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The Gender Pay Gap in Informal Employment in Poland

Magdalena Rokicka
Anna Ruzik

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CASE-Center for Social and Economic Research on behalf of CASE Network

12 Sienkiewicza, 00-010 Warsaw, Poland

tel.: (48 22) 622 66 27, 828 61 33, fax: (48 22) 828 60 69

e-mail: case@case-research.eu

<http://www.case-research.eu>



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Magdalena Rokicka is an economist, currently a candidate for Ph. D at the Institute for Social and Economic Research (Essex University). She holds a MA degree in economics from Warsaw University, and has obtained a postgraduate study diploma in Cross-Cultural Studies. She has worked for CASE-Center for Social and Economic Research since 2004, participating in its numerous projects including: *Poland's Shadow Economy: its size, characteristics and social consequences*, *ESCIRRU (Economic and Social Consequences of Industrial Restructuring in Russia and Ukraine)*, *ENEPO (The Eastern Neighbourhood: Economic Potential and Future Development)*, *Mobility of Polish Researcher*. Her current research interests are mainly in the area of labour market economics, including : gender related aspects of labour market, family and work- life balance, self-employment creation, and informal employment . She is fluent in English and French and has a working knowledge of Russian language.

Anna Ruzik, Ph.D, is an expert and author of publications in the fields of labour economics and social policy. Since 2004, she has been participating in numerous research projects carried out by CASE. Dr. Ruzik is employed as an assistant professor at the Warsaw School of Economics and at the Institute of Labour and Social Studies in Warsaw.



Abstract

This paper addresses the issue of the gender pay gap in the formal and informal labour markets in Poland. The authors verify the hypothesis of the existence of a gender pay gap in informal work and compare this gap with the one observed in the formal (registered) labour market.

Various analyses of available data show that size and characteristics of gender pay gap differ depending on the level of earnings. The inequality of earnings among unregistered women and men is more pronounced at the bottom tail of the earnings distribution. In the case of formal employees, inequality at the top of the distribution tends to be larger, confirming the existence of a 'glass ceiling'.

The decomposition of the gender pay gap for selected quintiles indicates that it would be even higher if women had men's characteristics.

A possible explanation of the results is the lack of minimum wage regulations in the informal market and the greater flexibility in agreement on wages in the higher quantiles.



1. Introduction

In the expanding stream of economic literature on gender aspects of the labour market, scant attention is given to the empirical analysis of male and female earnings differences in informal work. Even less can be found in terms of empirical analyses for the so called transition countries of Central and Eastern Europe. Furthermore, no specific analyses on the gender pay gap have been carried out in the transition economies in the context of differences between the formal and informal labour markets.

The main purpose of our study is to analyse if informal labor has any impact on the gender pay gap in Poland. Specifically, we will:

- verify the hypothesis of the existence of a gender pay gap in informal (unregistered) employment,
- check if it is larger or smaller than that in the formal (registered) labour market,
- try to explain possible differences between pay gaps in the two labour markets.

The paper has the following structure. First, we present the literature review and general findings on the gender pay gap in developed countries, followed by a review of the gender pay gap specifically in Poland, and finally on the economics of the informal labour market. Section III describes the dataset used and the methodology chosen for the analyses. That leads to the presentation in Section IV of the results of the analyses of wage distribution, as well as returns to different characteristics for female and male participants of the formal and informal labour market. Section V concludes and discusses possible further research. The last parts of the paper are appendixes and a list of cited literature.



2. Literature Review

2.1. Gender wage gap

Gender wage discrimination and the size of the gender pay gap are frequently researched fields in labour economics. The growing importance of this issue can be seen by its presence in the major labour economics textbooks (Ashenfelter and Card (ed.), 1999; Bosworth et al., 1996, Cahuc and Zyberberg, 2004).

Apart from pure discrimination, the wage rates of women and men also differ because of non-discriminatory factors connected with e.g. the generally shorter work experience of females due to different family duties (see e.g. O'Neill 2003). Altonji and Blank (1999) show that differences in earnings (and also in occupation and employment patterns) may result from differences in unobservable characteristics like preferences and skills, rather than discrimination.

Numerous empirical studies have been conducted to analyse the size of an earnings gap between women and men, and to estimate to what extent the gap results from differences in education, tenure, age, experience and to what extent it results from returns to observable characteristics in favour of men i.e. if it is an effect of discrimination. (e.g. Blau, 2000).

Our review of empirical findings supports the trend of a decline in gender wage discrimination since the 1960s in industrialized countries. An international analysis by Weichselbaumer and Winter-Ebmer (2005) indicates a decrease in the gender wage differential from about 65 percent in the 1960s to 30 percent in the 1990s in favour of men. That may reflect progress in women's education and increased job experience, as well as the broad introduction of non-discrimination regulations. The meta regression analysis carried out by Jarrel and Stanley (2004) also showed a strong trend for the estimates of wage discrimination to decline. Interestingly, it seems that there is a tendency for male researchers to report larger discrimination estimates.

The hypothesis that the institutional framework of a specific labour market and regulations concerning compensation matter for the gender pay gap was confirmed in a number of papers. Elvira and Graham (2002), in their paper on the relationship between pay system formalization and gender earnings effects, used personnel data from Fortune 500 financial corporations to show the existence of a negative relationship between earnings and the proportion of females in a job. This finding supports the conclusions of other researchers (e.g. England et al., 1988) that

the higher the proportion of women in a job, the lower the earnings for both women and men in that job. Larger gender-related earnings differences in the same job have been found in companies where bonus programs (apart from the basic wage) exist.

Results of models based on microdata for 22 countries over the 1985-94 period by Blau and Kahn (2003) show that an overall wage compression and a low female labour supply relative to demand reduce a country's gender pay gap. Additionally, wage-setting mechanisms, such as collective bargaining agreements that result in relatively high wage floors, raise the relative pay of women.

It would be also interesting to explore the effect of competition on the wage gap between men and women. Does market competition tend to reduce discrimination by employers? Weichselbaumer and Winter-Ebmer (2007) describe different theories on discrimination that show that more competition may or may not lead to a reduction in gender wage gaps. A number of studies have indeed found a negative relationship between competition and the gender wage gap at the industry or firm level. On the other hand, gender differences with respect to competitive behaviour may explain part of the male-female wage differential leading to higher wage differentials given higher competitive pressure.

This poses an interesting research question on whether a more competitive shadow economy labour market would cause more or less gender pay discrimination. Due to greater family duties, women are usually more interested in having flexible work hours. This trend could have an effect on their preferences towards informal work and the earnings they are willing to accept in such employment.

As the main part of our empirical work in this paper is for Poland, let us now have a closer look at the size of the gender pay gap in countries that started to transition from centrally planned economies to market economies in the beginning of the 1990s. For this area, the economic literature is smaller but still expanding, see e.g. Jurajda (2003), Adamchik and Bedi (2003), Newell and Reilly (2001), or Brainerd (2000).

It is a well known fact in transition economies that the distribution of income has become more concentrated since the beginning of 1990s. Growing differences between income levels have brought inequality coefficients closer to that of the OECD countries (see e.g. Milanovic 1997). This was caused on one hand by the restructuring of sectors, lay-offs, and the emergence of open unemployment, and on the other hand by a closer link (at least in the private sector) between productivity and wages. Analyses conducted by the European Foundation (2005) point to an observed improvement in the gender pay ratio since the pre-transition period for certain



Central and Eastern European countries and a slowdown of this improvement in recent years with variation between countries. Paci (2002) discusses changes in the labour market caused by the transition in countries of Europe and Central Asia. Despite the crude pay gap decline in the first years of the transition in the region, preliminary empirical evidence for some countries suggests there is still a high degree of wage discrimination.

In Poland, basic stylised facts on differences in monthly full-time gross wages in the official labour market can be derived from the biannual survey on wages in companies employing 9 or more workers. In 1996-2006, at least in the formal labour market, the factors that most differentiated wages that women and men earned were: education (with the highest difference in favour of men among employees with tertiary education) and type of occupation (with clerks and office workers as the relatively most "equal" groups and senior officials and professionals as the group with the highest gender pay gap). Age was less important as far as the gender pay was concerned¹.

More comprehensive studies for Poland also show that the gender pay gap declined at the beginning of the period of transition compared to its pre-transitional level, and that it has remained more or less stable since that time. Grajek (2001) investigated the earnings gap between women and men in Poland over the years 1987-1996 (using Household Budget Survey individual data) and suggested that women gained in the very first years of transition. The difference in log percentage points of the gender wages decreased from 34.5 in 1987 to 24.3 per cent in 1996. Adamchik and Bedi (2003) used Labour Force Survey individual data for the years 1993-97. In this period the gender wage gap *ceteris paribus* was at a similar level of 22-23 percent and most of the explained gap was due to industrial and occupational segregation. Marcinkowska (2005) focused on specific groups within the labour force. She analysed the gender wage gap among young people in Poland (aged 18-29) and found that young women aged 25-29 earn less by about 15.2 percent than men. The comparable figure is lower among workers aged 18-24, amounting to 12.6 percent.

Marcinkowska et al. (2008) also studied changes in the wage structure in Poland in the years 1996-2006 using different labour market and individual characteristics. They based their estimates on two data sources: the biannual Central Statistical Office survey of gross wages in companies employing 9 or more employees and on the Labour Force Survey information on net wages. The authors found that pay differentiation between females and males decreased in the

¹ Based on data from the biannual wage survey conducted by the Central Statistical Office of Poland, available at www.stat.gov.pl.



described period. That confirms results of earlier analyses by e.g. Newell and Reilly (2001). The between-sex differentiation is lower and decreasingly important as an explanation of all wage differentiation in Poland.

Newell and Socha (2005), on the basis of quantile analyses using LFS data for 1992–2002, showed that many of the factors influencing wages, including gender, have a stronger impact in higher quintiles for higher wages. This suggests that women are discriminated mainly in jobs or positions with a relatively better pay.

