Labor Supply in Transitional Hungary: A Life Cycle Setting Approach

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Abstract

The aim of the thesis is to examine the parameters that affected outcomes in the labor market of prime aged married men in transitional Hungary. The study draws upon two waves of Hungarian Household Panel Data. The hypothesis of a stable labor demand is rejected. “Synthetic cohort” approach is used to estimate labor supply equation. The results of the analysis suggest that in labor market outcomes what mattered more was the labor demand side, rather than the supply side.

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1. Introduction

Women's paid economic activity under socialist period in Hungary can be summarized in the following way: by 1960 half of the women aged 15-54 were active earners; by 1987 this figure had risen to 75%, thereafter decreasing moderately. A peculiarity of Hungary, like of several former socialist countries, was the very high involvement and integration of women into the labor market. Before the transition from communist system, more than 74% of women at working age population in Hungary participated in the labor market – a rate only comparable to the achievement of Scandinavian countries like Denmark and Sweden. A number of explanations have been proposed by researchers to explain this phenomenon in different post-socialist countries: having a job was both a near political obligation and an economic necessity, presence of well developed childcare structures favored female economic activity, etc. [Bonin & Euwals (2001), Lokshin (2004), Saget (1999), etc.].

The decrease in female participation rates in Hungary, which started in the mid-1980s, has accelerated since the end of the 1980s. Using post transition data, one can say that in 1992 51 per cent of the women aged 15-74 were active. However, participation rate for women decreases monotonically along the transitional period 1992-1997, dropping by 8.6 percentage points.

Table 1. Participation rates in Hungary for selected years

	1960	**1965**	**1970**	**1976**	**1980**	**1987**	**1988**	**1989**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Men	92.1	87.6	87.3	86.1	87.4	81.8	81.3	80.7	66.2	63.5	61.8	61.1	60.6	60.0
Women	49.9	56.6	63.7	67.7	70.7	74.7	74.0	73.9	51.0	48.5	46.3	43.8	43.4	42.4

Note: The participation rates before 1989 are for people aged 15-54, while after 1992 they are for people aged 15-74.

Male participation rates based on active earners seem to have fallen constantly since the 1960s, going from 87.6 per cent in 1965 to 80.7 in 1989, and falling again after 1991. In 1992 participation rate for male aged 15-74 was 66.2. This figure drops by 4.4 percentage points from 1992 to 1994 and continues to decrease moderately afterwards. The examination of aggregate participation rates, thus, seems to suggest that the transition may have slightly accelerated the long-term decrease of male labor participation but marked a turning point for women's economic activity.

The declines in participation rates for both males and females in Hungarian labor market leads to the interest of a researcher in the analysis of labor supply parameters in this country. Catherine Saget (1999) tries to examine the factors which affected married woman's labor supply decision in 1992 employing data of the first wave of Hungarian household panel. The paper provides estimates of labor supply behavioral parameters using Heckman two-step procedure which tries to control for self selection issues. The specifications she uses point to a positive and high effect of the wage rate on the female labor force participation decision, no effect of other household members' labor income, positive effect of household non-labor income.

The aim of the thesis is to examine the parameters that affected outcomes in the labor market of prime aged married men in transitional Hungary. Most empirical work on labor supply, including Saget (1999), assumes decision making in a one-period context. Typically, hours of work are regressed on the current wage rate and some measure of property income. A worker, however, determines his current labor supply in a life-cycle setting.

Similar to some of the studies on labor supply in a life-cycle context, I use so called “synthetic cohort” approach to estimate monthly hours of work equation for prime age men. I estimate hours of work equation separately for 1992 and 1997 using two waves of Hungarian Household Panel Data. To predict wages for non-workers Heckman two-step procedure is used. In addition, I group men in the sample with respect to their education and age and compare group averages of monthly hours of work and real earnings over time.

The rest of the paper is organized as follows. The second section describes the data, sample selection, and the variables. In the next section, I offer a brief summary of some approaches to labor supply estimation and provide the estimation methodology of the paper. Empirical analysis is presented in the fourth section. Section 5 concludes.

2. Data and Descriptive Statistics

2.1 Data and sample selection

This study draws upon Hungarian Household panel data set conducted by the Budapest Tarki Agency. There are the results of both individual and household questionnaires administered to more than 2000 households [varies over years], which were selected randomly. About 4500 individuals above the age of sixteen live in these households. In addition, there were about 1200 children in those households. Although the coverage is not national, the random selection of four counties within each of the three main areas of the country “intends to give a representative picture of living conditions in Hungary during the transitional period” [Saget (1999), p. 582]. The sampling procedure, as well as the questions asked, reflects international practice in the field of data gathering, and, particularly, that of the German Socio-Economic Panel. It derives from the nature of panel surveys that these households are visited each year and are questioned. The questions are very detailed, and there is a lot of valuable information on fluctuations in individual economic activity over years with different income sources. In addition, not necessarily with annual regularity, questions are put in many other topics [location of the household, number of the individuals in the household, information on health satisfaction of the individual, etc.]

