The effects of markets, politics, and society on the gender wage differential:

A meta-analysis

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Abstract

Since the first use in the early seventies, hundreds of authors have adopted and extended the Blinder-Oaxaca approach decomposing gender wage differentials between women and men into a part caused by different productive characteristics and a “productivity-unexplained” part, the discrimination coefficient. Consequently this measure for discrimination, as well as plain sex dummies in wage regressions, have been published for the most diverse countries at different points in time. This meta-study provides a quantitative review of this vast amount of empirical literature on gender wage discrimination as it concerns differences in methodology, data, countries and time periods. Furthermore, it also evaluates the impact of economic and legal variables on discrimination coefficients. While economic theory predicts a higher amount of discrimination for less competitive markets, other disciplines emphasize the impact of equal treatment laws and affirmative action. This paper investigates whether economic or legal variables are responsible for differences in women's relative earnings.

Keywords: Gender wage differential, competition, meta-analysis

JEL-Code: J16, J31, J71

1 Introduction

The literature on the economics of discrimination started with Becker's seminal study in 1957. Since then – due to the proliferation of the use of microdata in the last three decades – the study of gender wage differentials became a routine job for labor economists: you could easily assume that almost any empirical labor economist has worked on the puzzle why equally productive workers could be paid differently. Becker offered several possible explanations around the idea of a "taste for discrimination". In the long run, he stated, competition should do away with discrimination. This is the case, because employers with discriminatory tastes are not profit- but utility-maximizing as they are willing to forgo some profit for being able to practice discrimination.

While many economists stressed the effect of competition on discrimination, non-governmental organizations and politicians have fought for equal treatment laws which became increasingly common over the last decades.

Although there have been studies on the effects of competition in selected industries (Ashenfelter and Hannan, 1986, and Black and Strahan, 2001) as well as on the impact of equal treatment laws in particular countries (see Leonard, 1989 for a U.S. survey), no broad international studies have been conducted to assess the impact of these effects.

The usual empirical methodology to measure discrimination – pioneered by Blinder (1973) and Oaxaca (1973) – calls for a wage comparison of equally productive males and females and thus requires the use of microdata to assess productivity of the individuals correctly. So a fruitful strategy would be to collect an internationally comparable microdata set, calculate gender wage differentials and explain these differentials by country-specific equal treatment laws and the degree of competition.

However, this vast – and from the data load overstressing – enterprise is superfluous to a large degree, because in the last decades hundreds of studies for specific countries have already been competently done – by economists much more proficient in the institutions and data peculiarities of their respective countries than any international researcher could possibly be. We make use of these studies by performing a meta-regression analysis on international gender wage gaps. By doing so, we use all the published information from these studies: for example, we assess the impact of different empirical methodologies these researchers have used or the kind of data they had access to. Furthermore, this rich data set is supplemented

with information on competition and equal treatment laws which allows us to investigate, how big the often proclaimed impact of these two factors really is.

2 Meta Analysis

Meta-analysis is a helpful tool to cumulate, review and evaluate empirical research. Papers investigating one particular topic are collected and analyzed concerning their data and method. Meta-analysis then allows to evaluate the effect of different data characteristics and methodologies on the result reported, e.g. a regression parameter (Stanley, 2001). Instead of the usual practice of analyzing individual observations, each previously conducted study represents one data point.

While meta-analysis is a standard procedure in disciplines such as medicine, education, and psychology, it has been discovered in economics only lately. However, within the last ten years a substantial body of research has developed also in economics. Jarrell and Stanley (1990) examined the union-nonunion wage gap, Doucouliagos (1995) the effect of worker participation on productivity and Doucouliagos (1997) the demand for labor in Australia. Phillips and Goss conducted a meta-analysis concerning the effect of tax policy on economic development, Stanley (1998) examined the Ricardian equivalence theorem, and Görg and Strobl (2001) investigated the impact of the presence of multinational companies on domestic productivity. Card and Krueger (1995) as well as Ashenfelter, Harmon and Oosterbeek (1999) focused particularly on the publication bias in their meta-studies on minimum-wages and returns to schooling, respectively. Stanley and Jarrell (1998) conducted a meta-analysis on the gender wage differential also, but restricted themselves to US data while the goal of our study is to investigate the gender wage gap on an international level.

One of the advantages of a meta-study over a narrative or a vote counting review is that it does not allow to simply omit certain parts of the literature on apparently "methodological grounds" (Stanley, 2001). Rather, the goal is to estimate, what impact these methodological issues really have on the outcome. That way a meta-study provides a quantifiable assessment of the whole body of empirical literature in one particular area.

2.1 Estimates for wage differentials

The most common way to analyze discrimination based on gender is to compare male and female earnings holding productivity constant. One method is to simply include a sex dummy in the wage regression model:

$$W_i = \beta \ X_i \ + \gamma \ sex_i + \varepsilon_i \,, \qquad (1.1)$$

where W_i represents the log wage and X_i the control characteristics (e.g. education, job experience, marital status, job characteristics) of an individual i, β and γ are parameters.

However, the standard procedure to investigate differences in wages is the one developed by Blinder (1973) and Oaxaca (1973) which allows that productive characteristics of men and women are rewarded differently. Wages are estimated separately for individuals i of the different groups g, males and females:

$$W_{gi} = \beta_g \ X_{gi} + \varepsilon_{gi} \,, \qquad (1.2)$$

where g = (m, f) represents the two sexes; W_{gi} is the log wage and X_{gi} the control characteristics of an individual i of group g.

The total wage differential between men and women can then be decomposed into an explained part due to differences in characteristics and an unexplained residual.

The difference in mean wages can be written as:

$$\overline{W_m} - \overline{W_f} = (\overline{X_m} - \overline{X_f})\hat{\beta}_m + (\hat{\beta}_m - \hat{\beta}_f)\overline{X_f} \ \equiv \ E + U \,, \qquad (1.3)$$

where W_g and X_g denote the mean log wages and control characteristics of group g and $\hat{\beta}_g$ represents the estimated parameter from equation (1.2). While the first term stands for the effect of different productive characteristics (the endowment effect E), the second term represents the unexplained residual U which is due to differences in the estimated coefficients for both groups and is often referred to as “discrimination effect”.[1] Since the first use in the early seventies, hundreds of authors have adopted and also extended the Blinder-Oaxaca approach.[2] For our meta-study we accepted all estimates for log wage differentials, dummies as well as the unexplained gender wage residual U and its derivatives. These estimates are taken as the dependent variable in our meta-analysis which we try to explain by data and method characteristics.

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[1] Often authors also report a "discrimination index" which is given by $D = e^U - 1$ and indicates how much higher the average female wage would be if women's endowments would be remunerated such as men's.

[2] For extensions of the B-O decomposition see e.g. Brown et al. (1980), Reimers (1983), Cotton (1988), and Neumark (1988).

