THE IMPACT OF THE FLAT INCOME TAX ON THE LABOR SUPPLY: THE CASE OF UKRAINE

by

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Abstract

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This paper evaluates the impact of the flat income tax implementation on the labor supply of Ukraine. Tax changes are treated by the workers as wage increase, thus, they adjust their work hours responses to a new tax schedule. We aim at finding evidence in support of the hypothesis that the implemented tax reform will slightly influence labor force participants, though might affect the entrance of the non-participants. The part-timers are found to be more sensitive to the tax changes than full-timers. The wage elasticities are obtained through the Heckit and Quantiles estimation approaches.

TABLE OF CONTENTS

LIST OF FIGURES

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INTRODUCTION

Succesful fiscal policy contributes a lot to the improvement of the economic performance. Effective tax policy has strong macro and micro implications. The question of the primary interest is how taxes affect economic behavior. This paper attempts to answer this question, focusing on the analysis of the personal income taxation (PIT) in Ukraine.

Ukraine has adopted changes in the income tax schedule and employed flat 13% personal income tax (PIT). The corresponding law has been already in force since the beginning of 2004 (from the year 2007 the tax rate is to be raised up to 15%). Previously progressive tax within five tax brackets was employed in Ukraine. The flat taxation targets the decrease of the tax burden upon personal incomes, which is assumed to be followed by the increase of the tax base, i.e. labor market participation is expected to increase across individuals. It might be the case, mainly, due to the decrease of the shadow economy.

The focus in this paper is on the effect of the PIT reform on the labor supply in Ukraine. Tax changes can be interpreted in terms of wage change, i.e. the decrease in the income tax is treated by workers as the increase in the wage. Thus, the idea is to estimate the income and substitution effects resulting from the change of the wage rate. The goal of this paper to evaluate the advantages, if any, of the flat income tax implementation in terms of its impact on labor supply.

According to the theory, the prediction of the labor supply response, resulted from the wage increase, is ambiguous due to the opposite directions of income effect (increase in purchasing power to buy leisure) and substitution effect (substitution of more costly leisure by work). Besides, the response also can come from the changes in efforts of the workers. Consequently, the influence of the income tax can be approximated with the sensitivity of the labor supply decision with respect to marginal wages.

Different theoretical approaches are considered: estimation of the overall income elasticity and labor supply elasticity. Then labor supply elasticity estimation is employed within two different technical frameworks: estimation with non-participation and non-linear budget constraints (Heckman procedure for Tobit II model), and estimation with quantile regressions. The complications, named sample selection, heterogeneity across individuals, measurement errors in work hours and endoneity of the wages and incomes, are encountered and mitigated in the analysis.

Previous findings investigate that the labor supply is not very sensitive with respect to the change in the wage rate. It is expected that the results for Ukraine would be in line with the estimations across labor supply literature. Besides, it is expected that labor supply responses will be heterogeneous across individuals and will decrease as long as time constraints become binding ones.

Also it should be noted, the tax burden is shared between workers and firms. As far as employer is responsible to pay about 38% of payroll tax from the salary fund, the substantial broadening of the tax base is rather doubtful. Employers might just fix the net wage of the employees and adjust the gross figure following the cost minimization. The proposed measures will only make sense as a part of a general package of economic policies aimed at political, social and economic stability in the country and more active government initiatives to pursue institutional, structural and legal reforms. The measures to be taken should go beyond the PIT reform discussion, and include tax and expenditures problems into a wider framework of action.

The thesis is organized as follows. Chapter 1 contains the general overview of research related to the alternative approaches in labor supply estimation. Chapter 2 concentrates on the chosen theoretical framework and estimation strategies, and also points out potential problems and the ways to deal with them. It also includes data description. Data used is described in the third chapter. The empirical evidence, results of estimation and their comparison are presented in the fourth chapter. Conclusions offer a summary over the impact of flat income tax implementation on the labor supply and policy implications in the fifth chapter.

Chapter 1

LITERATURE REVIEW

A large variety of labor supply estimation techniques have been developed, targeting to answer policy-reform questions. The motivation for labor supply estimation in this paper is the anticipated changes in the Ukrainian personal income tax schedule.

Thus, the idea is to estimate the income and substitution effects resulting from the change of the wage rate. The goal of this paper is to evaluate the advantages, if any, of the flat income tax implementation in terms of its impact on labor supply.

As both the workers and the firms pay for the tax[1], personal income tax (PIT) burden is shared between them. Following McLure (1974), firms pay in the form of the higher labor costs, while workers pay in the form of the lower after tax wages. If the elasticity of the labor demand is less than the elasticity of the labor supply, then firms pay the bigger share of the tax, and vice versa. Flattering tax schedule in Ukraine targets the redistribution of the tax burden from workers to firms independent of the employees' earnings scope. From the supply side, the decrease in the income tax is treated by workers as the increase in the wage. From the demand side, in contrast, nothing has changed. Theory predicts that no

[1] Firms pay about 38% of the workers earnings, while worker pays 13% according to a new legislation

matter who is responsible for payments, the burden sharing is determined by the wage elasticities. The employers might just fix the net wage of the employees and adjust the gross figure following the cost minimization. Thus, estimation of labor supply elasticity allows to evaluate actual labor supply responses to tax reform.

Investigating of individual responses to policy reforms widely attracts research interest. There are two different mainstream approaches across economic literature, used to determine the impact of the changes in taxation: (i) estimation of the overall income elasticity with respect to marginal tax rates; (ii) the estimation of labor supply elasticities with respect to marginal tax rates.

Remarkable studies in the framework of the first approach, concerning overall income elasticity, were done by Lindsey(1987), Navratil(1995), Feldstein(1995), Slemrod (1996), Goolsbee(1998) and recently Saez(1999,2000). All these studies are based on the data from the US tax reforms (1980-1990s), which had reduced marginal tax rates on personal incomes and flattened tax rate schedules as the number of tax brackets had been substantionally reduced. A wide range of estimated elasticities had been obtained: up to 3 at the upper bound (Feldstein, 1995) and close to zero at the lower bound (Golsbee, 1998).

Flollowing Gruber and Saez (2000), variability of the estimates across different studies can be explained by different approaches to the definition of the

taxable income: if only employment income was encountered, the estimated elasticities were higher; whereas, if capital gains were also included, i.e. broader income definition used, lower elasticity estimates were found. Another reason for estimates' variability, known as a "mean reversion" problem. It addresses incorrect comparison of high income tax payers (who experience large tax rate cuts) with low and middle income ones (who experience almost no tax rate change). It was found that response of high taxpayers was very elastic, about 0.57, while for those with lower incomes, the elasticity was less than one-third as large. Besides, it was emphasized that the estimates of the overall income elasticity are neither a pure compensated, nor a pure uncompensated, but a mix of both. The techniques to overcome this problem were employed, that allow for the decomposition into income and substitution effects, and authors showed that these estimates were rather close to each other.

The second approach, concerning the estimation of labor supply elasticities, brings a lot of developments to the studies on the individuals' tax incidence in terms of labor supply. Much of labor supply researches has been widely surveyed in Blundell and MaCurdy (2000). Generally, small values of labor supply elasticities were found. Pencavel (1986) investigated labor supply choices in standard utility maximization framework with linear budget constraints, the estimated elasticities for prime age males were about zero (uncompensated was slightly negative -0.1, compensated was about 0,2). Hausman (1981) introduced

non-linearity of budget constraints (PWL) in order to reflect progressive tax schedule: the results were fairly small for uncompensated elasticity (close to zero), but income effect was larger (about 0.5). Flood (1998), while investigating male labor supply in Sweden, developed PWL approach and investigated that the estimates of the elasticity are rather sensitive both to specification and to the observations across the individuals, who were close to the kinks(i.e. points where the slope of the tax schedule changes). It was found that larger number of tax brackets leads to higher labor supply elasticity, and long initial segment followed by a large number of tax brackets implied different estimated supply elasticities compared to a system that is more progressive for smaller incomes.

