**15.5**
Potential Experience	0.016	34.5	-0.006	-12.3	0.022	46.8
Potential Experience^2/100	-0.003	-6.0	0.012	25.3	-0.015	-31.3
Tenure	**0.005**	**10.9**	**-0.001**	**-2.7**	**0.006**	**13.6**
Native (German = 1)	**-0.001**	**-1.9**	**0.000**	**0.6**	**-0.001**	**-2.5**
Industry	**0.004**	**9.2**	**0.004**	**7.4**	**0.001**	**1.8**
Energy and Mining	-0.002	-4.6	0.000	-0.7	-0.002	-3.9
Manufacturing	0.003	6.7	0.000	1.0	0.003	5.7
Construction	0.002	4.3	0.001	2.4	0.001	1.9
Trade	0.001	1.3	0.002	3.9	-0.001	-2.6
Transportation	0.001	2.1	0.000	0.0	0.001	2.2
Banking and Insurance	0.000	-0.6	0.000	1.0	-0.001	-1.5
Company Size	**-0.002**	**-4.8**	**0.003**	**5.9**	**-0.005**	**-10.7**
Between 20 and 200	-0.003	-6.3	-0.001	-1.1	-0.002	-5.2
Between 200 and 2000	0.010	21.3	0.009	20.0	0.001	1.3
More than 2000	-0.009	-19.9	-0.006	-13.0	-0.003	-6.9
Occupation/Training Match	**0.010**	**21.2**	**0.006**	**12.6**	**0.004**	**8.5**
Doesn't work in occupation trained for	-0.001	-1.1	0.000	-0.9	0.000	-0.2
In training or no training	0.010	22.2	0.006	13.5	0.004	8.7
Occupational Position	**0.007**	**14.8**	**0.010**	**21.2**	**-0.003**	**-6.3**
White collar	-0.007	-14.4	0.000	0.8	-0.007	-15.2
Civil service	0.000	0.4	0.000	0.5	0.000	-0.1
Qualified & highly qualified professional	0.011	24.2	0.010	21.7	0.001	2.6
Forman	0.000	-0.6	-0.002	-4.7	0.002	4.2
Managerial	0.002	5.1	0.001	2.9	0.001	2.2
Region	**-0.008**	**-17.5**	**-0.006**	**-12.9**	**-0.002**	**-4.6**
UNEXPL. CHANGE IN GENDER WAGE GAP	**0.018**	**38.4**	**0.001**	**2.6**	**0.017**	**35.8**

Source: Author

Table (11) reports the decomposition results of the gender wage in reunified Germany during the period 2001 – 2006. Here, the explained change caused the gender wage gap to decrease by 0.012, accounting for -115.8% of the total change. The unexplained change on the other hand caused the gender wage gap to increase by 0.022 log points, mainly driven by the gap effect as we shall see, and accounting for 215.8% of the total change.

The explained characteristics effect caused the gender wage gap to increase by 0.006 log points. It was mainly the change in the gender differential in potential experience that caused this trend, accounting for 0.016 log points. Furthermore, changes in the gender distribution amongst occupational positions caused the gender wage gap to increase by another 0.006 log points. On the other hand, changes in the gender differential in educational attainment caused the gender wage gap to decrease by 0.009 log points, and changes in the gender differences regarding the occupation/training match caused the gap to decrease by another 0.005 log points.

The explained coefficient effect caused the gender wage gap to decrease by 0.018 log points. The most significant factor causing this negative effect was the change in the returns to employment a given industry, which caused the wage gap to decrease by 0.018 log points. Also, changes in the returns to experience caused the wage gap to fall by another 0.009 log points. On the other hand, changes in the returns to the company size and occupational position caused the gender wage gap to rise by 0.005 and 0.003 log points respectively.

The gap effect played a significant role. It caused the gender wage gap to increase by 0.039 log points. This indicates that a considerable part of the change in the gender wage gap in Germany might have been caused by increasing wage discrimination practices against women. It is important however, to notice that this term captures effects other than changes in discrimination, such as any biases from misspecification or selection. Given the quality of the OLS regressions used in the decompositions, it is very likely that a considerable part of this term is actually due to changes discrimination. Finally, the unexplained coefficient caused the gender wage gap to decrease by 0.017 log points.

Table 11: JMP Decomposition of the Gender Wage Gap in Reunified Germany during the Period 2001 – 2006

	2001 - 2006					
CHANGE IN GENDER WAGE GAP	0.010					
Variable	**Total**	**%**	**Char. Eff.**	**%**	**Coeff. Eff.**	**%**
EXPLAINED CHANGE IN GENDER WAGE GAP	**-0.012**	**-115.8**	**0.006**	**62.3**	**-0.018**	**-178.1**
Education	**-0.011**	**-108.5**	**-0.009**	**-87.2**	**-0.002**	**-21.3**
Elementary and Secondary School 1	-0.002	-20.2	-0.001	-13.0	-0.001	-7.2
Secondary School 2	-0.009	-89.0	-0.006	-56.6	-0.003	-32.4
High school	0.000	0.7	-0.002	-17.6	0.002	18.3
Experience	**0.007**	**68.5**	**0.016**	**154.9**	**-0.009**	**-86.4**
Potential Experience	0.024	226.8	0.062	592.8	-0.038	-366.0
Potential Experience^2/100	-0.016	-158.3	-0.045	-437.9	0.029	279.6
Tenure	**0.002**	**14.7**	**0.001**	**8.9**	**0.001**	**5.8**
Native (German = 1)	**0.000**	**-2.8**	**-0.002**	**-14.6**	**0.001**	**11.7**
Industry	**-0.018**	**-171.1**	**0.000**	**0.9**	**-0.018**	**-172.0**
Energy and Mining	0.002	23.5	0.000	2.0	0.002	21.5
Manufacturing	-0.004	-34.1	0.003	33.5	-0.007	-67.5
Construction	-0.008	-75.8	-0.003	-32.6	-0.004	-43.2
Trade	-0.005	-49.3	-0.002	-17.3	-0.003	-32.0
Transportation	-0.004	-42.5	-0.001	-7.0	-0.004	-35.5
Banking and Insurance	0.001	7.1	0.002	22.3	-0.002	-15.3
Company Size	**0.008**	**78.3**	**0.003**	**28.0**	**0.005**	**50.3**
Between 20 and 200	0.004	37.5	0.003	24.2	0.001	13.3
Between 200 and 2000	0.008	73.9	0.007	66.9	0.001	7.0
More than 2000	-0.003	-33.1	-0.007	-63.1	0.003	30.0
Occupation/Training Match	**-0.004**	**-34.3**	**-0.005**	**-51.9**	**0.002**	**17.6**
Doesn't work in occupation trained for	0.000	0.5	-0.001	-8.2	0.001	8.7
In training or no training	-0.004	-34.8	-0.005	-43.7	0.001	8.9
Occupational Position	**0.009**	**90.9**	**0.006**	**60.6**	**0.003**	**30.3**
White collar	0.007	71.2	0.000	2.4	0.007	68.8
Civil service	0.000	-1.0	0.002	20.8	-0.002	-21.8
Qualified & highly qualified professional	0.001	4.9	0.004	42.6	-0.004	-37.8
Forman	0.004	41.1	0.001	11.8	0.003	29.3
Managerial	-0.003	-25.3	-0.002	-17.1	-0.001	-8.2
Region	**-0.005**	**-51.5**	**-0.004**	**-37.4**	**-0.001**	**-14.1**
UNEXPL. CHANGE IN GENDER WAGE GAP	**0.022**	**215.8**	**0.039**	**374.8**	**-0.017**	**-159.0**

Source: Author

To summarize, the decompositions above and the figures (13) to (15) from section III show that the gender wage gap was directly related to the level of wage inequality in Germany. Particularly, according to the findings in Al-farhan (2010), the period of 1999 – 2001, which was characterized with remarkable increases in the level of wage inequality in the western region, eastern region and both regions combined, is also the period where the gender wage gap was with no doubt increasing all over Germany as well. Furthermore, the period 2001 – 2006 was characterized by fairly stable levels of wage inequality on the one hand, and fluctuating levels of the gender wage gap on the other, ending however in an overall estimated increase in the gender wage gap in the western region, eastern regions and in reunified Germany as mentioned before.