3 Data

In November 2000 we searched the Economic Literature Index for any reference to: "(wage* or salar* or earning*) and (discrimination or differen*) and (sex or gender)".[3] This search strategy led us to 1541 references. In the next step, the titles and abstracts of the articles were evaluated to find whether a gender wage gap was estimated. Theoretical papers or those which were obviously covering a different topic were excluded. This left us with 457 articles. These papers were examined carefully whether they presented an empirical estimate of the gender wage differential or sufficient information to calculate it. Some papers were only descriptive, reporting just mean wage ratios without any regression analysis, others presented wage decompositions only concerning race, marital status, or work time status (full/part time). Yet another group calculated differences in wage differentials (between countries or different points in time) without providing explicit information also on the national, static wage differential. Eventually, the desired estimates could be gained from 238 articles.[4]

While Stanley and Jarrell (1998) excluded all data from other countries than the US, "because the history and severity of sex discrimination is known to vary greatly across cultures" (p. 954), our goal was exactly to evaluate these international differences. Consequently, estimates from all available countries were retained in our study. Furthermore, Stanley and Jarrell's data only covered papers published until 1995 (with original data for the time period 1959-1986), which also explains the low number of 41 studies covered in their meta-analysis.

Contrary to the previous meta-study, we included all available estimates from each study to make efficient use of all the existing information. For each paper all estimates as well as all the corresponding meta-independent variables, data characteristics and methodology, were collected and coded. (The meta-independent variables included in the analysis are listed in Table 1.) This procedure gives us one observation in our meta-dataset per reported estimate.

[3] At the beginning of our study we contacted friends in the discipline to give us access to recent estimates of the gender wage gap in their country. However, we quickly refrained from this strategy as we realized it may lead to a biased sample of papers.

4 Results of Meta-Analysis

Our meta-regression model takes the form:

$$R_j = \sum a_k \, Z_{kj} + b \, t_j + d \, c_j + \varepsilon_j \text{, (j = 1, 2, ... L) (k = 1, 2, ... M)} \qquad (1.4)$$

where R_j represents the unexplained log wage differential of study j, which can either be the Blinder-Oaxaca unexplained residual U_j from (1.3) or the coefficient of the gender dummy γ_j in (1.1), Z_{kj} are the k meta-independent variables, t_j and c_j are a set of time and country dummies, respectively; a_k, b and d are parameters to estimate.

The meta-regressions in Table 2 include meta-independent variables describing the data set, the econometric technique and the type of wage information used, the inclusion of certain control variables in the wage regressions and finally a dummy for the sex of the researcher. The base category is a random sample of the total population and the inclusion of all relevant human capital variables in the wage regressions. In addition, a set of country and time dummies is included.

4.1 Weighting the studies

As has been noted, in their meta-study on the gender wage differential for the U.S. Stanley and Jarrell (1998) selected one estimate per paper, in particular "the OLS estimate which the author seemed to promote as the best" (p. 955). This strategy is open to criticism because it is in the discretion of the researcher which of the available estimates to pick. Therefore, we decided to include all estimates the authors presented for a given sample. Including multiple estimates in the study is uncontroversial if they relate to different time periods or geographical or demographic units. However, there are two potential problems associated with allowing multiple estimates from one paper: First, obviously, estimates using the same data (same country and time period) are not independent from each other, leading to non-spherical error terms in the meta-regression. Second, there is the problem of biased sampling: if there are multiple estimates of one single study, each study is not given the same weight.

These problems are confronted with a particular weighting scheme applied in Col. (2) of Table 2. While Col. (1) presents the unweighted estimates, in Col. (2). all estimates of a study which examine the same country and time period (same data set) are weighted with the

[4] A full list of papers included in the meta-study is available from the authors upon request.

inverse of the number of estimates. Moreover, a clustering approach is used to correct for possibly downward-biased standard errors.

A further problem concerns the quality of the study. Meta-analysis is “democratic” in a way, that it treats all studies alike, which is not always fortunate, because the researcher might have some priors, how a good study should look like. Meta-studies typically tackle the question of "study quality" indirectly by including quality characteristics as a part of meta-independent variables – thus showing what their effect will be on the gender wage gap. For instance, a meta-study might estimate the effect of a more advanced econometric technique on a regression coefficient. Another approach, however, would be to weight well-done studies more heavily than others. We, therefore, experimented with different weighting schemes in Cols. (3) – (6), always in addition to the weighting that was already applied in Col. (2).[5]

At first, we used only studies published in journals and applied the citation-based journal rankings from Laband and Piette (1990) as weights. This scheme is agnostic about our own priors of study quality, but assumes, that the peer-review process does a good job in letting the very reliable studies be published in the best journals. A drawback of this approach is, that studies from exotic countries often find it much harder to get access to top-notch international journals. The next scheme, applied in Col. (4), uses only those papers reporting more than one estimate per study. One could argue, that if a researcher used different specifications and got the same results, her study should be judged as more reliable. Therefore we weight with a precision index of the estimates, i.e. with the inverse of the coefficient of variation among the estimates within one study. Of course, this weighting scheme treats the different estimates *within* a study alike, which might not be appropriate when the researcher wants to contrast different methodological approaches and single out the best one. Another quality indicator is the number of observations an estimate is based on. Consequently, we use sample size as a weighting scheme in Col (5). Finally, since the quality of a gender wage gap estimate should increase with the number of controls for individual productivity, Col. (6) uses the number of regressors in the wage equations as a final weighting scheme.

[5] A usual approach in meta-analysis is to take the precision of the estimate (in general the standard error) as a quality indicator. This cannot be done in our case, because the users of the Blinder-Oaxaca decomposition do not report the precision of this constructed indicator (See Silber and Weber [1999] for a bootstrap approach to construct standard errors for different decomposition procedures).

4.2 Meta-Results

Although all of the above-described weighting approaches are somewhat arbitrary and have some particular drawbacks, the general results are very similar. The biggest – and very consistent – impact on the gender wage gap results from the type of data set used. In comparison to a random sample of the population, the gender wage gap is much lower if only a sample of new-entries in the labor market is used. Likewise, the wage gap is lower in the public sector and if only a narrow occupation is studied, because in the latter case, holding productivity equal is much easier. Interestingly, the wage gap is higher in low-prestige occupations (blue-collar jobs) and also lower in high-prestige jobs (e.g. college graduates, academic jobs) as compared to medium-prestige, white-collar jobs. In accordance with Becker's household specialization model (1991), the wage gap is highest for married employees and significantly lower for singles. Among minority workers, the gender wage gap is somewhat smaller.

The impact of other variables is less consistent across specifications. In terms of econometric methods, studies using only a dummy variable approach instead of a Blinder-Oaxaca decomposition receive higher gender wage gaps. Instrumental variables approaches – which, in general, instrument for the endogeneity of work experience and/or training – result in slightly lower gaps, although this effect is not significant in some specifications. The use of panel data and sample selection techniques à la Heckman do not seem to matter. A further issue concerns the measurement unit of the wage variable. Contrary to prior expectations and also to Stanley and Jarrell (1998) we do not find a significant effect whether hourly wages or monthly incomes are observed in the original data. This is surprising, because considering that women work fewer hours and have more work interruptions, which are not observable in these data, one would expect that hourly wages lead to lower wage differentials than other measures.