Most studies indicate that labor supply elasticity was larger for secondary earners, i.e. married females, at about 0.5-1. As Killingworth (1983) suggested , there could be convergence over time between the estimates for men and women as female increase their participation in the labor force.

Heckman (1993) provides a comprehensive overview on the labor supply estimation techniques. Basically, two types of decisions are available for individuals: 1) choice over time reallocation between leisure and work (choice on intensive margin); 2) choice over participation, i.e. entry-exit decision (choice on intensive margin). The author found out that participation decisions, generally, are characterized with higher elasticity than choices over the hours of work.

Therefore, discrete-choice labor supply models are widely used in recent literature on tax reform evaluation. While dealing with such type of models, the awareness about the "selection bias" and measurement error is needed. Selection problem comes from the situation when the probability of selection into the sample is correlated with the realized value of the dependent variable, i.e. there is missing data on those, who do not participate in the labor force; measurement errors can be in hours working and hourly wage rates. These estimations might be done through the instrumental variables estimation (Heckit regression), otherwise the elasticities would be biased towards zero.

Among the most recent developments is a quantile regression estimation technique that can be used for labor supply estimation. The development of this approach, introduced in Koenker and Bassett (1978), is motivated by possible heterogeneity of the income distribution across individuals and asymmetries in the hours response to the wage changes. Quantile regressions allow, firstly, for different impacts of wage along the whole conditional distribution of working hours, and, secondly, the influence of the standard concentration of the working hours can be overcame. As Buchinsky (1994) suggested this approach might be used in case if "exogenous variables influence parameters of the conditional distribution of the dependent variable other than the mean" (in the case of labor supply estimation for Ukraine, it relates to different tax brackets and wage associated with working hours and participation within each wage range). Thus,

for heterogeneous population quantile regressions can give better results. Following Ribeiro (2001), the implementation of quantile regressions was employed to the labor supply estimation. It was found out that elasticities of those, working standard 40 hours week , were close to zero; whereas, for those, working longer hours, elasticities were about –0.02 to 0.10. The author proved that conditional work hours distribution is not symmetric around the mean, justifying the employed quantile regression technique.

The drawbacks of labor supply estimation approach should be also identified. Firstly, hours of work might not be the only channel through which the total influence of tax came into. For example, as Feldstein (1995) suggested, in the short-run it is rather the intensity of efforts to be changed rather than decision on participation, whereas in the long-run even the change in the occupation might occur. Secondly, the estimates of the elasticity are rather sensitive to the functional form assumptions.

The analysis in this paper is based on the second approach, i.e. estimation of the labor supply elasticity rather than overall income elasticity. The choice is, mainly, attributed to the nature of the question investigated. As the new PIT legislation has been adopted only since the beginning of the year 2004, data on the micro level across individuals is not available by now. The estimation of the overall income elasticity requires identification of the both treatment and control

groups, while the labor supply elasticities can be derived from the data available. Thus, the strategy is to estimate Heckit regression and then employ quantile regression. The elasticities from different estimation strategies are to be compared and the conclusions be derived.

As for expected results, it is highly possible that they would be in line with the similar researches in this area. Still, important note must be mentioned, Ukraine is a transition country and, following Brainerd (1998) and Earlie & Sabirianova (2000), the labor supply elasticity could be rather low at the early stage of transition.

This paper verifies whether Ukrainian data supports the results for labor supply elasticities from the studies surveyed above and how such analysis can be used for the tax incidence analysis. In particular, different estimation techniques are employed in order to investigate which specification fits the data better and whether results coincide.

Chapter 2

METHODOLOGY

1. Theoretical Framework

Labor supply estimates vary greatly across economic studies, depending on the theoretical framework and estimation strategy used. To keep this investigation comparable to other findings, both the theoretical model for the labor supply decision and estimation strategy are precisely identified.

Analysis in the thesis is based on the partial equilibrium analysis. Each individual maximizes his/her utility function with regard to the budget constraints. As a starting point the basic theoretical framework of the worker's one-period utility maximization problem subject to constraints on available leisure hours and income might be employed. By assumption, utility function is strictly quasi concave and satisfies utility maximization axioms, budget set is convex, hence, the solutions will be unique.

Agents decide over within period work hours H (while the total amount of time is constrained by L), and over the desired level of net income $M=WH+Y-T$, where W is a gross wage, Y is gross non-labor income, T is the tax liability function. T is determined by the tax rate t and taxable income $(WH+Y-D)$, where D stands for deductions, thus $T=t(WH+Y-D)$. As progressive income tax system

will be analyzed, the tax rate *t* increases through the tax brackets in the range j=1,…,J. Hence, marginal wage rate (i.e. after-tax wage) is $w_j = w(1-t_j)$.

The progressiveness of the income tax schedule implies "piecewise-linear" budget constraint. It is assumed that each individual has non-labor income (the income at zero hours of work), called virtual income *(VY)*. Thus, budget constraint becomes $M=WH+VY$ and is still convex.

While describing labor allocation across individuals, several utility functions were applied according to different assumptions on the agent's preferences. For the purposes of estimation in this thesis, it is assumed that preferences are described by a simple quasi-concave utility function. Therefore, utility maximization problem might be formulated as:

$$\begin{aligned} &U(M, L-H, X) \rightarrow \max \\ &s.t.\ M = WH + VY \end{aligned} \quad (1)$$

First order conditions are as follows:

$$U_M(M, L-H, X) = l \quad U_{L-H}(M, L-H, X) \geq lW \quad (2),$$

where l is the marginal utility of income. If the inequality in (2) holds strictly then the individual doesn't participate in the labor market and *(L-H)=T*. The

wage W_R such that $U_{L-H}(M, L-H, X) = lW_R$, is the reservation wage below which the individual will not work.

Utility maximization yields the labor supply function of a form:

$$H = H(W, VY, X) \quad (3)$$

From (2) the elasticity of the Marshallian function (E_u - uncompensated) can be derived:

$$E_u = \frac{\partial \ln(H)}{\partial \ln(W)} \quad (4)$$

The associated elasticity of the utility-constant Hicksian function(E_c - compensated) can be revealed from the Slutsky equation:

$$E_c = E_u - \frac{WH}{Y}\frac{\partial \ln(H)}{\partial \ln(Y)} \quad (5),$$

where $\frac{WH}{Y}$ stands for the size of earnings relative to non-labor income. Assuming that leisure is a normal good, formula (5) shows that compensated elasticity is larger than the uncompensated one. This confirms theoretically known ambiguity of the overall effect from the wage increase – income and substitution effects work in opposite directions.

2. Estimation Strategy

Many empirical studies investigate the labor supply estimations. Widely different results come from differences in controls incorporated and methodology used. Following the surveys by Blundell and MaCurdy (1999), Killingsworth (1983) and Pencavel (1986) the variety of approaches have been developed in labor supply estimation techniques. Clear distinction between different methodologies must be explicitly identified, as the results can vary greatly. The strategy of this paper is the estimation of the wage responses with two-step Heckman procedure and then verify the presence of the heterogeneity in responses across the workers with quantile regressions. The idea behind such a strategy is to employ relatively new quantile approach (asymmetric responses) and already classical one Tobit II (symmetric response) to Ukrainian annual data over the year 2003 (from Ukrainian Longitudinal Monitoring Survey, ULMS).

Across labor supply literature, several estimation complications are identified:

(i) sample selection:

a. labor supply decision cannot be observed for workers with higher reservation wages

b. sample of participants includes only those with positive hours.

(ii) endogeneity of wages and income: unobserved person-specific factors might be correlated with observable wage variable.

(iii) heterogeneity across individuals: an unobserved person-specific factor that makes particular person work more or fewer hours than other observationally-identical persons.

