Shadow Employment in Transition - A Matter of Choice or No Choice?[*]

Stanislaw Cichocki[†]
University of Warsaw
Transparency International Poland

Joanna Tyrowicz
University of Warsaw
National Bank of Poland

Abstract

Shadow employment may follow from two main labour market failures. In the first, official market labour taxation distortions make it ineffective for some agents to engage in registered employment due to a tax wedge, which makes the revenues from unofficial employment higher than the corresponding official ones (tax evasion hypothesis). The alternative explanation draws to labour market tightness - for workers regular employment may be unattainable, which results in seeking earning opportunities beyond the boundaries of the official labour market (market segmentation hypothesis).

We use a unique data set from a survey on undeclared employment. Using propensity score matching and decomposition techniques we demonstrate that workers of the shadow economy are characterized by slightly higher endowments, while their revenues are considerably lower than among the matched official economy counterparts. Although unobservable heterogeneity is considerable, results are robust and point to social exclusion and the market segmentation hypothesis.

Key words: undeclared employment, propensity score matching, Oaxaca-Blinder decomposition, transition

JEL Codes: O17, J22, P37

Introduction

In theory, decision of both parties not to formalise the employment relationship involves many aspects. Frequently the arguments of prohibitive tax wedge or minimal wage regulations are raised, by stating that it would not be attractive for the employer to formalise the employment contract because the wage he would be forced to pay would exceed the marginal value of the respective workers' contributions. According to this view, for some workers official employment relation is simply unattainable, suggesting labour market segmentation.

Some claim on the other hand, that these are indeed tax evasion reasons which underly undeclared work in many market economies, including mature ones, (Lemieux, Fortin and Frechette 1994). For example, Fugazza and Jacques (2004) construct a model, where some individuals go underground because they are able to fully escape taxation and/or labor regulations imposed by the government, implying that tax compliance is only partial in their model, while workers face heterogenous (perceived) costs of noncompliance. Kopczuk (2001) considers alternative sources for this heterogeneity, including those uncorrelated with skills, demographic characteristics or - rationally justifiable - access to opportunities.

Summarising, there seem to be two hypotheses underlying the observed occurrence of in-the-shadow-employment. First, market segmentation hypothesis suggests that for some workers the access to the official labour market may be limited, forcing them to accept the unofficial relation with employers. On the other hand, informal employment may indeed be preferred by the employees in accordance with the tax evasion hypothesis. In this view, undeclared or under-declared work is motivated by the benefits of evading taxation and/or social security contributions. Importantly, both these reasons may coexist - with different individuals responding to the two alternative hypotheses. The microeconometric evidence may merely demonstrate which of these effects dominates on a particular labour market.

In this paper we use a unique data set from survey on shadow employment. Based on this data, we are able to asses whether or not the observed discrepancies in declared income for regular and informal employment are justifiable by the individual characteristics (adverse selection). Namely, controlling for individual characteristics we compare the earnings paid by the official and unofficial economy. The main question we attempt to address is whether in-the-shadow-employment corresponds on average to an individual earnings maximisation strategy. Alternatively, we may confirm that *ceteris paribus* official earnings of these individuals would have been higher than the actually declared ones. We would find that to be evidence of the labour market dualism and limited access to formalised employment for some individuals.

We apply the decomposition and propensity score matching techniques to account for potential heterogeneity among regular and informal compensation (and workers). We demonstrate that actually workers of the shadow economy are characterized by slightly higher endowments, while their revenues are lower than among the matched counterparts. Although unobservable heterogeneity is considerable, results are robust and demonstrate that effectively shadow economy pays less than the regular market, which points to social exclusion and market segmentation hypotheses.

The paper is structured as follows. Section (1) briefly reviews the literature and the up to date studies for Poland and other CEECs. Following, sections (2) and (3) discuss data and empirical approach, respectively. Finally, section (4) present the results of analysis. With the Conclusions we also suggest some directions for further studies.

1 Literature review

The literature on shadow economy is vast. First papers on this phenomenon developed simple definitions and basic statistical methods of measurement, (Gutmann 1977). Tanzi (1983) as well as Frey and Weck-Hanneman (1984) focused on more sophisticated methods of gray economy measurement. In the course of research on shadow economy more attention was paid to causes of shadow economy Johnson, Kaufmann and Zoido-Lobaton (1998), while a comprehensive overview on definitions of underground economy, its size, causes, consequences and methods of measurement is given by Schneider and Enste (2000).