Next we consider the specification of the wage regressions. What effect does the in- or exclusion of a particular variable has on the estimated wage gap? Studies on gender wage differentials can be biased for two reasons: i) some productive characteristics are observed by the firm, but not by the econometrician. This will in general lead to an upward bias in the resulting gender wage gap or discrimination component. ii) some of the control variables might themselves be caused by unequal treatment of the sexes – e.g. occupational choice and promotion. Inclusion of such variables might give rise to a downward bias, because possible discrimination in promotion or occupational choice is falsely regarded as a difference in

productive characteristics. In general, this reasoning could be valid for most of the usual control variables, e.g. job tenure or work experience. To use a consistent specification, we always include indicators for the absence of these variables in the respective papers.

The impact of these variables on the gender wage gap is much lower – and less consistent – than the effect of the selection of the sample: Missing experience, marital status or training in the wage regression has in some specifications a negative effect on the wage gap, whereas missing tenure, occupation and industry has a positive effect. All of these effects are less significant in some of the weighting schemes used. Missing union status has a consistently positive effect on the gender wage gap, because union jobs tend to be better-paid male dominated jobs. The same is true if the information about the share of females in the respective occupation is missing. This means, including information whether the individual works in a female-dominated occupation reduces the measured gender wage gap considerably. There are two possible reasons for this outcome. Either occupational choice is governed by preferences and wages correctly reflect productivity, or pre-market discrimination in schooling as well as discrimination in hiring leads to occupational crowding. If the second is true, including a variable on female-domination produces a downward bias of the measured discrimination.

Interestingly, the gender of the researcher has no big impact on the outcome of the study. Only in the journal-rank-weighted specification, the wage gap is lower, if the researcher was female. One could interpret this finding that women have to be relatively more prudent if they want to get access to top economic journals.

What is the pattern of the gender wage gap over time and across countries? As we have included time and country dummies in the analysis, we can simply plot these. In Figure 1 we show the trend of three inequality indicators: the reported total wage gap (i.e. the raw differential in hourly wages from the original data set), the reported wage residual (i.e. the Blinder-Oaxaca wage gap from the examined papers[6]) and, finally, a meta wage gap. Considering our regressions from Table 2 we suggest a wage differential that will arise from a rather conservative design: this study would use only single individuals from an otherwise representative population, it should include all control variables and use sample selection procedures and an instrumental variables approach to control for endogeneity of human capital variables[7]. As we are here only interested in an interpretation of the time (and country)

[6] This also includes the impact of the gender dummy for studies not applying a Blinder/Oaxaca decomposition.
[7] Of course, our comparison to a "conservative design" is only one possible choice. Given the linear OLS regression we use, other choices would simply shift the line in Figure 1 up or down, but would leave the slope unchanged.

effects, we use a weighting scheme, which weighs by the number of observations in the meta–regression per year and country.

The reported total log wage differential falls significantly over time, with a rate of -0.8 log points per year. That means the total wage differential is almost halved across our time period 1963-1997. This decline of the gender gap is almost entirely due to an equalization of productive characteristics: females have become better educated and trained. The reported wage residual shows even a slight upward trend over time with a rate of 0.02 log points per year. Our constructed meta wage residual falls with a rate of -0.08 log points per year, which is only a slight improvement over time. Note that Stanley and Jarrell (1998, p. 966) for the US calculate a drop in their meta wage residual of more than 1 log point per year and predict that the differential will totally disappear in the year 2001, which seems a bit overoptimistic given recent U.S. estimates, but also our international trend.

Figures 2 and 3 present similar information for the countries in our study. Figure 2 shows the reported total wage gap and reported wage residual of the examined studies. In countries plotted above the 45° line, studies identified women as obtaining less human capital than men and assigned some of the total wage gap to differences in endowments. In countries plotted underneath the 45° line, the higher qualification of women relative to men should in fact lead to their higher wages, however, they suffer a wage penalty in the labor market. Figure 3 plots the gender wage residual reported in the examined study against the meta wage residual, calculated on the basis of the most conservative methodology. Here the differences are small, which means that researchers in different countries do not differ very much in the type of data and the research design they use.

5 Why are there international differences in the gender wage gap?

The advantage of an international investigation of the gender wage gap is that countries vary in a number of characteristics: e.g. competition, wage-setting institutions or equal treatment legislation. To our knowledge Blau and Kahn (1992, 1996, 2001) are the only authors who previously investigated the gender wage differential on a broad international level. Their particular interest is to analyze how general wage inequality and wage-setting institutions affect the observed gender wage gap in a country. To examine this issue they use microdata from the International Social Survey Programm (ISSP) and decompose international differences in the gender wage gap into a part due to gender specific factors and a part due to

differences in the pay structure. They show that the general wage inequality in a country has a quantitatively big effect on the gender wage gap, since women are typically on the lower end of the wage distribution. Moreover, collective bargaining reduces the wage differential. While internationally comparable, the ISSP data is not very rich. It includes information on schooling, age and average hours worked, but for example it does not provide data on actual experience. Furthermore, the number of countries covered by the ISSP is significantly smaller than the one in our meta-analysis data.

In our study we focus on two other factors which might affect the gender wage gap: competition and equal treatment legislation. Since Becker (1957) economists have repeatedly argued that competition rules out discrimination. Others, less optimistic about free markets, suggested equal treatment laws to combat discrimination. This study tries to evaluate the effect of these two factors.

5.1 Competition and discrimination

In his seminal work (1957) Becker argued that employers can have a "taste for discrimination".[8] To indulge their tastes, these utility maximizing entrepreneurs pay women lower wages and hire fewer than would be profitable. Since non-discriminatory firms make higher profits they should compete discriminators out of the market in the long run. If there is market power, however, owners of firms with a large market share earn higher profits than their competitive counterparts which allows them to continue "consuming" discrimination. When managers and owners are not the same person, monitoring of managers by capital owners will increase with competition and give managers less opportunity to forgo profits for discrimination. If market power is high, however, discriminating managers are more likely to go unnoticed.

A number of studies have investigated the effect of market competition on discrimination. Ashenfelter and Hannan (1986) analyzed the effect of market concentration in the banking industry. The advantage of this sector is the geographically limited nature of competition which allows for variability in the degree of concentration within one industry. They found a negative and significant impact of market concentration on the share of female employees in one firm.[9] Black and Strahan (2001) recently investigated the banking sector

[8] Becker also analyses coworker and customer discrimination.
[9] The authors also give an overview over earlier studies on the effect of competition on discrimination.

further and tested the effect of deregulation in this industry. Their results show that deregulation caused male wages to fall much stronger than female wages which indicates that in the previously protected market rents were mainly shared with men. Another study by Black and Brainerd (1999) looks at the effect of increased competition on women's relative wages where they compare the effect of trade in concentrated and unconcentrated sectors. They demonstrate that an increase in product competition due to international trade benefits reduces the gender wage gap. Hellerstein et al. (1997) examine profitability and sex composition of a firm's workforce and find that firms with high market power, which have a large share of female employees, obtain higher profits. However, no evidence is found that discriminatory firms are punished through lower growth or changing ownership to a non-discriminator as predicted by Becker.