However, the panel nature of data collection raises several problems, primarily because of the gradually occurring dropouts from the sample. This is the reason why the number of cases figuring in the tables is different for 1992 and 1997, with much more observations in 1992.

On the other hand, panel data set has the special advantage of allowing not only for the study of annual cross-sections, but the situation and characteristics of the same individuals and households in subsequent years, so that the changes can also be analyzed. Naturally such a longitudinal analysis raises new methodological problems: only the data of those men can be used, for who questionnaires were filled both in 1992 and 1997 of data collection, and on whose questionnaire the data studied are available. This will result in smaller sample sizes. Also, as the study analyzes prime age men, those individuals in the data set, who were between 55-60 in 1992 would not be at prime age in 1997 [similarly, men at age between 23-28 in 1997 were not at prime age in 1992]. Those were the reasons, why the selected samples are not balanced for 1992 and 1997.

For the following analysis I exclude from the sample those individuals, who do not report their hours of work, or there is missing information on their education. I also exclude self-employed individuals, and those who work in their own venture. In common with other studies, the selected sub-sample is restricted to married men aged 23 to 60, in order to exclude individuals in the process of acquiring human capital or with the possibility of retirement. The upper age limit corresponds to normal retirement age while the lower limit excludes youths who could attend university [as I control for post-secondary education in the estimation][1]. I also exclude from the analysis those, who

[1] Note, that the retirement age for men [and for women also] was changing from year to year, but for simplicity I use 60 for both years.

report varying hours of work. Those individuals are mostly under or above 23-60, and probably work on a daily basis. However, prime age individuals, who report varying hours of work, are not many and do not differ from the whole sub sample with their characteristics.

2.2 Variables

The labor-supply variable used in the empirical analysis is monthly hours of work. I obtain this variable by multiplying weekly hours of work with number of weeks in a month. The wage variable is monthly earnings after taxation. It is worth mentioning, that the budget constraint faced by the individual when making labor supply decision is the after-tax budget constraint.

The regional dummy variable indicates whether the individual is from Budapest or not. The educational binary variable indicates whether the male has less than or equal to eight years of education; secondary; vocational; or tertiary education. To control for children effects on labor supply decision I use the number of children under 18 years old. In contrast to some other studies on Hungarian labor supply, I do not concentrate on the ethnicity of the person[2].

I also control for number of household members and their monthly job-earnings. In common with Saget (1999), two other measures of household income are also used. The first is family non-labor income which is the sum of monthly share of yearly profits and

[2] Some studies on Hungarian labor supply differentiate whether the individual is of gipsy decent or not.

social transfers that are received by any member of the family in March of the current year. The second is occasional income. The separation of these income variables allows for the effect of occasional income and other non-labor income to be different on the grounds that occasional income – earned by renting rooms or selling animals – is irregular and thus less likely to affect labor supply.

I use a binary variable indicating whether the individual is satisfied with his health condition or not. The dummy is constructed in the following way: it takes value 1 if the individual evaluates his health condition more than or equal to 5 in 10-grade system; and it takes value 0 otherwise.

2.3 Descriptive statistics

The sample statistics for the variables in 1992 and 1997 are provided in Table 2. The first important observation of the table is that there are much fewer observations for 1997, which is a result of the panel nature of data collection. The consequence of few observations is large standard deviations of the variables. As can be seen from the table, participation of the men in the sample decreased sharply from 0.62 in 1992 to 0.42 in 1997, which is not very consistent with the difference of participation rates of male in 1992 and 1997 displayed in Table 1.

Average real monthly earnings are higher for prime age men in 1992. Table 1 suggests that household non-labor income has increased on average from 1992 to 1997.

On the other hand, occasional income variable is somehow the same at the sample means for both years.

From the observation of sample statistics of education dummies one can conclude that education level of male increased from 1992 to 1997, with more individuals having less than or equal to 8 years of education in 1992 and more individuals with vocational education in 1997. The sample means of variables for age and number of household members are similar for both years. However, it is interesting to notice the slight decrease in the number of children aged less than 18 over 5 years. Also on average, prime age men are less satisfied with their health condition in 1997 compared to those in 1992. Unfortunately, the location of the individual is not available for 1992.