Using qualitative evidence suggests that indeed motivations for undeclared work may be diverse. For example, Williams and Windebank (2002) argue - based on 515 structured interviews in British urban neighbourhoods - that higher income people engage into undeclared work for purely economic motivations, while for lower-income workers the reasons include predominantly social and casual origins. In earlier work Williams and Windebank (2001) argue even that paid informal exchange is seldom undertaken by either purchasers or suppliers to achieve maximum money gains, while it is mostly conducted for and by close social relations for reasons associated with redistribution and sociality. Contrary evidence is presented by Graversen and Smith (2002) for Danish LFS data, who estimate a bivariate random effect panel data model for the labour supply in the taxable regular and the non-taxable underground sectors, demonstrating that taxes divert the labour supply away from formal towards undeclared employment.

Former socialist economies are especially troubled by unofficial employment, (Schneider and Enste 2000), (Eilat and Zinnes 2002), (Schneider 2002). In addition, Eastern European countries are traditionally characterised by informal relationships between employers and employees, especially in some sectors of the economy, (Kalaska and Witkowski 1996). This process may be fading in time, as suggested by Gardes and Starzec (2002) or persist as a permanent structure, (Dupaigne M. 2001).

Indeed, conducted studies show a much bigger size of shadow economy for transition countries than for established market economies, (Friedman, Johnson, Kaufmann and Zoido-Lobaton 2000). This holds also for the enlarged EU. While the size of underground economy for EU-15 is estimated on average to be 18-19% of GDP it is about 31-32% of GDP for CEECs, (Schneider 2007). This difference in the size of shadow economy definitely needs explanation and research into it's causes. Regarding unregistered employment in other CEE countries Renooy, Ivarsson, van der Wusten-Gritsai and Meijer (2004) conducted a study estimating its size from 9% of GDP in Estonia and Czech Republic to 30% of GDP in Bulgaria.

On the other hand, these analyses face obvious shortcomings. First of all, focusing on the *size* of the shadow economy and/or unofficial employment, they rarely provide any insights into the verification of the determinants of this phenomenon. Kritz, Merikull, Paulus and Staehr (2008) discuss the determinants of employment in-the-shadow in Estonia using official, administrative data and surveys on "envelope wages". While most of the studies focus on tax evasion motivations, *cfr.* Meriküll and Staehr (2008), usually available data does not permit to approach empirically the market segmentation hypothesis.

Research on the shadow economy in Poland is no different in this respsect. [1]. After 1989 interest

---

[1] The first studies appeared even before the transition to the market economy. Bednarski, Kokoszczynski and Stopyra (1988) tried to measure its size, while already after the outbreak of transition Cassel, Jaworski, Kath,

in the problem of shadow economy in Poland rose resulting in new research[2], however the number of such analyses is still scarce. Poland was typically comprised in cross-country studies, while data usually originated from Central Statistical Office (CSO), which conducts biannual survey study on undeclared employment and shadow economy, (Johnson et al. 1998), (Schneider 2007).

Currently, the estimates for the size of undeclared employment for Poland are mostly conducted by the CSO. According to the latest available survey, about 9.6% of the labor force are active in shadow economy. These numbers are substantially lower than the findings from the beginning of transition period, while they are consistent with other sources of data on labour market choices in Poland. Namely, comparing the labour force survey (LFS) declarations with the official registry data one can present an "educated guess" about the scale of people formally unemployed or inactive (obtaining some form of social transfers) who actually do benefit from wage employment in an unofficial manner, compare Figure 1. Throughout the 1999-2007 on average approximately 10% of the declared unemployed were actually working, which corresponds roughly to 1-2% of the labour force.
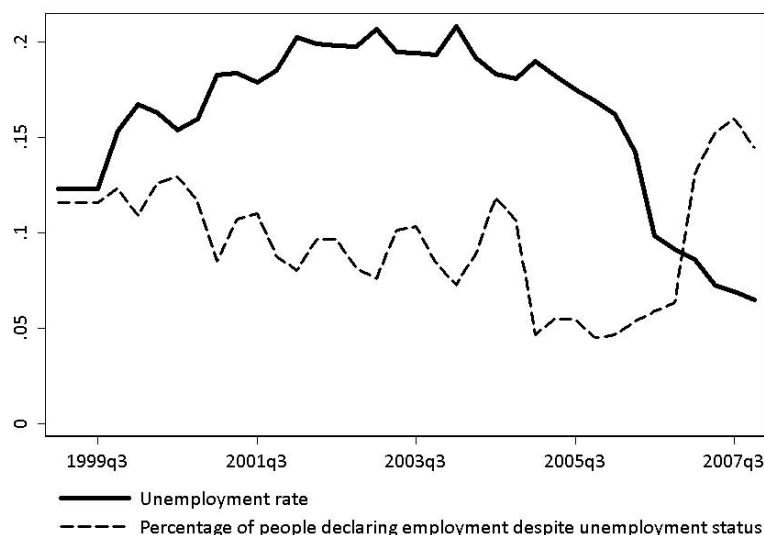