2.2. Informal economy

One of the motivations of our study originates from differences in the formal and informal economy. As argued by Renooy (1990), the informal economy: lacks formal regulations and laws, is perceived as more flexible than the formal economy, interacts with the formal economy, is highly fragmented (functioning only in certain specific areas), relies predominantly on social/family networks, and has a low entry threshold.

Research on the informal economy tends to focus mainly on its macroeconomic aspects. Socioeconomic, institutional, and political factors are analysed in order to establish a causal relation between levels of development, taxation, legislation, protective labour policy, and the existence of informality in the economy (Chong et al., 2007; Johansson, 2009; Karlinger, 2009; Maloney 2004). Furthermore, the lack of appropriate data results in a number of studies aimed at estimations of the size and scope of the informal market (Frey et al., 1983; Schneider and Enste, 2000).

Micro-level analysis is mostly limited by the unwillingness of respondents to openly admit engaging in unofficial activities, which results in a shortage of reliable data (Jutting et al., 2008). Another issue in micro analyses arises from the variety of alternative definitions of informal economy, which makes comparison of empirical studies quite complex and, as shown by Henley et al. (2006), it could lead to contradicting conclusions.

According to the conventional approach of labour market segmentation, informal workers do not compete with formal workers, as they belong to a 'secondary sector'. This sector is characterised by low-skilled and unstable jobs with low wages and poor working conditions. Yet, recently, a new approach has been suggested. The argument has been put forth that informal employment is a free choice, and those who work in the informal sector are maximising their utility, weighing the costs and benefits of these two sectors (Perry et al., 2007). Fields (2005)



builds on those two approaches and distinguishes between an 'upper tier' and a 'lower tier'. *The "upper tier" comprises the competitive part, i.e. those who voluntarily choose to be informal, and the "lower tier" is the part that consists of individuals who cannot afford to be unemployed but have no hope to get a formal job* (Fields, 2005). Similar heterogeneity among those voluntary and involuntary workers was also reported by Henley et al. (2006) and (Perry et al., 2007).

In line with this approach were studies of the impact of minimum wage on informal employment. The theoretical model suggested by Fiszbein (1992) shows that a decrease in minimum wage does not necessarily imply benefits for informal employees. Empirical evidence for Costa Rica by Terrell et al. (2001) also gives a mixed picture. On the one hand, the evidence shows that a unit increase in the minimum wage is associated with an increase in the average number of hours worked per week by 0.14 percent in the formal sector and 0.34 percent in the informal sector. On the other hand, the authors do not find supportive evidence to indicate that an increase in the minimum wage has any impact on the size of the informal sector (measured by the number of informal workers).

According to empirical studies, the probability of participating in the informal sector is also determined by socio-demographic factors such as age, level of education, gender, and marital status. As summed up by Jutting et al., (2008) individuals enter the informal market in certain moments of their lives. They may start their careers in the informal market in order to gain valuable experience and then move to formal employment, and, as some studies suggest, they may return to the informal market again when they are older. One's marital status and gender also have a considerable impact on choice of sector. Heads of households and single women are more often found among formal employees, while dependent household members, especially in households with young children, are more likely to work informally (Perry et al. 2007).

A review of the literature reveals some interesting gender patterns of informal employment. In developing countries, women outnumber men in the informal sector as a consequence of the underdevelopment of local labour markets (Maloney 2004). As it is argued by Cunningham (2001) that this disproportion may be also a result of women's choice, especially if they care for small children, and is motivated by the flexibility of jobs offered in the informal sector. Results for Ukraine for a 2005 study presented by Williams et al. (2008) are consistent with two of the studies above: almost 64 per cent of Ukrainian women participated in the informal market in the previous year compared to 59 per cent of men.



However, empirical studies for EU Member States do not confirm this pattern. In developed countries, women tend to participate less than men in undeclared work. As stated in the EC report on undeclared work (Renooy et al., 2004): *'in Denmark, almost three times more men than women carry out undeclared work (29.4 % and 11.5 %, respectively). In Germany, Sweden and the UK, male participation is generally twice as high: 14.5 % and 6.5 % respectively in Germany, 15.4 % and 7 % in Sweden and 10.3 % and 5.4 % in UK.'*

Also Andresen et al. (2005), using repeated survey data for Norway, confirm a substantial overrepresentation of males in the informal market as they found that the probability of having an unreported income is higher among men than women. Moreover, they point out that between 1980 and 2003, a significant number of women left the shadow economy, while the population of men working without registration remained relatively unchanged. They explain this trend by the increase in female participation in the formal market, the introduction of a more generous maternity leave scheme, and the development of subsidized public childcare institutions².

An interesting insight into labour market transitions (public, private, informal, and out of work) is provided by Dimova et al. (2005) in their analysis for Bulgaria during the economic crisis. The authors report a higher conditional probability of moving from the public to the informal sectors for women (0.707) than for men (0.564), and find the same trend in the case of the transition from the private formal sector into informal employment. Also Perry et al. (2007) claim higher mobility between being out of work to informal self-employment for women as compared to men, and point out that it is mainly due to the high participation of married women with children in this sector.

Women's participation in the informal economy in the context of family obligations is discussed by Leonard (1998). She argues that childcare shapes determinants of female labour market participation, though women often agree to do lower-paid and precarious jobs, which are mainly provided on an unregulated basis. Pfau-Effinger (2009) further develops this concept. She expresses the view that female participation in informal work is related to the different forms of welfare state regimes. In a social democratic system, which provides adequate social coverage (child care, elderly care, etc.), the need for female undeclared work is minimal. While in a conservative welfare regime (for example Germany), the demand for domestic labour considerably increases the number of people in the informal market, especially within the household sector. In regards to the *'Latin Rim'* she argues that cultural norms and ethics

² As a result, demand for private predominantly unreported child care decreased.



discourage women, especially mothers with young children, from participating in the formal labour market.

Not only has the participation rate in the informal sector indicated a clear division between genders, the nature and characteristics of informal jobs differ too. Women work mainly in more regular, but part-time jobs in sectors with traditional female overrepresentation (cleaning, personal care, hotels and restaurant, etc.), which provide only supplements to family income (Williams et al., 2008; Jutting et al., 2008; Renooy et al., 2004).

Scarce empirical evidence confirms the existence of a gender earnings gap in the informal economy. Specifically Williams et al. (2008), using Ukrainian data for 2005, show that women tend to receive on average 67% of the earning rate of men in the informal sector. Renoy et al. (2004) also report that in the Netherlands, men earn on average 50% more per hour than women do. Similar findings are shown for Latin America, where women earn on average 52% of men's earning rates, and this gap is larger than in the formal sector (64%) (Silveira and Matosas, 2005). However, as argued by Silveira and Matosas (2005), there is evidence of a diminishing gender pay gap in the informal sector in this region.

According to special modules of the Polish Labour Force Survey on informal work conducted in 1998 and 2004 by the Central Statistical Office, the size of the informal sector in Poland is diminishing (GUS 2004). However, in 2004, still around 9.6 per cent of the working population was engaged in either full-time or temporary informal jobs. The main reasons for choosing the informal sector as indicated by respondents were: the need to have any kind of income, the lack of jobs opportunities in the formal sector, and the aspiration to have higher income than in formal jobs. There were evident disparities in answers depending on the place of residence: town or village, and gender. Jobs in the informal sector tend to be concentrated in the construction and repairs, trade, private tutorial, and child care sectors. For 60 per cent of respondents, informal work was their main source of income.

Women represented 37 per cent of informal employees. Furthermore, women tended to work in the informal sector mostly in the middle of their carrier (35-45 years old). There were also visible gender disparities with regards to the education level. Women tended to be better educated than men, although the most numerous workers had only vocational education, regardless of gender (69 per cent of informal workers had vocational education). According to 2004 data, there was a considerable gender pay gap in favour of men. Women earned 79 per cent of men's monthly earnings, but because of the differences in work characteristics (full-time, part time, etc.) and the



unwillingness of respondents to provide accurate information, these results should be treated with caution.

The informal sector seems to provide certain benefits as well as disadvantages. As summarized by Jutting et al. (2008), the most common risks associated with informal work are:

- uncertainty and vulnerability,
- lack of social benefits related to formal work,
- worse and uncontrollable working conditions,
- potential fine.

While potential benefits are be as follows:

- higher pay,
- greater flexibility and autonomy,
- learning by doing and training opportunities (especially for young unskilled workers),
- free access to public goods.

Based on the above literature and empirical studies of the informal sector in both well developed Western countries and in developing regions, we are able to formulate certain hypotheses, which we can then test further using Polish data.

We expect that the gender pay gap in the informal, usually more competitive, unregulated market differs from the gender pay gap in the formal sector. There are two main factors which could have an impact on the earnings gap. First, based on previous studies, we can expect that legal regulations will result in a lower gender pay gap in the formal economy as reported for Ukraine (Williams et al., 2008), Netherlands (Renooy et al., 2004) and Mexico (Silveira and Matosas, 2005). On the other hand, higher job flexibility, the autonomy of the informal market, and the lack of regulation gives potential employees (including women) higher bargaining power, which may result in a smaller earnings gap in this market. The final outcome is a result of these two opposing forces. Taking the above reported heterogeneity of the informal market, we can suppose that these factors play different roles in voluntary and involuntary informal jobs. In voluntary jobs, bargaining power or more efficient use of special skills and ability, could lead to a better position for women in the informal labour market. In contrast, low skilled involuntary jobs in the informal sector do not provide such opportunities. Using several econometric approaches, we will address these questions in the next part of our paper.



3. Data And Methodology

3.1. Data

We used cross-sectional data from 2007, which were collected within the project entitled *Poland's Shadow Economy: its size, characteristics, and social consequences* financed by the Polish Ministry of Labour and Social Affairs (MPiPS, 2008). The data covers members of randomly sampled households. The size of the sample was approximately 8,000 households. The data refer to the non-institutionalized population and covered all persons aged 15 years and over. The survey contained an extensive set of demographic characteristics: age, education, marital status and also information about labour market status, hours worked, income in the previous month, in both the primary and additional jobs. Because of the sensitive nature of the analysed issue, the survey did not include a direct question about an informal job. Instead, there were a number of questions which identified certain characteristics of the informal employment. On the basis of this query, we considered a person to be informally employed in the following cases:

- a paid employee who works on the basis of an oral contract only without being declared to the authorities,
- an employee who is declared to the authorities but his/her social contribution payment and tax deductions are intentionally diminished, generally by joint agreement, for example a full-time worker is declared to earn half of the sum actually paid,
- a paid employee who has a legal primary job but who works without registration and without paying taxes and social security contributions in other jobs,
- a self-employed person, who works without being declared to the authorities,
- a self-employed person who declares only a part of his/her services for tax purposes.

