# Income, Schooling and Housing Wealth during Economic Reforms*

Jarko FIDRMUC—Zeppelin University Friedrichshafen; Institute of East and Southeast European
Studies (IOS), Regensburg; and Charles University Prague, Institute
of Economic Studies (jarko.fidrmuc@zu.de), *corresponding author*

Matúš SENAJ—National Bank of Slovakia, Research Department, and Comenius University,
Bratislava (matus.senaj@nbs.sk)

*Abstract*
*We analyze the household income and housing endowment during the economic reforms in Slovakia. We compare households that entered the labor market before and after the economic reforms in 1990. On the one hand, the returns to education are significantly different for both labor market cohorts according to household consumption surveys. On the other hand, we analyze the determinants of housing wealth and their resulting impact on consumption. The results imply that old cohorts are characterized by lower returns to schooling, but higher housing wealth. As a result, we cannot identify a clear pattern of winners and losers in the transition.*

## 1. Introduction

Human capital endowment is among the most important determinants of growth (Barro, 1991; Levine and Renelt, 1992). However, centrally planned countries in Eastern Europe had contradictory attitudes with respect to the importance of human capital. While Eastern European countries focused on technical education (Fischer et al., 1997), human and social sciences were generally underdeveloped. Likewise, high-quality research was often focused on top-priority secret military projects with low spillovers to other sectors. The economic reforms have not only brought the market economy, but they have also significantly changed the structure and orientation of education at all levels. Therefore, we study the returns to education for cohorts that finished their education before and after 1989 in the first part of the paper. Using a unique detailed data set on Slovak households, we show that education acquired before 1990 yields lower returns than recent education offered to students after the beginning of the economic reforms. Holding all other factors constant, income for households which completed education before 1990 is lower by about seven percentage points.

Does this mean that the early cohorts are worse off than the younger cohorts? We argue that this is not necessarily the case. In the second part of the paper we look at the composition of household wealth. The socialist system provided some important benefits to the population. While the majority of these benefits were short lived, they included easy and cheap access to housing with positive long-run impacts on

household welfare effects. Moreover, the easy access to housing before the beginning of economic reforms was further strengthened by the decline of residential construction during the initial years of reforms. Actually, weak supply and increasing demand have fuelled a housing bubble in several countries recently (Hlaváček and Komárek, 2009).

Looking at both sides of the welfare situation of households, we can see that different conditions in the education sector and housing market before and after 1990 have caused persistent differences between households in Eastern Europe. Before the start of economic reforms, households were characterized by ideologically biased education on the one hand and by a relatively higher endowment of housing stocks on the other. In contrast, the young cohorts enjoyed better access to market-type education, but the supply of housing for young households was constrained by imperfect housing markets.

The insufficient education of old households may have important implications for political economy and stability in Eastern European countries. Economic reforms have introduced welfare gains but also losses. These changes have had diverse effects on households, which are often reflected in their political behavior (Fidrmuc, 2000). Denisova et al. (2010) show that attitudes in Russia towards the transition and the role of the state vary according to the age and education of the respondents. Older and less educated respondents are more likely to have a critical view of economic reforms and to favor a more important role of the state in the economy. Therefore, it is important that no population group is excluded from growth and welfare improvements.

In the particular case of Slovakia, we show that the mixture of different economic reforms had relatively balanced effects on different cohorts of the population. Since the housing sector was heavily subsidized under the former regime, older households were and still are more likely than younger households to own apartments and houses, whereas home ownership is an important source of household wealth. Actually, several measures of economic reforms have aimed to improve the economic situation of households, which bore the main burden of economic reforms. This includes the sale of housing at low prices to incumbent tenants (Faltan and Dodder, 1995), but also the voucher privatization schemes introduced in Slovakia and several Eastern European countries (Svejnar and Singer, 1994; Boycko et al., 1994). Our results indicate that these actions were important in equalizing the welfare effects of economic reforms on different cohorts of the population.

We concentrate on Slovakia because that country is a good example of a fragile liberal democracy. Among the new European Union member states, Slovakia pursued a trailblazing economic policy,[1] but its political development faced regular populist and nationalist trends as well as reform reversals (Campos and Coricelli, 2012). Correspondingly, specific redistributive policies (e.g. voucher and housing privatization) were actively targeted, especially by liberal parties. We view these policies as being part of the compensation policies that targeted the political and economic equilibrium in the country.[2]

The paper is structured as follows: The next section reviews the previous literature on returns to education and housing wealth in Eastern Europe. Section 3

[1] Slovakia introduced a major taxation reform, including a flat tax, in 2004 (Moore, 2005). It joined the European Union in 2004 and the euro area in 2009.
[2] Similar arguments in favour of voucher privatization are presented by Roland and Verdier (1994).

describes our data sets on consumption expenditures and housing wealth in Slovakia. Em-pirical results are discussed in Section 4. In Section 5 we conclude the paper with a presentation of our results and discuss the implications for other countries in Eastern Europe.

## 2. Literature Overview

In general, countries with central planning tried to reduce all sources of inequality (Orazem and Vodopivec, 1995; Campos and Coricelli, 2002). Consequently, there was a tendency to equalize wages for all jobs, although several priority areas such as heavy industry were excluded.[3] As a result, returns to education were negli-gible in all of the central-planning countries. Münich et al. (2005) present an in-depth comparison of returns to education under the communist regime and during the tran-sition to the market economy. They find that the returns to education were extremely low before 1989, but already started increasing during the first years of transition. The findings bear major similarities to earlier estimations presented by Chase (1998) for the Czech Republic and Slovakia, for Romania by Andrén et al. (2005), and for Slovenia by Orazem and Vodopivec (1995). More recently, higher returns to educa-tion were reported by Newell and Socha (2007) for Poland. These results are con-firmed by Fleisher et al. (2005), who document in a meta-analysis that the average returns to schooling doubled between 1990 and 2002 in transition economies (including China). Orlowski and Riphahn (2009) contributed to the literature by studying the returns to tenure and skills in the former East and West Germany. They found that the returns to skills are lower in the former East Germany, which is probably the result of the economic transition, during which the skills of some workers became obsolete.