Figure 1: Employed, unemployed and undeclared employed over 1995-2007 in Poland

Also, other policy relevant issues remained unaddressed, including the issue of people undertaking employment in shadow economy additional to their official. Attempting to fill in these gaps, a dedicated study has been conducted in 2007 by the Ministry of Labour and Social Affairs on a sample of approximately 18 000 households, which we use in this study.

Kierczynski, Lutkowski and Paffenholz (1989) as well as Bednarski (1992) gave a detailed description of the shadow economy phenomenon. While this research coped predominantly with the consequences of centrally planned economy for the ways in which individuals exhibited economic activity, the comparability with analyses for the other countries, let alone Poland after the transformation is rather limited.

[2]The Institute for Market Research (1995) estimated that about 30% of adolescent Poles work in an undeclared fashion.

2 Data

The data set we use is a compilation of two data sets obtained during a research project on unregistered employment conducted by the Center for Socio-Economic Research for the Polish Ministry of Labor and Social Affairs in the period May-June 2007. For the aim of propensity score matching we combined:

1. a data set which consists of 18 121 observations of household members older than 15 years from 8 000 inquired households - questions to these individuals concerned both demographic characteristics, economic activity (including the declared earnings) and their views on the shadow economy;

2. a data set with 1000 individuals aged 16 to 75 who declared employment in the shadow economy - questions include socio-economic determinants and individually declared earnings.

Both datasets were collected during the same survey, while all subjects were inquired about their sentiments towards unregistered employment, as well as their labour market status and details on eventual employment. The samples for both data sets were stratified according to territorial location (16 voivodships) and the size for the town of residence[3]. For both datasets, stratification was performed independently based on each of the characteristic, while in the second stage the households were drawn proportionately from the selected communities. The registry od communities with the size of population was based on National Census.

Individuals were asked about their declared employment-related revenues (for the purposes of comparison and due to methodological difficulties we have excluded self-employed individuals). Although official, administrative data would have been more reliable, they are not accessible for Poland. At the same time, because this survey bore no consequences in terms of tax burden, it is likely that the reported employment-related revenues are actually more accurate.

The questions about shadow economy and informal employment included direct and indirect ones. Namely, aside from asking whether one is employed unofficially, individuals were inquired about specific forms of informal relationship with the employers. Namely, individuals were asked if (i) their compensation is paid without declaring it to the social security and taxing authorities, (ii) the employment contract with the current employer will only be signed in the future, (iii) performed any of the listed activities in an undeclared way[4]. Consequently, the definition of the in-the-shadow employment corresponds to any of the above three occurrences. Importantly, all these forms constitute informal employment under Polish legislation. Moreover, employment-related revenues declared in this survey effectively could not be declared to the tax authorities, as any transfer of the employment-relate social security contributions is a sole responsibility of the employers in Poland. Therefore, it seems reasonable to assume that these earnings are not reported in anyway by the employees.

---

[3]These strata include: rural areas, towns under 10 thou inhabitants, towns under 20 thou inhabitants, towns under 50 thou inhabitants, towns under 100 thou inhabitants, towns under 200 thou inhabitants, cities under 500 thou inhabitants, cities under 1000 thou inhabitants and Warsaw.

[4]Based on the preliminary qualitative research the typical areas of informal employment were found to include: compensated simple housework for someone outside direct family, compensated fieldwork or orchardwork for someone outside direct family, compensated assistance to children or elderly outside direct family, trade, extra-curricular teaching, translations, compensated intermediation.