All these problems are addressed and mitigated through both estimation approaches. The econometric treatments for the complications are as follows: sample selection requires specific methods for censoring data estimation, thus Heckit procedure is employed, endogeneity is mitigated with instrumented explanatory variable (i.e. log of wage), finally, the presence of heterogeneity is verified with quantiles.

2.a Heckman procedure estimation.

Following Heckman, 1974, labor supply regressions are estimated on a sample where the probability of selection into the sample is correlated with the realized value of the dependent variable. Consequently, the sample of workers is censored as participation can be observed only for those with lower reservation wages.

Let work hours in a cross-section of persons are given by such a structural labor supply equation:

$$\log(h_i) = d_0 + d_1 \log(w_i) + d_2 Z_i + e_i \quad (1),$$

where Z includes observable taste variables, which affect labor hours, while e_i stands for "unobserved tastes" for work. Thus, variable of the primary interest from the empirical specification is d_1.

Assume that the market wage that person *i* can command is given by:

$$w_i = b_0 + b_1 X_i + m_i \quad (2),$$

where X includes individual specific factors, which affect the scope of the market wage for each particular worker.

The OLS estimates of either (1) or (2), conducted over subsample of workers will be biased. The ultimate goal is to obtain unbiased estimates of the wage elasticity, thus, firstly, (2) might be substituted into (1):

$$\log(h_i) = d_0 + d_1[b_0 + b_1 X_i + m_i] + d_2 Z_i + e_i$$
$$\log(h_i) = [d_0 + d_1 b_0] + d_1 b_1 X_i + d_2 Z_i + [e_i + d_1 m_i]$$
$$let \quad a_0 = d_0 + d_1 b_0,\ a_1 = d_1 b_1,\ a_2 = d_2,\ h_i = e_i + d_1 m_i,$$
$$thus, \quad \log(h_i) = a_o + a_1 X_i + a_2 Z_i + h_i \quad (3)$$

Hence, equation (3) can be referred as a reduced form labor supply equation and work hours for each particular individual will be positive iff:

$$\log(h_i) > 0,\ i.e.\ h_i > -a_0 - a_1 X_i - a_2 Z_i \quad (4),$$

thus, the presence of a particular person in the subsample of workers is conditional on observable controls X and Z and determined by: 1) either high unobserved tastes for work (e_i) or (2) high unobserved wage-earning ability(m_i, $if\ d_1 > 0$), which permits to match the reservation wage with the market one. Across labor supply literature, it was proven that error terms from (1) and (2) follow joint normal distribution and that implies that the error term from (3) also follows joint normal distribution.

As long as condition (4) must be satisfied, it can be verified that the expectation of the error term from (1) doesn't equal zero, leading to biased estimates if simple OLS used.

$$E(e_i \mid \log(h_i) > 0) = E(e_i \mid h_i > -a_0 - a_1 X_i - a_2 Z_i) =$$

$$= \frac{s_{eh}}{s_h^2} E(h \mid h > -a_0 - a_1 X_i - a_2 Z_i) =$$

$$= \frac{s_{eh}}{s_h^2} \bullet \frac{f\left(\frac{-a_0 - a_1 X_i - a_2 Z_i}{s_h}\right)}{1 - \Phi\left(\frac{-a_0 - a_1 X_i - a_2 Z_i}{s_h}\right)} = q_1 l_i \quad (5),$$

where Φ is a standard normal cdf and j is the standard normal density function. Thus, q_1 does not vary across observations, while l_i, known as inverse Mills ratio, does. Hence, taking into account (5), the equation of the labor supply over the sample of participants takes the following form:

$$\log(h_i) = a_o + a_1 X_i + a_2 Z_i + q_1 l + e_i' \quad (1a),$$

which is called the augmented labor supply equation.

The same reasoning can be applied to wage equation:

$$E(m_i | \log(h_i) > 0) = E(m_i | h_i > -a_0 - a_1 X_i - a_2 Z_i) =$$

$$= \frac{s_{eh}}{s_h^2} E(h | h > -a_0 - a_1 X_i - a_2 Z_i) =$$

$$= \frac{s_{mh}}{s_h^2} \bullet \frac{f\left(\frac{-a_0 - a_1 X_i - a_2 Z_i}{s_h}\right)}{1 - \Phi\left(\frac{-a_0 - a_1 X_i - a_2 Z_i}{s_h}\right)} = q_2 l_i \quad (6),$$

It follows from (5) and (6) that the nature of the biases is the same, but the coefficients with which they enter the equations are different. Similarly to (1a), augmented wage equation can be derived:

$$w_i = b_0 + b_1 X_i + q_2 l_i + m_i \quad (2a).$$

Selection bias problem can be mitigated by Heckman two-stage procedure: (i) estimation of probit equation by maximum likelihood for wages yields a selection correction variable (namely, the inverse Mills ratio) and the corresponding

coefficient for this correction term q_2; (ii) estimation of the labor supply with the inverse Mills ratio from the first stage gives unbiased estimator of labor force participation. Thus, the correction term for selection bias serves as an instrument in getting correct estimator within the censored sample of participants.

Thus, at first stage the structural wage equation is estimated with the selection one, which defines a probit equation where the regressant is a binary choice for participation in the labor force, in other words the probability that the reservation wage would be matched with the offered one. Market wage, observable in the labor market, is known only for participants. It is a function of characteristics such as education, occupation, type of settlement and enterprise ownership. Then the labor-force participation equation estimated as a function of the same explanatory variables, that identify the scope of market wage and individual specific variables, determining the reservation wage. As noted in Verbeek, 2000, the equation on labor supply should include at least all the exogenous variables contained in wage equation, and, possibly, other exogenous variables, which influence the reservation wage though not the offered wage for an individual. Such variables can only be included into participation equation and not into wage specification, if their influence on market wage is expected to be insignificant. Among such variables are non-wage income, gender dummy, marital status dummy, age, age squared, health condition.

While estimating the equation identified, the classical problem of endogeneity in wages might be mitigated through instrumental variables estimation. According to Mroz, 1987, in labor supply equation wage variable may be correlated with the error term due to unobservable individual effects via productivity, and the preferences. Thus, wage variable might be instrumented with, exogenously determined gender, marital status, household size, age, squared age, years of education, squared years of education, sector of occupation, enterprise size, type of settlement.

2.b Quantile approach.

The use of quantile regression approach targets the modeling asymmetric responses in the labor supply with respect to wage changes. If the sample is heterogeneous and there are large outliers, or the distribution of the disturbances is non-normal, conditional mean estimators may be inefficient and often biased. The solution is conditional median regression where half the errors lie above, and half below the fitted curve. The problem of estimating an equation with endogenous explanatory variables under quantile analysis was investigated successfully by Powell (1983).

The simple quantile regression model can be written as $h_i = w_i^{'} b_q + u_{iq} \quad with\ Quant_q(h_i|w_i) = w^{'}{}_i b_q, \quad (i = 1.....n)$ where b_q and w_i are K*1 vectors $Quant_q(h_i|w_i)$ stands for θth conditional quantile of working hours (h) given wages (w). The formulation for the censored quantile regression was proposed by Powell,1984, and Buchinsky, 1994. In the latent variable setup the model is as follows:

$$w^{*}{}_i = x_i^{'} b_q + u_{iq} \quad with\ Quant_q(u_{iq}|x_i) = 0$$

and let

$$w_i = w^{*}{}_i \quad if\ \ w^{*}{}_i \geq w^{r}{}_i \quad and \quad h_i = 1 \ \ if \quad h^{*}{}_i > 0$$
$$w_i = 0 \quad if\ \ w^{*}{}_i < w^{r}{}_i \quad and \quad h_i = 0 \ if \quad h^{*}{}_i \leq 0$$

where $w^{r}{}_i$ stands for reservation wage value, which determines the decision over participation choice. Censored quantile mitigates sample selection problem.