Our definition is also consistent with an approach suggested by the ILO in 2003, which includes workers outside informal enterprises into the informal sector. In which informal employment refers to: *“total number of informal jobs, whether carried out in formal sector enterprises, informal sector enterprises, or households”* (ILO 2002).



In this paper we have excluded from our analysis any illegal activity which is associated with crime and criminal action. The analysis is restricted to respondents between 15 and 65 years of age, who reported their income in the last month before interview, and number of hours worked in the same period with an income higher than 1 Polish Zloty. After excluding those who have not met the criteria we ended up with 5276 observations in the sample: 2545 observation for women and 2731 for men regardless the employment status. Those who were considered as informal employees/self-employed represent around 8.5% of the sample (452 observations).

3.2. Methodology

There is no perfect measure of earnings inequality; each of the inequality measures satisfies certain conditions, while disregarding other properties. There are many ways to measure the dispersion of income distribution. In our analysis, first, we estimated the earnings distribution in the formal and informal economies in Poland in 2007, using deciles ratios, Gini coefficients, and other entropy indices (including Theil index).

The commonly used Gini coefficient is a measure of dispersion based on the Lorenz curve³:

$$G = 1 - 2 \int_0^1 L(X) dX \quad (1),$$

where $L(X)$ is a Lorenz curve

The coefficient varies between 0, which indicates complete equality, and 1, which indicates complete inequality.

The inequality measures which are symmetric and additively decomposable are Generalized Entropy inequality indices. We applied several generalized entropy indices in our analysis since, as we shall show, this allows for more detailed decompositions:

$$I_a(x) = \left(\frac{1}{a(a-1)} \right) \left[\left(\left(\frac{1}{N} \right) \sum_{i=1}^N (x_i / \mu)^a \right) - 1 \right], a \neq 0, 1 \quad (2)$$

$$Theil = I_1(x) = \left(\frac{1}{N} \right) \sum_{i=1}^N (x_i / \mu) \log(x_i / \mu), a = 1 \quad (3)$$

³ See: Dorfman, Robert, 1979, *A Formula for the Gini Coefficient*, „The Review of Economics and Statistics” vol. 61, p.146-149.



$$MLD = I_0(x) = \left(\frac{1}{N}\right) \sum_{i=1}^N \log(\mu / x_i), a = 0 \quad (4),$$

where x_i is a wage (earnings) of the i -th individual, N is a number of observations, μ is a mean of earnings of N individuals.

The parameter 'a' specifies sensitivity to earnings differences in different parts of earnings distribution: $a > 0$ is related to a greater sensitivity to higher earnings values, while $a < 0$ corresponds to a greater sensitivity to low earnings. Mean Log Deviation (MLD) is recognised as relatively middle sensitivity. The value of indices varies between 0, which indicates total equality, (everyone's earnings are equal to a mean), and $\ln N$ (where only one individual has earnings). The Theil index is equal to 0.5 for an inequality represented by a 74/26 distribution, and is 1 for an inequality represented by an 82/18 distribution.

We could further decompose total inequality into a weighted sum of the inequalities within each sub-group, plus inequality between groups:

$$I(x) = I_{\text{within}} + I_{\text{between}} \quad (5)$$

This decomposition allows us to estimate earnings inequalities among men and compare them with wage inequalities among women. We conducted the same decomposition twice, first using information about informal employees, then applying the method to formal employees.

The next step is the measurement of the gender pay gap. As the raw gender pay gap could be a result of the differences in productivity characteristics between the two genders, we applied a method which allows for a more in-depth analysis. The main methodology used was the quantile regression, as it gives a more detailed overview of wage characteristics depending on the wage level. We first ran a regression on a pooled female and male sample, introducing a gender specific variable. Then, we estimated quantile regression for each gender separately.

Quantile regression was introduced by Koenker and Bassett (1978). It is an extension of the classical least squares estimation, in which instead of a mean estimation the estimation of the quantile function is performed.

Let us assume that wage level depends linearly on a set of labour market characteristics:

$$y_i = x_i' \beta_\theta + v_\theta \quad (6)$$

The conditional quantile functions can be estimated by minimizing an asymmetrically weighted of absolute errors (Koenker and Bassett 1978, Buchinsky 1998). If the conditional quantile of y , q_θ , is linear in x ; $q_\theta = x\beta(\theta)$, consequently, vector $\beta(\theta)$ is a solution to a:

$$\min \left\{ \sum_{i: y_i \geq x_i \beta(\theta)} \theta |y_i - x_i \beta(\theta)| + \sum_{i: y_i < x_i \beta(\theta)} (1 - \theta) |y_i - x_i \beta(\theta)| \right\} \quad (7)$$

where $0 < \theta < 1$.

The estimator that minimizes (7) has good asymptotic properties: it is asymptotically normal under general conditions (Cameron and Trivedi, 2009).

Sample selection – parametric approach

As only 56.5% of women aged 15-64 participate in the labour market in Poland, we have also corrected for the selection into labour market.⁴ The reason for this is that we did not observe wages of individuals who do not participate in the labour market. Individuals in employment tend to have higher wages than those not in the labour force. As a result, the sample selection could have biased our results if the selection was not random.⁵

In the analysis of female wage determinants, we applied the parametric procedure suggested by Heckman (1979).

Let us assume that an individual is observed in employment only if a wage he is offered is above his reservation wage:

$$G_i^* = W_i - G'_i \quad (8),$$

where W_i is a wage, and G'_i is a reservation wage, so we could observe an indicator variable for the employment $G=1$ if $G_i^* > 0$ and $G=0$ otherwise

$$G_i^* = z_i \alpha_i + \varepsilon_i \quad (9)$$

The Heckman model is based on the assumptions that both error terms (v , ε) are normally distributed with the mean 0; (v , ε) is independent of X and Z . We used a probit model to estimate equation (9), from this the Heckman correlation term (inverse of Mill's ratio) is computed and integrated into the wage equation (6).

Sample selection – semi-parametric approach

⁴ Data for 2007 based on Polish Labour Force Survey (Badanie Aktywności Ekonomicznej Ludności)

⁵ Because of the higher rate of male participation in labour market, we ignored the issue of sample selection in this case.



As suggested by Buchinsky (1998), the parametric correction for the sample selection, which assumes a specific distributional form of the disturbances, is not the best choice in the context of quantile regression. Instead he recommends a non-parametric approach. Here, we decided to use the semi-parametric estimator suggested by Klein and Spady (1993) to estimate the model of labour market participation. Let us assume that X_i and μ_i are independent and the equation has the form:

$$Y = g(Z' \alpha_0) + \mu \quad (10),$$

where g is an unknown function and the error term μ satisfies the condition: $E(\mu | Z) = 0$, and Z is a set of explanatory variables of labour market participation.

Klein and Spady (1993) suggested estimating α using a maximum likelihood method. The log-likelihood function is given by:

$$L(\alpha) = \sum_i (1 - Y_i) \ln(1 - \hat{g}_{-i}(X'_i \alpha)) + \sum_i Y_i (\hat{g}_{-i}(X'_i \alpha)), \quad (11)$$

where $\hat{\alpha}$ maximizes $L(\alpha)$.

In the next step – using estimates from the above equation – a selectivity term is constructed. We follow Buchinsky (1998) and calculate the selectivity term as:

$$P_{sj}(g) = \lambda (\hat{\mu} + \sigma g)^{j-1} \quad (12),$$

where:

λ - the usual inverse Mill's ratio,

$\hat{\mu}$ - the constant, and

σ - the slope coefficient from a probit regression of y_i on the index $g(x_i, \hat{\alpha})$

Decomposition

Then, we used decomposition, which permits us to explain gender differences in the earnings gap. Since the 1970s, researchers have typically used the Blinder-Oaxaca decomposition to divide the observed average gender gap into two components. The first is the portion attributable to differences in endowments (or skills), and the difference in coefficients (or return to skills) (Blinder 1973; Oaxaca 1973)

$$\Delta \ln W = \beta^m (\bar{X}^m - \bar{X}^f) + (\bar{\beta}^m - \bar{\beta}^f) \bar{X}^m + se \quad (13),$$

where $\ln W$ represents the log earnings evaluated by an earnings equation separately for males and females. The indices f and m represent female and male earnings respectively, \bar{X} is the average observed variables related to labor supply and labor demand characteristics, β is the estimated returns on these characteristics and se is the selection effect.

We used a similar technique, but instead of examining the sources of the differences between the means of two distributions, we explained the differences in quantiles between the male and female log income distributions. The approach allows for the decomposition of differences in different parts of the distribution in order to show that discrimination can depend on the quantile at which it is estimated. It decomposes the observed differences in distributions into one part that is explained by differences in characteristics (justified differentials), and another part that is explained by differences in coefficients (usually interpreted as discrimination) and residuals.

We followed the counterfactual decomposition approach suggested by Machado and Mata (2005) with a contribution suggested by Melly (2006). Machado and Mata first ran a quantile regression separately for men and women, and then generated counterfactual densities: one if women were given men's characteristics but were paid as women, another one if women retained their characteristics but were paid as men. Then, the decomposition of the difference between quantiles of the unconditional distribution of males (m) and females (f) could be written as:

$$\hat{q}_m(\theta) - \hat{q}_f(\theta) = [\hat{q}_m(\theta) - \hat{q}_{Cm}(\theta)] + [\hat{q}_{Cm}(\theta) - \hat{q}_f(\theta)] \quad (14),$$

where q_{Cm} is the counterfactual distribution and q_f and q_m are unconditional quantile distributions for women and men. The first parentheses give estimators of returns to characteristics and the second for coefficients.