The above decompositions also reveal that the explained characteristics effects that consistently explained the increase in the gender wage gap were changes in the gender differentials in potential experience, and changes in the gender distribution across occupational positions. Changes in gender differences in industries, company size and occupation/training match also played and important role in explaining the changes in the gender wage gap, but to a lesser extent compared to the former two. This indicates that the increase in the gender wage gap in Germany was in part explained by the fact that women have potentially less job market experience, and are more concentrated in occupational positions that pay lower wages. This latter effect might also be due to the presence of allocative discrimination as mentioned by Holst and Bush (2009).

The explained coefficient effects were mostly pushing the gender wage gap to decline. The most consistent of those forces were however, the changes in the returns to industries and company sizes. That is, holding constant the gender differentials, the returns to being employed in higher paying industries and larger companies which normally pay higher wages have decreased. This in turn led the gender wage gap to fall and improved women's position in the men's wage distribution.

The gap effect was mostly positive in the western region, eastern region and the sample of reunified country, indicating that the gender wage gap in Germany might indeed have increased partly because of increases in wage discrimination. Particularly in the eastern region, the total gap effect during the period 1999 – 2006 was 0.185 log points, compared

to 0.027 log points in the western region and 0.040 log points in reunified Germany. Since the gap effect captures other effects along with changes in discrimination, it is hard to tell how much of these magnitudes are actually due to changes in discriminatory practices. Therefore, I will implement the Smith and Welch (1989) decomposition which, I think, is more capable to identify changes in discrimination if at all present.

Finally, the unexplained coefficient effect was positive in the western region, eastern region and reunified Germany during 1999 – 2001, and the negative during the period2001 – 2006. The total effect of this term was negative for the period as a whole in all samples, indicating that the changes in the returns to unexplained characteristics caused the gender wage gap in Germany to decline.

IV.2 The Smith and Welch Decomposition Results during the Period 1999 - 2006[7]:

Table (12) reports the decomposition results for the change in the gender wage gap in the western region, eastern region and reunified Germany during the period 1999 – 2006, using the Smith and Welch (1989) decomposition methodology.

It stands out that the decomposition results using this methodology are remarkably close to the results obtained from the JMP decomposition. As a matter of fact, the first two terms of this decomposition are similar in construction to the first two terms in the JMP decomposition. Therefore, one would expect that their values should be very close, if not equal. The third and fourth terms deviate however from those of the JMP decomposition in their construction and hence, interpretation[8].

The third term, as mentioned before, represents the change in the gender wage gap that is due to changes in mean characteristics of workers from period 1 to period 2, assuming their equality across genders and given time period, weighed by a constant gender differential in the returns. The fourth term measures the part of the change in the gender

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[7] The detailed year-to-year Smith and Welch decompositions are reported in appendix C.
[8] The first and second terms of this decomposition are assuming the returns to be equal across genders in any given period, and use the returns from the men's regression as reference. The third and fourth terms are assuming the characteristics to be equal across genders in any given period, and use the women's characteristics as reference.

wage gap that is due to change in the gender differential of the returns to characteristics, given a constant level of mean characteristics. Hence, these two terms allow for gender differences in the returns to workers observable characteristics, and consequently allow for the identification of that part of the change in the gender wage gap that is due to wage discrimination.

Table (12) shows that the gender wage gap increased in the western region by 0.033 log points during the period 1999 – 2001, and by 0.011 log points during the period 2001 – 2006. Similarly, in the eastern region the gender wage gap increased by 0.140 log points during the first period and by 0.019 log points during the second period. Also, in reunified Germany, the gender wage gap increased by 0.052 log points during the first period and by 0.008 during the second.

As shown by the bottom raw in each of the three sections of table (12), the explained characteristics effect caused the wage gap to increase in the western region by 0.030 log points, in the eastern region by 0.033 log points and in reunified Germany by 0.027 log points. The explained coefficient effect cause the gender wage gap to fall by 0.004 log points in the western region, increase by 0.005 log points in the eastern region and to decrease by 0.004 log points in the sample of reunified Germany. The unexplained characteristics effect on the other hand caused the gender wage gap to decrease by 0,001 log points in the western region, 0.013 log points in the eastern region and by 0.001log points in reunified Germany. Finally the unexplained coefficient effect, which captured the effect of changes in discrimination, caused the gender wage gap to increase by 0.018 log points in the western region, 0.133 log points in the eastern region and by 0,038 log points in reunified Germany.

In the following pages, I will analyze in further detail the decomposition results of the change in the gender wage gap in the western region, eastern region and reunified Germany during 1999 – 2006, using the Smith and Welch methodology.

Table 12: Smith and Welch Decompositions of the Gender Wage Gap in the Western Region, Eastern Region and Reunified Germany during 1999 – 2006

Western Region					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	Char. Effect	Coeff. Effect
1999 - 2000	-0.013	0.007	0.017	-0.006	-0.032
2000 - 2001	0.046	0.021	-0.011	0.007	0.030
Subtotal	**0.033**	**0.028**	**0.007**	**0.001**	**-0.002**
2001 - 2002	-0.038	-0.032	0.009	-0.006	-0.009
2002 - 2003	0.007	0.008	0.012	0.000	-0.012
2003 - 2004	0.001	0.007	0.003	0.004	-0.012
2004 - 2005	0.053	0.020	-0.017	0.001	0.050
2005 - 2006	-0.013	0.000	-0.017	0.000	0.004
Subtotal	**0.011**	**0.003**	**-0.010**	**-0.002**	**0.020**
Total	**0.044**	**0.030**	**-0.004**	**-0.001**	**0.018**
Eastern Region					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	Char. Effect	Coeff. Effect
1999 - 2000	0.053	-0.021	0.031	0.020	0.024
2000 - 2001	0.086	0.070	-0.016	-0.017	0.050
Subtotal	**0.140**	**0.049**	**0.015**	**0.003**	**0.074**
2001 - 2002	-0.075	0.002	-0.060	0.007	-0.024
2002 - 2003	0.022	0.027	0.054	-0.019	-0.039
2003 - 2004	0.017	-0.011	-0.054	0.002	0.081
2004 - 2005	-0.015	-0.029	0.000	-0.004	0.018
2005 - 2006	0.069	-0.005	0.051	-0.001	0.024
Subtotal	**0.019**	**-0.016**	**-0.009**	**-0.016**	**0.060**
Total	**0.158**	**0.033**	**0.005**	**-0.013**	**0.133**
Reunified Germany					
		Explained Change		Unexplained Change	
Period	Change in Wage Gap	Char. Effect	Coeff. Effect	Char. Effect	Coeff. Effect
1999 - 2000	-0.004	-0.002	0.022	-0.001	-0.023
2000 - 2001	0.055	0.029	-0.015	0.005	0.037
Subtotal	**0.052**	**0.027**	**0.007**	**0.004**	**0.014**
2001 - 2002	-0.045	-0.023	0.001	-0.002	-0.021
2002 - 2003	0.010	0.014	0.017	-0.003	-0.018
2003 - 2004	0.002	0.002	-0.007	0.002	0.005
2004 - 2005	0.040	0.009	-0.008	-0.002	0.042
2005 - 2006	0.000	-0.002	-0.013	0.000	0.016
Subtotal	**0.008**	**-0.001**	**-0.010**	**-0.005**	**0.024**
Total	**0.060**	**0.027**	**-0.004**	**-0.001**	**0.038**

Source: Author

IV.2.1. The Smith and Welch Decomposition of the Change in the Gender Wage Gap in the Western Region during the Period 1999 - 2006:

Table (13) indicates that the majority of the change in the gender wage gap during the period 1999 – 2001 in this region was explained. The explained change in the wage gap was 0.034 log points thereby constituting 103% of the total. On the other hand, the unexplained change was only -0.001 log points, accounting for -3% of the total change in the gender wage gap.