Several authors address the suitability of education provided by the communist education system. In particular, previous authors discussed several ways of how education completed before the economic reforms may be less valuable in a market economy. First, it is often argued that education was focused on areas (e.g. rocket science) that are less needed in today's market economies (Campos and Dabušinkas, 2009). Second, important soft skills in marketing and management may have been missing (Campos and Coricelli, 2002). Third, the quality of education could also have worsened due to technological progress, which was not associated with economic reforms. Card and DiNardo (2002) show that low computer skills caused a negative wage premium in the United States. Thus, it can be assumed that old cohorts have lower computer skills and therefore may have lower wages. Finally, a low education premium for tenured employees may be perpetuated in their later wage profile if wage-setting practices use former income as a negotiation base for later wages (Andrén et al., 2005). Be that as it may, the last two factors are not related to the eco-nomic transition.

Several authors test whether the returns to education completed before the eco-nomic reforms are lower than returns to modern education. Contrary to the initial expectations, the previous analysis shows statistically insignificant difference between

---

[3] Münich et al. (2005) present the wage grid applied in the Czech Republic for industry, heavy industry and the public sector.

the returns to education completed before and after 1990. Münich et al. (2005) compared the marginal returns of a year of education completed before and after 1990. Somewhat surprisingly, they found lower returns to education completed during the economic reforms. Likewise, Andrén et al. (2005) found no statistical difference between education acquired before and after economic reforms.

However, these results may be influenced by the low number of observations of post-communist education (about 14% of the samples used by Münich et al., 2005, comprise approximately 320 employees). They may also be influenced by adverse labor market developments during the first year of transition (reduction of employment and increase of youth unemployment). Moreover, the quality of education could have declined during the reforms in Romania as argued by Andrén et al. (2005). Campos and Coricelli (2002) note that education indicators (e.g. enrolment rates) declined in all transition economies including Central Europe. Finally, previous authors consider the wage premium of an additional year of education.

There are only a few analyses of housing wealth in Eastern Europe. Early studies pointed out the importance of housing as a part of non-wage benefits. In planned economies, municipalities and firms were often obliged to provide social services to employees and the general population (Juurikkala and Lazareva, 2006). State-owned enterprises used non-wage benefits to attract employees. Thus, the enforced equalization of incomes was at least partly compensated for by non-wage benefits, and housing played a key role in this respect. Berger et al. (2008) show that Russian employees were compensated for differences in regional standards of living through better access to housing.

Unlike other areas, economic reforms did not target distortions in the housing market. Low supply resulted in soaring housing prices. Égert and Mihaljek (2007) show that housing prices grew similarly to income. By contrast, Hlaváček and Komárek (2009) find several periods containing housing bubbles (in particular, in 2002–2003 and 2007–2008) in the Czech Republic. The different access to the housing markets before and after 1990 implies that households' stocks of housing wealth vary significantly.

## 3. Data Description

We merge two different data sets for households in Slovakia. First, we use data on household income from the household expenditure survey (HES), which is conducted annually by the Statistical Office of the Slovak Republic. Second, we merge household data with housing prices, which are published quarterly by the National Bank of Slovakia. Both data sets are available for the period between 2004 and 2009. Thus, our data is not influenced by the flat-tax reform in 2004 (Moore, 2005). However, the data sets may be influenced marginally by the country's accession to the European Union, which occurred in May 2004. We do not deflate the nominal data; instead, we include time effects in the estimated equations. *Table A1* in the *Appendix* presents the definitions and *Table 1* the descriptive statistics for the variables used.

Although survey data on income are not often used in the literature on determinants of earnings, there are actually several advantages of using household survey data in comparison to wage data from enterprise surveys. First of all, it is