As can be observed from the table, average monthly hours of work and real earnings are much bigger for 1992. . It is very likely, that this is a consequence of having so many non-participants in 1997 sample. However, comparison of means of these variables for only participants shows that average hours of work is slightly higher for 1992 [183 and 176 for 1992 and 1997, respectively]. Meanwhile, the average of monthly real earnings is higher for 1997 compared to that for 1992 [15900 for 1992 and 17000 for 1997].

Table2. The Characteristics of the Sample for 1992 and 1997

Variable	1992		1997	
	Mean	**S.E.**	**Mean**	**S.E.**
Monthly hours	*113*	*96*	*59*	*87*
Participation	*0.62*	*0.48*	*0.42*	*0.45*
Monthly earnings	*9841*	*13000*	*5504*	*17045*
Dummy=1 if elementary education	*0.33*	*0.47*	*0.25*	*0.45*
Dummy=1 if secondary education	*0.24*	*0.44*	*0.21*	*0.35*
Dummy=1 if vocational education	*0.31*	*0.43*	*0.42*	*0.50*
Dummy=1 if tertiary education	*0.12*	*0.34*	*0.11*	*0.32*
Dummy=1 if living in Budapest			*0.16*	*0.36*
Age in years	*43*	*9.6*	*43*	*11*
Number of household members	*3.8*	*1.3*	*3.8*	*1.5*
Number of children under 18	*1.2*	*1.1*	*1.13*	*1.25*
Other household members' earnings	*16700*	*18200*	*19265*	*23706*
Non-labor income	*8262*	*8487*	*21255*	*15350*
Household occasional income	*805*	*2967*	*1443*	*4120*
Dummy=1 if satisfied with health	*0.59*	*0.49*	*0.53*	*0.50*
Observations	*2610*		*423*	

Note: Monthly earnings and other household income variables for 1997 are deflated by CPI.

3. Estimation Methodology

3.1 The canonical model

According to the model that guides many economists' analysis, the labor supply function is derived from a general model of consumer in which a fixed endowment of a commodity is divided into one part for sale on the market and another part reserved for direct consumption. In this instance, the endowment consist of a fixed block of time, T, that for simplicity is to be divided between hours worked in the market, h, and hours spent in other activities, l: $T=h + l$. So the demand for hours of leisure simply consists of what is left over from market sales of h. In this canonical model it is assumed that there is no savings decision to be made and the individual is fully informed about the values of the relevant variables and parameters. An individual with personal characteristics A possesses a certain well-behaved utility function defined over his/her consumption of commodities, x, and hours of work, h:

$$U = U(x , h , A , \varepsilon)$$

Whether ε is called a "taste component" or an individual's "ability in home production", or whatever, the important point is that, unlike the variables in A, ε is unobserved to the researcher.

The individual chooses values of $x > 0$ and $h \geq 0$ to maximize the utility function, subject to the budget constraint, which is linear and homogeneous of degree zero in *p*, *w*, and *y*:

(1) $px = wh + y$,

where *p* is per unit price of *x*, and *w* is fixed reward for each hours of work. Deriving the first order conditions for the case of interior solution[3], $h > 0$, and solving it jointly with the budget constraint equation, one can get the commodity demand and working hours supply functions:

(2) $x = x\,(p, w, y, A, \varepsilon)$

(3) $h = h\,(p, w, y, A, \varepsilon)$

Quite often the working hours supply function convenient for estimation has been specified as linear in the parameters:

(4) $h_i = \alpha_0 + \alpha_1 (w/p)_i + \alpha_2 (y/p)_i + \alpha_3 A_i + \varepsilon_i$,

where *i* denotes individual i.

In equation *(4)* it is assumed that all the individuals face the same price *p*. However, prices of commodities, for instance, in Budapest are probably different from those in other parts of Hungary. This rationalizes the presence of region and city size dummy variables that often appear in estimated labor supply equations. However, the studies which included those dummies in the estimated equation report small changes in the estimated wage coefficient [Pencavel (1986)].

It is important to mention that the budget constraint *(1)* implies that each and every hour supplied by the individual to the market is rewarded at the fixed rate. Also it is assumed that the budget constraint covers continuum of possible hours of work. Pencavel

[3] The case of corner solution, $h=0$, is discussed later.

(1986) discusses in detail the cases of non-linear budget constraint and restrictions on hours of work by the employer.