The Melly (2006) estimator is asymptotically equal to the one of Machado and Mata (2005). Melly suggested that differences in distribution be decomposed by applying a semi-parametric estimator of distribution functions. His approach is again a generalization of the Oaxaca/Blinder decomposition.



4. Results

4.1. Descriptive statistics

Table 1 shows differences between formal and informal employment and between genders within those groups. In general, women who work unofficially have on average the lowest earnings, while the highest mean earnings are received by men from formal employment. Earnings dispersion is greater in the informal market than in formal employment, and among women those differences are larger than among men.

The differences are also visible with regard to other characteristics. In the informal sector, both women and men are on average younger than their counterparts in formal employment. This finding is in line with an explanation suggested by Jutting et al. (2008), who claims that the informal market is a good place for younger people to gain experience and valuable skills. Regardless of their form of labour market participation, women tend to have on average a higher level of education than men do. Interestingly, almost the same proportion of women who work informally have post secondary (29,4%) and vocational education (29,4%), while a huge proportion of men in the informal sector have only a vocational level of education (44,8 %).

As far as family composition is concerned, our descriptive statistics are in line with previous empirical analyses (Perry et al. 2007; Leonard 1998): women in informal sectors have on average more children who are under 15 than their counterparts in the formal sector. However, the proportion of single women in the informal sector is unexpectedly higher than in the formal one: 28% of women in the informal sector are single, while in formal employment, 24% are single.

Women in our sample experienced unemployment more often than men did, and more of them had held an informal job in the past. Almost 60% of women who work in informal sector had previous experience in unemployment (we include here all previous incidents of unemployment), and 43% of them had worked in the informal market before. We suspect that these women are more often forced into the informal market because of previous labour market records, and that they might have low bargaining power, being potentially vulnerable to bad working conditions and low earnings.

Among men, a similar pattern emerged, but its scope was more limited: respectively 46% of informal male workers had been previously unemployed, and 38% of them had worked in the informal sector before.

As expected, we also found a strong sectoral segregation. Unofficially working women are underrepresented in the construction and transport sectors, while their presence is more common in the trade, hospitality, health and education sectors. Those are the stereotypically 'female' sectors, in which women outnumber men in both the informal and formal sectors.

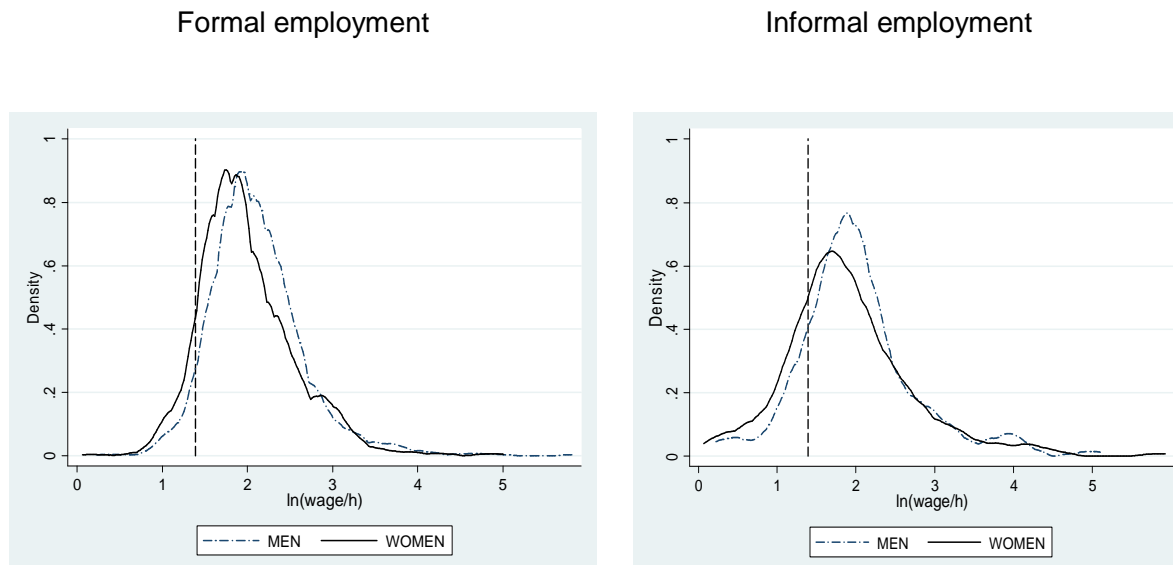
Table 1. Descriptive analysis

Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Ln(inc)	1.900	0.824	2.011	0.758	1.988	0.562	2.112	0.559
P90/P10	7.233	n.a	6.025	n.a	3.846	n.a	3.516	n.a
P90/P50	3.100	n.a	3.012	n.a	2.396	n.a	2.083	n.a
P50/P10	2.333	n.a	2.000	n.a	1.605	n.a	1.687	n.a
Age	35.098	11.242	36.992	11.477	37.820	10.669	38.090	10.802
Education (in years)	11.847	2.118	11.533	2.005	12.950	2.155	12.209	2.048
Tertiary education	0.078	0.270	0.069	0.253	0.248	0.432	0.142	0.350
Post secondary*	0.294	0.457	0.278	0.449	0.305	0.461	0.295	0.456
General secondary	0.201	0.402	0.048	0.215	0.180	0.384	0.084	0.277
Vocational education	0.294	0.457	0.444	0.498	0.215	0.411	0.411	0.492
Primary education	0.132	0.340	0.161	0.369	0.052	0.222	0.067	0.250
Single	0.289	0.455	0.298	0.458	0.240	0.427	0.245	0.430
Married	0.505	0.501	0.565	0.497	0.602	0.490	0.693	0.461
Widowed	0.137	0.345	0.081	0.273	0.136	0.343	0.040	0.197
No. children <15 years	2.302	1.367	2.010	1.129	2.054	0.976	2.216	1.134
Agriculture	0.142	0.350	0.141	0.349	0.014	0.118	0.033	0.179
Manufacturing	0.113	0.317	0.097	0.296	0.132	0.339	0.210	0.408
Construction	0.020	0.139	0.375	0.485	0.012	0.107	0.142	0.350
Trade	0.206	0.405	0.081	0.273	0.217	0.412	0.086	0.281
Hotel	0.098	0.298	0.016	0.126	0.040	0.196	0.015	0.121
Transport	0.015	0.121	0.057	0.232	0.029	0.167	0.104	0.305
Health and education	0.088	0.284	0.012	0.110	0.240	0.427	0.053	0.224
Other sectors	0.275	0.447	0.173	0.379	0.309	0.462	0.270	0.444
City	0.309	0.463	0.242	0.429	0.299	0.458	0.245	0.430
Town	0.392	0.489	0.391	0.489	0.452	0.498	0.440	0.496
Village	0.299	0.459	0.367	0.483	0.249	0.433	0.315	0.465
# observation	204		248		2334		2478	

Graph 1 presents an estimated density of log wages for both genders in the informal and formal sectors. In the informal sector, the density curve for men is steeper and higher than that for women. Furthermore, the level of earnings with the highest density is greater for men than women. In both sectors, we observed a higher concentration of women than men in the lowest

log of earnings. Surprisingly, in the formal market, we also observe wages below the minimal wage. A possible explanation for this is the presence of ‘civil contracts for specific jobs’ which are exempted from labour market regulations that apply to employees hired according to the Labour Code.

Graph 1. Women and men’s log wage distribution (kernel density)



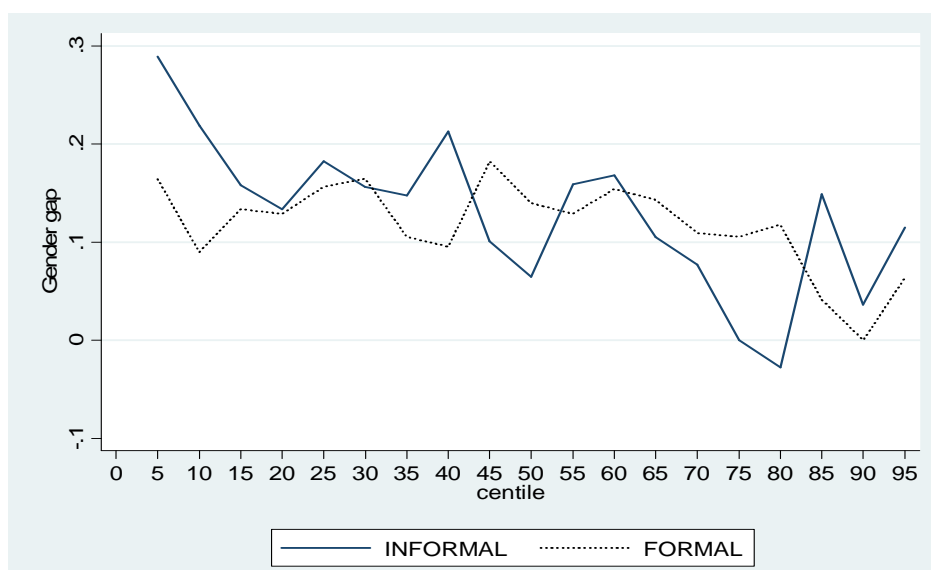
Reference line is equal to $\ln(\text{minimal wage}/h)$, which was calculated on the basis of minimal monthly payment for full time employment for 2007, assuming 21 working days in a month and 8 hrs of work per day .

As reported in Graph 2., a gender earnings gap in informal employment is visible mainly at the bottom of the distribution, as it converges in the group with middle earnings, therefore we do not observe the distinctive glass ceiling effect reported in some other EU countries (e.g. for Sweden by Albrecht et al., 2001; for Germany by Holst and Busch, 2009)⁶. When comparing the gender earnings gap in the informal economy to the one observed in the regular labour market, we notice that the gender gap is larger in the informal market at the two tails of the distribution (for very low earnings and very high earnings). This lower gender gap in the formal market at the bottom of the earnings distribution might be an effect of the minimum wage legislation. We may also expect that in the informal economy those who agreed to relatively low earnings also have lower bargaining power and females seem to be the more disadvantaged group.