**Table 1  Descriptive Statistics**

| Variable | No. of obs. | Mean | St. dev. | Min. | Max. |
|---|---|---|---|---|---|
| Disposable income | 27 962 | 9.969 | 0.574 | 5.989 | 11.684 |
| Age | 27 962 | 5.148 | 1.446 | 1.800 | 10.100 |
| Age squared | 27 962 | 28.595 | 15.460 | 3.240 | 102.010 |
| Number of adult members | 27 962 | 2.159 | 0.960 | 0 | 7 |
| Number of children | 27 962 | 0.655 | 0.954 | 0 | 8 |
| Female | 27 962 | 0.333 | 0.471 | 0 | 1 |
| Single | 27 962 | 0.339 | 0.473 | 0 | 1 |
| Education primary | 27 962 | 0.119 | 0.324 | 0 | 1 |
| Education secondary | 27 962 | 0.745 | 0.436 | 0 | 1 |
| Education tertiary | 27 962 | 0.136 | 0.343 | 0 | 1 |
| Partner's education primary | 27 650 | 0.073 | 0.260 | 0 | 1 |
| Partner's education secondary | 27 650 | 0.517 | 0.500 | 0 | 1 |
| Partner's education tertiary | 27 650 | 0.078 | 0.269 | 0 | 1 |
| Cohort 90 | 27 962 | 0.690 | 0.463 | 0 | 1 |
| Cohort 90 (primary education) | 27 962 | 0.112 | 0.315 | 0 | 1 |
| Cohort 90 (secondary education) | 27 962 | 0.490 | 0.500 | 0 | 1 |
| Cohort 90 (tertiary education) | 27 962 | 0.088 | 0.283 | 0 | 1 |
| Work experience | 27 962 | 3.046 | 1.134 | 0 | 4.500 |
| Work experience squared | 27 962 | 10.561 | 6.375 | 0 | 20.250 |
| Years of education | 27 962 | 1.220 | 0.229 | 0.800 | 1.700 |
| Years of partner's education | 27 962 | 0.803 | 0.601 | 0 | 1.700 |
| Years of education after 1990 | 27 962 | 0.093 | 0.261 | 0 | 1.700 |
| Years of education before 1990 | 27 962 | 1.128 | 0.309 | 0 | 1.700 |
| Work experience after 1990 | 27 962 | 1.402 | 0.543 | 0 | 2 |
| Work experience after 1990 sq. | 27 962 | 2.260 | 1.204 | 0 | 4 |
| Work experience before 1990 | 27 962 | 1.373 | 0.971 | 0 | 3 |
| Work experience before 1990 sq. | 27 962 | 2.828 | 2.633 | 0 | 9 |
| Housing wealth | 27 962 | 13.612 | 3.491 | 0 | 17.475 |
| Homeownership rate | 27 962 | 0.940 | 0.237 | 0 | 1 |
| Bratislava Region | 27 962 | 0.122 | 0.327 | 0 | 1 |
| Trnava Region | 27 962 | 0.126 | 0.332 | 0 | 1 |
| Trenčín Region | 27 962 | 0.125 | 0.331 | 0 | 1 |
| Nitra Region | 27 962 | 0.125 | 0.331 | 0 | 1 |
| Žilina Region | 27 962 | 0.125 | 0.331 | 0 | 1 |
| Prešov Region | 27 962 | 0.126 | 0.332 | 0 | 1 |
| Košice Region | 27 962 | 0.125 | 0.331 | 0 | 1 |
| Year 2005 | 27 962 | 0.154 | 0.361 | 0 | 1 |
| Year 2006 | 27 962 | 0.167 | 0.373 | 0 | 1 |
| Year 2007 | 27 962 | 0.167 | 0.373 | 0 | 1 |
| Year 2008 | 27 962 | 0.168 | 0.374 | 0 | 1 |
| Year 2009 | 27 962 | 0.167 | 0.373 | 0 | 1 |

likely that the household survey at least partly covers incomes from the shadow economy.[4] Since the questionnaire is anonymous, the household members are less likely to underreport their incomes in countries with large shadow economies. Secondly, household surveys provide information on not only on wages, but also on all kinds of income including social benefits, pensions, in-kind income, etc.

The HES has been conducted since the late 1950s. However, due to several important methodological changes implemented in the household survey in 2004, we cannot use the previous household surveys for our analysis.[5] The survey provides data on the structure of income and expenditures of households. The sample size of the HES is approximately 4,700 households every year. Since 2004, the surveys have been conducted using random sampling which, combined with sample weights, guarantees the representativeness of the survey not only on the country level but also on the regional level. The basic sampling unit is a private household composed of one or more persons who live together in the same dwelling and share living costs. The methodological changes in 2004 considerably improved the representativeness of the surveys. Nevertheless, the samples may underreport the highest and lowest ends of the income distribution of households (Deaton, 2005). Another drawback is the missing time dimension, as households are included only for one period.[6]

The household expenditure survey provides detailed information on housing quality, but it does not include the market value of housing facilities. In order to examine housing wealth, we use our second data set, which comes from the survey of residential property prices[7] conducted by the National Bank of Slovakia in coope-ration with the National Association of Real Estate Agencies. We set housing wealth as being equivalent to the market value of the household main residence because information on mortgages is generally not available. Furthermore, the surveys do not include other real-estate properties. According to the Household Finance and Consumption Survey (ECB, 2013), the share of households with a mortgage is less than 10% in Slovakia. Possession of other real-estate property is also not very prevalent with a participation rate of only 15.3%. This implies that the net effect could be relatively small.

Based on the region, location and number of rooms of the property, we dis-tinguish between 120 different types of flats and houses. From the household expenditure survey, we know which types of properties the households possess. Moreover, from the survey of residential property prices we apply the prices for every housing type.[8] We impute the value of housing wealth by multiplying the size of the flat or house with the corresponding square-meter price from the database. This imputation adds a proxy on housing wealth to the original HES database.

---

[4] Schneider and Enste (2000) and Buehn and Schneider (2007) estimate that the share of the shadow economy is relatively stable at approximately 20% of GDP in Slovakia.
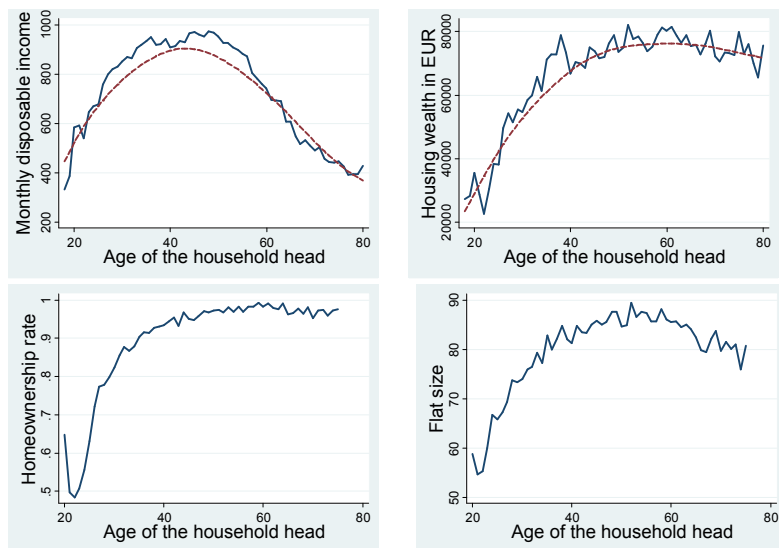
[5] Before 2004, the sample size of HES was significantly smaller (about 1,600 households) and a significant part of Slovak households were not surveyed (e.g. households with an unemployed person, disabled person or single mother as head of the household).