The explained characteristics effect caused the wage gap to increase by 0.028 log points. The change in the gender differential in potential experience counted for 0.011 log points, followed by the change in the gender distribution among occupational positions, the occupation training match and the company size, which accounted cased the wage gap to increase by 0.009, 0.008 and 0.004 log points respectively.

The explained coefficient effect caused the gender wage gap to increase by 0.007 log points. The main factors leading to this trend where changes in the returns to tenure, which accounted for 0.011 log points, and changes in the returns to potential experience, which caused the gender wage gap to increase by 0.007 log points. Changes in the returns to workers' occupational position on the other hand, caused the gender wage gap to decrease by 0.010 log points.

The unexplained characteristics effect caused the gender wage gap to increase by only 0.001 log points indicating that given a certain differential in the returns, the change in average observable characteristics had an almost negligible influence on the change in the gender wage gap. Changes in women's occupational positions and industries accounted for 0.015 and 0.005 log points respectively, and changes in their average potential experience and occupation/training match accounted for -0.014 and -0.009 log points respectively.

The unexplained coefficient effect is the term that measures the effect of changes in discrimination on the gender wage gap in this decomposition. This term caused the gender wage gap to decrease by 0.002 log points, indicating that changes in discrimination had no role in widening the wage gap during this period in the west.

Table 13: Smith and Welch Decomposition of the Gender Wage Gap in the Western Region during the Period 1999 – 2001

Variable	1999 - 2001							
	Explained Change				Unexplained Change			
	Total		%		Total		%	
	0.035		104.5		-0.001		-4.5	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**-0.003**	**-10.5**	**0.002**	**5.9**	**-0.003**	**-9.8**	**0.003**	**8.4**
Elementary and Secondary School 1	0.000	-0.1	0.000	0.1	-0.004	-11.9	0.015	43.9
Secondary School 2	-0.004	-12.7	0.001	1.9	0.002	4.9	-0.011	-34.4
High school	0.001	2.3	0.001	4.0	-0.001	-2.9	0.000	-1.0
Experience	**0.011**	**33.6**	**0.007**	**21.8**	**-0.014**	**-42.3**	**0.217**	**656.1**
Potential Experience	-0.011	-33.4	0.035	105.4	-0.029	-88.9	0.484	1464.7
Potential Experience2/100	0.022	67.0	-0.028	-83.6	0.015	46.6	-0.267	-808.6
Tenure	**-0.002**	**-6.3**	**0.011**	**31.8**	**0.002**	**6.4**	**0.012**	**35.2**
Native (German = 1)	**0.001**	**3.3**	**-0.001**	**-2.7**	**0.003**	**10.4**	**0.156**	**471.1**
Industry	**0.000**	**1.2**	**-0.001**	**-3.1**	**0.005**	**14.9**	**-0.024**	**-73.6**
Energy and Mining	0.000	1.1	-0.003	-10.3	0.003	7.6	-0.002	-5.2
Manufacturing	-0.002	-7.4	0.002	5.2	0.000	1.0	-0.021	-63.2
Construction	0.006	17.8	-0.003	-8.8	0.000	-1.1	0.005	15.0
Trade	-0.004	-12.5	0.003	10.2	0.003	10.5	-0.012	-37.1
Transportation	0.000	0.7	0.000	-0.4	0.000	-0.2	-0.001	-2.9
Banking and Insurance	0.000	1.5	0.000	1.0	-0.001	-2.9	0.007	19.7
Company Size	**0.004**	**11.4**	**-0.004**	**-13.5**	**0.002**	**5.7**	**-0.111**	**-334.8**
Between 20 and 200	0.000	1.2	-0.002	-5.1	-0.001	-3.8	-0.024	-71.3
Between 200 and 2000	0.012	37.3	0.001	2.4	-0.001	-4.5	-0.045	-135.4
More than 2000	-0.009	-27.1	-0.004	-10.7	0.005	14.0	-0.042	-128.1
Occupation/Training Match	**0.008**	**23.8**	**0.003**	**9.1**	**-0.009**	**-27.2**	**-0.008**	**-23.3**
Doesn't work in occupation trained for	0.000	-0.2	0.000	0.4	-0.002	-6.5	-0.026	-79.7
In training or no training	0.008	24.0	0.003	8.7	-0.007	-20.7	0.019	56.4
Occupational Position	**0.009**	**27.5**	**-0.010**	**-28.8**	**0.015**	**44.4**	**-0.054**	**-163.6**
White collar	-0.002	-5.7	-0.007	-21.2	0.009	27.8	-0.004	-11.0
Civil service	-0.001	-2.6	-0.003	-8.1	0.001	4.4	-0.005	-14.9
Qualified & highly qualified professional	0.009	27.5	0.000	-0.2	0.004	10.9	-0.044	-133.1
Forman	-0.002	-6.2	0.000	1.4	0.000	-0.9	0.001	4.5
Managerial	0.005	14.5	0.000	-0.6	0.001	2.3	-0.003	-9.1
Level Effect	**0.000**	**0.0**	**0.000**	**0.0**	**0.000**	**0.0**	**-0.193**	**-582.3**
Total	**0.028**	**84.0**	**0.007**	**20.5**	**0.001**	**2.3**	**-0.002**	**-6.8**
Change in Gender Wage Gap	**0.033**							

Source: Author

Table (14) shows the decomposition results of the gender wage gap in the western region during the period 2001 – 2006. The explained change was relatively small, causing the wage gap to decrease by 0.007 log points, accounting for -63.6% of the total change. The unexplained change caused the wage gap to increase by 0.018 log points, accounting for 163.6% of the total change.

The explained characteristics effect was positive, increasing the wage gap by 0.003 log points. Mainly changes in the gender differential in potential experience and changes in the gender distribution amongst occupational positions were responsible for this positive influence, accounting for 0.014 and 0.007 log point respectively. Changes in the gender differences in the occupation/training match, as well as changes in the gender distribution across industries caused the gender wage gap to decrease by 0.008 and 0.006 log points respectively.

The explained coefficient effect caused the gender wage gap to decrease by 0.010 log points. Changes in the returns to potential experience and the returns to being employed in a given industry each led the wage gap to decline by 0.010 log points. On the other hand, changes in the returns to the occupation/training match and occupational position each caused the wage gap to increase by 0.004 log points.

The unexplained characteristics effect is again the smallest of all three terms, leading the wage to decrease by 0.002 log points. Changes in women's occupations/training match lead the wage gap to decrease by 0.005 log points, Changes in their average tenure caused the gap to decrease by 0.002 log points and changes in women's employment with respect o company size caused the gender wage gap to increase by 0.005 log points.

The unexplained coefficient effect during this period was positive and actually dominated the overall change of the gender wage gap. This term caused the wage gap to increase by 0.020 log points. The greatest positive impact came from the level effect, which is the difference in the intercepts' differential from the men and women wage equations from period 1 to period 2. This defines the part of the wage gap that is not caused by any of the characteristics. It is the wage gap that would still exist if all characteristics were equal to zero. The level effect caused the gender wage gap to increase by 0.547 log points.

Furthermore, the change in the gender differential in the returns to the occupation/training match and to occupational position caused the wage gap to increase by 0.040 and 0.005 log points respectively, indicating increases in gender wage discrimination in these two particular characteristics. On the other hand, the change in the gender differential in the returns to potential experience caused the gender wage gap to decrease by 0.309 log points, indicating that wage discrimination in this particular characteristic has fallen during 2001 – 2006 in the western region. Similarly, the change in the gender differential in the returns to being native and being employed in a given industry caused the gender wage gap to decrease by 0.204 and 0.033 log points respectively.