⁶ Although in the top of wage distribution in informal market, we again observe the increase of the gender gap.



Graph 2. Gender earnings gap in formal and informal employment (5 percentile intervals)



*Gender gap is calculated as $\ln(Mwage/h) - \ln(Wwage/h)$, where M stands for men, and W stands for women.

4.2. Earnings inequality

Table 2 presents the value of population and earnings share by gender in informal and formal employment. An interesting feature is that women in our sample of informal workers represented 45 per cent of the population, while their share in overall earnings is around 41 per cent. A similar trend is observed among registered workers. Women’s share in earnings is slightly lower than their share in population. This again could indicate the existence of a certain gender earnings inequality pattern (dominance of male earnings vs. female earnings) in both the formal and informal labour markets.

Table 2. Population and earnings share by gender in informal and formal work

	Population share	Income share	Log(mean)
Informal work			
Women	0.449	0.414	2.235
Men	0.551	0.586	2.376
Formal work			
Women	0.486	0.457	2.186
Men	0.514	0.543	2.301

As we expected, generalized entropy indices indicate a higher level of earnings inequality in the informal economy than in the regulated jobs market. The Gini coefficient in the formal labour market is 0.345, while in the informal labour market it reaches the level of 0.476.

While 'gender inequality' is a major contributor to overall earnings inequality in both analysed labour markets, in the case of the informal market, its effect is more pronounced. Female workers are more homogeneous with respect to their earnings dispersion than male workers in the informal labour market. The value of entropy indices are lower for women than for men in all analyzed cases, both in the case of indices sensitive for lower earnings $I(-1)$, as well as in those capturing inequality in higher earnings distributions $I(2)$. The contrary results are reported for dependent employees. According to results reported in Table 3, the male sub-group in the formal labour market seems to experience a lower earnings inequality than the female sub-population.

It is also worth highlighting that inequality of earnings among unregistered women and men is more pronounced at the bottom and top tails of the earnings distribution. As we can see, the value of the $I(-1)$ index, which is a more sensitive indicator of inequality at the bottom of distribution, is higher than the MLD or Theil Indexes. Similarly $I(2)$, which captures inequality mostly in the top of the earnings distribution, is more than twice as large as the value of the Theil Index.

Table 3. Generalized Entropy Indices and Gini coefficient

	I (-1)	MLD	Theil Index	I (2)	Gini
Informal employment					
All	0.535	0.395	0.483	0.987	0.476
Women	0.512	0.380	0.443	0.782	0.469
Men	0.546	0.404	0.507	1.098	0.479
Within group	0.532	0.393	0.480	0.982	n.a
Between group	0.002	0.002	0.002	0.002	n.a
Formal employment					
All	0.210	0.200	0.256	0.496	0.345
Women	0.221	0.204	0.260	0.515	0.348
Men	0.193	0.193	0.249	0.476	0.338
Within group	0.208	0.198	0.254	0.495	n.a
Between group	0.002	0.002	0.002	0.002	n.a

The analysis above provides us with basic background information about earnings inequalities in the informal and formal labour market. However, for a more in-depth analysis of the determinants of earning gaps between men and women, we will apply more specific methods.



4.3. Quantile Regression

To use all possible information collected in our data source and to describe the dependence between the form of employment (formal or informal) and the gender pay gap, we adopted the following approach. First, standard Mincerian regression models for log wages were estimated using the OLS method. Then, the results for quantile analyses (25th percentile, median and 75th percentile) provided an overview of the relationship between the outcome and regressors at several points of dependent variable distribution.

The explained variable was LOG INCOME from work per hour worked and the set of explanatory variables consisted of age, age squared, family size and the following categorical variables:

- EDU, level of education, 1 for tertiary (college or university), 2 for secondary vocational and post-secondary, 3 for general secondary, 4 for vocational primary, 5 for gymnasium, primary and incomplete primary education,
- GEN, variable that equals 1 for women and 0 for men,
- MARR, equals 1 for a married individual and 0 otherwise
- FULL, 1 for full time job and 0 otherwise
- Dummy variables for sectors:
 - AGR, value 1 in the case of work in agriculture,
 - MANUF, value 1 if a person works in the manufacturing sector
 - TRADE, value 1 if a person's job is in trade
 - CONSTR, if a person works in construction
 - HOTEL, if a person works in the hotels and restaurants sector
 - TRANS, if a person works in transport
 - HEALTH, if a person works in the health or education sectors

CITY, value 1 if a person lives in a city

TOWN, value 1 if a person lives in a town

We did not have reliable information on tenure in the database so we assumed that individual labour market experience can be approximated by age and years of education.

Pooled regression

In the first step, the regression on pooled data (men's and women's sample) was run using a dummy gender variable (0=female, 1=male). We used this method to explain to what extent differences between male and female characteristics explained gender disparity in log of hourly earnings, controlling for such characteristics as: age, level of education, sectors and place of living. In this analysis, we assumed that returns to labour market characteristics do not vary among genders.

Table 4 presents quantile and OLS estimates of the gender dummy variable in two models. In Model I, we included into the analysis such explanatory variables as: age, age squared, and four levels of education. Then, in model II, we extended our analysis adding more variables: a set of dummies for the sector of activity, a set of dummies for the place of residence, a indicating full or part-time work and one for family size. The full set of results is presented in the Appendix, Table A.1 and Table A.2.

Table 4. Summary of the result of pooled regression

	Informal workers (n=452)				Formal workers (n=4812)			
	Quantile regression			OLS	Quantile regression			OLS
	q=0.25	q=0.5	q=0.75		Q=0.25	Q=0.5	q=0.75	
Model I								
Gender coefficient	0.242***	0.210***	0.151**	0.191**	0.178***	0.214***	0.229***	0.207***
Standard error	0.091	0.070	0.060	0.074	0.016	0.015	0.019	0.015
Model II								
Gender coefficient	0.214***	0.222***	0.114	0.180**	0.158***	0.211***	0.211***	0.180**
Standard error	0.066	0.082	0.105	0.082	0.016	0.017	0.019	0.082

***statistically significant at 1% level, ** significant at 5% level

Model I (we regress ln wage on age, age2, gen, edu_1, edu_2, edu3, edu4_) basis category for education is edu_5= primary education. Model II (Model I plus family size, full/part time work, place of living: city/ village and sector of activity :a) sectors: agriculture, manufacturing, construction, trade, hotels, transport and health care, base category other.)

We found that the gender variable is statistically significant in the majority of regressions, although gender was insignificant in the sub-sample of unregistered workers in 75 percentile regression in MODEL II. As expected, because of the higher dispersion of earnings in the informal labour market, results from the OLS regression in comparison to the median regression differ in the case of informal employment more than in the case of the formal labour market.

The gender coefficients vary across quantiles. In the informal labour market, the gender coefficient has a much greater impact at the lower (0.25) than median conditional quantiles of log earnings.

Consequently, the gender pay gap in the informal labour market decreases as we move up the earnings distribution. This might suggest, as previously mentioned, that females who receive very low hourly earnings, might suffer from larger discrimination in the absence of legal regulations because they have lower bargaining power in the informal market than men. As suggested by Fields (2005), they belong to a 'lower tier,' which consists of individuals who cannot afford to be unemployed, and are rather 'involuntary employees' in the informal sector. This effect of a higher gender gap at the bottom of the earnings distribution is often called the 'sticky floor effect'.

A different pattern is observed in formal employment. After controlling for age and education, we found that the gender pay gap increases as we follow the earnings distributions, and in fact the glass ceiling effect could be reported. Newell and Reilly (2001) found a similar relationship using Polish Labour Force statistics for 1996. They reported that the gender raw gap in the 25th quantile was approximately 17.3%, while in the 75th quantile, the differences grow to 27.3%.

Taking into account results reported for the basic model (model I) we can interpret the gender coefficient in the following way: being a man increases the conditional median of hourly earnings by 1.52 PLN (0.21* 7.26) in informal employment.⁷ Being a male employee in the formal employment increases the median of hourly earnings by 1.56 PLN (0.214* 7.30). If we compare the results from a basic model (MODEL I) with those in a more extended model, we see that the gender earnings gap in both markets diminishes while we are controlling for additional characteristics: sectors of activity, character of work (full time, part time) and place of residence. This pattern is common for both the informal and formal markets, although the impact of additional explanatory variables is higher among informal employees.

In general, the gender pay gap at the top of the earning distribution (75th percentile) is greater in the formal economy than in the informal labour market. A different pattern is observed at the bottom of the distribution, where the female earnings disadvantage is more pronounced in the informal market.

⁷ The Coefficients in Table 4 give marginal effect for lnwage. We can compute the marginal effect on wages in the following way: Given $Q_q(\ln y/x) = x' \beta_q$, we have $Q_q(y/x) = \exp\{Q_q(\ln y/x)\} = \exp(x' \beta_q)$. The marginal effect on y is $\frac{\partial Q_q(y/x)}{\partial x_j} = \exp(x' \beta_q) \beta_{qj}$, then the average marginal effect is $\{N^{-1} \sum_{i=1}^N \exp(x'_i \beta_q)\} \beta_{qj}$. (Cameron & Trivedi, 2009)



These findings give us an interesting insight into the gender pay gap in both analysed forms of the labour market. It seems that a regulatory legal system works well in terms of eradicating gender pay inequality among those with lower earnings. This might be an effect of the minimum wage scheme. We can also suppose that in the case of basic, mainly manual, lower paid jobs, the gender equality law could be more easily applied and an equal pay for an equal job is more often the case. In contrast, it appears from the above analysis that female workers with higher earnings are less discriminated in informal employment than in the formal labour market. One of the characteristics of the informal labour market is its flexibility, and this factor might be useful in explaining this phenomenon. Women who are at the top end of the earnings distribution seem to have higher bargaining power; they can negotiate their remuneration more easily, and it is easier for them to leave their jobs if their financial requirements are not met.