[6] Households are available for several periods in an alternative household survey, EU SILC. However, the source does not cover information on housing equipment.

[7] Detailed information on the survey can be found in Cár (2006).

[8] For example, prices ranged from EUR 418 to EUR 5,130 per square meter in 2009 (see http://www.nbs.sk/en/statistics/selected-macroeconomics-indicators/residential-property-prices).

**Figure 1  Household Income and Housing by Age Cohorts**



The HES data reveals several interesting features of households' disposable income. To begin with, the age-income profile has a nonlinear shape (see *Figure 1*). The peak income is attained when the household head (HH) reaches approximately the age of 50. After that, the family income decreases sharply.

Since housing wealth is the most important component of private capital, our attention focuses on housing.[9] *Figure 1* shows that older households possess more housing wealth. In general, former communist countries are known as countries with very high home-ownership rates due to the mass housing privatization of former state-owned rental housing (Lux, 2004; Edgar et al., 2007). This is also true in the case of Slovakia. In addition, *Figure 1* shows the pattern of ownership rates in our sample and it displays the dependency between age and home ownership. The ownership rate increases from 50% for the youngest households to 95% for households that are older than 50 years.

A very similar pattern can be found in the value of housing wealth in accordance with age. Housing wealth rises during the life cycle. What is surprising is the average house price per square meter for different age groups. Although properties of older households are smaller, they are more valuable mainly due to the better location of their apartments and houses.

## 4. Empirical Analysis

In this section we proceed in two steps. Firstly, we focus our analysis on the education level of the households and its impact on disposable income. Secondly, we turn our attention to housing wealth and look for the determinants of residential property prices.

---

[9] In Slovakia, the median value of household main residence is EUR 55,900 euro. In contrast, the sum of median values of real and financial assets is EUR 64,300. For more information, see ECB (2013).

## 4.1 Income Determinants

Following the previous literature (Mincer, 1974), we start our analysis with the estimation of the log-linear income equation,

$$y_{it} = \sum_{d=1}^{D} \alpha_d demo_{kit} + \sum_{e=p,u} \alpha_e educ_{eit}^{head} + \sum_{f=p,u} \alpha_f educ_{fit}^{part} + \sum_{k=1}^{K} \alpha_k z_{kit} + \varepsilon_{it} \qquad (1)$$

The depended variable, $y$, is defined as the monthly income of household $i$ in time $t$. *Table 2* presents estimations of household income determinants. The first specification includes standard demographic indicators, denoted by *demo*, such as gender, age and family size, which are defined for the principal earner (household head). As far as income is a non-linear function of age (see *Figure 1*), we include age (divided by 10) and age squared (divided by 100) in the regression. We also use dummy variables for households whose head is widowed, divorced or single. Furthermore, the number of household members and children are included in order to capture the size of the households.

In addition to standard demographic variables, we include dummies for education (primary and university levels as compared to secondary level, which is used as the base category) of the household head and his/her partner, which are denoted by *educ*. Finally, we include several control variables (time and regional dummies) denoted by $z$, and $\varepsilon$ which denotes the i.i.d. error term.

All variables are highly significant and have signs in line with the literature. The size of estimated effects is also economically important. Households with a female principal earner have incomes that are lower by 4.8 percentage points and single persons have even lower incomes, by 23.0 percentage points. Moreover, we document a positive effect of education. We also include the level of the partner's education, where we find that the partner's education has significantly lower returns to schooling. For example, households have incomes higher by 18.5 percentage points if the household head has a university education as compared to secondary education (base category). However, households in which the partner also has a university education earn only 13.7 percentage points more. The negative differential of the secondary earner is visible also for primary education, where the difference between income effects for the household head and the partner equates to 0.9 percentage points. In line with the literature, we find that the age coefficient is positive, whereas the squared age coefficient is negative. Thus the relationship between the income and age of the principal earner has a convex shape.

The next specification extends the analysis with a cohort dummy. This specification also includes Cohort 90, which is a dummy variable that equals one if the principal earner entered the labor market before 1990 (i.e. if he or she was older than 25 in 1989). When excluding the rare exceptions of people starting university educations after some years of work experience, these earners received their complete education before the economic reforms. This specification shows that the income of households belonging to Cohort 90 is 7.0 percentage points lower than the income of the base category (young households).

Nevertheless, cohort differentials may correspond to several factors including previous earning profiles (see discussion in Section 2). Therefore, we compare the returns to schooling for different levels of education in the next specification.