Table 14: Smith and Welch Decomposition of the Gender Wage Gap in the Western Region during the Period 2001 – 2006

Variable	Explained Change				Unexplained Change			
	Total -0.007		% -73.4		Total 0.018		% 173.4	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**-0.003**	**-27.0**	**-0.002**	**-19.8**	**-0.002**	**-15.9**	**0.001**	**8.9**
Elementary and Secondary School 1	-0.003	-25.1	-0.002	-14.4	-0.001	-14.0	-0.006	-57.6
Secondary School 2	0.001	12.5	0.000	-2.7	0.002	20.0	-0.001	-12.2
High school	-0.002	-14.4	0.000	-2.6	-0.002	-21.9	0.008	78.8
Experience	**0.014**	**134.5**	**-0.010**	**-95.1**	**0.002**	**21.4**	**-0.309**	**-2929.4**
Potential Experience	0.072	683.5	-0.046	-437.8	-0.006	-57.0	-0.766	-7264.0
Potential Experience2/100	-0.058	-549.0	0.036	342.7	0.008	78.4	0.457	4334.6
Tenure	**0.000**	**-1.0**	**0.001**	**11.8**	**-0.002**	**-15.1**	**-0.012**	**-110.8**
Native (German = 1)	**-0.002**	**-16.6**	**0.003**	**25.1**	**-0.001**	**-6.2**	**-0.204**	**-1937.2**
Industry	**-0.006**	**-60.6**	**-0.010**	**-93.4**	**0.001**	**9.8**	**-0.033**	**-317.6**
Energy and Mining	-0.001	-8.6	0.004	36.1	0.000	3.9	0.001	11.7
Manufacturing	0.002	14.6	-0.004	-39.1	0.001	10.8	-0.010	-94.2
Construction	-0.005	-46.0	-0.007	-63.0	-0.004	-35.3	-0.007	-63.4
Trade	-0.002	-17.8	0.000	-2.0	0.000	4.1	-0.012	-116.3
Transportation	0.000	-3.7	-0.003	-28.5	0.002	16.6	0.001	10.1
Banking and Insurance	0.000	0.8	0.000	3.1	0.001	9.6	-0.007	-65.5
Company Size	**0.001**	**5.7**	**0.001**	**5.1**	**0.005**	**44.4**	**-0.014**	**-134.9**
Between 20 and 200	0.000	1.8	0.001	10.0	0.005	45.8	0.001	13.2
Between 200 and 2000	0.005	46.4	0.001	6.9	0.002	15.3	-0.005	-45.7
More than 2000	-0.004	-42.6	-0.001	-11.8	-0.002	-16.6	-0.011	-102.4
Occupation/Training Match	**-0.008**	**-77.7**	**0.004**	**35.0**	**-0.005**	**-47.7**	**0.040**	**376.7**
Doesn't work in occupation trained for	-0.001	-8.2	0.002	20.1	-0.004	-37.9	0.037	347.8
In training or no training	-0.007	-69.5	0.002	14.9	-0.001	-9.7	0.003	28.9
Occupational Position	**0.007**	**66.8**	**0.004**	**33.8**	**-0.001**	**-5.8**	**0.005**	**46.9**
White collar	0.000	4.6	0.004	35.3	-0.003	-31.0	-0.019	-182.6
Civil service	0.000	0.8	0.002	16.6	0.001	13.7	0.003	30.9
Qualified & highly qualified professional	0.003	29.8	-0.007	-64.2	-0.005	-45.1	0.013	127.7
Forman	0.001	7.5	0.007	65.8	0.006	56.5	0.006	59.4
Managerial	0.003	24.1	-0.002	-19.8	0.000	0.1	0.001	11.6
Level Effect	**0.000**	**0.0**	**0.000**	**0.0**	**0.000**	**0.0**	**0.547**	**5185.8**
Total	**0.003**	**24.1**	**-0.010**	**-97.5**	**-0.002**	**-15.0**	**0.020**	**188.5**
Change in Gender Wage Gap	**0.011**							

Source: Author

IV.2.2. The Smith and Welch Decomposition of the Change in the Gender Wage Gap in the Eastern Region during the period 1999 - 2006:

Table (15) reports the decomposition results of the gender wage gap in the eastern region during the period 1999 – 2001. The explained change caused the wage gap to increase by 0.063 log points, accounting for 45% of the total change in the wage gap, whereas the unexplained change caused the gender wage gap to increase by 0.077 log points, accounting for 55%.

The explained characteristics effect increased the wage gap by 0.049 log points. The main factors leading this trend were the change in the gender distribution amongst occupational positions, accounting for 0.023 log points, and the change in the gender distribution amongst companies of different sizes, accounting for 0.022 log points. Changes in the gender differential in educational attainment also caused the gender wage gap to increase by 0.005 log points.

The explained coefficient effect led the gender wage gap to increase by 0.015 log points. The most important forces leading to this effect were the change in the returns to occupational positions, which caused the wage gap to increase by 0.032 log points and the difference in the returns to being employed in a given industry, which caused the gap to increase by 0.015 log points. On the other hand, the difference in the returns to education caused the wage gap to decrease by 0.025 log points.

The unexplained characteristics effect was again the smallest of all three terms, indicating that changes in the average characteristics had a minor effect on the change in the gender wage gap. This term caused the gap to increase by 0.003 log points.

The unexplained coefficient effect on the other hand was positive and relatively high. This term caused the wage gap to increase by 0.074 log points. This effect was mainly caused by the level effect, causing the wage gap to rise by 0.374 log points. Second in significance was the change in the gender differential in the returns to employment in a given industry, accounting for 0.029 log points. Also, changes in the gender differential in the returns to the occupation/training match caused the wage gap to increase by 0.010 log points. Changes in the gender differential in the returns to company size, educational

attainment and potential experience caused the gender wage gap to decrease by 0.099, 0.062 and 0.047 log points respectively.

Table 15: Smith and Welch Decomposition of the Gender Wage Gap in the Eastern Region during the Period 1999 – 2001

Variable	1999 - 2001							
	Explained Change				Unexplained Change			
	Total 0.064		% 45.4		Total 0.077		% 54.6	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**0.005**	**3.9**	**-0.025**	**-17.6**	**0.001**	**0.5**	**-0.062**	**-44.1**
Elementary and Secondary School 1	-0.007	-5.3	-0.004	-3.0	0.003	2.2	0.010	6.8
Secondary School 2	0.014	10.0	-0.020	-14.3	-0.005	-3.7	-0.061	-43.9
High school	-0.001	-0.8	0.000	-0.3	0.003	2.0	-0.010	-7.0
Experience	**-0.004**	**-2.7**	**0.001**	**0.8**	**0.002**	**1.5**	**-0.047**	**-33.4**
Potential Experience	0.001	0.6	0.004	3.2	0.012	8.2	-0.107	-76.3
Potential Experience2/100	-0.005	-3.3	-0.003	-2.3	-0.009	-6.7	0.060	42.9
Tenure	**0.001**	**0.5**	**-0.001**	**-1.0**	**0.001**	**0.5**	**-0.010**	**-6.9**
Industry	**0.000**	**0.3**	**0.015**	**11.0**	**0.008**	**6.1**	**0.029**	**20.8**
Energy and Mining	-0.003	-2.2	0.002	1.5	0.001	0.8	0.001	0.9
Manufacturing	0.000	0.0	0.018	12.9	-0.003	-2.0	0.008	5.5
Construction	0.007	4.7	-0.009	-6.2	0.004	3.1	-0.005	-3.8
Trade	-0.001	-0.7	0.000	0.3	0.010	6.8	-0.003	-2.3
Transportation	-0.003	-2.4	0.008	6.0	-0.002	-1.8	0.010	7.3
Banking and Insurance	0.001	0.9	-0.005	-3.5	-0.001	-0.8	0.019	13.3
Company Size	**0.022**	**15.5**	**-0.010**	**-6.9**	**0.012**	**8.3**	**-0.099**	**-70.8**
Between 20 and 200	-0.003	-2.4	-0.009	-6.4	-0.007	-5.3	-0.037	-26.7
Between 200 and 2000	0.024	17.5	-0.003	-2.1	0.011	7.6	-0.005	-3.6
More than 2000	0.001	0.4	0.002	1.6	0.008	5.9	-0.056	-40.4
Occupation/Training Match	**0.001**	**0.9**	**0.001**	**0.9**	**-0.012**	**-8.5**	**0.010**	**7.0**
Doesn't work in occupation trained for	0.000	0.2	-0.001	-1.0	-0.002	-1.2	0.017	12.1
In training or no training	0.001	0.7	0.003	2.0	-0.010	-7.2	-0.007	-5.1
Occupational Position	0.023	16.6	0.032	23.2	-0.009	-6.5	-0.122	-87.5
White collar	**0.001**	**1.0**	**0.001**	**0.6**	**0.001**	**0.7**	**-0.015**	**-11.0**
Civil service	0.014	10.1	0.001	1.0	0.002	1.8	-0.003	-2.4
Qualified & highly qualified professional	0.012	8.2	0.020	14.4	0.000	0.0	-0.117	-83.6
Forman	0.001	0.6	0.008	5.4	0.000	0.2	0.000	-0.2
Managerial	-0.005	-3.4	0.002	1.8	-0.013	-9.1	0.014	9.7
Level Effect	0.000	0.0	0.000	0.0	0.000	0.0	0.374	267.6
Total	**0.049**	**34.9**	**0.015**	**10.5**	**0.003**	**1.8**	**0.074**	**52.8**
Change in Gender Wage Gap	0.140							