To our knowledge no international investigation of the effect of competition on the gender wage differential has been conducted so far.

5.2 Equal treatment law

Obviously, an international comparison of regulations protecting women from discrimination is difficult because of fundamental differences in national institutions and legislation. However, the existence of international conventions, such as the CEDAW and the ILO conventions, allows such a comparison nevertheless.

The Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) has been adopted by the UN General Assembly in 1979 and progresses earlier human rights conventions by addressing the specific nature of discrimination against women and aiming at "all forms" of disadvantages women suffer. With ratification, states commit themselves to undertake a number of measures to end discrimination, e.g. to adopt the principle of equality of men and women in their legal system and to establish institutions to guarantee the protection of women against discrimination by persons, organizations or enterprises. Furthermore, state parties regularly have to report to a committee which monitors states' compliance with the convention and asserts which measures to combat discrimination a state still has to take.[10]

[10] Despite the achievements of CEDAW (for an overview see Schöpp-Schilling, 1998), the convention has some obvious limitations to its efficiency. For example, it can be ratified with a large number of reservations, which in part are substantial, and there are no sanctions. With the optional protocol, the previous handicap that no individual complaints to the committee were allowed, was eliminated in the year 2000.

Setting international labor standards is one of the International Labour Organization's key functions. From 1919 until today, the ILO adopted 184 conventions to provide humane conditions of labor internationally. The core conventions cover issues such as the freedom of association, child and forced labor, as well as discrimination. States which have ratified have to report regularly on the measures they took to implement the ILO Convention.

The Equal Remuneration Convention (C 100) was adopted in 1951 and aims at establishing equal remuneration for men and women for work of equal value. The Discrimination Convention (C 111), adopted in 1958, prohibits "discrimination on grounds of race, color, sex, religion, political opinion, national extraction or social origin in regard to access to vocational training, access to employment and to particular occupations and terms and conditions of employment." (Gunderson, 1994, p. 58)

Often international conventions, like the CEDAW and the ones adopted by the ILO, are characterized as having no substantial meaning ("no teeth") since the organizations setting these standards have no means to actually enforce them. Chau and Kanbur (2001), however, demonstrate that the ratification of an ILO convention is not random. The authors conclude that costs of ratification actually do exist, and that ratification leads to higher domestic standards.[11]

5.3 Measures for competition and equal treatment law

5.3.1 Competition

Typically in industry studies, four-firm concentration ratios or Herfindahls are used as indicators for competition in an industry. For an economy at large, such measures are not available. Therefore, we use an indicator for protection from foreign competition: tariff rates (trade taxes as a percentage of revenues) from Frankel and Rose (2001). This indicator has the disadvantage that its importance and relevance varies by country size and, especially, by trade openness of the country. Moreover, the amount of intra-country competition is totally ignored. Another, more encompassing indicator is the Index of Economic Freedom assembled from the Fraser Institute, Vancouver (Gwartney, et. al, various years). This index has the explicit aim

to measure economic freedom, which is characterised by a lack of regulation, no government intervention in markets and, generally, a high degree of competition. The index comprises seven sub-components: size of government, structure of the economy and the use of markets, price stability, freedom to use alternative currencies, property rights, freedom in international exchange and freedom in financial markets. This index also includes the mean tariff rates as a part of the international exchange section. The index has been used in many studies to explain development and growth[12]. The index is available for 1970 up to 1999 for every five years; we use interpolated values to match our data to the index..

5.3.2 Equal treatment law

Data for the ratification of CEDAW were obtained from Wistat, Women's Indicators and Statistics Database, Version 4, by the United Nations. Since some reservations substantially devalue a ratification, these were taken into account in the corresponding variable. While article 2 is fundamental to the convention, reservations to other articles are less crucial.[13] Data on ratification of ILO conventions were taken from the ILOLEX web-page.[14] Besides ILO C100 and C111 which explicitly aim at combating discrimination, ratification of two additional conventions was included in our study. As Chang (2000) notes, some ILO legislation also aims at "protecting women generally because of their sex, based on attitudes toward their capabilities and appropriate role in society." In particular, these are convention 45, which prohibits women's underground work, and convention 89, which prohibits women's night work. Contrary to ILO C100 and C111 which combat discrimination, these regulation in fact restrict women's occupational choices and represent a work ban against women in certain jobs. Consequently, it is expected that these regulations, contrary to the others, *increase* the observed gender wage differential. Our variable "work ban" counts how many of the two conventions a state signed at a certain point in time.

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[11] The ILO labor standards have become prominent in discussions on international trade and trade policies of the World Trade Organization (see Brown, 2001, for a survey). Singh (2001) gives a survey over the vast theoretical literature in the field.

[12] Academic publications using the Economic Freedom index are listed under the following URL: http://www.freetheworld.com/papers.html

[13] CEDAW not ratified: 0
CEDAW ratified, reservation art. 2: 1
CEDAW ratified, reservation art. 4, 5, 7, 9, 11, 13, 15, 16: 2
CEDAW ratified, reservation art. 29(1): 3
CEDAW ratified without reservation: 4

[14] http://webfusion.ilo.org/public/db/standards/normes/

6 Results for effects of competition and law

To examine whether competition and equal treatment laws can explain international gender wage gaps, we extend the meta-regression of equation (1.4) in the next step. The same control variables as in eq. (1.4) are used to make the unexplained gender wage gap comparable across countries and over time. In addition, variables for competition, equal treatment laws and other country-specific socio-economic factors are included now. As ratification of the ILO conventions C100 and C111 highly correlate (0.75) with each other, we present results based on C111 only in Table 3 and results based on an "ILO composite index" which adds up the ratification of CEDAW, ILO C100 and C111 (divided by three) in Table 4.

As can be seen from Table 3, we find that countries having signed the CEDAW convention or the ILO convention C111 prohibiting gender discrimination have significantly lower gender wage residuals. The effects are relatively high: signing CEDAW reduces the residual by 3-7 log points, the ILO C111 causes a decrease by 8-14 log points. Labor standards, on the other hand, that try to protect women by prohibiting women's night and underground work have a counterproductive effect. As these work bans reduce access to jobs for females, they lead to occupational crowding and lower wages: the wage differential rises between 4 and 7 log points if the country signed a "protective" ILO convention.

Col. (1) in Table 3 uses tariff rates as a measure for competition, for which no impact on the gender wage gap was found. This could be due to the fact, that their theoretical impact could be very different depending on country size and openness. As tariff rates are also part of the Economic Freedom Index, we proceed only with the Economic Freedom Index from Col. (2) on. A higher rate of economic freedom reduces the gender wage gap significantly, although the effect is somewhat smaller than the impact of the equal treatment laws.

Table 4 presents the results for an "ILO composite index". We see that this composite index always has a significantly negative sign, leaving the other variables practically unchanged.

In Cols (3) – (5) in Table 3 and Table 4 we incrementally include other variables, dummies for continents[15], socio-economic indicators like fertility rate, GDP, female activity rates and geographical position of the country as well as indicators for religious composition

[15] A full fixed-effects model was not possible because many countries appear only once in the data set.

of the population[16]. The inclusion of these variables does not change the conclusions qualitatively with the exception of the impact of the Economic Freedom Index, which gets bigger. Among the new variables, fertility rates have a negative effect on the gender wage gap. Countries with a high proportion of Protestants have the lowest wage gaps; those with high proportions of Muslims, Hindus and Jews have the highest gender wage gaps.