3.2 Life cycle models

The model outlined above is static, one-period description of behavior. The decision makers are assumed to act as if actions taken today were irrelevant to tomorrow's economic environment, and accumulation of nonhuman and human wealth is ignored. An important development in research on labor supply has been the specification and estimation of life-cycle, multi-period models, according to which consumption and labor supply decisions in each period are made with regard to prices and wage rates in all periods. Utility is defined over lifetime consumption and lifetime hours of work, and similarly the budget constraint incorporates incomes and expenditures in different periods and also the opportunity to reallocate incomes and expenditures across periods by borrowing and lending. The supply of labor is a function of present and future discounted wages as well as wealth and constraints in other periods. Accordingly, the cross-sectional regression of hours of work on hourly wage rates confuses the response of labor supply to wage changes of three types: those arising from movements along the male's lifetime wage profile, those arising from shifts in his wage profile, and those arising from changes in the profile slope. As a result, the wage coefficient in empirical studies usually has no behavioral interpretation in the context of a life-cycle framework [MaCurdy (1981)].

The archetypal study of male life-cycle labor supply was MaCurdy's (1981). Under certain assumption about the form of utility function, perfect certainty, etc., the hours of work equation of individual *i* at time *t* at an interior optimum is derived as follows:

$$(5)\quad \ln h_{it} = F_i + \alpha_1 \ln (w/p)_{it} + \alpha_2 A_{it} + \alpha_3 t + \varepsilon_{it}, \quad ,$$

where F_i is individual fixed effects, which incorporate individual *i*'s tastes of work and lifetime marginal utility of wealth.

MaCurdy used ten year panel data 1967-1976 of white, continuously married prime age men from the Michigan PSID to estimate equation *(5)* with fixed effects methods. The estimator of the coefficient on wage variable gives the intertemporal substitution elasticity or, in other words, the response of work hours to evolutionary wage changes.

Unfortunately, in many studies on labor supply both the measured hours and the measured wages do not precisely correspond to their counterparts in the economic model. For instance, in the thesis monthly hours of work are computed as the product of weekly hours of work and number of weeks in a month. The measurement error problem in hours worked [or wage rates] may be well exacerbated by the first-differencing the variables in fixed effects method because the permanent components in these variables are thereby eliminated, and the "noise" components account for a relatively larger part of the measured total.

One of the important assumptions of MaCurdy's paper was that labor supply equation *(5)* was derived at an interior optimum. This problem is considered in Heckman & MaCurdy (1980), who examine life cycle labor supply decisions of married women in an environment of perfect certainty. A fixed effect Tobit model suitable for analysis of panel data is proposed and implemented. However, the sample on which their empirical work is based is that of individuals who work at least once in the panel data set.

Using a different approach to labor supply problem, Mulligan (1998) obtains a non-linear version of MaCurdy's "λ-constant" labor supply equation. The parameters in F_i [e.g. preferences of working] are allowed to vary over time, which seems to be very probable for case of transitional Hungary in the 1990s.

Similar to the literature which use so called "synthetic cohort" approach [Pencavel (1986)], I assume that

(6) $F_{it} = \gamma_t \, age_{it} + \omega_{it}$ and for each age group $\omega_{it}^a = \omega_t$

Thus, the equation *(5)* will take the following form:

(7) $ln\ h_{it} = \alpha_1\ ln\ W_{it} + \alpha_2 A_{it} + \varepsilon_{it,} + \omega_{it}$

where W_{it} is after-tax real wage A_{it} is assumed to include t and age_{it}.

Similar to Mulligan's "synthetic cohort" approach, I average labor supply equation *(7)* over individuals of the same age and obtain:

(8) $ln\ h_t^a = \omega_t + \alpha_1\ ln\ W_t^a + \alpha_2 A_t^a + \varepsilon_t^a + B_t^a$

where letters with superscript a are the cohort arithmetic-averages at time t; and B_t^a is within-cohort aggregation bias, depending on the second and higher moments of the within-cohort distributions of $ln\ W_{it}$ and ε_{it} [Mulligan (1998), p. 87]. As in MaCurdy (1981) labor supply case, the least-squares estimator of α_1 will show the response of hours of work to evolutionary wage changes.

The assumption *(6)* is crucial, so it needs some interpretation. Though tastes for work are allowed to vary over time, under assumption *(6)* those tastes, which cannot be explained by a linear term in age, should be the same on average for each age group at each time *t*. As suggested in Mulligan (1998), the assumption can be made weaker when proxies for tastes are included in the regression [e.g. family size, or earnings of other household members]. It is also very important to take into account health conditions of the individual. Health conditions of the person affect tastes for work, and also it generally deteriorates with age. Thus, the assumption that health conditions on average are the same for each age group would not be plausible. Accordingly, I include a binary variable for health satisfaction of the individual in A_{it}.