Regressions by gender

According to approach presented in the methodological part in the case of female wage equation, we first looked at women's labour market participation. The results of parametric and semi parametric estimation are discussed below and presented in the Appendix (Table A.1, Table A.2 and Table A.3).

Female labour market participation

Although the coefficients from estimations of female labour market participation vary depending on the method used, their signs remain the same.

From the selection analysis it appears that a low level of education is an important factor for labour market exclusion. The probability of female employment is low for women with only basic or vocational basic education completed in comparison to those with at least post secondary education (base category). These findings are in line with existing literature (Buchinsky 1998; Fersterer and Winter-Ebmer, 2002; Bosio 2009).

Having controlled for other characteristics, married women had a lower propensity to work, and again those findings are similar to other empirical studies. Surprisingly, in contrast to studies for other countries (Fersterer and Winter-Ebmer, 2002; Connelly 1992) the presence of children (younger than 15 years old) in a household increased the probability of labour market participation for women. We expect that the system of after-school care centres, which are located in the majority of schools, allows mothers to undertake professional activity, and that expenses related to childbearing push them into the labour market. Unfortunately, the database



did not provide enough information to analyse the labour market participation of women with younger children (less than 6 years old).

Table A2 in the appendix presents the results of a quantile regression with a correction for women's labour market selectivity. For comparison's sake, an estimation which ignores selection is also presented (last column). Women's selectivity into employment only slightly influences our results, although the direction of the bias depends on the quantile of the earnings distribution.

Age had a positive but diminishing effect on logs of earnings at any point of female earning distribution, but had the strongest impact at the 50th percentile. An analysis of level of education reveals an interesting pattern: having university education in comparison to vocational or lower education increases a log earning in the informal market mostly for women in the middle of earnings distribution. We expect that this impact is stronger at higher percentiles of earnings distribution, and this is a fact in the case of female earnings in the formal market (Table A3). Although in the informal market a level of education might not be the most important factor of wage increase, which is why this relation is not so visible. An earning penalty for working informally in agriculture is highest at the 50th percentile. While the highest positive impact of sector variable on female earnings is observed in the case of health and education at the 75th percentile. This is in line with our observation that most private tutorial lessons are given informally, and it is an activity which generates rather significant income.

In the formal market, we observe slightly different patterns (Table A3 in the Annex). Age has the strongest impact on female wages at the bottom of the earnings distribution, and is relatively less important than in case of the previously analysed informal market. As mentioned above, having a university degree increases the log of earning mainly for women with higher earnings (75th percentile). Unlike in the previous analysis, employment in agriculture does not seem to have a negative impact on the log of earnings, and returns from health and education are more moderate than in the informal market. Interestingly, women working in the construction sector receive a high premium in all levels of earnings distributions.

Coefficients not only differed between women working in the informal and formal markets, they also differed from those observed for men. As the main part of our analysis is focused on differences between genders, Table A4 presents closer estimates of quantile regression for men. Due to the small sample size, there are only a few statistically significant coefficients in the earnings regression for men in the informal market, and mainly at the top of the earnings distribution (75th percentile). In the informal sector the highest returns for men are associated with post secondary (or vocational post secondary) education. These results are different than



those reported for women in the informal sector for whom a university degree gives the highest returns, and different from men's situation in the formal market, which also rewards more higher education. One might assume that post secondary education provides men with skills and knowledge which is better valued at informal market⁸. Contrary to the findings from the informal sector for women, men working informally in health and education have a lower log of earnings than if they work in a different sector.

There are also noticeable differences between males and females working in formal employment. The majority of disparities are related to the sector of activity, while socio-demographic characteristics have the same sign, and differ only in the size of impact. For example men working in construction can expect lower logs of earnings than if they work in another other sector, while for women, activity in this sector is rewarded more than their work in a reference sector of activity.

As we mentioned before, age can be treated as an approximation of experience. The results of our estimations suggest that returns to experience are higher in informal jobs (in all analysed percentiles for women and in the 75th percentile for men) than in formal ones. Moreover there is a different pattern in regards to education. A closer look at our results shows that secondary vocational and post-secondary education of men in the informal market is more favourable than a university degree from the point of view of wages, and this is a particular characteristic of males in informal sector. Interestingly, working full time increases the log of earnings mainly at the bottom of the earning distribution in informal sector, while being located in city has a positive impact on wage distribution on both markets and for both genders.

In formal sector also working full-time in comparison to part-time is important, but a person (both a woman and a man) in 25th quantile can expect higher wage when working full-time and in 75th quantile one can expect lower wage.

Results of quantile regressions, separately for women and men working in formal and informal sectors, presented in Graphs A1 to A4 in the Appendix allow for graphical comparison of parameter estimates.

Counterfactual decomposition of quantile regression

Table 5 summarises the results of the decomposition of the gender earning gap in the formal and informal sectors in selected percentiles. It reports a decomposition of the wage gap into the

⁸ This category includes professions common in the informal market: construction workers, mechanics, etc.

characteristics and coefficients effects. Results from all decompositions indicate that the gender earnings gap would be even higher if women had men's characteristics.

Table 5. Decomposition of the gender earnings gap

	INFORMAL EMPLOYMENT		FORMAL EMPLOYMENT	
Quantile 0.25	Effect	St. Error	Effect	St. Error
Raw difference	0.181**	0.073	0.135***	0.014
Characteristics	-0.071	0.121	-0.014	0.012
Coefficients	0.252*	0.139	0.148***	0.016
Quantile 0.5				
Raw difference	0.133**	0.058	0.139***	0.015
Characteristics	-0.076	0.141	-0.048**	0.017
Coefficients	0.208	0.131	0.186***	0.021
Quantile 0.75				
Raw difference	-0.003	0.117	0.109***	0.025
Characteristics	-0.173	0.133	-0.071**	0.027
Coefficients	0.170	0.154	0.180***	0.031
OLS				
Raw difference	0.106	0.077	0.124***	0.016
Characteristics	-0.105	0.140	-0.044***	0.017
Coefficients	0.129	0.099	0.184***	0.019
Interaction	0.082	0.153	-0.016	0.019

***statistically significant at 1% level, ** significant at 5% level, * significant at 10% level

The first conclusion from the presented numbers is that according to characteristics observed in the data, women should have higher wages than men. That is in line with descriptive statistics presented in Table 1 which show the relatively better education of women in Poland, no matter which labour market (formal or informal) they work in. The majority of the gender log pay gap in both types of work is due to differences in returns to labour market characteristics rather than to differences in these characteristics.

Differences in coefficients are significant at least at 10% level mainly for the formal labour market but the results for the informal labour market have been presented as well. The results confirm our findings that in formal employment, a higher gender pay gap exists. Due to some type of discrimination, it is in the higher end of the wage distribution. In informal employment, there is a higher level of discrimination among lower paid workers.

In the informal sector, women have relatively better characteristics than men even in comparison with the formal sector. Our models take into account education level but not type of education, which may explain the result to some extent.



The negative sign at the 75th quantile may suggest that in informal work, highly paid women have such favourable characteristics in comparison to men that even lower returns cannot influence their lower wages. However, as this value is not significant – again due to the small sample size – more thorough examination of this thesis could be an interesting research question for future.

5. Conclusions

In this paper we used a set of cross-sectional data on both formal and informal work in Poland in 2007 to check if the gender pay gap observed in the formal market also occurs when a person works without registration. Additionally, we examined the gender differences in earning distribution for both types of employment. Various methodological approaches were used, starting from measures of dispersion in earnings for women and men in both labour markets, then adopting the quantile regression method using the Machado-Mata (2005) and Melly decomposition (2006) developing the Blinder/Oaxaca (1973) approach. Additionally, the issue of selectivity to employment for women was accounted for.

As we expected, an analyses of entropy indices indicated a higher level of earnings inequality in the informal economy than in the regulated jobs market. This finding supports the argument of Fields (2005) who suggested there is a substantial level of heterogeneity among voluntary and involuntary workers engaged in the informal sector.

Furthermore our results confirm the existence of the gender pay gap in both informal (unregistered) and formal employment in Poland. However its size and characteristics differ depending on the level of earnings. The inequality of earnings between unregistered women and men is more pronounced at the bottom of the earnings distribution. In the case of formal employees, the inequality at the top of the distributions tends to be larger. Consequently, the gender pay gap in the informal labour market decreases as we move up the earnings distribution. Yet a different pattern is observed in formal employment. After controlling for age, education and sector of activity, we found that the gender pay gap increases as we follow the earnings distributions.



Findings from the Polish formal labour market confirm those of other European studies, in which the existence of a strong glass ceiling effect is observed (Albrecht et al., 2004; Albrecht et al., 2001). On the other hand, results from the informal labour market indicate that specific characteristics of this type of employment, especially the lack of a minimum wage scheme, and regulations of conditions and hours of work, could partially explain the unfavourable situation of women in the 'lower tier'.

We also found that returns to experience (approximated by the age variable) are higher in informal jobs, but differences in these returns between men and women are significant only at the bottom part of wage distribution. Age in formal employment has the strongest positive impact on female wages at the bottom of earnings distribution, but it is relatively less important that in the informal market.

Returns to education increase with wage distribution for both men and women but some of the education levels become insignificant.

We also identified gender disparity in returns to sectors of activity. In the informal sector, women gain if they are working in the health or education sectors, while there is an earning penalty for working in agriculture sector. In the case of male informal workers, working in the construction sector substantially increased their log of earning in all analyzed quantiles.

The results from a decomposition of the wage gap into the characteristics and coefficients effect indicate that the gender earnings gap would be even higher if women had men's characteristics. This finding is contrary to those reported for some Western Economies and might indicate specific characteristics of women in a post-socialist country. Women are generally better educated than men but probably the type of education (not visible in our data) also has some effect.

As the topic of a gender pay gap in the informal market is only meagrely covered in the literature, there is a lot of potential for further studies. The use of longitudinal data might give an interesting insight into the dynamics of the informal market and especially gender specific aspects. An analysis of the macro condition of the labour market in the current economic situation could add to knowledge of informal market mechanisms. As the main limitation of our study is the size of our dataset (especially with regards to informal workers), the use of larger, more developed dataset would be the most valuable extension of this study.