A two stage method, where a least square regression is run on the first stage and median regression on the second as in 2SLS, was proven to give consistent estimates with asymptotically normal distributions under weaker assumptions than least squares. This special case of a two-stage quantile regression (2SRQ) was generalized for any quantile by Chen and Portnoy (1996). The following two-step procedure is employed: at first, reduced form equation of the endogenous variable is regressed on the set of exogenous variables (previously described instrumented wage estimation); secondly, the fitted values

are used as an explanatory variable in the estimation of the structural equation of the work hours.

As employers demand the workers to supply the certain constrained amount of hours, it follows that observed work hours might not coincide with that optimal predicted choice, implied by tangency condition from the utility maximization problem. The solution comes from instrumental variables (IV) for wages, besides, it is also recommended if there is a correlation between wages and unobserved individual's characteristics, which means that wages are endogenous for labor supply determination. In fact, the same treatments as were identified for the Tobit II estimation can also be effectively employed in the quantile framework.

Chapter 3

DATA DESCRIPTION

The data used in thesis is supplied by Kyiv international Institute of Sociology, following EROC labor group's request. Ukrainian Longitudinal Monitoring Survey (ULMS) is a retrospective questionnaire that, in particular, covers labor market issues across both individuals and households. The data set was generated upon the filled questionnaire by 8641 individuals (3063 households), which possessed the representative characteristics of the total labor force in Ukraine.

The data estimated is a cross-section, gathered upon the reference week in 2003 year. The representative validity of the data set can be verified through a simple statistical analysis.

Initial analysis confirms the reliability of the data following demographical and geographical characteristics, although general reliability of a survey as a research method is arguable due to its retrospective character. But as long as for the purposes in this thesis a cross-section over the reference week is used, ULMS can be considered a plausible overview of forming labor supply in Ukraine.

Following the defined estimation strategy the following variables are those of primary interest: wages and labor hours. The descriptive statistics for these variables is represented in the table 1 (their scatters can be found in Annex 2, tables 2.1 and 2.3, figures 2.1 and 2.2.).

Table 1.
Descriptive statistics for wages and work hours.

Variable	Number of observations	Mean	Standard Deviation	Min	Max
Wage	3592	306.0415	242.4458	1	5000
Work hours	3869	39.78478	15.932	0	160

Reported working hours, although containing some volatility, still are highly concentrated around standardized full-time work week of 40 hours (see Appendix 2, figure 2.2). Thus, there indeed might be asymmetric responses in the labor supply decisions from the tails of the work hours distribution. The inference about labor supply sensitivity could be credibly inferred on the basis of the wage elasticity estimated from the Heckit procedure. Still it might be the case that the responses from the tails of the distribution are different from those of the median interval. To reveal whether this assumption holds, the quantile estimation would be carried out, which will provide elasticity results for upper and lower quantiles.

Composition of the wage schedule suggests that in Ukraine individuals were, mostly, a subject to the tax bracket with a marginal tax rate of 20%. As long

as there was an upward adjustment of the minimal untaxed amount (from 17UAH to 205UAH), all the individuals might experience the reduction of the tax burden, reflected in the raised wages. The earnings are predominantly concentrated in the former 20%-tax bracket.

Following the preliminary data analysis, it was verified that 309 out of 3869 labor force participants indicated that they actually work but do not receive wages. This fact is attributed either to the wage arrears or to the self-employment when the entrepreneur incurs cost of his own efforts.

The set of explanatory variables for the Heckman selection model is as follows:

- individual-specific variables: dummies for gender (ones – for males) and marital status (ones – for married), age and age squared, ordered responses for health condition, non-labor income. The description of this set of explanatory variables can be found in Appendix 2, Table 2.5.

- education variables reflected by dummies for the highest degree, that a person possessed: in particular, PHD, MA, specialist, BA, incomplete higher education, vocational school, secondary education, incomplete secondary education. The description of this set of explanatory variables can be found in Appendix 2, Table 2.6. Generally, the vast majority of the interviewed sample has professional

education (41.11%), nearly one-fourth of this sample has incomplete general secondary education (25.21%), complete general secondary education is possessed by 19.07% of the sample, higher education – 14.38%.

- occupation identifiers represented by dummies (ones – for the occupation of choice): in particular, managers, clerks, technicians, plant workers, service providers, craft workers, agrarians, elementary workers. The analysis of the Ukrainian labor-force data suggested that, mostly, people are engaged in "blue-collar" activities, trade and social sphere services, and agriculture. The description of this set of explanatory variables can be found in Appendix, Table 2.7.

- Settlement-type variables represented by dummies. Respondents, predominantly, have urban residence (54.58%), respectively – rural one is observed for 45.42% (i.e. villages, settlements of a town significance). The description of this set of explanatory variables can be found in Appendix 2, Table 2.8.

- Type of ownership of the enterprises represented by dummies. Employers are, predominantly, either of medium or very big size (with respect to the number of people employed) with the prevailing domestic ownership within the entities. The description of this set of explanatory variables can be found in Appendix 2, Table 2.9.

The set of explanatory variables for the instrumented wage in addition to some of the regressors listed above includes:

- Household size and squared size of the household. The vast majority of the households consist of two persons (44.44%), then follows three-person households (22.71%), singles (19.59%), households with more than three persons (13.26%).

- Enterprise type variables represented by dummies. Predominantly, enterprises are engaged in the industrious production, sales, agriculture, health protection, education provision. The description of this explanatory variable can be found in Appendix 2, Table 2.10.

The set of explanatory variables for the labor supply in addition to some of the regressors listed above includes:

- Regional dummies. The sample is representative with respect to geographical location.

Thus, ULMS is a plausible overview of forming labor supply decisions within Ukrainian labor market. The preliminary analysis suggested that asymmetric labor supply responses indeed might be observed, supporting the chosen strategy of the comparison Heckit procedure results with those from the quantile estimations.

Chapter 4

ESTIMATION RESULTS

Following the defined estimation strategy the following steps are performed:

- in order to eliminate selection bias Heckit procedure is employed: 1) Heckman selection model (Tobit II model), where selection equation is "reservation" wage; 2) OLS for work hours, including correction term, obtained from the first step;
- in order to overcome endogeneity of wages with respect to labor supply, wage was instrumented;
- in order to verify heterogeneity of labor supply responses across individuals, Quantile approach is employed.

Heckman two-step procedure eliminates the selection bias that arise due to unobservability of those, for whom the reservation wage is higher than the offered one. Following Lacroix and Fortin (1992), individual-specific factors might be included into the selection equation in order to reflect those factors that influence reservation wage though not the offered one. Both market wage and the reservation one are influenced by person's education, occupation, settlement and ownership of the work place. The factors included into the selection

equation, not the market one, are as follows: non-labor income[2], gender, marital status, age, age squared, health indicator. Table 2 presents the estimates of Heckman model.

Table 2.
Heckman Selection Model

Regressant-wage	**Structural equation**		**Selection equation**	
Regressor	**Coefficient**	**t-stat**	**Coefficient**	**t-stat**
Education				
PHD	298.077	2.54	1.48605	2.99
MA	250.0775	2.52	1.058197	2.54
Specialist	182.9759	1.92	1.145999	2.93
BA	232.2773	2.36	1.342121	3.25
Incomplete higher	148.7515	1.56	.4666149	1.16
Vocational school	136.0174	1.44	.4977466	1.28
Secondary education	127.1276	1.34	.1659989	0.42
Incomplete secondary	110.0431	1.12	-.0738167	-0.19
Settlement				
Village	.1769973	0.01	-.1950726	-3.19
Village type town	31.75911	1.18	-.0227953	-0.31
Medium town	49.16559	1.82	-.3254716	-2.81
City	77.66161	3.01	.0441121	0.69
Big_city	96.62391	3.73	.0799493	1.23
Occupation				
Agrarian	-44.05793	-1.54	1.565817	10.29
Craft worker	24.62058	1.41	1.982923	25.24
Plant worker	53.97093	2.43	1.816668	14.62
Elementary	-72.80143	-4.27	1.672071	26.9
Militarian	177.8738	5.05	2.031102	7.7
Enterprise ownership				
Dometic	37.24116	3.39	1.013859	17.19
Foreign	38.68427	0.64	.8163496	2.05
Mix	105.6658	3.10	1.415802	4.89
Constant	121.3549	1.21	-4.066855	-9.27
Gender			-.2227585	-5.86
Marital status			.0284882	0.68

[2] Non-labor income is proxied with the monetary income, other than wage, all the assets owned and wages of the other household's members.