As frequently in survey datasets, some available data were inconsistent. Although interviewees had the option of not declaring income (coded separately in the data set), in some records information about income was simply missing. Sometimes, also information about education (coded categorically) or age was lacking. We also eliminated elderly who did not declare any form of labour activity. Therefore, after merging the data sets we removed those observations. Table 1 reports the descriptive statistics for both the original and the trimmed data set.

Table 1: Descriptive statistics

Variable	Original sample	Trimmed sample		
		Total	Formal employment	Informal employment
Declared earnings	401.11	521.72	524.5899	510.7482
	(752.20)	(819.13)	(836.2377)	(738.9243)
Gender (1=female)	.524	.501	0.5179	0.3183
	(.499)	(.5)	(.4997)	(.4662)
Marital status (1=has a dependant)	.951	.822	.6088	.6565
	(.876)	(.874)	(.488)	(.4752)
Age	41.54	35.18	34.8765	40.0368
	(17.20)	(12.82)	(12.8449)	(12.9032)
Undeclared employment	.052	.059		
	(.223)	(.234)		
Work (1=working, 0=not working)	.535	.614		
	(.536)	(.487)		
Activity (1=active, 0=inactive)	.558	.758		
	(.522)	(.428)		
No of observations	19 122	13889	13071	818

Source: Data from *Undeclared Employment* study by Ministry of Labour and Social Affairs, 2007. Standard errors in parentheses. Some categorical variables (education, profession, sector of employment) used in subsequent study not reported.

As Table 1 suggests, earnings in the shadow sphere of the economy are somewhat lower than among those who declare official employment. Although the difference between the means does not seem to be statistically significant at any reasonable level, the observation itself is puzzling already. Should the analysis confirm higher returns to employment in the shadow economy, we would find support to the belief that such form of employment is preferred by employees (and employers), while the reasons may be complex and include tax evasion and/or myopia[5]. However, proving the alternative hypothesis would suggest that some employees lack access to the formal labour market and thus are forced to exist in the "shadow", despite relatively high productivity. As the magnitude of the standard errors suggests, heterogeneity of earnings is considerable in both spheres. Therefore, a suited econometric technique is necessary to distinguish between the interacting determinants of work compensations.

3 Empirical strategies

Following the literature developments, we approach the issue of formal and informal compensations by the use of two analytical techniques: Oaxaca-Blinder decomposition and propensity score matching. We are intending to test whether shadow employment effectively increases the potential benefits for the individuals or posits the only available opportunity of guaranteeing wage income.

---

[5]In Poland, pension system is capital based, which implies avoiding these contributions has consequences in the social security transfers after retirement.

To this end we chose two independent techniques, which correspond to two opposite *ex ante* beliefs about the nature of the unobserved heterogeneity.

Discrimination on the labour market can be defined to exist, if the actual mean earnings of members of specific groups are not identical to the mean which would be observed in a perfectly functioning labour market, without discrimination. In principle, if one applies Heckman (1979) correction to a Mincerian wage equation, one controls for a non-randomly distributed unobserved heterogeneity, *i.e.* the purposefulness of the selection mechanism is implicitly assumed. Consequently, performing Oaxaca (1973) - Blinder (1973) decomposition on these estimates leads to finding the size and direction of discrimination *conditional* on the assumption that non-random selection is the only source of potential earnings differential. Naturally, the decomposition itself is crucial, because even with the Heckman (1979) correction, in case of systematic discrimination results obtained may be false. As Blinder (1973) demonstrates, the unexplained component (the difference in the shift coefficients) does not necessarily have to be attributed to discrimination, which necessitates the use of decomposition techniques. Consequently, we follow Oaxaca-Blinder decomposition to address the potential systematic differences between individuals employed formally and in-the-shadow, *systematically conditional on some individual characteristics.*

Alternatively, the opposite *ex ante* belief about the nature of the unobserved heterogeneity may hold. Namely, if the selection was *random conditionally on some individual characteristics*, Heckman (1979) correction would not necessarily bring about correct results. Consequently, one would not be able to use selection equation correction as reliable counterfactual in the second stage equation of the compensation, Rosenbaum and Rubin (1983), Heckman, Ichimura and Todd (1997), Heckman, Ichimura and Todd (1998). By applying propensity score matching one is able to "create" the counterfactual, *i.e.* correct the calculations for the effect of choosing among the control group only those who "match" (are similar) the observed characteristics to the analysed group. Consequently, by using the property of randomness within the matched groups, one is able to evaluate the average effect of a particular phenomenon (in this case: shadow employment) with respect to a reasonable benchmark.