**Table 2  OLS Estimates of Disposable Income Equation**

|  | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Age | 0.094** (0.012) | 0.160** (0.013) | 0.163** (0.013) |  |  |  |
| Age squared | -0.015** (0.001) | -0.020** (0.001) | -0.021** (0.001) |  |  |  |
| Number of adult members | 0.271** (0.009) | 0.276** (0.010) | 0.275** (0.010) | 0.244** (0.007) | 0.292** (0.010) | 0.275** (0.009) |
| Number of children | 0.058** (0.003) | 0.052** (0.003) | 0.053** (0.003) | 0.030** (0.007) | 0.064** (0.006) | 0.049** (0.004) |
| Female | -0.048** (0.008) | -0.048** (0.008) | -0.049** (0.008) | -0.076** (0.015) | -0.019 (0.012) | -0.039** (0.009) |
| Single | -0.230** (0.010) | -0.226** (0.010) | -0.227** (0.010) | 0.090 (0.062) | 0.119** (0.030) | -0.227** (0.011) |
| Education primary | -0.122** (0.010) | -0.122** (0.010) | -0.328** (0.025) |  |  |  |
| Education tertiary | 0.185** (0.012) | 0.185** (0.012) | 0.187** (0.014) |  |  |  |
| Partner's education primary | -0.131** (0.014) | -0.131** (0.014) | -0.128** (0.014) |  |  |  |
| Partner's education tertiary | 0.137** (0.015) | 0.136** (0.015) | 0.135** (0.015) |  |  |  |
| Cohort 90 |  | -0.070** (0.011) |  |  |  |  |
| Cohort 90 (primary education) |  |  | 0.148** (0.024) |  |  |  |
| Cohort 90 (secondary ed.) |  |  | -0.074** (0.011) |  |  |  |
| Cohort 90 (tertiary education) |  |  | -0.076** (0.018) |  |  |  |
| Years of education |  |  |  | 0.488** (0.029) | 0.265** (0.025) |  |
| Years of partner's education |  |  |  | 0.261** (0.042) | 0.304** (0.022) |  |
| Work experience |  |  |  | 0.377** (0.024) | 0.242* (0.098) |  |
| Work experience sq. |  |  |  | -0.103** (0.008) | -0.050** (0.014) |  |
| Years of education before 1990 |  |  |  |  |  | 0.415** (0.021) |
| Years of education after 1990 |  |  |  |  |  | 0.495** (0.021) |
| Work experience before 1990 |  |  |  |  |  | -0.173** (0.014) |
| Work experience b. 1990 sq. |  |  |  |  |  | 0.041** (0.005) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Work experience after 1990 | | | | | | $0.096^{**}$ |
| | | | | | | $(0.022)$ |
| Work experience after 1990 sq. | | | | | | $0.036^{**}$ |
| | | | | | | $(0.013)$ |
| Constant | $9.117^{**}$ | $8.960^{**}$ | $8.961^{**}$ | $8.135^{**}$ | $8.197^{**}$ | $8.604^{**}$ |
| | $(0.027)$ | $(0.035)$ | $(0.036)$ | $(0.076)$ | $(0.166)$ | $(0.043)$ |
| Sample | All househ. | All househ. | All househ. | Young cohort | Old cohort | All househ. |
| No. of obs. | 27 650 | 27 650 | 27 650 | 8 674 | 19 288 | 27 962 |
| $R^2$ | 0.641 | 0.642 | 0.643 | 0.464 | 0.666 | 0.637 |

*Notes:* Robust standard errors are reported in parentheses. Regional and time effects are not reported.
\*\* and *denote significance at the 1% and 5% level, respectively.

Employees with university degrees receive lower incomes if they entered the labor market before 1990 in comparison to employees with a university education completed after 1990. In contrast, the income of respondents with basic education is actually higher for those who entered the labor market before 1990. This contradicts alternative explanations of income differentials (e.g. wage persistence).

The specification (5) in *Table 2* shows that the gender differences became insignificant for the old cohort. This finding is in line with the reduction of the gender gap documented by Brainerd (2000). Actually, the returns to the partner's education are even slightly higher than for the household head.

These results are highly robust to various sensitivity tests. First, the threshold of labor market entry at the age of 25 years was confirmed in a placebo test (Chow structural break test) for household age between 20 and 30 in 1990. This test confirmed that the age of 25 years in 1990 is associated with the highest *t*-statistics.

Second, we split the sample for both cohorts according to the age of the principal earner. The columns (4) and (5) in *Table 2* present the regressions of household incomes in years of education, years of potential experience and squared experience, and other variables capturing the households' characteristics. Similarly to the previous results, the estimated coefficient of years of education is significantly lower among the older households, confirming our previous findings. Likewise, the effect of work experience is lower in the older cohort group.

Finally, following Chase (1998) we include years of education and work experience in the disposable income equation (eight years for basic education, four years for secondary education and five years for university education). Additionally, we define the potential work experience indicator as age minus the years of education and the pre-school age (six years). Thus, we estimate

$$y_{it} = \alpha_1 edyear_{it}^{pre} + \alpha_2 edyear_{it}^{post} + \alpha_3 workyear_{it}^{pre} + \alpha_4 workyear_{it}^{post} + $$
$$+ \sum_{d=1}^{D} \alpha_d demo_{kit} + \sum_{k=1}^{K} \alpha_k z_{kit} + \varepsilon_{it} \qquad (2)$$

The last column of *Table 2* summarizes the estimated coefficients. Not surprisingly, it turns out that education completed before 1990 is much less rewarded than education from the reformed schooling system after 1990. Thus, our sensitivity

analysis confirms that schooling obtained before the economic reforms yields lower returns than schooling attained more recently.

## 4.2 Determinants of Housing Wealth

Under central planning, housing was under tight state control. The majority of dwellings[10] were owned directly by the state or by state-owned enterprises. Lux (2004) classifies the following four types of housing: state-owned rental flats, rental flats owned by state-owned enterprises, cooperative rental flats and privately owned family houses. The privatization of former state-owned rental housing began in the early 1990s. Due to privatization, a lot of families became owners of the flats they were living in. Moreover, the residents had to pay far less than the market price for such flats. Thus, older families acquired their housing wealth for relatively low prices and therefore they are often equipped with higher housing stocks.