3.3 Imputation of wages for non-participants

Most of the models discussed above do not consider the case of the corner solution of utility maximization problem. However, both individual panel and cross-sectional studies must make inferences about the market value of time, when the individual is not working. The “selection bias” issue is especially important for the case of studies on female labor supply, where participation rates are much lower than those of male. When someone is not working at time *t*, it is typically assumed that the market value of time can be inferred from earnings during some other nearby period, or from the earnings of a similar person who is working, or some combination of these.

To infer wages of those who do not work I use the following specifications:

(9) $E_{it} = \alpha_1 W_{it} + \alpha_2 A_{it} + v_{it}$ - participation equation;

(10) $W_{it} = a + bX_{it} + \mu_{it}$ - expected wage rate in the labor market;

(11) $E_{it} = \eta_1 X_{it} + \eta_2 A_{it} + e_{it}$ - reduced form of participation.

In the specifications above E is a binary variable for participation [equals one, if the respondent reported positive weekly working hours]; W monthly real earnings; X and A are explanatory variables affecting monthly earnings and participation; e_{it} and μ_{it} are time-varying error terms independent of A and X; i stands for individual, and t for year. I assume that X includes age, age^2, location dummy, dummies controlling for education of the individual; and A includes household non-labor income, household occasional income other household members' monthly earnings, number of children in the household, age, number of household members, and a binary variable indicating whether the individual is satisfied with his health.

I cannot use the results of OLS regression of equation *(10)* based on the observed wages for working individuals to predict wages for inactive people, because the estimated parameters of this regression could be biased, as shown below:

$$(12)\quad \mathrm{E}(W_{it} \mid E_{it}>0) = \mathrm{E}(a + bX_{it} + \mu_{it} \mid E_{it}>0) = a + bX_{it}+\mathrm{E}(\mu_{it} \mid e_{it}>-(\eta_1 X_{it} + \eta_2 A_{it}))$$

Assuming joint normal distribution of μ_{it} and e_{it} for each t,

$$(13)\quad \mathrm{E}(W_{it} \mid E_{it}>0)= a + bX_{it}+cov(\mu_{it}, e_{it})/\sigma_e\ \lambda((\eta_1 X_{it} + \eta_2 A_{it})/\sigma_e),$$

where λ is the inverse Mills ratio [Johnson & Kotz (1972), pp. 112-113].

The latter term in *(13)* may not be equal to zero, unless $cov(\mu_{it}, e_{it})=0$.

Equivalently, equation *(13)* can be rewritten as

$$(14)\quad W_{it}= a + bX_{it}+cov(\mu_{it}, e_{it})/\sigma_e\ \lambda((\eta_1 X_{it} + \eta_2 A_{it})/\sigma_e)+\gamma_{it};$$

where γ_{it} has mean zero and is uncorrelated with independent variables in the reduced equation of participation. From equation *(14)* it is obvious that the OLS regression of log earnings on the sample of working individuals only would result in biased estimated coefficients, unless $cov(\mu_{it}, e_{it})=0$.

Thus, I use Heckman two-step procedure [Heckman (1979)] to predict wages for non participants using estimators of parameters in equation *(14)*. In the first step I run probit estimation of equation *(11)* on the sample of both workers and non-workers. Obtaining consistent estimator for the index of inverse Mill's ratio, in the second stage I run OLS regression on working individuals of equation *(14)*. Using consistently estimated parameters of the second stage, a predicted wage is derived for non-working men. It is important to mention, that by including children variable and household income variables only in A I ensure the identification of the parameters in the two-step model.

4. Empirical Analysis

4.1 Imputation of wages for non-workers: Empirics

I impute wages for non-participants by Heckman two-step procedure. In the first step I run probit regression of equation *(11)* on the whole sample of married participants and non participants for both years separately. The results of the estimation are shown in Table 3.

Table 3. Probit Estimation of the First Stage

Dependent Variable: Participation	Year	
Independent Variables	**1992**	**1997**
Dummy=1 if secondary education	*0.87**	*0.31*
Dummy=1 if vocational education	*0.85**	*-0.04*
Dummy=1 if tertiary education	*1.29**	*0.73**
Dummy=1 if living in Budapest		*-2.09**
Age in years	*0.13**	*0.15**
Age square	*-0.001**	*-1.97*
Number of household members	*0.01*	*0.29**
Number of children under 18	*-0.03*	*-0.39**
Other household members' earnings	*-0.001**	*-0.001*
Non-labor income	*-0.002**	*0.001***
Occasional income	*0.0001*	*0.0001*
Dummy=1 if satisfied with health	*-0.02*	*0.51**
Intercept	*-2.54**	*-3.64**
Included Observations	*2610*	*423*

*significant at the 5% level
**significant at the 10% level

As may be observed, the variables for tertiary education, age, and non labor income are significant at 5% level for both years. The effect of other household members' earning on participation is negative for both years, though it is small and significant only for 1992. Numbers of household members and number of children under 18 have positive and negative effect on participation, respectively, though both variables are significant only for 1997.