3.1 Oaxaca-Blinder decomposition

To examine gap between high-wage and low-wage workers Blinder (1973) decomposes the explained component into (i) the differences in endowments between the two groups, "as evaluated by the high-wage group's wage equation" and (ii) "the difference between how the high-wage equation would value the characteristics of the low-wage group, and how the low-wage equation actually values them", (Blinder 1973). Blinder called the first part the amount "attributable to the endowments" and the second part the amount "attributable to the coefficients", and he argued that the second part should also be viewed as reflecting the discrimination: "[this] only exists because the market evaluates differently the identical bundle of traits if possessed by members of different [...] groups, [and] is a reflection of discrimination [...]" (p. 454).

For the purpose of this analysis we implement Oaxaca-Blinder decomposition on a wage equation with a Heckman (1979) correction, where the source of the "discrimination" is the type of employment: informal or formal. Wage equation (as well as selection equation) comprise typical variables including gender, age and education (as well as interactions) in both equations, while selection includes additionally a marital status variable.

3.2 Propensity score matching

Propensity score matching is typically applied to estimate causal treatment effects, *eg.* the effectiveness of labour market policies, pharmaceutical research, profitability of particular marketing solutions or the effect of institutions on economic development[6]. The critical element in propensity score matching lies in the conditional independence assumption construct. In other words, for the reliability of the results it is important that the selection is solely based on observed characteristics and that all variables that influence belonging to the shadow economy and potential earnings are simultaneously observed. In practice it implies that there should be no other sources of systematic (i) selection and (ii) outcome.

With propensity score matching, the quality of estimation depends much on the data availability. In the case of this study, the pool for matching (the size of the control sample in the relation to the size of the analysed sample) is relatively large, so there is no need for sampling with replacement. We apply kernel estimates of propensity scores with the nearest neighbour matching, following Heckman, Ichimura, Smith and Todd (1998). Alternatively, we could have used the oversampling technique. However, the choice of the oversampling magnitude is always arbitrary, while tenfold oversampling (as feasible in our sample) should not differ from the kernel approach in terms of statistical quality.

Although the set of variables is limited in this study, we believe relying on demographics (gender and age) as well as education and individual incentives (marital status) may be sufficient for the stability of propensity score matching approach and conformity with the conditional independence assumption. We verify this approach empirically by the use of t-tests, as suggested by Rosenbaum and Rubin (1983). All propensity score matching estimations demonstrated adequate statistical properties. Although age remained unbalanced, the bias reduction approached 60%, which corroborates confidence in these results.

4   Results

Performing the Oaxaca-Blinder decomposition requires in the first stage estimating a "wage equation", preferably with a Heckman correction. Unfortunately, for the estimation of a two-stage equation for people employed an informal way, simple activity variable cannot be sufficient. If one works in an informal way, *by definition* one already works. Consequently, we sought another variable that could proxy the state of activity without directly invoking the labour market status. For this purpose we have used the other parts of the questionnaire, namely the opinions interviewees expressed with reference to informal employment. The survey contained questions of wether one has *ever* worked without a formal agreement and whether one has ever looked for employment and was unable to find it. These two variables proxied for generating an activity variable used in the selection equation used for the informally employed.

Oaxaca-Blinder decomposition   Results of these estimations are reported in Table 2. We report separately the findings for the formally and the informally employed. The first stage estimates correspond to the selection equation, while the second stage estimates correspond to the

---

[6]Caliendo and Kopeinig (2008) discuss in detail recent development as well as guide through the process of adequate construct of this approach.

wage equation. We performed two-step Heckman (1979) in the estimation, but the results were essentially the same when full maximum-likelihood estimator.