7 Instrumenting for signing international conventions

A causal interpretation of the impact of signing an equal treatment law is not possible at this stage because ratification may simply measure the pre-disposition of a country towards gender equality. Moreover, a country may sign such a law, if the gender wage gap is low anyway; in such a case the “costs” of signing – in terms of having to change policies involuntarily – would be low. Another twist of this argument would be, that the signing of an international law is domestically not binding and therefore inconsequential. Our measured (negative) coefficients would then reflect something else. Chau and Kanbur (2001) strongly argue that this is not the case: the signing of such laws is not costless. Samson and Schindler (1999) also make the case that states, today, do not ratify conventions for "window-dressing" purposes because they "are aware that they will be held to account through the supervisory system." (p. 214) In order to address this issue of causality, we need to find instruments that can predict the signing of such laws, but which are totally unrelated to the countries’ gender wage gaps.

Two instrumental strategies will be ventured. Chau and Kanbur (2001) explain the signing of International Labor Standards by – amongst others – peer group effects: “if our peers do sign this international law, we will also sign.” We implement this idea by using for each country the ratification standard of its geographic neighbors for CEDAW, ILO C100 and C111. Insofar as the immediate neighbors can proxy peer groups, an impact on the ratification of the international laws should be given. On the other hand, an equal treatment law in the neighboring country is highly unlikely to influence the gender wage gap in the original country.

[16] These data are only cross-sectional data relating to the late eighties and were taken from Xavier Sala-i-Martin (1997).

The second instrumental strategy uses a state's willingness to bind itself by international treaties: if a state is generally willing to sign international agreements, it may also be more inclined to sign the ILO conventions on equal treatment. As indicators for the willingness to bind oneself internationally, we used the ratification of the other ILO core conventions on forced labor, freedom of association, the right to organize and minimum working age (C29, C87, C98, C105 and C138)[17]. As these conventions have nothing to do with equal treatment of men and women, they should exert no separate influence in the wage gap equations.

Results of the instrumented regressions are reported in Table 5. As the correlation between the equal treatment laws is considerable, we instrument for only one of them at a time. The IV regressions shown use the most complete specifications from Table 3 and Table 4, i.e. Cols. (5) including all control variables. The IV procedure does not change the main message: signing an international convention reduces the gender wage residual considerably: the coefficients for the ILO C111 remain practically unchanged, those for the composite ILO index are well below the OLS estimates, but still highly significant. The other variables do not change. Statistics like a marginal R^2 and an F-test for the inclusion of the instruments in the first stage regression are very big, showing a big influence of the instruments on the endogenous regressors.

8 Conclusions

In this paper we tried to cover two issues, on the one hand we provided a meta-analysis of the existing literature on the gender wage gap, on the other hand we used the gained data to examine the impact of competition and equal treatment law on the gender wage differential.

Our meta-regression showed a strong impact of data set restrictions on the estimated wage gap: male and female workers who just entered the labor market earn more equal wages, the same is true for employees in the public sector. The wage differential is largest in low prestige occupations and decreases with the status of a job. Similarly, the gap for married individuals is larger than for singles. Minority men and women earn more similar wages than the majority group of a country. Variables pertaining to methodology, wage measurement and the inclusion of theoretically important variables did not show such a universal effect on the estimated gender wage residual. Concerning the methodology, only the use of a dummy

[17] These, together with the two equal treatment conventions and the convention on child labor (C182 in 1999), are considered the eight core ILO conventions.

variable, instead of a Blinder/Oaxaca decomposition, increased the estimated wage gap. If a study did not control for tenure, union status, or share of females in the occupation this systematically increased the gender wage differential.

Obviously, a data-set as rich as the one resulting from the meta-analysis is hardly obtainable through other means. Micro data for a similarly large number of countries simply do not exist, and the micro data that are available do not provide as extensive information as our meta-data-set which consists of all conducted studies on the national level with the best data locally obtainable. We used this vast information to examine the reasons for gender wage differential on an international level. Do market forces and equal treatment laws successfully combat discrimination? The answer to both questions is yes: Countries with a higher economic freedom have a lower gender wage gap than others, but also the ratification of international conventions supporting equal treatment of men and women has a strong and significant impact on the gender wage differential. We, therefore, conclude that ratification of international law prohibiting discrimination is a positive and desirable measure to work towards a world with more equality between the sexes.

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10 Data-Appendix

Voting rights, fertility rates, economic activity rates, parliamentary seats, CEDAW ratification from Wistat, Women's Indicators and Statistics Database, Version 4, United Nations.

CEDAW: Convention on the Elimination of All Forms of Discrimination against Women

Coding:

CEDAW not ratified: 0
CEDAW ratified, reservation art. 2: 1
CEDAW ratified, reservation art. 4, 5, 7, 9, 11, 13, 15, 16: 2
CEDAW ratified, reservation art. 29(1): 3
CEDAW ratified without reservation: 4

Data on ratification of ILO convention from the ILO web-site:

http://webfusion.ilo.org/public/db/standards/normes/

ILO C100 (Equal Remuneration Convention, Date of signing: 1951),

ILO C111 (Discrimination (Employment and Occupation) Convention, 1958),

ILO C45 (Underground Work (Women) Convention, 1935),

ILO C89 (Night Work (Women) Convention, 1948),

ILO C29 (Forced Labor Convention, 1930),

ILO C87 (Freedom of Association and Protection of the Right to Organize Convention, 1948),

ILO C98 (Right to Organze and Collective Bargaining Convention, 1949),

ILO C105 (Abolition of Forced Labor Convention, 1957),

ILO C138 (Minimum Age Convention, 1973).

Journal Ranking from Laband and Piette (1994), Rankings based on impact adjusted citations per character, 1990 citations to articles published 1985-1989.

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Tariffs from Frankel and Rose (2001).

Religion from Sala-I-Martin (1997).