Obtaining consistent estimator for the index of inverse Mill's ratio, in the second stage I run OLS regression on working individuals of equation *(14)*. The results of the estimation for both years are shown in Table 4.

Table 4. Estimation of the Wage Equation in the Second Stage

Dependent Variable: Monthly Earnings	Year	
Independent Variables	**1992**	**1997**
Dummy=1 if secondary education	*5532**	*15250**
Dummy=1 if vocational education	*3034**	*9768***
Dummy=1 if tertiary education	*15458**	*11823*
Dummy=1 if living in Budapest		*39243***
Age in years	*420*	*-2180*
Age square	*-5.3*	*21*
Inverse Mills ratio	*2900*	*-21148*
Intercept	*1017*	*42256*
Included Observations	*1618*	*177*

*significant at the 5% level
**significant at the 10% level

The results summarized in Table 4 suggest, that the effect of secondary and vocational education on monthly earnings with respect to elementary education is positive and highly significant, with bigger impact of secondary education. The tertiary education dummy is significant at 5% level for 1992, and has the highest effect on monthly earnings. However, the coefficient on tertiary education binary variable is not significant for 1997, which can be a consequence of few observations. In 1997 men who lived in Budapest, earned almost 40000 Ft more than those living in other parts of Hungary. Surprisingly age variable is not significant for both years.

It is important to mention, that the dependent variable in the second stage was in forints of 1997. Deflating the coefficients with CPI using 1992 as a base year, I obtained the effects of secondary and elementary education on monthly earnings in forints of 1992 – 5570 and 3560 respectively. This result suggests that the returns to education have increased over transitional period.

Another important result of Table 4 is the absence of self-selection bias in male labor supply decision – inverse mills ratio variable is not significant for both years, which can be surprising for 1997 sample, as only 42% are participants. In fact, most of the studies on male labor supply in one period analysis, which apply Heckman's sample selection procedure, find no self-selection bias [Pencavel (1986)]. Moreover, using Hungarian Household panel, Saget (1999) finds no selection bias in female labor participation decision for 1992[4].

[4] However, this might be because of exclusion of women on maternity or childcare leave from her sample.

4.2 Stable labor demand hypothesis

I commence the empirical analysis by examining changes of average monthly real wage rates and hours of work of prime age male from 1992 to 1997. The following analysis relies on the approach from Katz & Murphy, 1992. Similar to them, I assume a concave aggregate production function consisting of K type of labor inputs, and associated factor demands as follows:

(15) $H_t = D(W_t , Z_t)$,

where $H_t = Kx1$ is a vector of labor inputs employed in year t, $W_t = Kx1$ is a vector of market wages for these inputs in year t, and $Z_t = mx1$ vector of demand shift variables in year t.

Differentiate equation *(15)* as:

(16) $d H_t = D_w d W_t + D_z Z_t$

From concavity of aggregate production function it follows that matrix D_w is negative semi definite. The negative semi definiteness of the matrix implies from equation *(16)* that

(17) $d W_t^{'} (d H_t - D_z Z_t) = d W_t^{'} D_w d W_t \leq 0$

Thus, if factor demand is stable (Z_t is fixed), then

(18) $d W_t^{'} d H_t \leq 0$

[the intuitive basic implication of stable factor demand is that an increase in the relative supply of a group must lead to a reduction in the relative wage of that group]. On the other hand, if inequality *(18)* fails, then factor demands are not fixed.

To assess the stable demand hypothesis, I group men in the sample with respect to their education and age and treat those demographic groups as distinct labor inputs. I divide the sample into 16 groups by age [23-30, 31-40, 41-50, and 51-60] and education [elementary, vocational, secondary, and tertiary]. Similar to Katz & Murphy (1992), I calculate the measure of labor inputs H_t of each group by summing the total monthly work hours in the cell and deflating by the sum of the total hours worked over all the cells. The monthly wage rate for each group is computed by averaging monthly earnings of the individuals in each cell [for those who work zero hours I use imputed wages]. The estimates of $(H_t ; W_t)$ for 1992 and 1997 are provided in Table 5.