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Appendix

Table A1. Selection into labour market (female)

Variable	Probit model		Semi-parametric model
	Coefficients	Standard error	Coefficients
Basic education	-1.089***	0.051	1.00 (default)
Vocational basic education	-0.501***	0.038	-0.234
General secondary education	-0.221***	0.046	-0.049
Married	-0.042	0.034	-0.005
No of children <15	0.037**	0.017	0.015
Constant	0.410***	0.033	-
No of observations	6720		No of observations: 6720
Log likelihood	-4376.72		Bandwidth: 0.00734533
Correctly classified	62.02%		Correctly classified: 62.94%

***statistically significant at 1% level, ** statistically significant at 5% level, * statistically significant at 10% level

**Table A2. Estimations of quantile regressions for women in the informal sector**

	Semiparametric (n=204)			Parametric(n=204)			Ignoring selection (n=204)		
	q=0.25	q=0.5	q=0.75	q=0.25	q=0.5	q=0.75	q=0.25	q=0.5	q=0.75
Age	0.079***	0.114**	0.103***	0.067*	0.116**	0.102**	0.052	0.140***	0.105***
Age sq	-0.113***	-0.150**	-0.133***	-0.099	-0.155**	-0.131**	-0.078*	-0.185***	-0.135***
Edu_3	0.116	0.389**	0.354***	0.012	0.305	0.259	0.077	0.452***	0.295**
Edu_2	0.180*	0.006	-0.039	-0.062	-0.216	-0.194	0.134	0.024	-0.107
Edu_1	0.526***	0.737***	0.534***	0.271	0.533*	0.347	0.473**	0.598**	0.458**
Married	0.096	0.182	0.022	0.003	0.109	-0.077	0.107	0.085	-0.021
Familysizee	-0.069**	-0.110**	-0.101***	-0.074**	-0.110**	-0.109***	-0.068**	-0.074*	-0.109***
Full- time	0.081	0.229	0.251***	0.102	0.215	0.265**	0.096	0.197	0.258**
City	0.350***	0.342*	0.025	0.278	0.301	-0.012	0.386***	0.345*	0.007
Town	0.149	-0.005	-0.191	0.143	-0.011	-0.205	0.207	0.069	-0.207*
Agriculture	-0.470***	-0.500**	-0.301**	-0.469**	-0.502**	-0.261	-0.605***	-0.495**	-0.248*
Manufacturing	0.025	-0.152	-0.292*	0.039	-0.123	-0.254	0.047	-0.038	-0.248*
Construction	0.100	-0.020	-0.292	0.097	-0.026	-0.301	0.097	-0.027	-0.286
Trade	-0.203	-0.184	-0.334***	-0.144	-0.155	-0.287*	-0.121	-0.137	-0.282**
Hotel	0.285*	0.431*	0.301*	0.288	0.426*	0.301	0.291*	0.383*	0.319*
Transport	-0.020	-0.274	-0.550***	0.012	-0.290	-0.547***	-0.006	-0.172	-0.513**
Health/educatio n	0.212	0.495*	0.650***	0.203	0.509*	0.670***	0.229	0.436*	0.716***
Constant	-0.162	-0.369	0.461	0.929	0.371	1.057	0.569	-0.667	0.725

***statistically significant at 1% level, ** significant at 5% level, * significant at 10% level

Edu_1- tertiary education ; Edu_2 – Post secondary and secondary vocational education ; Edu_3 – General secondary education

**Table A3. Estimations of quantile regressions for women in the formal sector**

	Semiparametric (n=2334)			Parametric (n=2334)			Ignoring selection (n=2334)		
	q=0.25	q=0.5	q=0.75	q=0.25	q=0.5	q=0.75	q=0.25	q=0.5	q=0.75
Age	0.033***	0.028***	0.015	0.034***	0.029***	0.014	0.038***	0.029***	0.018
Age sq	-0.035***	-0.026***	-0.009	-0.036***	-0.027***	-0.008	-0.041***	-0.027***	-0.013
Edu_3	0.220***	0.257***	0.308***	0.192***	0.244***	0.263***	0.216***	0.248***	0.296***
Edu_2	0.192***	0.210***	0.247***	0.119***	0.184***	0.144***	0.177***	0.198***	0.230***
Edu_1	0.516***	0.612***	0.790***	0.437***	0.583***	0.686***	0.504***	0.595***	0.775***
Married	0.023	0.029	0.039	-0.003	0.019	0.004	0.018	0.026	0.037
Family size	-0.014**	-0.024***	-0.019**	-0.018***	-0.025***	-0.021**	-0.017**	-0.024***	-0.019*
Full time	0.124***	0.053*	-0.119***	0.120***	0.047*	-0.119***	0.104***	0.050*	-0.101**
City	0.134***	0.189***	0.144***	0.114***	0.185***	0.117***	0.143***	0.188***	0.144***
Town	0.028	0.058**	0.013	0.024	0.058**	0.016	0.024	0.055**	0.007
Agriculture	0.167**	0.241***	0.347***	0.161*	0.221***	0.347***	0.188**	0.201***	0.328***
Manufacturing	-0.006	0.017	-0.005	-0.007	0.027	-0.026	0.002	0.015	-0.001
Construction	0.303***	0.319***	0.291***	0.300***	0.330***	0.291***	0.293***	0.334***	0.291**
Trade	-0.103***	-0.112***	-0.161***	-0.101***	-0.107***	-0.171***	-0.095***	-0.108***	-0.160***
Hotel	0.036	-0.011	-0.014	0.037	-0.009	-0.015	0.004	-0.010	-0.023
Transport	0.179***	0.066	0.038	0.179***	0.074	0.038	0.168***	0.072	0.027441
Health/education	0.091***	0.109***	0.128***	0.092***	0.112***	0.117***	0.084***	0.113***	0.112***
Constant	0.535***	0.892***	1.474***	0.803***	0.979***	1.856***	0.578***	0.939***	1.522***

***statistically significant at 1% level, ** significant at 5% level, * significant at 10% level

Edu_1- tertiary education ; Edu_2 – Post secondary and secondary vocational education ; Edu_3 – General secondary education



Table A4. Estimations of quantile regressions for men

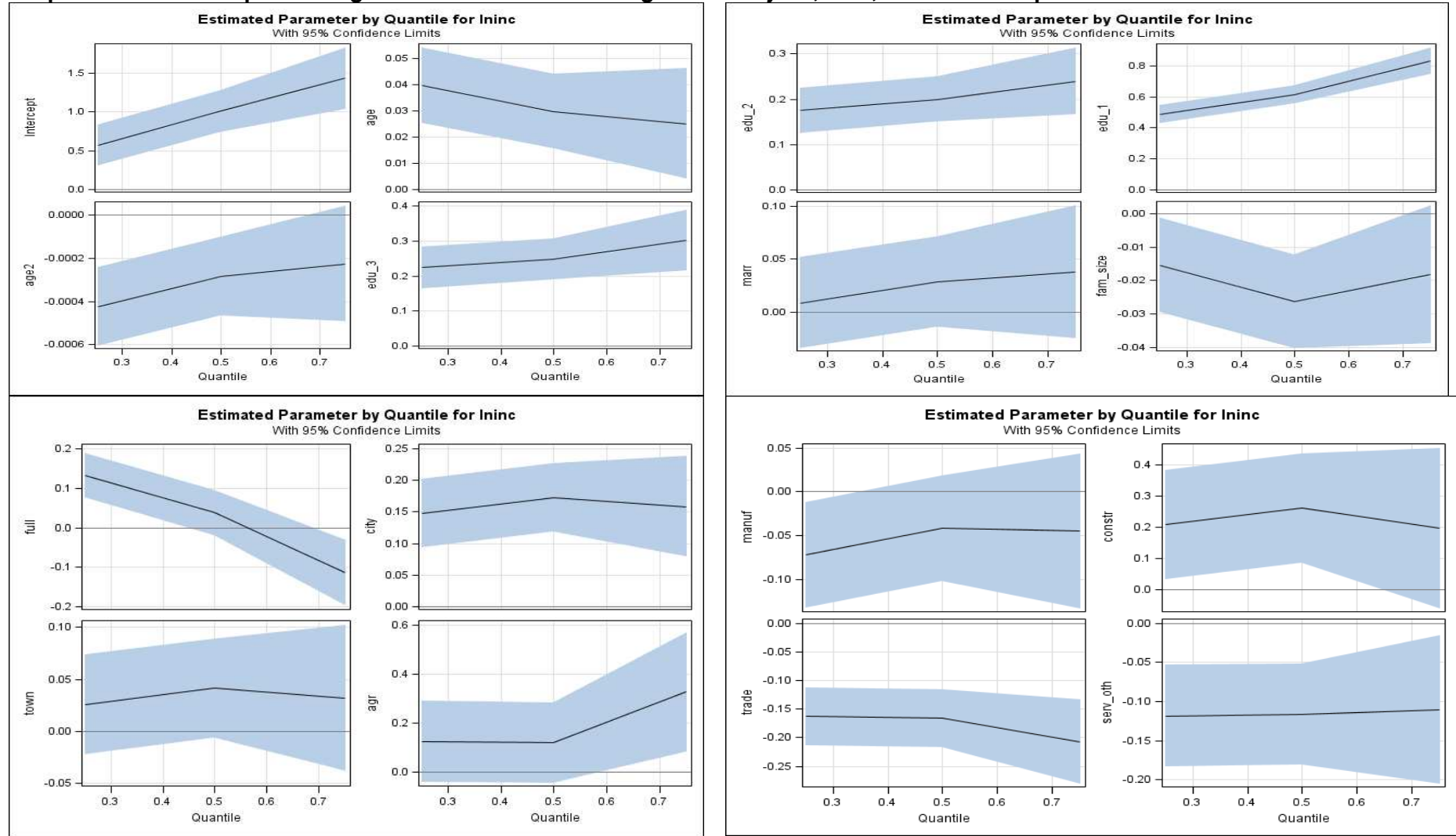
MEN	INFORMAL (n=248)			FORMAL (n=2478)		
	q=0.25	q=0.5	q=0.75	q=0.25	q=0.5	q=0.75
Age	0.010	0.037	0.060**	0.037***	0.054***	0.052***
Age sq	-0.012	-0.048	-0.073**	-0.044***	-0.006***	-0.062***
Edu_3	-0.011	0.094	0.210	0.129***	0.129**	0.139***
Edu_2	0.209*	0.153	0.337***	0.178***	0.152***	0.119***
Edu_1	0.252	0.293	0.199***	0.431***	0.435***	0.451***
Married	0.142	0.186	-0.002	0.098***	0.090***	0.122***
Family size	-0.017	-0.035	-0.005	-0.021***	-0.018**	-0.023***
Full time	0.172	0.170	0.110	0.127***	-0.025	-0.149***
City	0.256*	0.192	0.280***	0.100***	0.155***	0.207***
Town	0.196	0.037	0.010	0.007	0.038	0.061**
Agriculture	-0.266	-0.351*	-0.037	-0.206***	-0.246***	-0.125*
Manufacturing	0.245	0.200	0.107	-0.058*	-0.079**	-0.101***
Construction	0.123	0.175	0.186**	-0.029	-0.073**	-0.106***
Trade	0.206	0.096	0.186	-0.065	-0.160***	-0.177***
Hotel	-0.041	0.075	-0.254	-0.180*	-0.258***	-0.170*
Transport	0.341*	0.307	0.009	0.017	-0.031	0.031
Health/education	0.290	-0.072	-0.431***	-0.060	0.033	-0.017
Constant	1.016	1.027	0.805*	0.845***	0.927***	1.323***