Age			.1558487	18.87
Age_squared			-.0018373	-19.38
Non-labor income			-.0008686	-5.02
Health			.4477171	3.91
Health_squared			-.1195519	-5.76
Inverse mills ratio			-37.55917	-2.19
Correlation between the error terms in structural and selection equations			-0.16263	
Number of observations			8641	
Number of censored observations			5049	

The results of the Heckman selection model suggest that there is a negative correlation between the error terms in structural and selection equations. Thus, computed Inverse Mills ratio should be included into the labor supply equation, as negative correlation coefficient indicates that there is an omitted variable, which adversely affects the decision to work and positively the scope of the market wage, or vice versa. Therefore, it can be concluded that there is a sample selection bias in the wage equation and this confirms the validity of used Heckman estimation technique.

Selection equation reflected the probability, experienced by a particular individual, to match the own reservation wage to the market one. Thus, as follows from the Table 2, higher education increases the probability that the person matches his requirements with the observable wage and decides to participate in the labor force. The probability to find appropriate wage offer decreases if the person's residence is rural. The higher probability to agree for the

offered salary is indicated for “manual” (i.e., elementary occupation), “blue-collar” (i.e., plant and craft occupations), agrarians and militarians. Across ownership types of the enterprises, i.e. demanders of the work hours, the most significant is domestic type. Non-labor income is negatively related to the participation decision. Gender dummy indicates higher wage requirements of males. The influence of the age and health indicator is significant, though not linear.

Structural equation determines the factors that affect the scope of the market wage. It clearly indicates the advantages of higher education, in particular PHD, MA and BA degrees, urban residence, military and “blue-collar” (i.e. plant and craft) occupations, either mixed or domestic ownership of the working place. “Manual” occupation has an adverse impact on the scope of the market wage, while the influence of the agrarian one is insignificant.

Before proceeding with the final labor hours estimation, there might be correction for the endogeneity of the wage and labor supply decision. To eliminate this problem, the log of wage must be instrumented (correction term from the Heckman procedure is incorporated). Table 3 represents estimation results:

Table 3.
Estimation of log (Wage)

Regressor	**Coefficient**	**t-statistics**
Non-labor income	.6373251	42.98
Inverse Mills Ratio	-.0561397	-2.58
Marital status	-.014708	-0.70
Gender	.21764	11.85
Age	.04549	9.15
Age_squared	-.0005867	-9.98
Household size	-.2717716	-8.13
Household size_squared	.019876	3.40
Urban residence	.0555115	3.01
Enterprise size	.0192423	5.19
Collective farm	-.1648504	-2.37
Industrial enterprise	.0769339	1.14
Services	.0725752	1.10
Budgetary organization	-.0523332	-0.78
Construction	.1425121	2.01
Constant	.9983626	6.69
R-squared	0.5010	
F(16,3253)	204.16	

Thus, explanatory variables account for 50% of variation in wages and their validity is supported by F-test. The incorporation of the instrumented variable into the labor supply regression permits to mitigate the problem of the correlation between explanatory variable (i.e. log of wage) and the error term. Therefore, next step is labor supply estimation with the inclusion of the instrumented wage and correction inverse Mills-ratio term. The results are represented in the Table 4.

Table 4.
Labor Supply estimation (dependant variable – log of work hours)

Regressor	**Coefficient**	**t-statistics**
Instrumented log of wage	.1363423	9.03
Inverse mills ratio	-.0609096	-2.91
Occupation		
Manager	.2304975	7.14
Agrarian	.2201615	4.73
Craft worker	.0129938	0.53
Plant worker	.1075801	3.21
Elementary	.0841013	3.40
Militarian	.22623	3.56
Technician	.040671	1.67
Clerk	.0883581	2.90
Services	.2304612	8.15
Settlement rural	.078145	5.03
Regions		
Crimea	.3133764	5.04
Kyiv	.3184063	5.25
Kyivskaya_oblast	.2936271	4.46
Vinnytskaya_oblast	.1984279	3.13
Volynskaya_oblast	.1690199	2.28
Dnepropetrovskaya_oblast	.2826614	4.74
Donetskaya_oblast	.361543	6.29
Jitomirskaya_oblast	.2564981	3.80
Zakarpatskaya_oblast	.3283763	4.95
Zaporozhskaya_oblast	.3133987	4.90
Ivano-Frankovskaya_oblast	.0013064	0.02
Kirovogradskaya_oblast	.3294476	4.81
Luganskaya_oblast	.3084518	5.09
Lvovskaya_oblast	.218432	3.62
Nikolaevskaya_oblast	.4156691	6.50
Odesskaya_oblast	.3579882	5.80
Poltavskaya_oblast	.3692104	5.54
Rovenskaya_oblast	.2590199	3.78
Sumskaya_oblast	.3104607	4.65
Ternopolskaya_oblast	.2688813	3.60
Kharkovskaya_oblast	.3088542	5.18
Khersonskaya_oblast	.2376573	3.55
Khmelnitskaya_oblast	.2844919	4.05
Cherkasskaya_oblast	.3193878	4.62

Chernigovskaya_oblast	.2468348	3.59
Constant	2.548722	24.36

From the results of the estimation it follows that work hours are positively related to the wage. The estimated elasticity of hours worked to the wage rate is 13.6%. Statistically significant correction term confirms the validity of the chosen specification. It can be inferred that labor supply increases mostly with the "white-collar" occupation (i.e. manager and services), then follows agrarians and militarians, "blue-collars" (i.e. plant workers) and "manual" occupations; craft and clerk occupations are insignificant with respect for work hours. The estimates suggest that rural residence increases labor supply. There is a significant and positive influence across all the regions, except for Ivano-Frankovsk, when the base category is Chernovtsy region. The residence of the industrial regions (Dnepropetrovsk, Donetsk, Lugansk, Zaporizhzhia), Kiev, south regions (Odessa, Nikolaev, Crimea), Kharkov, Poltava, Zakarpattia increases the supply of work, driven by the demand for labor.

So far, the estimated wage elasticity, which accounts for selection bias and endogeneity, was estimated as the same one across all the laborers, though taking into account individual specific characteristics. The next step is to apply Quantile approach in order to verify whether work hours responses to the wage increase vary across individuals. It is expected that those, for whom the time constraints are already almost binding (more than 40 work hours per week) would have lower

wage elasticity, while those, who work part-time, are likely to be more sensitive with respect to wage changes. The results are represented in the table 5.

Table 5.
2SRQ estmation of the Labor Supply[3] (t-statistics is in brackets).