Source: Author

Table (16) shows the decomposition results of the change in the gender wage gap in the eastern region during 2001 – 2006. The explained change caused the wage gap to decrease by 0.025 log points, accounting for -131.6% of the total change. The unexplained change on the other hand caused the gap to increase by 0.044 log points, accounting for 231.6% of the total change.

The explained characteristics effect led the wage gap to decrease by 0.016 log points. This negative effect was mainly caused by the change in the gender difference in educational attainment, change in the gender difference in the occupation/training match, and change in the gender distribution across occupational positions, which caused the wage gap to fall by 0.020, 0.018 and 0.008 log points respectively. On the other hand, the change in the gender distribution across companies of different sized and across industries caused the gender wage gap to increase by 0.024 and 0.013 log points respectively.

The explained characteristics effect also had a negative influence, causing the gender wage gap to decline by 0.009 log points. Changes in the returns to employment in a given industry, changes in the returns to occupation/training match and changed in the returns to education caused the wage gap to fall by 0.016, 0.011 and 0.009 log points respectively. Changes in the returns to potential experience and occupational positions however, caused the gap to increase by 0.015 and 0.007 respectively.

The unexplained characteristics effect for this period was negative. This effect caused the wage gap to decline by 0.016 log points. The main contributors to this decline were changes in women's distribution across industries and changes in women's average tenure, which caused the gap to decrease by 0.024 and 0.006 log points respectively. Changes in women's distribution across occupational positions and changed in their average educational attainment caused the wage gap to increase by 0.006 and 0.004 log points respectively.

The unexplained coefficient effect caused the wage gap to increase by 0.060 log points. The level effect accounted for 0.066 log points. The change in the gender differential in the returns to company size accounted for 0.058 log points. Furthermore, the change in

the gender differential in returns to employment in a given industry caused the wage gap to increase by another 0.024 log points. On the other hand, changes in the gender differential in the returns to educational attainment, the occupation/training match and tenure caused the gender wage gap to fall by 0.039, 0.028 and 0.018 log points respectively.

Table 16: Smith and Welch Decomposition of the Gender Wage Gap in the Eastern Region during the Period 2001 – 2006

Variable	2001 - 2006							
	Explained Change				Unexplained Change			
	Total -0.025		% -135.9		Total 0.044		% 235.9	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**-0.020**	**-107.7**	**-0.009**	**-45.8**	**0.004**	**22.2**	**-0.039**	**-208.0**
Elementary and Secondary School 1	-0.004	-22.8	0.012	65.9	0.002	10.2	0.006	33.9
Secondary School 2	-0.017	-91.8	-0.031	-166.8	0.005	27.8	-0.036	-193.3
High school	0.001	6.9	0.010	55.2	-0.003	-15.7	-0.009	-48.5
Experience	**0.000**	**-2.3**	**0.015**	**78.1**	**0.002**	**12.2**	**0.001**	**7.5**
Potential Experience	-0.050	-271.1	0.028	150.2	-0.018	-97.7	-0.098	-526.7
Potential Experience2/100	0.050	268.8	-0.013	-72.1	0.020	109.9	0.099	534.1
Tenure	**-0.004**	**-21.6**	**0.003**	**13.6**	**-0.006**	**-34.6**	**-0.018**	**-95.6**
Industry	**0.013**	**68.7**	**-0.016**	**-88.3**	**-0.024**	**-131.6**	**0.024**	**128.0**
Energy and Mining	0.004	20.8	-0.002	-10.4	0.000	-1.5	-0.002	-11.1
Manufacturing	-0.004	-21.8	-0.005	-28.3	0.001	3.7	-0.008	-45.4
Construction	0.007	39.6	0.007	39.5	-0.004	-24.0	0.005	27.5
Trade	0.009	50.3	-0.015	-80.9	-0.018	-98.3	0.025	133.1
Transportation	-0.003	-17.1	-0.001	-7.9	-0.001	-5.7	0.007	38.5
Banking and Insurance	-0.001	-3.1	0.000	-0.3	-0.001	-5.9	-0.003	-14.6
Company Size	**0.024**	**131.8**	**0.002**	**9.0**	**0.005**	**24.7**	**0.058**	**311.3**
Between 20 and 200	0.019	100.0	0.006	32.2	0.002	10.7	0.023	121.6
Between 200 and 2000	-0.005	-25.7	-0.001	-3.5	0.002	10.9	-0.009	-49.1
More than 2000	0.011	57.5	-0.004	-19.7	0.001	3.2	0.044	238.7
Occupation/Training Match	**-0.018**	**-98.7**	**-0.010**	**-54.3**	**-0.002**	**-9.9**	**-0.028**	**-152.4**
Doesn't work in occupation trained for	**-0.002**	**-9.2**	**-0.011**	**-60.7**	**0.001**	**6.4**	**-0.032**	**-171.0**
In training or no training	-0.017	-89.6	0.001	6.4	-0.003	-16.3	0.003	18.6
Occupational Position	**-0.010**	**-55.4**	**0.007**	**36.9**	**0.006**	**32.2**	**-0.004**	**-24.1**
White collar	-0.008	-42.3	0.007	40.3	0.000	0.7	-0.012	-64.3
Civil service	-0.003	-17.9	-0.007	-37.0	-0.004	-20.5	0.000	-0.7
Qualified & highly qualified professional	0.004	23.3	0.023	123.5	0.009	49.3	0.011	59.2
Forman	0.005	24.6	-0.018	-96.3	0.001	3.2	-0.003	-14.9
Managerial	-0.008	-43.1	0.001	6.4	0.000	-0.5	-0.001	-3.3
Level Effect	0.000	0.0	0.000	0.0	0.000	0.0	0.066	354.0
Total	**-0.016**	**-85.2**	**-0.009**	**-50.7**	**-0.016**	**-84.8**	**0.060**	**320.7**
Change in Gender Wage Gap	0.019							

Source: Author

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IV.2.3. The Smith and Welch Decomposition of the Change in the Gender Wage Gap in Reunified Germany during the Period 1999 - 2006:

Table (17) shows the decomposition results for the sample that includes both regions together during 1999 – 2006. During this period, the gender wage gap has increased by 0.052 log points. The explained change is identical to that for the western region alone. It caused the wage gap to increase by 0.034 log points, accounting for 65.4% of the total change. The unexplained change however looks quite different. Instead of being almost negligible as the case was for the western region, here it caused the gap to increase by 0.018 log points, hence accounting for 34.6% of the total increase in the wage gap. The difference lies in the effect of the change in wage discrimination as I shall explain shortly.