Table 2: Decomposition results

Variables	Formal employment		Informal employment	
	Second stage	First stage	Second stage	First stage
Gender	-127.5***	-0.482***	102.81**	-0.226*
	(24.38)	(0.0261)	(47.50)	(0.122)
Secondary education	-151.8***	-0.605***	-112.2	-0.454***
	(49.76)	(0.0425)	(158.6)	(0.159)
Vocational education	-238.4***	-0.833***	-127.8**	-0.741***
	(50.82)	(0.0398)	(64.2)	(0.160)
Primary education	-376.1***	-1.490***	-12.90	1.501***
	(60.41)	(0.0529)	(289.6)	(0.307)
Age	4.724	0.188***	-2.667	0.140***
	(8.866)	(0.00705)	(37.45)	(0.0297)
Age^2	-0.107	-0.00216***	0.00896	-0.00160***
	(0.107)	(8.78e-05)	(0.434)	(0.000362)
Family status		0.339***		0.179*
(1=has a dependant)		(0.0342)		(0.139)
ρ		-0.195***		-0.0222
		(0.0541)		(0.506)
$\ln(\sigma)$		6.823***		6.575***
		(0.00937)		(0.0345)
Observations	13 060		641	

Source: Data from *Undeclared Employment* study by Ministry of Labour and Social Affairs, 2007. *Note:*Standard errors in parentheses. ***, ** and * denote significance at 1%, 5% and 10% level, respectively. Higher education as reference level in estimations. Constant, regional, industry and interaction dummies included but not reported, available upon request.

Both estimations have satisfactory properties (Wald statistics highly significant), with expected signs and intuitive differences in the sizes of the estimator. For the education variables we find customary relatively higher returns to the higher educational attainments. The worrying characteristic is much worse performance of the second stage equation in both cases, especially in the case of informally employed. Specifically, it is rather rare that age estimators prove insignificant in the wage equation for the informally employed, which probably results from large standard errors of this estimation.

Decomposition proves that indeed the differential in the wages level is (i) significant and (ii) mostly attributable to the coefficients and not to the differences in endowments. The adjusted raw differential is estimated to 27.7%, of which only 12% may be attributed to the differential in endowments (the so called explained differential). Furthermore, the endowments component has a positive sign suggesting that actually workers in the informal employment are better equipped. This is the coefficients component that has a negative sign. Summarising, as much as 92% remains unexplained and may therefore be only justified by different pricing mechanisms on the market for the formally employed work and the informally employed one.

One could have many doubts regarding this analysis though. With the weak performance of the second stage equation, the interpretations of the coefficients remains troublesome, while Oaxaca-Blinder decomposition relies heavily on these estimators. Much of their weakness follows probably from the large heterogeneity of earnings and individuals. The parametric econometric techniques are not best suited to deal with this kind of issues. Therefore, we subsequently move to propensity score matching results.

Propensity score matching   The diagnostics demonstrate indeed that before matching there was a relatively strong pre-treatment bias with respect to all determinant variables: education, age, gender and family status. Due to the matching procedure the bias was considerably reduced (unlike pre-matching tests, t-statistics show no significant difference between treated and control group at 5% level, age is the only exception showing 0.072 p-value as the below 15% threshold[7]). Bias was reduced by approximately 46.2% to 76.9% with respect to education variables and over 70% with respect to age and gender. Taking into account the fact that the control group is 10-20 times bigger than the treated, it seems that the statistical properties of the matching procedure are satisfactory. Table 3 reports the results.

Table 3: Propensity score matching results

Declared earnings (PLN)	Shadow economy	Official economy	Difference	S.E.	T-stat
	Whole sample				
Unmatched	1038.16	1369.43	-331.27	46.27	-7.16
Matched	1038.16	1283.47	-245.30	50.09	-4.90
No of observations	636	13 041	-	-	-
	Above median earnings				
Unmatched	1466.43	1807.58	-341.16	59.32	-5.75
Matched	1466.43	1841.43	-375.00	66.72	-5.62
No of observations	231	2 708	-	-	-
	Below median earnings				
Unmatched	453.89	835.35	-381.47	17.57	-21.71
Matched	453.89	792.34	-338.40	17.52	-19.32
No of observations	405	10 333	-	-	-

Source: Data from *Undeclared Employment* study by Ministry of Labour and Social Affairs, 2007.
Notes: All individuals on support after matching. Kernel matching, one-to-many, without replacement.

The results indicate that the formally employed declare higher net employment-related earnings than the informally employed, while this difference is reduced by approximately 30% when only matched individuals are considered as reference group. The computed earnings gap between the informally employed and their "statistical twins" in formal employment amounts to approximately 24%, which is consistent with the earlier finding of approximately 27% discrimination in the Oaxaca-Blinder decomposition.