11 Tables

Table 1: Meta-independent variables

A. Paper

Author_female	= percentage of authors who are female
Count	= country
Year	= year in which wages were earned
Main topic	= 1 … if gender inequality was main topic of the paper

B. Data Sets

New entries	= 1 ... study investigated the wages of new entrants only
Public sector	= 1 ... study investigated the wages of workers in the public sector only
Narrow occup.	= 1 ... study investigated the wages of workers of a narrowly defined occupation only
Low prestige occup.	= 1 ... if a study investigated only low prestige occupations (e.g. blue collar)
Med. prestige occup.	= 1 ... if a study investigated only medium prestige occupations (e.g. white collar)
High prestige occup.	= 1 ... if a study investigated only high prestige occupations (e.g. college graduates, academics)
Single_only	= 1 ... if a study investigated only singles
Married_only	= 1 ... if a study investigated only married people
Minority_only	= 1 ... if a study investigated only minority or immigrant population
Majority_only	= 1 …if a study investigated only majority population
Source	= 0 ... if data come from administrative statistics
	= 1 ... if data come from survey data
Partt_only	= 1 ... if a study included only part-time workers
Fullt_only	= 1 ... if a study included only full-time workers

C. Method of estimation

Dummy variable	= 1 ... if a study used a dummy to investigate the gender wage gap and no Blinder/Oaxaca decomposition
IV	= 1 ... if a study used instrumental variables
Panel data	= 1 ... if a study used panel data
Heckman	= 1 ... if a study corrected for selectivity á la Heckman
Blinder-Oaxaca with male coefficients	= 1 ... if male coeffients were used for the decomposition instead of female ones
Neumark	= 1 … if Neumark decomposition was used
Cotton	= 1 … if Cotton decomposition was used
Brown	= 1 … if Brown et al decomposition was used

D. Alternative Measures of Wages

No hourly wages	= 1 ... if a study used daily, monthly or annual earnings
Hourly constructed	= 1 ... if a study used hourly wages computed from daily, weekly, monthly or annual salary
Gross	= 0 … if a study used net wages
	= 1 … if a study used gross wages

E. Variables for worker's characteristics

Potential exper.	= 1 ... if a study used potential experience
Experience	= 1 ... study omitted worker's job experience
Race or immigr.	= 1 ... study failed to account for race or immigrant status
Age	= 1 ... study omitted worker's age
Marital status	= 1 ... study omitted worker's marital status
Kids	= 1 ... study omitted whether or not worker has children
Marital/kids inter.	= 1 ... study omitted interaction children * marital status
Training	= 1 ... study omitted on the job training
Tenure	= 1 ... study omitted tenure
Occupation	= 1 ... study omitted worker's occupation
Industry	= 1 ... study omitted worker's industry of employment
Government work	= 1 ... study omitted a government/private employment distinction
Union status	= 1 ... study omitted worker's union/nonunion status
Share of females in occ.	= 1 ... study omitted the percentage of women in the worker's job
FT-PT	= 1 ... study omitted worker's full time/part time status
Urban	= 1 ... omitted SMSA, city size
Reg	= 1 ... study omitted worker's geographical area of employment
Working time	= 1 … study omitted worker’s working time

Table 2: Meta-Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
Weighting scheme	**no**	**# of rows in study**	**(2) + journal rank**	**(2) + precision of estimates**	**(2) + # of observ**	**(2) + # of regressors**
Author_female	-0.006	-0.004	-0.056	-0.013	-0.009	0.012
	(0.014)	(0.015)	(0.019)**	(0.018)	(0.019)	(0.013)
Selective data set						
New entries	-0.101	-0.085	-0.176	-0.067	-0.104	-0.089
	(0.023)**	(0.024)**	(0.032)**	(0.031)*	(0.026)**	(0.021)**
Public sector	-0.044	-0.062	-0.078	-0.060	-0.072	-0.050
	(0.022)*	(0.022)**	(0.034)*	(0.029)*	(0.025)**	(0.019)*
Narrow occup.	-0.046	-0.040	-0.019	-0.032	-0.071	-0.046
	(0.019)*	(0.019)*	(0.034)	(0.026)	(0.023)**	(0.020)*
Low prestige occ.	0.045	0.049	0.155	-0.009	0.088	0.083
	(0.020)*	(0.020)*	(0.017)**	(0.044)	(0.022)**	(0.017)**
Med. prestige occ.	-0.044	-0.044	-0.051	-0.062	-0.054	-0.045
	(0.017)*	(0.016)**	(0.016)**	(0.037)	(0.020)**	(0.014)**
High prestige occ.	-0.135	-0.126	-0.125	-0.119	-0.159	-0.126
	(0.018)**	(0.016)**	(0.011)**	(0.033)**	(0.013)**	(0.012)**
Single_only	-0.102	-0.097	-0.112	-0.028	-0.027	-0.096
	(0.028)**	(0.023)**	(0.043)*	(0.035)	(0.036)	(0.022)**
Married_only	0.126	0.120	0.158	0.231	0.266	0.096
	(0.044)**	(0.044)**	(0.079)*	(0.100)*	(0.046)**	(0.046)*
Minority_only	-0.053	-0.082	0.021	0.012	-0.070	-0.055
	(0.020)**	(0.021)**	(0.043)	(0.028)	(0.007)**	(0.022)*

Methods of estimation						
Dummy variable	0.034	0.031	0.050	0.062	0.053	0.018
	(0.014)*	(0.016)	(0.021)*	(0.020)**	(0.024)*	(0.014)
IV	-0.037	-0.049	-0.020	-0.060	-0.114	-0.046
	(0.023)	(0.027)	(0.035)	(0.027)*	(0.037)**	(0.032)
Panel data	0.011	0.044	0.067	0.023	-0.091	0.024
	(0.026)	(0.025)	(0.037)	(0.072)	(0.037)*	(0.022)
Heckman corr.	0.005	0.020	-0.008	0.016	-0.033	0.012
	(0.009)	(0.012)	(0.013)	(0.009)	(0.018)	(0.011)
Measures of wages						
No hourly wages	0.017	0.012	-0.012	0.017	0.031	0.017
	(0.016)	(0.019)	(0.022)	(0.018)	(0.016)	(0.016)
Hourly constructed	0.002	-0.006	-0.050	0.026	0.001	0.004
	(0.016)	(0.018)	(0.023)*	(0.018)	(0.021)	(0.015)
Variables workers' char.						
Potential exper.	0.005	0.022	0.060	0.002	0.011	0.015
	(0.013)	(0.014)	(0.022)**	(0.019)	(0.018)	(0.013)
Variables missing						
Experience	-0.011	-0.033	-0.055	-0.069	-0.081	-0.042
	(0.026)	(0.027)	(0.033)	(0.032)*	(0.040)*	(0.020)*
Race or immigr.	-0.010	-0.009	0.022	-0.017	0.018	-0.014
	(0.015)	(0.016)	(0.021)	(0.021)	(0.017)	(0.013)
Marital status	-0.018	-0.023	-0.044	-0.002	-0.017	-0.035
	(0.013)	(0.014)	(0.025)	(0.020)	(0.024)	(0.013)**
Kids	0.009	0.015	0.001	-0.060	0.008	0.020
	(0.014)	(0.015)	(0.020)	(0.020)**	(0.018)	(0.014)
Marital/kids inter.	-0.069	-0.023	-0.025	0.020	-0.082	-0.042