***statistically significant at 1% level, ** significant at 5% level, * significant at 10% level

Edu_1- tertiary education ; Edu_2 – Post secondary and secondary vocational education ; Edu_3 – General secondary education

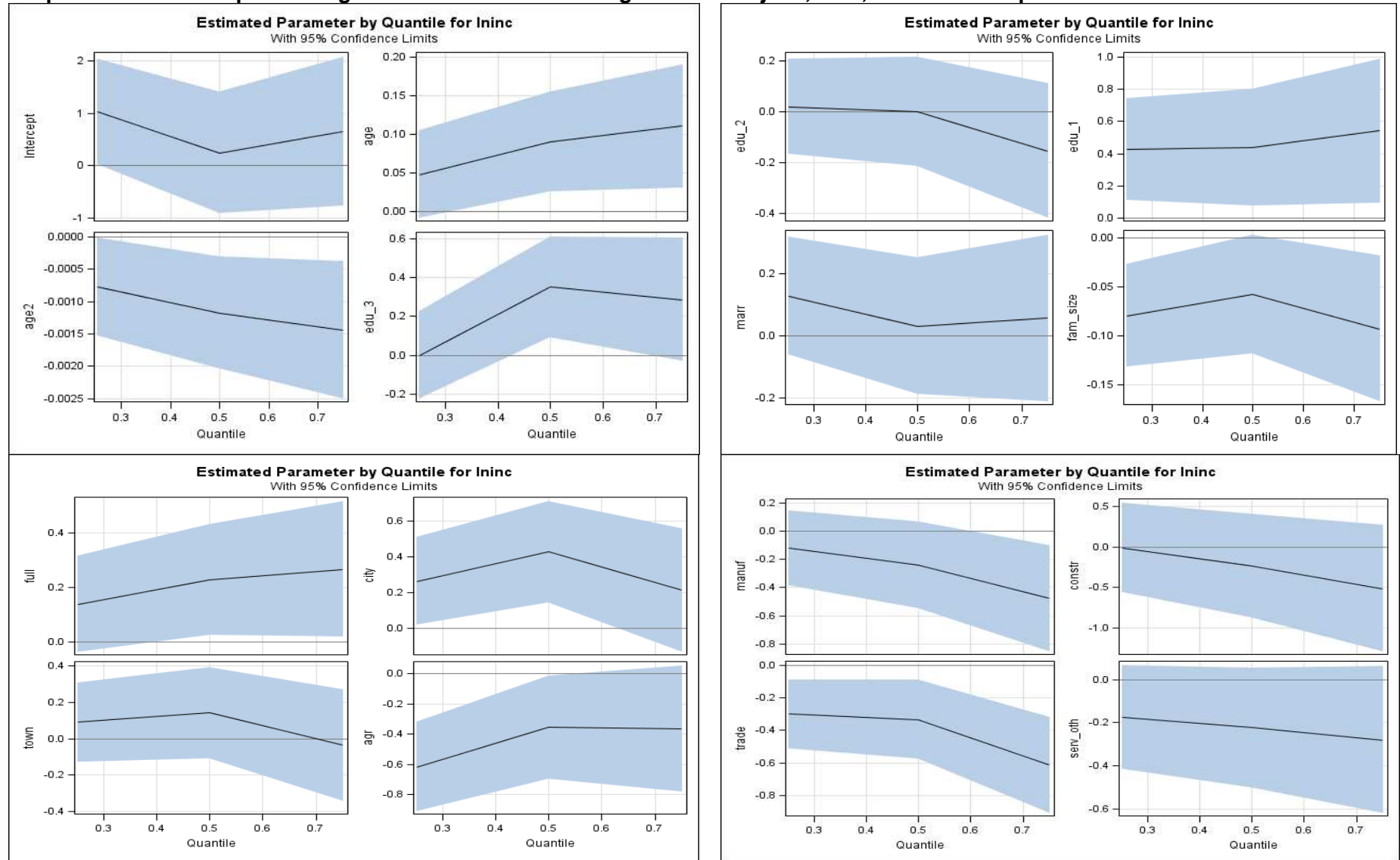


Graph A1. Results of quantile regression for women working in formal jobs, 25th, 50th and 75th percentiles



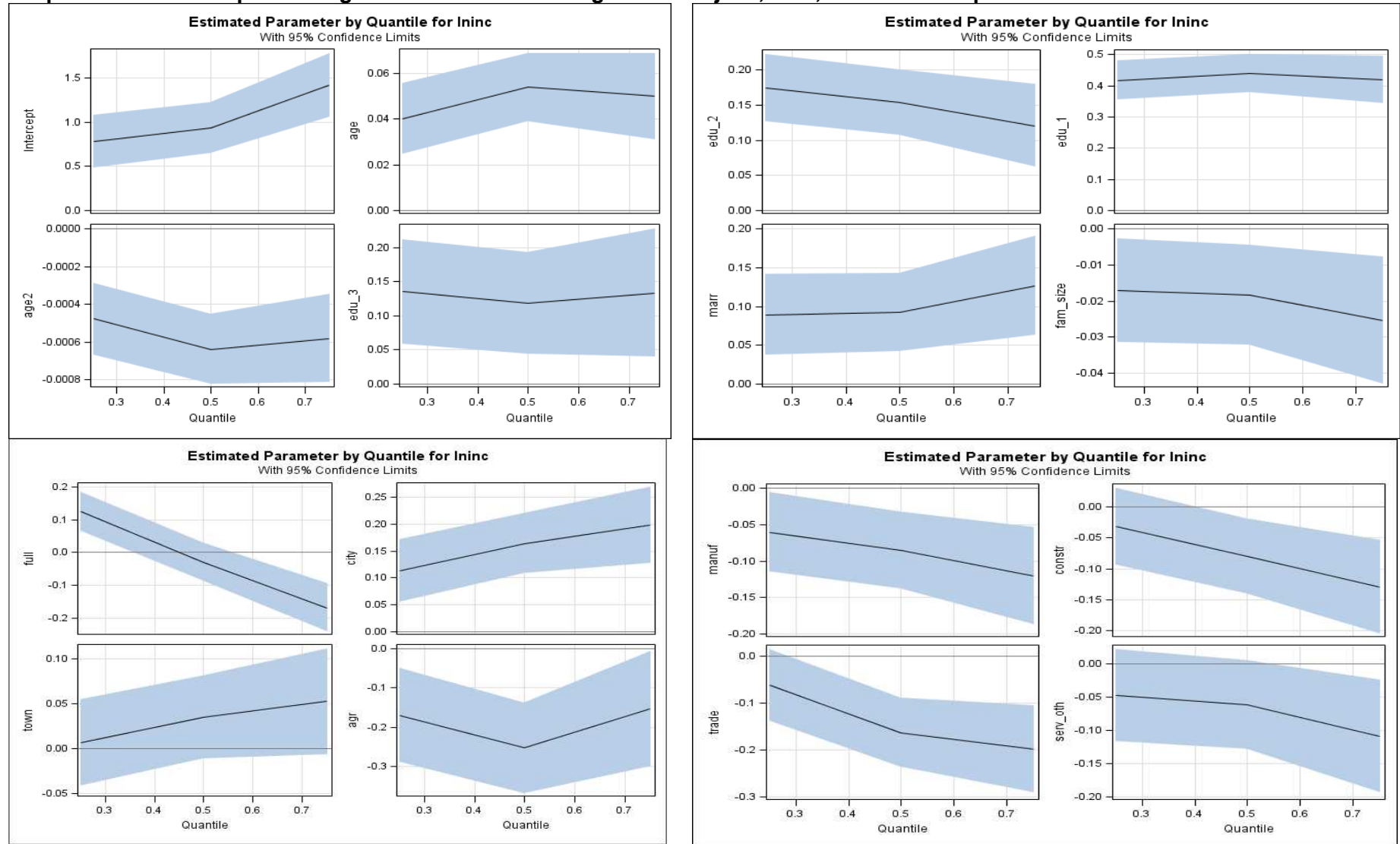


Graph A2. Results of quantile regression for women working in informal jobs, 25th, 50th and 75th percentiles





Graph A3. Results of quantile regression for men working in formal jobs, 25th, 50th and 75th percentiles





Graph A4. Results of quantile regression for men working in informal jobs, 25th, 50th and 75th percentiles