The estimation of determinants of housing wealth has to reflect that the sample includes households with zero housing wealth. Moreover, the households with housing wealth are likely to be different from the remaining households. In this case, the OLS approach will not yield consistent estimates mainly because the censored sample is not representative of the population (Cameron and Trivedi, 2009). As a result, we apply the Heckman selection model,[11] which reflects possible selection bias in the housing wealth equation.

The Heckman selection model represents a bivariate sample selection model. In general, the model includes a selection equation (probit) for home ownership, $ho$,

$$\Pr\left(ho_{it} = 1\right) = \Phi\left(\mathbf{x}_{it}'\boldsymbol{\beta} + \mathbf{z}_{it}'\boldsymbol{\gamma} + v_{it}\right) \tag{3}$$

where $\Phi$ has a cumulative distribution function of the standard normal distribution, $\mathbf{x}$ is a vector of explanatory variables and $\mathbf{z}$ is a vector of exclusion restrictions (i.e. the variables that influence the probability of owning a house and do not influence its value), $\boldsymbol{\gamma}$ and $\boldsymbol{\beta}$ are the vectors of estimated parameters and $v$ is the normally distributed error term. The outcome or regression equation for housing wealth has a linear form. The dependent variable housing wealth, $hw$, is observed only if $ho$ equals one. Thus we estimate

$$hw_{it} = \mathbf{x}_{it}'\boldsymbol{\beta} + \rho\lambda\left(\mathbf{x}_{it}'\boldsymbol{\beta} + \mathbf{z}_{it}'\boldsymbol{\gamma}\right) + u_{it} \tag{4}$$

where $\lambda$ stands for the inverse Mill's ratio and $u$ denotes normally distributed error terms.

The Heckman selection model can be estimated by using two different methods. The first method applies a two-step approach that estimates separately the outcome and selection equation. Alternatively, both equations can be estimated simultaneously by a maximum likelihood method, which is generally considered to be more efficient and robust. *Table 3* presents results of both methods supporting the robustness of our results. The explanatory variables include disposable income, number of family members, a dummy variable for singles and a dummy for house-

---

[10] Due to data limitation, we consider only the main residence of the households. Unfortunately, we cannot extend our analysis to other properties owned by the families.

[11] The results of the Tobit model are available upon request from authors.

**Table 3  Heckman Selection Model Estimates of Housing Wealth**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Heckman model ML | Heckman model 2STEP | Heckman model ML | Heckman model 2STEP |
| Disposable income | 0.061** | 0.043** | 0.061** | 0.054** |
| | (0.018) | (0.010) | (0.018) | (0.008) |
| Number of family members | 0.050** | 0.056** | 0.063** | 0.062** |
| | (0.007) | (0.004) | (0.007) | (0.003) |
| Single | -0.058** | -0.045** | -0.060** | -0.058** |
| | (0.012) | (0.011) | (0.012) | (0.009) |
| Cohort 90 | | | 0.133** | 0.093** |
| | | | (0.010) | (0.011) |
| Constant | 13.434** | 13.619** | 13.285** | 13.393** |
| | (0.164) | (0.097) | (0.160) | (0.082) |
| ***Homeownership—selection model*** | | | | |
| Disposable income | 0.370** | 0.336** | 0.359** | 0.336** |
| | (0.053) | (0.030) | (0.054) | (0.030) |
| Single | -0.199** | -0.238** | -0.206** | -0.238** |
| | (0.031) | (0.036) | (0.030) | (0.036) |
| Number of family members | 0.042 | 0.018 | 0.034 | 0.018 |
| | (0.026) | (0.014) | (0.028) | (0.014) |
| Age | 1.025** | 1.096** | 1.060** | 1.096** |
| | (0.108) | (0.069) | (0.107) | (0.069) |
| Age squared | -0.068** | -0.077** | -0.071** | -0.077** |
| | (0.010) | (0.006) | (0.010) | (0.006) |
| Cohort 90 | 0.040 | -0.001 | -0.032 | -0.001 |
| | (0.053) | (0.052) | (0.050) | (0.052) |
| Constant | -5.303** | -4.936** | -5.181** | -4.936** |
| | (0.671) | (0.323) | (0.711) | (0.323) |
| No. of observations | 27 962 | 27 962 | 27 962 | 27 962 |
| No. of censored obs. | 1 673 | 1 673 | 1 673 | 1 673 |
| Rho | -0.446 | -1.000 | -0.274 | -0.696 |

*Notes:* Robust standard errors are reported in parentheses. Regional and time effects are not reported.
** and *denote significance at the 1% and 5% level, respectively.

holds belonging to Cohort 90. Moreover, the selection equation includes the age and age squared of the principal earner, which are used as the exclusion restriction.[12] This reflects the assumption that households are more likely to become home owners as they age. Having acquired housing, households stay in the same housing for a relatively long period of time (see *Figure 1*, which confirms this assumption). Consequently, the value of housing does not change again with age (it is actually insignificant if included in the outcome equation). Nearly all variables keep the expected signs in the selection equation, and the age variables, which are used for the exclusion restriction, are highly significant. By contrast, the number of family

[12] Because of the identification condition, we only use age in the selection equation. Therefore, it does not appear in the regression equation.

members, as well as the dummy variable for Cohort 90, are insignificant and do not have any effect on home ownership.