	(0.038)	(0.042)	(0.052)	(0.049)	(0.042)*	(0.035)
Training	-0.046	-0.062	-0.023	-0.003	-0.029	-0.030
	(0.027)	(0.031)*	(0.009)*	(0.026)	(0.013)*	(0.018)
Tenure	0.038	0.038	0.034	0.019	0.028	0.023
	(0.011)**	(0.013)**	(0.018)	(0.015)	(0.015)	(0.011)*
Occupation	0.004	0.005	0.004	0.017	0.029	0.004
	(0.010)	(0.011)	(0.020)	(0.013)	(0.011)*	(0.010)
Industry	0.019	0.026	0.025	0.015	0.019	0.018
	(0.014)	(0.014)	(0.023)	(0.018)	(0.013)	(0.013)
Government work	0.010	0.003	0.042	-0.024	0.010	0.007
	(0.017)	(0.017)	(0.025)	(0.019)	(0.024)	(0.015)
Union status	0.032	0.032	0.068	0.069	0.047	0.023
	(0.014)*	(0.015)*	(0.025)**	(0.019)**	(0.018)**	(0.014)
Share of females in occupation	0.074	0.075	0.080	0.048	0.070	0.074
	(0.012)**	(0.014)**	(0.010)**	(0.013)**	(0.008)**	(0.011)**
Constant	0.251	0.271	0.028	-0.014	0.194	0.272
	(0.080)**	(0.092)**	(0.126)	(0.111)	(0.111)	(0.084)**
Observations	1404	1404	1210	990	1137	1404
Adjusted R-squared	0.54	0.55	0.80	0.79	0.84	0.56

Robust standard errors in parentheses.
* significant at 5%; ** significant at 1%.
Other variables in the regressions include: indicators whether the sample was official data or survey data, whether gender wage differentials were the main topic of the paper, dummies for only-part-time, only-full-time workers or only from a majority population in the sample; dummies for different forms of the discrimination component: Blinder-Oaxaca with male characteristics or from the Neumark, Cotton or Brown type; dummies for gross wages; and dummies for working time, regional, urban status missing.

Table 3: Impact of competition and law on gender wage gaps

	(1)	(2)	(3)	(4)	(5)
	Base	**Base**	**(2) + continents**	**(3) + other vars.**	**(4) + religion**
CEDAW signed (0-1)	-0.053	-0.072	-0.053	-0.037	-0.028
	(0.020)*	(0.026)**	(0.023)*	(0.032)	(0.033)
ILO C111 signed (0,1)	-0.080	-0.077	-0.102	-0.108	-0.137
	(0.025)**	(0.027)**	(0.016)**	(0.022)**	(0.019)**
Work ban signed (0,2)	0.070	0.057	0.063	0.055	0.042
	(0.017)**	(0.018)**	(0.012)**	(0.011)**	(0.013)**
Tariff rate	0.000				
	(0.001)				
Ec. Freedom index (0-10)		-0.014	-0.023	-0.046	-0.040
		(0.006)*	(0.010)*	(0.006)**	(0.006)**
Fertiliy rate				-0.006	-0.039
				(0.022)	(0.014)*
Activity rate females				-0.002	0.003
				(0.001)	(0.002)
GDP per head (in 1000$)				0.006	0.007
				(0.003)*	(0.005)
Latitude above equator				0.000	0.001
				(0.001)	(0.001)
Remoteness: Average distance to ROW				-0.012	0.033
				(0.030)	(0.041)
% Catholic					0.125
					(0.067)
% Hindu					0.337
					(0.139)*
% Muslim					0.520
					(0.141)**
% Jew					0.263
					(0.050)**
% Confucius					0.070
					(0.103)
% Buddhist					0.093
					(0.074)
Time trend	Yes	Yes	Yes	Yes	Yes
Observations	1184	1347	1347	970	947
Adj R^2	0.49	0.45	0.50	0.59	0.65

Robust standard errors in parentheses.
* significant at 5%; ** significant at 1%.
The regressions include also all the control variables from Table 2 except the time and country dummies.
Weighted regression with the inverse of the number of rows per year and country.

Table 4: Impact of competition and law on gender wage gaps

	(1)	(2)	(3)	(4)	(5)
	Base	**Base**	**(2) + continents**	**(3) + other vars.**	**(4) + religion**
ILO composite index signed (0-1)	-0.141	-0.144	-0.155	-0.154	-0.198
	(0.038)**	(0.036)**	(0.026)**	(0.025)**	(0.030)**
Work ban signed (0,2)	0.073	0.058	0.060	0.057	0.038
	(0.018)**	(0.018)**	(0.012)**	(0.013)**	(0.014)*
Tariff rate	-0.001				
	(0.001)				
Ec. Freedom index (0-10)		-0.013	-0.019	-0.043	-0.039
		(0.006)*	(0.010)	(0.007)**	(0.011)**
Fertiliy rate				-0.011	-0.047
				(0.020)	(0.014)**
Activity rate females				-0.002	0.004
				(0.001)	(0.002)*
GDP per head (in 1000$)				0.005	0.006
				(0.003)	(0.006)
Latitude above equator				0.000	0.002
				(0.001)	(0.001)
Remoteness: Average distance to ROW				-0.007	0.061
				(0.036)	(0.057)
% Catholic					0.169
					(0.068)*
% Hindu					0.313
					(0.138)*
% Muslim					0.473
					(0.152)**
% Jew					0.304
					(0.054)**
% Confucius					-0.088
					(0.109)
% Buddhist					0.019
					(0.090)
Time trend	Yes	Yes	Yes	Yes	Yes
Observations	1184	1347	1347	970	947
Adjusted R-squared	0.48	0.44	0.49	0.57	0.63

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%
The regressions include also all the control variables from Table 2 except the time and country dummies.
Weighted regression with the inverse of the number of rows per year and country.

Table 5: Instrumental variables estimates

Instruments	(1) neighboring countries	(2) neighboring countries	(3) other ILO conventions	(4) other ILO conventions
ILO C111 signed (0,1)	-0.110		-0.127	
	(0.031)**		(0.019)**	
ILO composite index signed (0-1)		-0.047		-0.069
		(0.016)**		(0.010)**
Work ban signed (0,2)	0.036	0.032	0.039	0.039
	(0.013)*	(0.012)*	(0.012)**	(0.012)**
Ec. freedom index (0-10)	-0.032	-0.032	-0.035	-0.040
	(0.009)**	(0.014)*	(0.008)**	(0.013)**
Marginal R^2 for inclusion of instruments in 1st stage	0.093	0.087	0.261	0.181
F-test for inclusion of instruments in 1st stage	106.6	142.1	465.2	346.1
Observations	947	947	947	947
R^2	0.67	0.66	0.68	0.66

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%
The regressions include also all the control variables from Table 3. Weighted regression with the inverse of the number of rows per year and country as weights. Degrees of freedom for F-test: 3 in rows (1) and (2), 5 in rows (3) and (4).