The explained characteristics effect caused the wage gap to increase by 0.027 log points. The change in the gender distribution across occupational positions led the gender wage gap to rise by 0.010 log points. The change in the gender differential in potential experience and the occupation/training match each caused the gap to increase by 0.008 log points, and the change in the gender distribution across companies of different sizes caused the gap to increase by 0.007 log points. The characteristics effect of living in the western region caused the wage gap to decrease by -0.006 log points, which is not surprising as we have seen that the change in the wage gap in the eastern region was higher than in the west during the entire period 1999 -2006.

The explained coefficient effect caused the wage gap to increase by 0.007 log points. The main contributors to this positive effect were the change in the returns to tenure, which caused the gap to increase by 0.007 log points, and the change in the returns to potential experience and the occupation/training match, each of which caused the wage gap to rise by 0.005 log points. The change in the returns to the company size in which the worker in employed, and the returns to occupational position caused the wage gap in the other hand to decline by 0.006 and 0.003 log points respectively.

The unexplained characteristics effect was the smallest of all terms, leading the wage gap to increase by 0.004 log points. Changes in the distribution of women across occupational

positions caused the gap to increase by 0.012 log points, whereas each the changes in women's tenure, distribution across industries and company sizes contributed to the rising gap by 0.003 log points. There positive effects were counterbalanced by the effects of changes in women's potential experience and occupation/training match, which led the wage gap to decrease by 0.009 and 0.008 log points respectively.

The unexplained coefficient effect caused the gender wage gap to rise by 0.014 log points. The main factors responsible for this positive effect were the changes in the gender differential in the returns to being native and in the returns to potential experience, which caused the wage gap to increase by 0.162 and 0.158 log points respectively. On the other hand, the change in the gender differential in the returns to the company size, working in the western region and the occupational position caused the gender wage gap to decrease by 0.112, 0.087 and 0.067 log points respectively. The level effect was relatively small, compared to the other effects, causing the gender wage gap to decrease by 0.018 log points.

Table17: Smith and Welch Decomposition of the Gender Wage Gap in Reunified
Germany during the Period 1999 – 2001

Variable	1999 - 2001							
	Explained Change				Unexplained Change			
	Total 0.034		% 65.5		Total 0.018		% 34.5	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**0.000**	**-0.1**	**0.000**	**-0.8**	**-0.002**	**-3.3**	**-0.015**	**-28.3**
Elementary and Secondary School 1	0.000	-0.4	0.000	-0.3	-0.002	-4.8	0.010	19.1
Secondary School 2	-0.001	-1.2	-0.001	-2.2	0.001	2.2	-0.022	-42.0
High school	0.001	1.5	0.001	1.7	0.000	-0.8	-0.003	-5.4
Experience	**0.008**	**14.7**	**0.005**	**10.3**	**-0.009**	**-17.3**	**0.158**	**305.7**
Potential Experience	-0.008	-15.9	0.027	51.6	-0.016	-30.5	0.359	694.7
Potential Experience2/100	0.016	30.7	-0.021	-41.2	0.007	13.2	-0.201	-389.0
Tenure	**-0.002**	**-3.8**	**0.007**	**13.9**	**0.003**	**5.4**	**0.010**	**19.7**
Native (German = 1)	**0.001**	**1.7**	**-0.001**	**-2.0**	**0.003**	**5.0**	**0.162**	**313.3**
Industry	**0.003**	**4.9**	**0.001**	**2.0**	**0.002**	**4.5**	**-0.011**	**-22.2**
Energy and Mining	0.000	0.3	-0.002	-4.0	0.001	1.9	-0.001	-1.0
Manufacturing	-0.003	-5.2	0.006	11.6	0.000	-0.2	-0.014	-27.6
Construction	0.007	12.8	-0.005	-9.2	0.000	-0.7	0.003	5.9
Trade	-0.003	-5.3	0.002	4.4	0.003	6.3	-0.009	-17.0
Transportation	0.000	0.3	0.001	1.3	0.000	-0.1	0.000	0.5
Banking and Insurance	0.001	1.9	-0.001	-2.2	-0.001	-2.6	0.009	17.0
Company Size	**0.007**	**13.1**	**-0.006**	**-12.0**	**0.003**	**4.9**	**-0.112**	**-216.5**
Between 20 and 200	0.000	0.0	-0.003	-5.2	-0.002	-3.4	-0.030	-57.9
Between 200 and 2000	0.014	27.4	0.000	0.9	0.002	3.4	-0.040	-78.2
More than 2000	-0.007	-14.3	-0.004	-7.7	0.003	4.9	-0.042	-80.4
Occupation/Training Match	**0.008**	**14.8**	**0.005**	**9.2**	**-0.008**	**-15.4**	**-0.006**	**-10.7**
Doesn't work in occupation trained for	-0.001	-1.2	0.000	0.5	0.000	-0.8	-0.017	-33.8
In training or no training	0.008	15.9	0.005	8.8	-0.008	-14.5	0.012	23.1
Occupational Position	**0.010**	**18.5**	**-0.003**	**-5.1**	**0.012**	**22.6**	**-0.067**	**-129.3**
White collar	-0.001	-1.3	-0.006	-11.2	0.007	12.8	-0.007	-13.7
Civil service	0.000	-0.4	0.000	-0.2	0.002	3.2	-0.002	-4.6
Qualified & highly qualified professional	0.010	18.7	0.001	2.7	0.004	7.1	-0.058	-112.5
Forman	-0.002	-4.2	0.002	4.6	0.000	0.2	0.001	1.7
Managerial	0.003	5.8	0.000	-0.9	0.000	-0.7	0.000	-0.1
Region	**-0.006**	**-11.0**	**-0.001**	**-2.8**	**0.000**	**0.8**	**-0.087**	**-168.9**
Level Effect	**0.000**	**0.0**	**0.000**	**0.0**	**0.000**	**0.0**	**-0.018**	**-35.6**
Total	**0.027**	**52.8**	**0.007**	**12.7**	**0.004**	**7.2**	**0.014**	**27.3**
Change in Gender Wage Gap	0.052							

Source: Author

Table (18) reports the decomposition results of the rather mild increase in the gender wage gap of 0.008 log points in reunified Germany during the period 2001 – 2006. The explained change caused the wage gap to decrease by 0.011 log points, accounting for - 137.5% of the total change. The unexplained on the other hand caused the wage gap to increase by 0.019 log points, accounting for 237.5% and dominated again by the positive effect of changes in discrimination.

The explained characteristics effect caused the gender wage gap to decrease by 0.001 log points. The change in the gender differential in potential experience caused the wage gap to increase by 0.014 log points. Moreover, the change in the gender distribution across occupational positions and companies of different sizes caused the gap to increase further by 0.006 and 0.003 log points respectively. On the other hand, changes in the gender differential in the occupation/training match caused the wage gap to decrease by 0.008 log points. Furthermore, changes in the gender differential in educational attainment and the gender distribution across industries caused the gap to decrease by 0.005 log points. The characteristics effect of living in the west led the gap in reunified Germany to decline by another 0.005 log points.

The explained coefficient effect caused the gender wage gap to decrease by 0.010 log points. Changes in the returns to occupational position caused the wage gap to increase by 0.004 log points. Changes in the returns to company size and being native each increased the gender wage gap by another 0.002 log points. Negative were the effects of the changes in the returns to industries and potential experience, which caused the gender wage gap to decrease by 0.011 and 0.005 log points respectively.

The unexplained characteristics effect caused the gender wage gap to fall by 0.005 log points. The change in women's distribution across companies of different sizes changes in their average potential experience caused the gap to increase by 0.004 and 0.002 log points respectively. Changes in women's occupation/training match however, cased the wage gap to decrease by 0.005 log points. Furthermore, changes in women's average tenure, and changes in their distribution across occupational positions each caused the gender wage gap to fall by 0.003 log points.