Both pre- and post-matching differentials remain statistically significant. The the size of the standard errors marginally increases after matching, which suggests larger heterogeneity in earnings for the control group. This suggests that individual differences may be larger than the average 24-27%. The fact that "statistical twins" earn more than individuals declaring informal employment may only be interpreted as an indication of the segmentation of the labour market, with "gray" workers remaining informal not for the tax benefits but from the lack of other options.

Accounting for the potential heterogeneity among higher and lower income workers, we have split the sample (after matching) with reference to median income and repeated the comparison of declared employment-related earnings for these two groups. The difference between matched formal employees and those in the shadow economy remains significant and in the same direction. Namely, the earnings for matched controls are consistently higher than for the informally employed individuals. On the other hand, in the below the median subsample - as in the whole sample - the earnings of matched controls are slightly lower than among the unmatched ones. On the contrary, among the higher earning workers, the matched revenues are higher than in the general

---

[7]Detailed results available upon request.

control group. While this difference is not likely to be statistically significant, we interpret of these findings as evidence of potential heterogeneity of motivations behind the in-the-shadow employment. However, the sample size is too small to allow further explorations.

Conclusions

Research into shadow employment in the transition countries is scarce and mostly conducted by the central statistical offices. Furthermore, they mainly focus on the size of unregistered employment without looking more deeply into its causes and the characteristics of people working in shadow economy.

In this paper we try to answer the question whether shadow employment results: (i) from higher revenues as compared to registered employment (official market distortions make it ineffective for agents to engage in the latter form of employment) or (ii) labor market tightness from the side of an employee - for a particular group of workers registered employment may be unattainable and work in shadow economy the only earning opportunity. We use a unique data set from a survey on informal employment. First we apply the Oaxaca-Blinder decomposition technique. Next we use propensity score matching to match people working informally with their counterparts with an official employment contract.

The variables we consider are: gender, age, education and marital status. Our results show that unregistered employees are characterized by slightly higher endowments as compared to their statistical twins working in official economy. However, revenues of people working in shadow economy are lower than among their matched counterparts. We believe this is an indication that unregistered employees are active in shadow economy not because it is an optimal solution to their individual strategy but because they are forced to do so due to limited access to formal employment. These results confirm the social exclusion and market segmentation hypotheses.

The obtained results also suggest directions for further research. One should focus on policy recommendations and their consequences towards tackling unregistered employment which stems from the labour market tightness and not from the official market distortions. This topic seems to be neglected as research mostly focuses on size of shadow employment. Research on policy recommendations would allow to find appropriate measures for reducing the negative consequences of unregistered employment.

References

Bednarski, M.: 1992, *Drugi obieg gospodarczy – Przeslanki, mechanizmy i skutki w Polsce lat osiemdziesiatych*, Wydawnictwa Uniwersytetu Warszawskiego, Warsaw.

Bednarski, M., Kokoszczynski, R. and Stopyra, J.: 1988, Ksztaltowanie sie rozmiarow drugiego obiegu w Polsce w latach 1977-1986, *Bank i Kredyt* (8-9), 11–18.

Blinder, A. S.: 1973, Wage Discrimination: Reduced Form and Structural Estimates, *Journal of Human Resources* **18**(4), 436–455.

Caliendo, M. and Kopeinig, S.: 2008, Some Practical Guidance For The Implementation Of Propensity Score Matching, *Journal of Economic Surveys* **22**(1), 31–72.

Cassel, D., Jaworski, W., Kath, D., Kierczynski, T., Lutkowski, K. and Paffenholz, H.-J.: 1989, *Inflation und Schattenwirtschaft im Sozialismus*, S+W Steuer- und Wirtschaftsverlag, Hamburg.

Dupaigne M., H. P.: 2001, A Dynamic Macro Model of the Informal Economy, *Working paper*, Cepremap, CERGE.

Eilat, Y. and Zinnes, C.: 2002, The shadow economy in transition countries: Friend or foe? a policy perspective, *World Development* **30**(7), 1233–1254.

Frey, B. S. and Weck-Hanneman, H.: 1984, The Hidden Economy as an 'Unobserved' Variable, *European Economic Review* **26**(1-2), 33–53.

Friedman, E., Johnson, S., Kaufmann, D. and Zoido-Lobaton, P.: 2000, Dodging the Grabbing Hand: the Determinants of Unofficial Activity in 69 Countries, *Journal of Public Economics* **76**(3), 459–493.