Table 5. Average Monthly Earnings and Work Hours by Age, Education and Year

Education		**Elementary**		**Vocational**		**Secondary**		**Tertiary**	
Age	Year	H	W	H	W	H	W	H	W
23-30	*1992*	0.02	14350	0.03	14100	0.03	14100	0.01	21570
	1997	0.05	3770	0.09	13500	0.02	12000	0.03	8700
31-40	*1992*	0.05	12350	0.12	14040	0.09	15700	0.05	24100
	1997	0.07	2450	0.11	6610	0.06	9030	0.02	9200
41-50	*1992*	0.06	11200	0.09	13150	0.12	15900	0.07	28200
	1997	0.07	1800	0.13	3430	0.04	9300	0.05	10500
51-60	*1992*	0.07	10700	0.09	12500	0.05	17100	0.04	24000
	1997	0.11	1750	0.08	1350	0.02	7000	0.04	9300

Using estimates of $(H_t ; W_t)$ for each group, I evaluate whether

$$(19)\ \ (W_{97} - W_{92})' \ (H_{97} - H_{92}) \leq 0$$

Careful observation of Table 5 shows that inequality *(19)* is not satisfied for most of the groups, especially for those with higher educational attainment [secondary and tertiary]. Thus, this result suggests that labor demand shifts were not fixed for the period, and quite probably no story relying entirely on the supply shifts is consistent with the data.

However, one concern with the analysis is that it draws upon few observations compared to that in Katz & Murphy (1992). The data they employ are from March CPS, which enables them to have smaller cells with many observations in each group. In contrary, I use the data from Hungarian Household panel with relatively few observations [especially for 1997]. As a consequence, I have to group the data on men into larger cells to get relatively more observations in each cell.

4.3 Empirical analysis: Labor supply equation

Figure 1 displays monthly hours worked for male cohorts aged 23 – 60 in 1992[5]. The hours worked increase until the age of 38, and then start decreasing moderately up to the age 55. After that age it falls dramatically, reaching to its minimum at the age of 60. Similar pattern can be observed for monthly earnings in Figure 2. It is worth noticing, that though the youngest cohorts [before the age of 28] work much more than older

[5] For 1997 the hours-age and wage-age patterns are of unclear form, which can be the result of much smaller sample sizes.

cohorts [after the age of 55], on average they earn less than the older groups. Interestingly, this pattern coincides with that in the similar figures in Mulligan (1995) for CPS data in 1976, with an exception that hours worked and wage rates reach to their maximum at the age of 43.

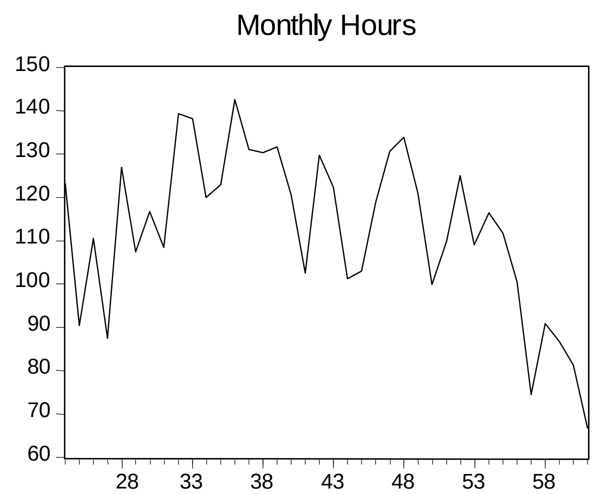

Figure 1. Male monthly hours of work by age group, 1992

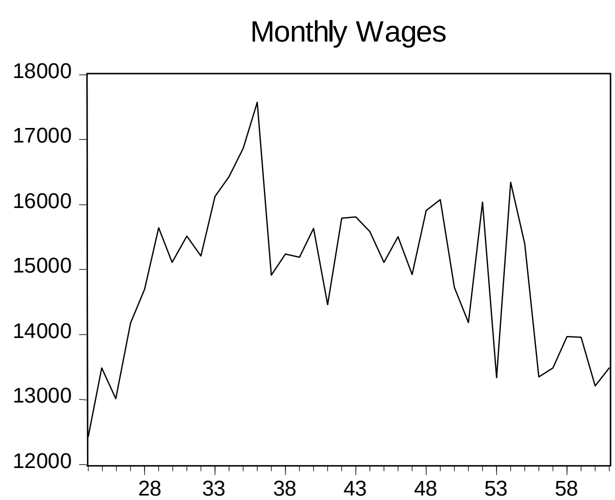

Figure 2. Male market value of time by age group, 1992

I continue the cohort analysis by estimating equation *(8)* separately for 1992 and 1997. The estimation results are provided in Table 6.