Regressor	**.1 Quantile**	**.2 Quantile**	**.9 Quantile**
Instrumented log of wage	**.337374 (6.97)**	**.1124242 (3.78)**	**.0563412 (2.50)**
Occupation			
Manager	.1855876 (1.67)	.1208323 (2.42)	.3857342 (8.32)
Agrarian	.3916598 (4.31)	.1698669 (3.25)	.3195783 (3.35)
Craft worker	.1586854 (2.29)	.0727399 (1.65)	-.0012673 (-0.05)
Plant worker	.2806456 (4.20)	.1075807 (2.40)	.1283515 (2.52)
Elementary	.1766587 (2.14)	.0765518 (1.57)	.1693955 (4.29)
Militarian	.3603643 (4.36)	.1411955 (2.20)	.6066506 (2.64)
Technician	.1224818 (1.51)	.052496 (1.01)	-.0198958 (-0.77)
Clerk	.2202184 (2.63)	.0968918 (2.12)	-.006986 (-0.18)
Services	.2518422 (3.38)	.1144395 (2.27)	.3839209 (5.38)
R-squared	0.1652	0.0825	0.1416

The results suggest that those, who already participate in the labor market are not very sensitive to the wage increase, though part-timers' response would be higher. Laborers in the lowest Quantile, representing 10% of the whole sample of

[3] The explanatory variables, describing regions and type of residence can be found in the Appendix XX.

the participants, actually work up to 20 hours per week and their elasticity with respect to the wage increase is 0.34 (higher than previously estimated from Heckit estimation at 0.14). The second lowest quantile, representing 20% of the sample of participants, includes individuals supplying up to 35 hours per week and these workers are far less responsive than those, who work less than 20 hours per week: their wage elasticity is estimated at 0.11 (slightly lower than previously estimated 0.14). Finally, the individuals from the upper quantile, who work more than 52 hours and for whom time constraints are almost binding have the estimated elasticity of 0.06.

Across occupations the importance of the "white-collar" occupation increases to the upper quantile, in contrast the importance of the "blue-collars" (plant and clerk occupations) decreases. The occupations of "manual" workers, agrarians, militarians and service providers are more significant with respect to the number of work hours in the lowest and upper quantiles, while in the middle the responses are a bit lower. The occupation of technicians in the tails of the distribution is found out to be insignificant.

Thus, the results are in line with those in the labor supply literature: work hours are not very sensitive with respect to the wage changes. It is revealed that wage responses in the tails of the work hours distribution are heterogeneous and sensitivity decreases, when time constraints became binding ones.

Chapter 5

CONCLUSIONS

The analysis of the labor supply choices reveals small wage elasticity across different countries. Ukrainian evidence confirms the hypothesis of the low incidence of the labor supply decision with respect to wages. It suggests that there will be no immediate tax base increase as a result of the flat income tax implementation in Ukraine.

In the short-run it is highly possible that the tax rate decrease will influence rather the efforts, than the supply of labor per se. While in the long-run individuals might change their decision over participation or job-to-job switching. Quantile approach confirms higher sensitivity of the part-timers with respect to the wage changes in comparison to those, for whom time constraints are binding ones. At the macro-level, in the short-run the tax revenues are likely to decline before government attains the target of broadening the tax base.

There is also one more empirical risk: employer is responsible to pay about 38% of payroll tax from the salary fund, thus, it might be the case that employers just fix the net wage of the employees and adjust the gross figure following the cost minimization.

Following estimation results, such conclusions could be derived:

1. Across those, already in the labor force and working full-time, the response to the tax schedule changes is unlikely to be followed by the increase in the labor supply. Still, it could be the case that the efforts might be improved;
2. Across those, already in the labor force and working over-time, the response to the tax changes will be the lowest as time constraints became binding for such laborers;
3. Across those, already in the labor force and working part-time, the response will be higher than average across sample;
4. Across non-participants there might be the highest response because as a result of the tax changes, more individuals will be able to match their reservation wage with the increased offered one.

Thus, the implications for the policy, targeting, the increase in the labor supply are as follows:

1. Policy, targeting either tax burden decrease upon wages or general increasing of the wage rates (for example, through the minimal wage requirements) will successfully increase: (i) the probability for non-workers to match the reservation wage with the market one and (ii) the chances for the workers from the irregular sector to move into the regular one.

2. Improvement in education increases both the chances of participation and higher earnings. Thus, policy that targets enriching laborers' human capital will rise both their requirements along with the level of expected earnings, hence - will stimulate them for the job search.
3. The highest chances to join the labor force are among "manuals", "blue-collars" and agrarians, while those skilled laborers with higher requirements could be attracted only when the wage rates increase, otherwise they either will not participate in the labor market or will choose the employment in the irregular sector.
4. The policy targets development and convergence across regions will stimulate labor supply increase in the western areas up to the level of the industrial eastern, central and south regions.
5. The lightening of the payroll tax burden upon the employers will increase their incentives to shrink the scope of the unofficial payments to the employees, thus, will be followed by the tax base increase and, consequently, the increase in the labor supply in the regular sector.

Summarizing the findings, there are three groups, potentially sensitive to the tax cut: part-timers, non-participants and workers from the irregular sector. The analysis can be improved by introducing the unofficial sector responses. Further investigation of the general equilibrium model, i.e. through demand side incorporation, could give additional insights.

BIBLIOGRAPHY

Bernardi L. *Tax Policy in EU new members: Estonia and the othetr Baltics , Department of Public and Environmental Economics* - University of Pavia, Italy, , 2000.

Blundell R., McCurdy T., *Handbook of Labor Economics*, Vol. 3, 1999.

Borjas G. J., *Labour Economics.* New-York: McGraw-Hill, 1996

Buchinsky M., *Changes in the US Wage Structure 1963-1987: Application of Quantile Regression*, Econometrica, Vol 62, No.2, 1994

Burtless, G & Hausman, J., *The Effect of Taxes on Labour Supply*, Journal of Political Economy, 86, 1978

Chen L-A., Portnoy S., *Two-stage regression quantiles and trimmed least squares estimators for structural equations . Communications in Statistics-Theory and Methods*, No. 25, 1996.

Eduardo P. Ribeiro, 2001, *Asymmetric labor supply,* Empirical economics, 2001

Ehrenberg R. G., Smith R. S., *Modern Labour Economics: Theory and Public Policy*.-7th edition, Addison-Wesley, 2000.

Flood L., *The Structure of the Tax-system and the Estimation of Labor Supply Models*, Working Paper in Economics No. 1, 1998

Green W. H., *Econometric Analysis*, 4th edition, Prentice hall, New Jersey, 2000.

Gruber J., Saez E., *The elasticity of taxable income: evidence and implications*, NBER Working Paper Series, 2000

Harvey S. Rosen, *Public Finance*, Fifth edition, Irwin/McGraw-Hill, 1999.

Heckman J. J., *Varieties of Selection Bias.* The Emerican Economic Review, Vol. 80, Issue 2,1990.

Heckman J. J., *What has been learned about labor supply in the past twenty years?*, The American Economic Review, Vol.83, Issue 2, 1993

Johnston J. and DiNardo J., *Econometric Mathods*. New-York: McGraw-Hill, 1997.

Killingsworth M., *Labor Supply.* Cambridge University Press, New York, 1983

Koenker R., Basset G., *Regression quantiles*, Econometrica, No. 46, 1978

Lacroix G. and Fortin B., *Utility-based estimation of labour supply functions in the regular and irregular sectors*. The Econometric Journal, Vol. 102, Issue 415, 1992

Luzik P. C., *International Experience in Tax Reform Lessons for Ukraine*, Discussion Paper No. 99/04, 1999.

Mitra P., Stern N., *Tax Systems in Transition*, World Bank Publications, 2003.

Mroz T., *The sensitivity of an empirical model of married women's hours of work to economic and statistical*

.

Doe, John B. *Conceptual Planning: A Guide to a Better Planet*, 3d ed. Reading, MA: SmithJones, 1996.

assumptions. Econometrica, No. 55, 1987

Pereira T. P., Martins P. S., Does *Education Reduce Wage Inequality? Quantile Regressions Evidence from Fifteen European Countries*, 2000

Pencavel J., *Labor Supply of men: a survey, Handbook of Labor Economics*, 1986

Taube M., *Want a Flat Tax that Might Actually Work? Try Russia*, Options Politiques, 2001

Verbeek, Marno, *A guide to modern econometrics.* Chichester, England: John Wiley and Sons, Ltd, 2000

Smith, Chris. *Theory and the Art of Communications Design.* State of the University Press, 1997.

APPENDIX 1.

Table 1.1
Tax Schedule employed before 2004 year.