Fugazza, M. and Jacques, J.-F.: 2004, Labor Market Institutions, Taxation And The Underground Economy, *Journal of Public Economics* **88**(1-2), 395–418.

Gardes, F. and Starzec, C.: 2002, Polish Households between Transition and Informal Markets. mimeo, http://www.rennes.inra.fr/jma2002/pdf/gardes.pdf.

Graversen, E. K. and Smith, N.: 2002, Tax evasion and work in the underground sector, *CLS Working Papers 01-2*, University of Aarhus, Aarhus School of Business, Centre for Labour Market and Social Research.

Gutmann, P.: 1977, The Subterranean Economy, *Financial Analysts Journal* **33**(6), 24–27.

Heckman, J., Ichimura, H., Smith, J. and Todd, P.: 1998, Characterizing Selection Bias Using Experimental Data, *Econometrica* **66**(5), 1017–1098.

Heckman, J., Ichimura, H. and Todd, P.: 1997, Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme, *Review of Economic Studies* **64**, 605–654.

Heckman, J., Ichimura, H. and Todd, P.: 1998, Matching as an Econometric Evaluation Estimator, *Review of Economic Studies* (65), 261–294.

Heckman, J. J.: 1979, Sample Selection Bias as a Specification Error, *Econometrica* **47**(1), 153–61.

Johnson, S., Kaufmann, D. and Zoido-Lobaton, P.: 1998, Corruption, Public Finances and the Unofficial Economy, *Technical report*, World Bank.

Kalaska, M. and Witkowski, J.: 1996, Praca nierejestrowana w polsce w 1995 roku- wyniki badania ankietowego (undeclared work in poland in 1995 - results of a survey study), *Szara Gospodarka w Polsce, GUS-ZBSE, Warszawa* .

Kopczuk, W.: 2001, Redistribution When Avoidance Behavior Is Heterogeneous, *Journal of Public Economics* **81**(1), 51–71.

Kritz, K., Merikull, J., Paulus, A. and Staehr, K.: 2008, Why Do Individuals Avoid Payroll and Income Taxation in Estonia, *in* M. Pickhardt and E. Shinnick (eds), *The Shadow Economy, Corruption and Governance*, INFER Advances in Economic Research, Edward Elgar.

Lemieux, T., Fortin, B. and Frechette, P.: 1994, The Effect of Taxes on Labor Supply in the Underground Economy, *American Economic Review* **84**(1), 231–54.

Meriküll, J. and Staehr, K.: 2008, Unreported Employment and Tax Evasion in Mid-transition: Comparing Developments and Causes in the Baltic States, *Bank of Estonia Working Papers 2008-06*, Bank of Estonia.

Oaxaca, R.: 1973, Male-Female Wage Differentials in Urban Labor Markets, *International Economic Review* **14**(3), 693–709.

Renooy, P., Ivarsson, S., van der Wusten-Gritsai, O. and Meijer, R.: 2004, Undeclared Work in an Enlarged Union: An In-Depth Study of Specific Items, *Final report*, European Commission, Directorate-General for Employment and Social Affairs, Brussels.

Rosenbaum, P. and Rubin, D.: 1983, The Central Role of the Propensity Score in Observational Studies for Causal Effects, *Biometrika* **70**(1), 41–55.

Schneider, F.: 2002, The Size and Development of the Shadow Economies of 22 Transition and 21 OECD Countries, *IZA Discussion Papers 514*, Institute for the Study of Labor (IZA).

Schneider, F.: 2007, Shadow Economies and Corruption all over the World: New Estimates for 145 Countries, *Technical report*, University of Linz.

Schneider, F. and Enste, D. H.: 2000, Shadow Economies: Size, Causes, and Consequences, *Journal of Economic Literature* **38**(1), 77–114.

Tanzi, V.: 1983, The Underground Economy in the United States: Annual Estimates, 1930-1980, *Staff papers*, IMF.

Williams, C. C. and Windebank, J.: 2001, Beyond Profit-Motivated Exchange Some Lessons from the Study of Paid Informal Work, *European Urban and Regional Studies* **8**(1), 49–61.

Williams, C. C. and Windebank, J.: 2002, Why Do People Engage in Paid Informal Work? A Comparison of Higher- and Lower-income Urban Neighbourhoods in Britain, *Community, Work & Family* **5**(1), 67 – 83.