Table 6. Estimates of Labor Supply Parameters in 1992 and 1997

Dependent Variable: Log Hours	Year	
Independent Variables	**1992**	**1997**
Log Earnings	*-0.38*	*-0.05*
Age in years	*-0.007**	*-0.007*
Number of household members	*-0.001*	*0.50**
Number of children under 18	*0.14*	*-0.49**
Other household members' earnings	*0.00001**	*-0.00002**
Non-labor income	*-0.0001*	*0.0001*
Occasional income	*-0.00002*	*0.0001*
Dummy=1 if satisfied with health	*0.26*	*0.70*
Intercept	*8.12**	*3.14**
Included Observations	*38*	*38*

*significant at the 5% level

As can be observed from the table, intertemporal wage elasticity is negative and insignificant. The theoretical prediction for its sign is positive, as no wealth effect is associated with evolutionary wage variation [MaCurdy (1981)]. However, the estimates of intertemporal substitution elasticity for prime-age men in the literature differ by their sign and magnitude. For instance, Mulligan (1998) finds an estimate of 0.37 from a sample of prime-age men, who were employed some time during the year. On the other hand, Becker (1975) finds an estimate of -0.06 on a sample of prime-age nonwhite men. Overall, the estimates of intertemporal substitution elasticities using different specifications range from -0.07 to 0.45 [Pencavel (1986)].

The estimate of the coefficient on age variable is negative for both years, but the effect is marginal and significant for only 1992. The signs of the coefficients on the number of households and the number of children in the household variables are different for different yeas, but the effects of those variables are only significant for 1997. The effect of non-labor income and other household members' earnings on worked hours has also different signs for 1992 and 1997, though only the latter is significant. On the other hand, the binary variable indicating the satisfaction of the individual with his health conditions keeps its positive sign for both years, though being insignificant.

It is important to remember, that while imputing wages for non-participants I assumed that the error term *e* in equation *(11)* is not correlated with independent variables. However, if this assumption fails, the inference of earnings of non-workers will not be correct[6]. For checking robustness of the results, as suggested in Nakamura A. & Nakamura M. (1981), p. 477, I impute monthly earning not only for non-participants, but for participants also, based on the data for those who did work. I average obtained monthly wage variable for all the individuals at the same age and use it in equation *(8)* as a wage variable. The results of the estimation almost identically coincide with those in Table 6 for 1997 – the coefficients do not change their sign, significance, or even the magnitude. For 1992 only the estimates of the coefficients on number of household

[6] As a matter of fact, Mulligan (1998), p. 87, uses similar kind of assumption about the error term in labor supply equation.

members and log monthly earnings change their sign to positive, but they remain insignificant.

However, one concern with the estimation of the coefficients in *(8)* is that there is a within-cohort aggregation bias B_t^a, which is an omitted variable in the regression. Unfortunately, I could not do much about the problem but to hope that aggregation bias is small.

Another problem with the estimation procedure is that it draws upon relatively few observations. A peculiarity of synthetic cohort analysis in the literature is that it usually draws upon large cross-sectional data sets which enable to have many individuals in each age group [e.g. Mulligan (1998) uses March CPS data]. On the other hand, it is important to mention that those data sets usually do not provide such information as, for instance, health conditions of the individual.

5. Conclusion

Using a life-cycle setting approach to labor supply, the paper has attempted to examine the factors that affected labor market outcomes of prime aged married men in transitional Hungary.

To predict monthly wage rate for non-workers, Heckman two-step procedure is implemented. In fact, no self-selection in male labor supply decision is found both for 1992 and 1997. One of the intermediate results from the second stage is that the returns to education have increased from 1992 to 1997.

I have grouped men in the sample by their age and education and examined changes of average monthly real wage rates and hours of work from 1992 to 1997. The stable labor demand hypothesis is rejected, thus, suggesting that quite probably no story relying entirely on the supply shifts is consistent with the data.

Averaging observations over individuals at the same age and assuming that tastes for work are the same for each age group at each year, I obtain OLS estimates of the intertemporal substitution elasticity and coefficients of other independent variables. Overall, the only variable that is significant for both years is monthly earnings of household members of the individual, though the effect changes its direction from positive to negative.

Thus, the "synthetic cohort" approach to labor supply equation reveal, that though prime age men took into account some parameters in their labor supply decisions, evolutionary changes of monthly earnings did not matter much for hours of work decision. Taking into account that labor demand shifts were not fixed for the period, the results from synthetic cohort analysis suggest that in labor market outcomes what mattered more was the labor demand side, rather than the supply side.

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