12 Figures

Figure 1: Reported wage gap, reported wage residual and meta wage residual over time

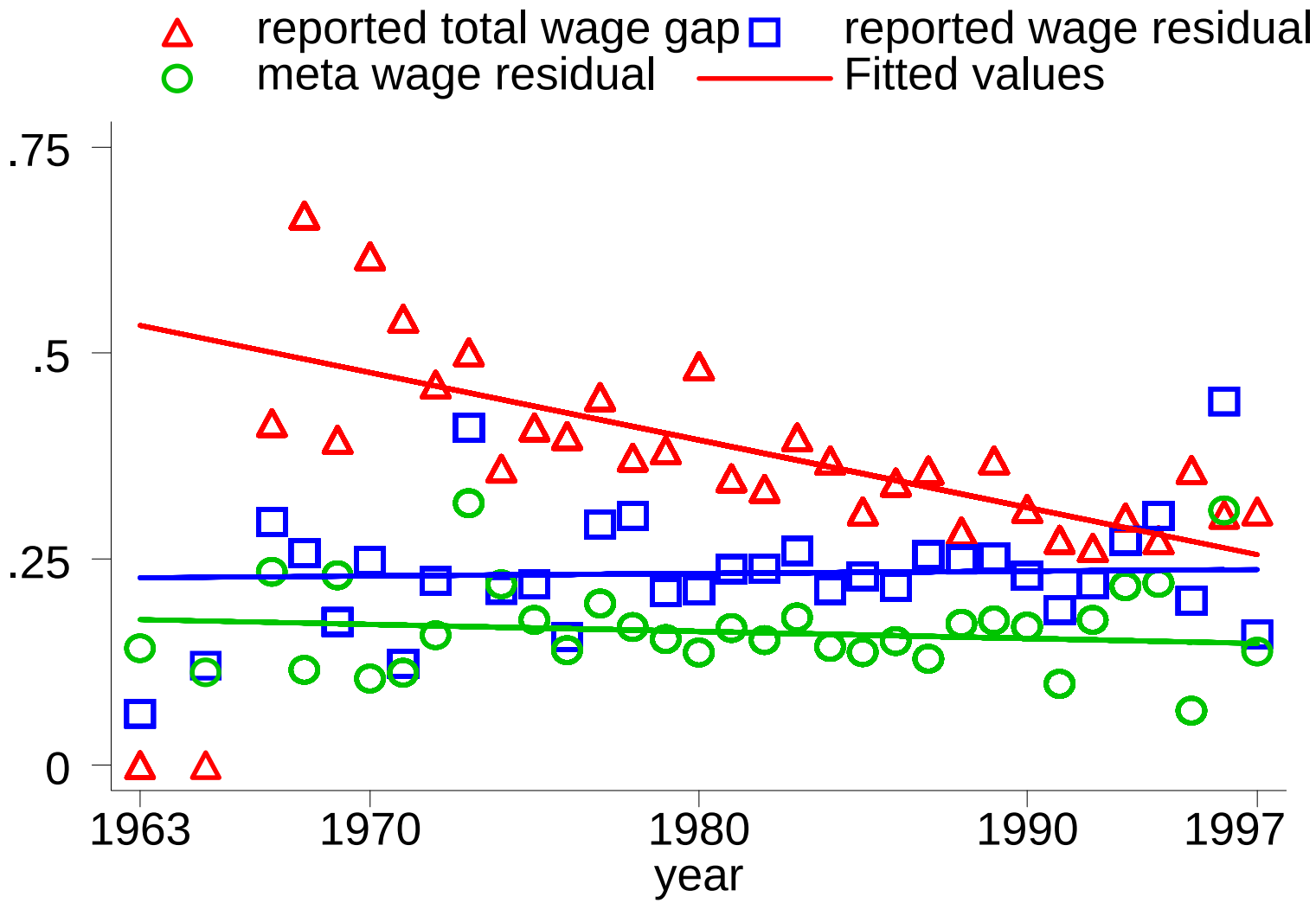

Figure 2: Reported wage gap and reported wage residual across countries

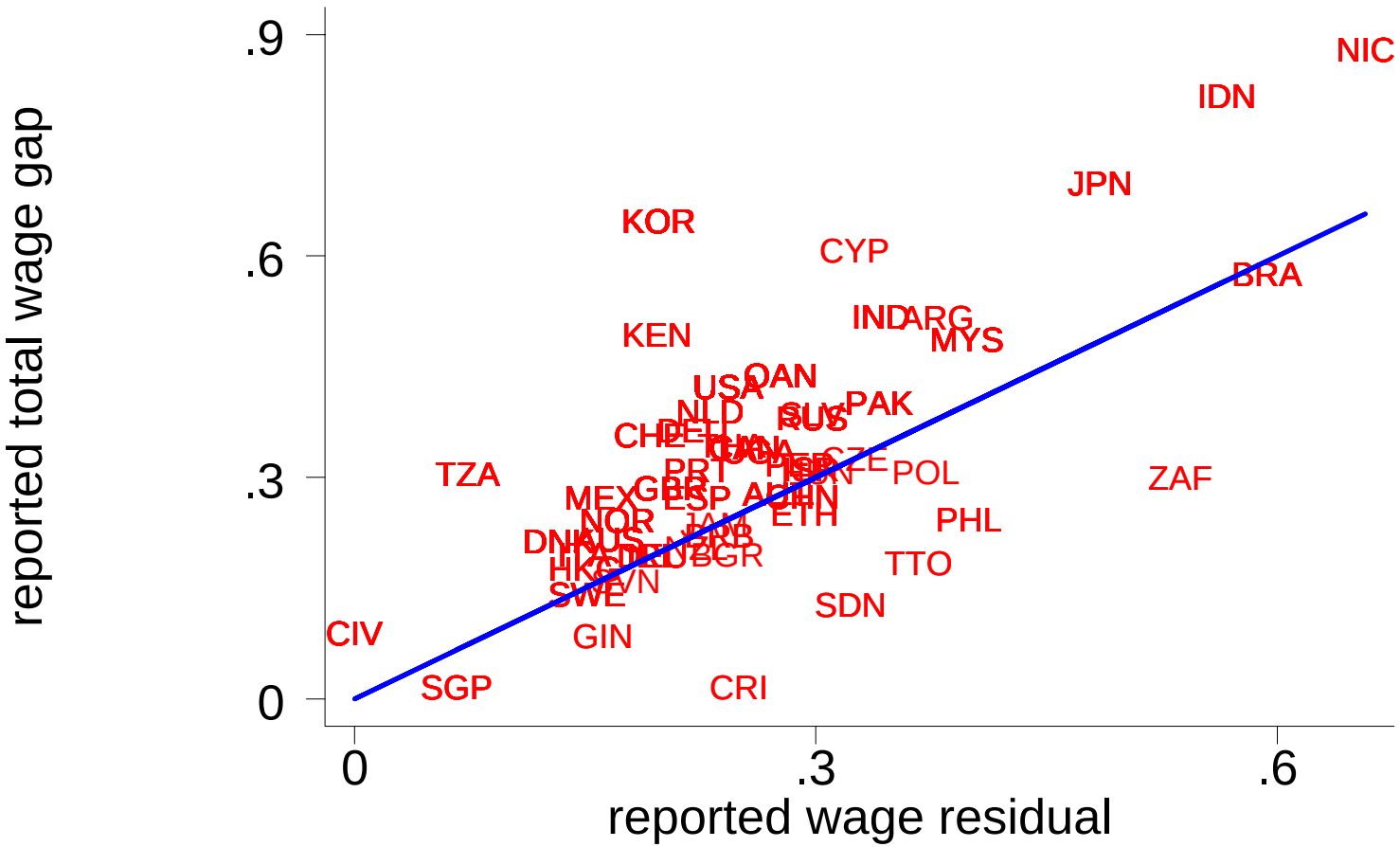

Figure 3: Reported wage residual and meta wage residual across countries