Finally, the unexplained coefficient effect was again dominantly positive, causing the wage gap to increase by 0.024 log points. The main contributors to that positive effect were the level effect which caused the wage gap to increase by 0.525 log points, and the changes in the gender differential in the returns to the occupation/training match and company size, which contributed to a widening wage gap by 0.019 and 0.018 log points. Changes in the gender differential in the returns to potential experience on the other hand caused the gap to decrease by 0.268 log points. Furthermore, changes in the gender differential on returns to being native and in returns to industries caused the gender wage gap in reunified Germany during the period 2001 – 2006 to decrease by 0.184 and 0.033 log points respectively.

Table 18: Smith and Welch Decomposition of the Gender Wage Gap in Reunified Germany during the Period 2001 – 2006

Variable	2001 - 2006							
	Explained Change				Unexplained Change			
	Total 0.011		% -133.8		Total 0.019		% 233.8	
	Char. Eff.	%	Coeff. Eff.	%	Char. Eff.	%	Coeff. Eff.	%
Education	**-0.005**	**-54.2**	**-0.002**	**-18.1**	**-0.001**	**-13.5**	**0.001**	**13.8**
Elementary and Secondary School 1	-0.001	-12.8	-0.001	-17.8	-0.002	-19.2	0.000	-5.6
Secondary School 2	-0.001	-9.2	-0.002	-28.0	0.000	5.7	-0.003	-35.0
High school	-0.003	-32.2	0.002	27.6	0.000	0.0	0.005	54.4
Experience	**0.014**	**161.9**	**-0.005**	**-63.5**	**0.002**	**20.7**	**-0.268**	**-3189.7**
Potential Experience	0.054	647.4	-0.035	-420.9	-0.005	-56.7	-0.693	-8243.5
Potential Experience2/100	-0.041	-485.5	0.030	357.4	0.007	77.4	0.425	5053.8
Tenure	**-0.001**	**-8.6**	**0.000**	**-1.1**	**-0.003**	**-35.8**	**-0.016**	**-194.5**
Native (German = 1)	**-0.001**	**-17.3**	**0.002**	**23.8**	**-0.001**	**-6.0**	**-0.184**	**-2191.6**
Industry	**-0.005**	**-56.1**	**-0.011**	**-133.3**	**0.000**	**0.8**	**-0.033**	**-387.5**
Energy and Mining	0.000	-2.3	0.002	28.4	0.001	9.5	0.001	8.3
Manufacturing	0.002	18.4	-0.005	-57.8	0.001	15.1	-0.014	-161.4
Construction	-0.004	-45.7	-0.004	-47.0	-0.003	-39.2	-0.006	-68.4
Trade	-0.001	-8.8	-0.002	-28.7	-0.001	-8.8	-0.010	-114.1
Transportation	-0.001	-16.0	-0.003	-35.4	0.001	12.2	0.003	37.3
Banking and Insurance	0.000	-1.7	0.001	7.3	0.001	11.9	-0.008	-89.2
Company Size	**0.003**	**38.6**	**0.002**	**28.4**	**0.004**	**48.7**	**0.018**	**210.8**
Between 20 and 200	0.002	24.8	0.002	23.0	0.004	53.5	0.010	115.5
Between 200 and 2000	0.004	48.2	0.000	0.1	0.001	16.6	0.002	28.9
More than 2000	-0.003	-34.5	0.000	5.3	-0.002	-21.4	0.006	66.3
Occupation/Training Match	**-0.008**	**-93.0**	**0.001**	**16.2**	**-0.005**	**-62.6**	**0.019**	**227.4**
Doesn't work in occupation trained for	-0.001	-11.3	0.001	12.8	-0.003	-34.7	0.021	250.9
In training or no training	-0.007	-81.7	0.000	3.4	-0.002	-27.9	-0.002	-23.5
Occupational Position	**0.006**	**75.2**	**0.004**	**43.3**	**-0.003**	**-30.8**	**-0.022**	**-263.3**
White collar	0.000	-0.9	0.007	85.0	-0.003	-35.2	-0.026	-308.2
Civil service	-0.001	-6.2	0.000	2.2	0.001	11.2	-0.002	-27.6
Qualified & highly qualified professional	0.005	65.4	-0.005	-57.4	-0.004	-42.2	0.000	-1.7
Forman	0.001	6.6	0.003	36.4	0.003	34.7	0.006	73.3
Managerial	0.001	10.2	-0.002	-23.0	0.000	0.6	0.000	0.9
Region	**-0.005**	**-55.5**	**-0.002**	**-20.3**	**0.002**	**24.7**	**-0.015**	**-180.2**
Level Effect	**0.000**	**0.0**	**0.000**	**0.0**	**0.000**	**0.0**	**0.525**	**6242.6**
Total	**-0.001**	**-9.1**	**-0.010**	**-124.7**	**-0.005**	**-53.8**	**0.024**	**287.6**
Change in Gender Wage Gap	0.008							

Source: Author

To summarize, the above decompositions are to a great extent consistent with the JMP decompositions reported previously. In addition, they provide a clearer understanding of how changes in discrimination have affected the gender wage gap in the western region, eastern region and in reunified Germany.

The explained characteristics effect was mostly positive, and like in the JMP decompositions, changes in the gender differences in potential experience, their distribution across companies of different sizes and occupational positions were the most relevant factors in determining that positive effect.

The explained coefficient was positive during the period 1999 – 2001 and negative during the period 2001 – 2006 in all three samples. The positive influence was mainly due to changes in the returns to occupational position, followed by changes in the returns to potential experience, tenure and occupation/training match. The negative impact of the second period was mainly due to changes in the returns to industries, followed by changes in the returns to educational attainment, potential experience and occupation/training match.

The unexplained characteristics effect, like the explained coefficient effect was positive for the first period and negative in for the second period, ending with an overall negative influence on the gender wage gap for the period 1999 – 2006 in all three samples. This effect was however the smallest effect of all, indicating that changes in the average characteristics of workers from year to year was relatively irrelevant in explaining the gender wage gap.

The unexplained coefficient effect as mentioned before is the term that shall capture changes in discrimination and hence, is equivalent to JMP's gap effect. One main difference between this term and the gap effect is that it is not assumed to capture the influences of any sources of bias as long as the estimated coefficients are unbiased and consistent. Another difference is that a unique value of this term can be identified for each variable in the wage regressions, whereas the gap effect is one "aggregate" term computed by manipulating the residuals of the wage regressions for men and women. Hence, while this term is able to provide information on the particular returns in which

wage discrimination has changed between two periods of time, JMP's gap can at best provide information on whether there was any net effect, positive or negative, on changes in the gender wage gap.

This term was consistently positive, with an exception during the period 1999 – 2001 in the western region. During the period 1999 – 2006, changes in discrimination had the impact of increasing the gender wage gap in the western region by 0.018 log points. In the eastern region changes in discrimination increased the gap by 0.133 log points and in the sample of reunified Germany changes in discrimination increased the gender wage gap by 0.038 log points. If we compare these values with the results of JMP's gap effect, which were 0.027, 0.185 and 0.040 log points for the western region, eastern region and reunified Germany respectively, we can clearly see that JMP's gap estimated the effect of changes in discrimination on the gender wage gap to be larger by 0.009 log points in the western region, by 0.052 log points in the eastern region and by 0.002 log points in the sample of reunified Germany.

Also, the level effect, which captures the change in the differential between the constants of the gender wage regressions, played a remarkable role in increasing the gender wage gap during the period 1999 – 2006 in Germany. That is, men were generally paid increasingly more than women regardless of their human capital characteristics, training, occupations or industries. Changes in the gender differential in the returns to the occupation/training match were also important in explaining the widening gender wage gap. That means that men with any given training level for a particular occupation were paid increasingly more than women with the same kind and amount of training. On the other hand, changes in the gender differential in the returns to educational attainment and experience caused the wage gap to decrease indicating that during 1999 – 2006 women received a favorable treatment in rewarding their human capital. Changes in the gender differential in the returns to tenure where negligible and changes in the gender differential in the returns to industries where mixed.