The outcome equation contains disposable income, which has a positive sign. Families with higher income live in properties that are more valuable. If the income of the household goes up by 10%, the household tends to live in a more expensive property. This price increase ranges between 0.4% and 0.6%. In addition, the coefficient of the number of family members also has a positive sign, indicating that larger families own dwellings that are larger and thus worth more. All specifications confirm that households belonging to Cohort 90 possess more valuable housing wealth than younger households. Year dummies capture the development of house prices compared to the omitted year 2004. Moreover, we include regional dummies to control different regional prices of properties. For example, households in the capital city, Bratislava, are less likely to own their housing, but if they do, their housing is more expensive than in other regions.[13]

In sum, we can see that the early labor market cohorts have income levels that are nearly 0.7 percentage points lower than those of younger cohorts. However, the income of older households would be higher if rents for better housing were properly imputed. In the following example, we try to evaluate the size and the impact of imputed rents. In *Table 3*, we estimate that the housing value of older households is higher by 9.3 to 13.3 percentage points. Given the annual rent-to-price ratio of 5.5% (Global Property Guide, 2012) and the average income and house price, this implies that imputed rent for older households increases their consumption by 5 to 7 percentage points. Hence, the differences in income levels between the cohorts are rather negligible if rent imputation is considered.

## 5. Conclusions

Nearly 25 years after the beginning of the economic reforms and transition in Eastern Europe, former policies of communist governments still determine people's financial situation. Using household expenditure surveys in Slovakia, we demonstrate significant differences between cohorts entering the labor market before and after 1990. On the one hand, returns to schooling are lower for education obtained before market reforms. On the other hand, the early labor market cohorts enjoyed easier access to housing.

We find that both effects seem to counteract each other to some degree. Older employees face lower returns to schooling, which lowers their disposable income. Keeping other effects unchanged, this would result in negative implications on their wealth. However, older households enjoyed preferential access to housing. The variability of both effects among individuals leads to the conclusion that it is difficult to identify the winners and losers in the transition.

The importance of both effects describes how fragile political support for economic reforms in Eastern Europe is. We argue that privatization programs (voucher privatization and, even more so, privatization of housing to incumbent tenants) played an important role in ensuring political support during the economic reforms. Beyond political economic considerations, we provide several findings with regard to income and wealth determinants at the household level.

---

[13] We do not report time and regional dummies, but they are available upon request.

# APPENDIX

**Table A1  Definition of Variables**

| Table label | Definition |
|---|---|
| Disposable income | Monthly disposable income of the household in logs |
| Age | Age of the reference person divided by 10 |
| Age squared | Age of the reference person squared and divided by 100 |
| Number of adult members | Number of household members older than 18 years |
| Number of children | Number of household members younger than 18 years |
| Female | Dummy variable which is coded as 1 if the reference person is women and 0 otherwise |
| Single | Dummy variable which is coded as 1 if the reference person does not have any partner and 0 otherwise |
| Education primary | Dummy variable which is coded as 1 if the highest level of education achieved by reference person is primary and 0 otherwise |
| Education secondary | Dummy variable which is coded as 1 if the highest level of education achieved by reference person is secondary and 0 otherwise |
| Education tertiary | Dummy variable which is coded as 1 if the highest level of education achieved by reference person is tertiary and 0 otherwise |
| Partner's education primary | Dummy variable which is coded as 1 if the partner of the reference person achieved primary education and 0 otherwise |
| Partner's education secondary | Dummy variable which is coded as 1 if the partner of the reference person achieved secondary education and 0 otherwise |
| Partner's education tertiary | Dummy variable which is coded as 1 if the partner of the reference person achieved tertiary education and 0 otherwise |
| Cohort 90 | Dummy variable which is coded as 1 if household head was older than 25 in 1989 and equals to 0 otherwise |
| Cohort 90 x primary education | Dummy variable which is coded as 1 if household head was older than 25 in 1989 and if he or she achieved primary education. Otherwise it equals to 0 |
| Cohort 90 x secondary education | Dummy variable which is coded as 1 if household head was older than 25 in 1989 and if he or she achieved secondary education. Otherwise it equals to 0 |
| Cohort 90 x tertiary education | Dummy variable which is coded as 1 if household head was older than 25 in 1989 and if he or she achieved tertiary education. Otherwise it equals to 0 |
| Work experience | Years of potential work experience. It equals to age ofthe household head—years of education—6. Then it is divided by 10 |
| Work experience squared | Years of potential work experience squared. It equals to age of the household head—years of education—6. Then it is squared and divided by 100 |
| Years of education | Years of schooling of the reference person. It equals to 8, 12 or 17 according to the highest achieved level of education (primary, secondary or tertiary) |

| | |
|---|---|
| Years of partner's education | Years of schooling of the partner. It equals to 8, 12 or 17 according to the highest achieved level of education (primary, secondary or tertiary) |
| Years of education after 1990 | Years of schooling of the reference person after 1990 |
| Years of education before 1990 | Years of schooling of the reference person before 1990 |
| Work experience after 1990 | Years of potential work experience after 1990 |
| Work experience after 1990 sq. | Years of potential work experience after 1990 squared |
| Work experience before 1990 | Years of potential work experience before 1990 |
| Work experience before 1990 sq. | Years of potential work experience before 1990 squared |
| Housing wealth | Market value of the house or flat in logs |
| Homeownership rate | Dummy variable which is coded as 1 if the household owns the house or flat they occupy and 0 otherwise |
| Regional dummies | Set of dummy variables for 8 regions (NUTS 3). The dummies are coded as 1 for the indicated region and 0 otherwise. |
| Year dummies | Set of dummy variables for surveys between 2005 and 2009. The dummies are coded as 1 for the indicated period and 0 otherwise. |

REFERENCES

Andrén D, Earle JS, Sapatoru D (2005): The wage effects of schooling under socialism and in transition: Evidence from Romania, 1950–2000. *Journal of Comparative Economics*, 33(2):300–323.

Barro RJ (1991): Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2):407–443.