Income (UAH)	up to 17	18-85	86-170	171-1020	1021-1700	Over 1700
Marginal Tax rate	0%	10%	15%	20%	30%	40%

Table 1.1
Tax Schedule employed after 2004 year.

Income (UAH)	up to 205	over 205
Marginal Tax rate	0%	10%

APPENDIX 2.

Table 2.1.
Labor Supply decisions

Actual working hours per week (out of 3869 participants)	
Less than 20	11
20-40	57.8
40-60	25.4
60-80	11.5
80-100	3.8
More than 100	1.68

Figure 2.1.
Scatter of work hours.

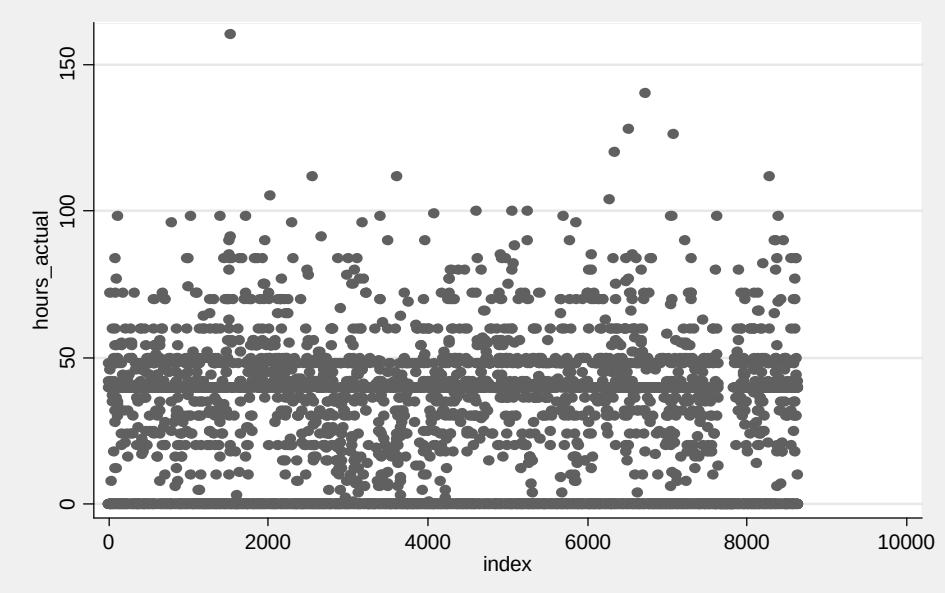

Figure 2.2.
Quantiles plot for work hours.

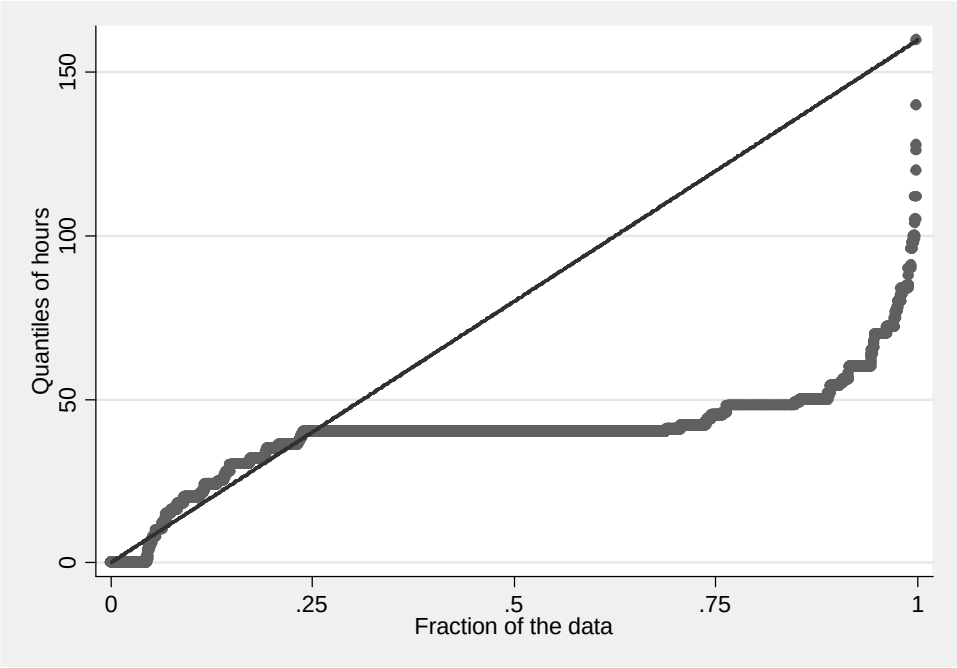

Table 2.2.
Wage composition within Ukraine in 2003

Wages (according to former tax brackets) in UAH per month	Percent
Non-participants	58.31
0-17	1.28
18-85	1.87
86-170	9.14
171-1020	29.01
1020-1700	0.27
Over 1700	0.11

Figure 2.3.
Scatter for Net Wages.

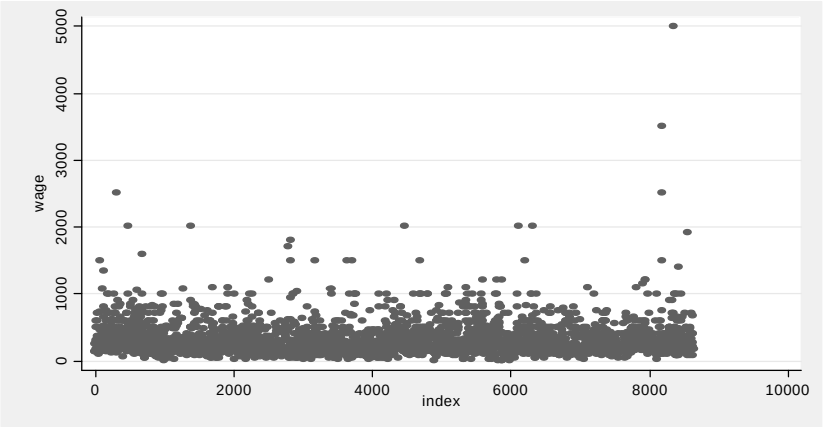

Table 2.3.
Non-labor income.

Non-wage income (including assets and wages of the other members of the household, computed per each person)	Percent
Total	100
0	29.47
1-49	17.83
50-99	20.03
100-199	23.20
200-399	7.74
400-599	1.25
600-999	0.29
Over 1000	0.17

Table 2.4.
Descriptive statistics for Non-labor income.

Variable	Number of observations	Mean	Std. deviation	Min	Max
Virtual Income	8641	82.94896	110.983	0	2675

Figure 2.4.

Scatter of Non-labor Income.

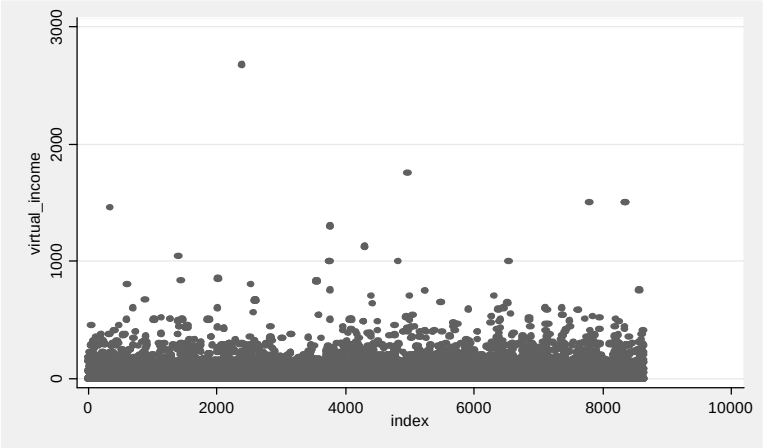

Table 2.5. Demographical composition of the surveyed sample.