Finally, table (19) below shows the deviation of the estimated change in the gender wage gap from the actual change, measured by the squared difference. The fifth and sixth columns indicate that both the JMP and the Smith and Welch decompositions estimated

the change in the gender wage gap equally well. In most of the years, the squared difference was very small. Therefore, one could chose between both methodologies without having to sacrifice the estimation quality. However, one might prefer one method over the other according to objectives of the study. If the purpose was particularly measuring the effect of changes in discrimination on the gender wage gap, then the Smith and Welch decomposition might be a better fit.

Table 19: The Deviation of the Estimated Change in the
Gender Wage Gap from the Actual Change

| Period | Change in Wage Gap | | | Squared Residual | |
	Actual	JMP	SW	Actual - JMP	Actual - SW
Western Region					
1999 - 2000	0.035	-0.019	-0.013	0.003	0.002
2000 - 2001	0.011	0.049	0.046	0.001	0.001
2001 - 2002	-0.020	-0.039	-0.038	0.000	0.000
2002 - 2003	-0.008	-0.005	0.007	0.000	0.000
2003 - 2004	0.014	0.026	0.001	0.000	0.000
2004 - 2005	0.003	0.035	0.053	0.001	0.003
2005 - 2006	-0.014	-0.005	-0.013	0.000	0.000
Total	**0.022**	**0.041**	**0.044**	**0.006**	**0.007**
Eastern Region					
1999 - 2000	0.019	0.045	0.053	0.001	0.001
2000 - 2001	0.049	0.097	0.086	0.002	0.001
2001 - 2002	0.009	-0.082	-0.075	0.008	0.007
2002 - 2003	-0.055	0.019	0.022	0.006	0.006
2003 - 2004	-0.001	0.010	0.017	0.000	0.000
2004 - 2005	-0.006	0.003	-0.015	0.000	0.000
2005 - 2006	0.030	0.064	0.069	0.001	0.001
Total	**0.046**	**0.157**	**0.158**	**0.018**	**0.018**
Reunified Germany					
1999 - 2000	0.024	-0.011	-0.004	0.001	0.001
2000 - 2001	0.014	0.058	0.055	0.002	0.002
2001 - 2002	-0.003	-0.047	-0.045	0.002	0.002
2002 - 2003	-0.009	0.005	0.010	0.000	0.000
2003 - 2004	-0.006	0.016	0.002	0.001	0.000
2004 - 2005	0.018	0.031	0.040	0.000	0.001
2005 - 2006	-0.015	0.006	0.000	0.000	0.000
Total	**0.023**	**0.058**	**0.060**	**0.006**	**0.005**

V.   CONCLUSIONS:

In this article I used data from the German Socio-Economic Panel for the period 1999 – 2006 and implemented the decomposition methodologies of Juhn, Murphy and Pierce (1991) and Smith and Welch (1989) to analyze and decompose changes in the gender wage gap in Germany into the various effects that cause it.

In conclusion, I have shown that the gender wage gap has increased in Germany during the period 1999 – 2006. Particularly, estimated by the JMP methodology, in the western region the gap increased by 0.041 log points, in the eastern region by 0.157 log points and in the sample of reunified Germany, the wage gap increased by 0.058 log points. According to Smith and Welch's methodology, the estimated increases in the gender wage gap in the western region, eastern region and reunified Germany where 0.044, 0.158 and 0.060 log points respectively.

The majority of the increase in the gender wage gap has occurred during the period 1999 – 2001, which was also a period of increasing levels of wage inequality all over Germany. Therefore, the results reported in this article and those of Al-farhan (2010) confirm that the positive association between rising levels of wage inequality and widening gender wage gaps does indeed exist, not only in international comparisons, as indicated by Blau and Kahn (1996), (1997), (2003) and (2006), but also across time using data from the same population, regardless of where we are in the wage distribution. In other words, it is not only true that countries with relatively higher levels of wage inequality experience larger gender wage gaps, but also periods of rising levels of wage inequality in a particular country are marked with simultaneously widening gender wage gaps in all segments of that country's wage distribution.

Using the same sample period from Germany as Al-farhan (2010), I find that the variables that were the most significant in explaining the increases in wage inequality during 1999 – 2006, were also the most consistent in explaining the widening gender wage gap during that period. Specifically, these variables were potential experience, worker's company sizes and worker's occupational position and their occupation/training

match. The effects of educational attainment, tenure, and distribution of workers across industries, as well as being native were secondary.

Measured by the JMP methodology, changes in the gender differentials of workers characteristics, or simply the explained characteristics effect, was consistently positive and caused the gender wage gap during 1999 – 2006 to increase by 0.039 log points in the western region, 0.067 log points in the eastern region and by 0.030 in the eastern region. Estimated by the Smith and Welch method, these numbers were 0.030, 0.033 and 0.027 log points respectively. This positive influence was mainly driven by the effect of changes in potential experience, company size and occupational positions, in which women have seemingly worsened compared to men.

Changes in the returns to characteristics during the period 1999 – 2006, or simply the explained coefficient effect, caused the gender wage gap according to the JMP methodology to decline by 0.017 log points in the western region, 0.037 log points in the eastern region and by 0.013 log points in reunified Germany. Estimated by the Smith and Welch method, these numbers were 0.004, 0.005 (increase) and 0.004 log points respectively. This improvement in women's wage position was mainly caused by the effects of educational attainment, potential experience, industries and the occupation/training match. What this negative effect means is that the returns to those characteristics in which women have a favorable (unfavorable) position compared to men, have increased (decreased) from 1999 to 2006. For instance, the fact that the returns to education has increased from 1999 to 2006 in reunified Germany, led to the women's wage position to improve relative to men, because they enjoyed a slightly higher level of educational attainment, which on average was 12.21 years compared 12.12 years for men. Alternatively, the fact that the returns to potential experience has declined in the western region between 1999 and 2006 has caused women's wage position relative to men to improve, because women have less potential experience than men do.

JMP's gap effect has estimated the gender wage gap to increase by 0.027 log points in the western region, 0.185 log points in the eastern region and by 0.040 log points in the sample of reunified Germany. This indicates that changes in wage discrimination have potentially increased the gender wage gap all over Germany. However, since the gap

effect is unable to show the contribution of each individual regressor, and on the other hand captures the effects of many potential biases, I implemented the Smith and Welch decomposition, which helps providing a more detailed and clearer picture of changes in discrimination. According to this alternative, changes in discrimination as measured by the unexplained coefficient effect have caused the gender wage gap to increase by 0.018 log points in the western region, 0.133 log points in the eastern region and by 0.038 log points in the sample of reunified Germany. Compared to JMP's gap effect, these estimates of changes in discrimination were consistently smaller. The reason of this discrepancy might be that the gap effect also captures the effect of omitted variables and potential selection bias.

An important reason why changes in discrimination had a positive influence on the gender wage gap was the remarkable role played by the level effect. That is, men were generally paid increasingly more than women regardless of their human capital characteristics, training, occupations or industries. Originating from the regression' constant terms, the value of the level effect will change if one changes the choice of the reference groups of the dummy variables included in the regressions, and has no conceptual meaning.

Moreover, changes in the gender differential in the returns to the occupation/training match were also important in explaining the widening gender wage gap. That means that men with any given training level for a particular occupation were paid increasingly more than women with the same kind and amount of training. Furthermore, given that women have on average lower job-specific training endowments, it is not surprising to observe a higher gender wage gap.

Interesting however, was the result that changes in the gender differential in the returns to educational attainment, experience and tenure in Germany during 1999 – 2006 where causing the wage gap to decrease, indicating that during that period, women actually received a favorable treatment in rewarding their human capital (other than job-specific training) compared to men.

Hence, the increase in the gender wage gap during the period 1999 – 2006 can be attributed to changes in the gender differentials in human capital endowments, such as worker's potential experience, and to changes in the gender distribution across industries, company sizes and occupational positions, discrimination in the returns to job-specific training, and furthermore, due to non-market institutional settings.

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