Battistin E, Blundell R, Lewbel A (2009): Why Is consumption more log normal than income? Gibrat's law revisited. *Journal of Political Economy*, 117(6):1140–1154.

Berger MC, Blomquist GC, Sabirianova PK (2008): Compensating differentials in emerging labor and housing markets: Estimates of quality of life in Russian cities. *Journal of Urban Economics*, 63(1):25–55.

Buehn B, Schneider F (2007): Shadow economies and corruption all over the world: Revised estimates for 120 countries. *Economics: The Open-Access, Open-Assessment E-Journal*, 1:1–53, http://dx.doi.org/10.5018/economics-ejournal.ja.2007-9.

Boycko M, Shleifer A, Vishny RW (1994): Voucher privatization. *Journal of Financial Economics*, 35(2):249–266.

Brainerd E (2000): Women in transition: Changes in gender wage differentials in Eastern Europe and former Soviet Union. *Industrial and Labor Relations Review*, 54(1):138–162.

Cár M (2006): Monitoring residential property prices in Slovakia. Biatec, 14(1):9–15.

Cameron AC, Trivedi PK (2009): *Microeconometrics Using Stata*. A Stata Press Publication.

Campos NF, Coricelli F (2002): Growth in transition: What we know, what we don't, and what we should. *Journal of Economic Literature*, 40(3):793–836.

Campos NF, Coricelli F (2012): Financial liberalization and reversals: Political and economic determinants. *Economic Policy*, July:483–513.

Campos NF, Dabušinskas A (2009): So many rocket scientists, so few marketing clerks: Estimating the effects of economic reform on occupational mobility in Estonia. *European Journal of Political Economy*, 25(2):261–275.

Card D, DiNardo JE (2002): Skill-biased technological change and rising wage inequality: Some problems and puzzles. *Journal of Labor Economics*, 20(4):733–783.

Chase RS (1998): Markets for communist human capital: Returns to education and experience in the Czech Republic and Slovakia. *Industrial and Labor Relations Review*, 51(3):401–423.

Deaton A (2005): Measuring poverty in a growing world (or measuring growth in a poor world). *Review of Economics and Statistics*, 87(1):1–19.

Denisova I, Eller M, Zhuravskaya E (2010): What do Russians think about transition? *Economics of Transition*, 18(2):249–280.

ECB (2013): The Eurosystem Household Finance and Consumption Survey Results from the First Wave. (European Central Bank) *ECB Statistical Paper,* No. 2.

Edgar B, Filipovic M, Dandolova I (2007): Home ownership and marginalisation. European Journal of Homelessness, 1:141–160.

Égert B, Mihaljek D (2007). Determinants of house prices in Central and Eastern Europe. *Comparative Economic Studies*, 49(3):367–388.

Faltan L, Dodder RA (1995) Privatizing the housing sector: the case of Slovakia. *Public Administration and Development*, 15:391–396.

Fidrmuc J (2000): Political support for reforms: Economics of voting in transition countries. *European Economic Review*, 44(8):1491–1513.

Fischer S, Sahay R, Végh C (1997): From Transition to Market: Evidence and Growth Prospects. In: Zecchini S (Ed.): *Lessons from the Economic Transition: Central and Eastern Europe in the 1990s*. Kluwer Dordrecht, pp.: 79–101.

Fleisher BM, Sabirianova K, Wang X (2005): Returns to skills and the speed of reforms: Evidence from Central and Eastern Europe, China, and Russia. *Journal of Comparative Economics*, 33(2): 351–370.

Global Property Guide (2012): *Europe: Price/Rent Ratio—Rent Years to Buy 120 Sq.M. Property*. http://www.globalpropertyguide.com/Europe/price-rent-ratio/ (viewed January 12, 2012).

Hlaváček M, Komárek L (2009): Housing Price Bubbles and their Determinants in the Czech Republic and its Regions. *Czech National Bank, Working Paper*, no. 12.

Juurikkala T, Lazareva O (2006): Non-wage benefits, costs of turnover, and labor attachment: Evidence from Russian firms. (Bank of Finland, Institute for Economies in Transition, Helsinki), *BOFIT Discussion Papers,* no. 4.

Levine R, Renelt D (1992): A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4):942–963.

Lux M (2004): Housing the Poor in the Czech Republic: Prague, Brno and Ostrava. In: Fearn J. (Ed.): *Too Poor To Move, Too Poor To Stay*. Budapest, Local Government Initiative, pp. 23–66.

Mincer J (1974): *Schooling, Experience and Earnings*. NBER Press, New York.

Moore D (2005): Slovakia's 2004 Tax and Welfare Reforms. *IMF, Working Paper,* no 05/133.

Münich D, Svejnar J, Terrell K (2005): Returns to human capital under the communist wage grid and during the transition to a market economy. *Review of Economics and Statistics*, 87(1):100–123.

Newell A, Socha MW (2007): The Polish wage inequality explosion. *Economics of Transition*, 15(4):733–758.

Orazem PF, Vodopivec M (1995): Winners and losers in transition: Returns to education, experience, and gender in Slovenia. *World Bank Economic Review*, 9(2):201–230.

Orlowski R, Riphahn RT (2009): The East German wage structure after transition. *Economics of Transition*, 17(4):629–659.

Roland G, Verdier T (1994): Privatization in Eastern Europe: Irreversibility and critical mass effects. *Journal of Public Economics*, 54(2):161–183.

Schneider F, Enste DH (2000): Shadow economies: Size, causes, and consequences. *Journal of Economic Literature*, 38(1):77–114.

Svejnar J, Singer M (1994): Using vouchers to privatize an economy: The Czech and Slovak case. *Economics of Transition*, 2(1):43–69.