Characteristics	**Percent**
Total	100
Gender	
Male	42.74
Female	57.26
Age	
Less than 20	11.32
20-30	15.39
30-40	26.71
40-50	19.3
50-60	15.39
Over 60	22.91
Marital status	
Married	64.91
Single	35.09
Health condition (from 1-very good to 4 –rather bad)	
na	0.69
1	1.74
2	22.81
3	52.38
4	22.38

Table 2.6.
Education Composition

Education (out of 8631 respondents)	Percent
Total	100
Grades 1-6	3.08
Grades 7-9	14.19
Grades 10-11 without a diploma of a high school	7.94
General secondary education	19.07
Vocational elementary education (without general secondary education)	6.56
Vocational elementary education (with general secondary education)	13.41
Professional secondary education	19.02
Incomplete professional higher education	2.12
Bachelor degree from institute, university, academy	1.23
Diploma of specialist from institute, university, academy	11.92
Master degree from institute, university, academy	1.01
Candidate of sciences, doctor of sciences	0.22

Table 2.7.
Occupation Composition

Occupation (out of 3948, i. e. 46% of the whole sample)	Percent
Managers	5.95
Professionals	14.74
Technicians and associate professionals	14.31
Clerks	6.59
Service workers	8.51
craft and related trades workers	19.2
plant and machine operators and assemblers	5.88
elementary occupations	20.64
Armed forces	1.44

Table 2.8.
Geographical characteristics.

Type and size of a settlement	Percent
Total	100
Village	33.49
settlement of a town significance	11.93
small town (up to 20,000.)	3.28
medium town (20,000 - 99,000)	11.47
city (100,000 - 499.000)	20.18
big city (more than 500,00)	19.65
Region of residence	
Total	100
Respublika Krym	4.85
Kiev	5.18
Kievskaja	2.99
Vinnickaja	4.10
Volynskaja	1.86
Dnepropetrovskaja	6.05
Doneckaja	10.76
Zhitomirskaja	2.68
Zakarpatskaja	2.65
Zaporozhskaja	3.69
Ivano-Frankovskaja	3.03
Kirovogradskaja	2.62
Luganskaja	5.38
Lvovskaja	5.59
Nikolaevskaja	3.36
Odesskaja	4.84
Poltavskaja	3.14
Rovenskaja	2.15
Sumskaja	3
Ternopolskaja	2.8
Harkovskaja	6.71
Hersonskaja	2.73
Hmelnickaja	2.92
Cherkasskaja	2.72
Chernovickaja	1.35
Chernigovskaja	2.85

Table 2.9
Type of enterprise ownership

Type of ownership (out of 1191)	Percent
Total	100
Domestically owned	85.64
Domestically owned with some foreign capital	4.45
Foreign-owned	1.43
ds/don't know	7.22
n/a	1.26

Table 2.10
Enterprise Size.

Size of enterprise (out of 3956)	Percent
Total	100
1	4.30
2 to 4	8.29
5 to 9	5.81
10 to 19	8.95
20 to 49	12.54
50 to 99	11.40
100 to 249	11.63
250 to 499	7.56
500 to 999	5.89
1000 or more	14.69
ds	8.39
na	0.56

Table 2.11
The main activity of enterprise:

Type of the enterprise activity (out of 3950)	Percent
Total	100
Agriculture, forestry	12.28
Industry	22.96
Electricity, gas, and water supply	3.22
Construction	4.89
Sale, maintenance and repair of motor vehicles	13.57
Transport, post and telecommunications	7.72
Financial intermediation, real estate	1.90
Public administration and defense	4.43
Education, health, and social protection	21.01
Other service activities, municipal services	7.06

Other	0.96

APPENDIX 3.

Table 3.1
Quantiles Estimation of the labor Supply

Regressor	**.1 Quantile**	**.2 Quantile**	**.9 Quantile**
Instrumented log of wage	**.337374 (6.97)**	**.1124242 (3.78)**	**.0563412 (2.50)**
Occupation			
Manager	.1855876 (1.67)	.1208323 (2.42)	.3857342 (8.32)
Agrarian	.3916598 (4.31)	.1698669 (3.25)	.3195783 (3.35)
Craft worker	.1586854 (2.29)	.0727399 (1.65)	-.0012673 (-0.05)
Plant worker	.2806456 (4.20)	.1075807 (2.40)	.1283515 (2.52)
Elementary	.1766587 (2.14)	.0765518 (1.57)	.1693955 (4.29)
Militarian	.3603643 (4.36)	.1411955 (2.20)	.6066506 (2.64)
Technician	.1224818 (1.51)	.052496 (1.01)	-.0198958 (-0.77)
Clerk	.2202184 (2.63)	.0968918 (2.12)	-.006986 (-0.18)
Services	.2518422 (3.38)	.1144395 (2.27)	.3839209 (5.38)
Regions			
Crimea	.8738142 (3.27)	.8803918 (3.21)	.1974668 (1.80)
Kyiv	.846699 (3.65)	.837999 (3.14)	.0444525 (0.45)
Kyivskaya_oblast	.9518894 (4.19)	.8547689 (3.18)	-.0217761 (-0.21)
Vinnytskaya_oblast	.5630089 (2.26)	.4925901 (1.66)	.0268154 (0.26)
Volynskaya_oblast	.6967043 (2.19)	.5059556 (1.76)	.0463763 (0.37)
Dnepropetrovskaya_oblast	.8919155 (3.94)	.7560254 (2.81)	.0379342 (0.37)
Donetskaya_oblast	.993592 (4.47)	.8727666 (3.28)	.0605947 (0.65)
Jitomirskaya_oblast	.9271301 (3.82)	.8726789 (3.16)	-.1151771 (-1.14)
Zakarpatskaya_oblast	1.02607 (4.6)	.8786079 (3.30)	-.0149543 (-0.14)
Zaporozhskaya_oblast	.8931565	.8567516	.0695443

	(3.47)	(3.20)	(0.65)
Ivano-Frankovskaya_oblast	.0895934 (0.24)	.1187835 (0.37)	.1136956 (0.385)
Kirovogradskaya_oblast	.8951652 (3.58)	.8902135 (3.23)	.1136956 (0.87)
Luganskaya_oblast	.7940846 (3.44)	.7736315 (2.87)	.0797508 (0.81)
Lvovskaya_oblast	.7008051 (3.01)	.7874798 (2.84)	-.0141526 (-0.14)
Nikolaevskaya_oblast	1.123453 (5.03)	.9277022 (3.48)	.0539373 (0.52)
Odesskaya_oblast	.9815127 (4.36)	.8576892 (3.21)	.0966438 (0.79)
Poltavskaya_oblast	1.056235 (4.69)	.8910083 (3.33)	.0447664 (0.41)
Rovenskaya_oblast	.7882336 (2.79)	.820159 (2.79)	.0241481 (0.24)
Sumskaya_oblast	.9679567 (3.94)	.9153592 (3.42)	-.0860132 (-0.83)
Ternopolskaya_oblast	.8001631 (2.78)	.8871012 (3.10)	-.100816 (-1.00)
Kharkovskaya_oblast	.8541763 (3.51)	.7909424 (2.92)	.10238 (1.02)
Khersonskaya_oblast	.9005406 (3.80)	.7447533 (2.60)	-.1394376 (-1.48)
Khmelnitskaya_oblast	1.10915 (4.49)	.8901859 (3.29)	-.1293335 (-1.40)
Cherkasskaya_oblast	.879181 (3.25)	.7212018 (2.53)	.2959431 (2.16)
Chernigovskaya_oblast	1.01864 (3.87)	.8656086 (3.19)	-.1126172 (-1.04)
Constant	.3635221 (1.01)	2.047234 (6.44)	3.51996 (22.58)
Rural residence	.0778012 (2.44)	.0136614 (1.02)	.0587125 (2.15)
R-squared	0.1652	0.0825	0.1416