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DIMINISHING RETURNS TO EDUCATION IN THE SOVIET PERIOD. RESULTS FROM THE ESTONIAN HOUSEHOLD INCOME DATA

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Abstract

Analysts observed relatively low returns to education in the countries of Soviet bloc right before the collapse of the communist system. There is less information on the development of returns to education during the state socialist period and how the prevalence of low returns emerged. In the case of the USSR scarce data made it difficult to estimate earnings by education and its trend over time. This paper investigates the change in returns to education in the Soviet Union from the 1950s to 1980s. We analyse individual level household income survey data collected in Estonia since 1958. Wage income is modelled using linear and linear mixed regression model. Descriptive and analytical results indicate decreasing returns to education over time, leading to more equal distribution of wage income by educational level. The background of this process is concentration of higher education and higher wage income into different sectors of economy.

Keywords: education, wage, income, socialism, planned economy

Contents

1 Introduction

The transition of East and Central European countries from Soviet type socialism to market economy has changed greatly these societies and their economy. Among other adjustments to new conditions there was a noticeable increase in returns to human capital as centrally managed wage grids were replaced by market regulation. Analysts of the transition noted that education became much more powerful determinant of wage income than it had been during the socialist period (Chase 1998, Filer *et al.* 1999, Flabbi *et al.* 2008, Flanagan 1998, Orazem and Vodopivec 1997). Some of these studies showed that education acquired in the state socialist period was successfully turned into higher wage income during the transition. Münich *et al.* (2005) argue that the socialist system generated a considerable amount of human capital, but was rewarding it only modestly. A question one may ask is whether such conditions prevailed for a longer period of time or described mostly the situation right before the collapse of the Soviet bloc. Especially in the case of the USSR, there has been very few possibilities to study how education and human capital were rewarded throughout the years of the state socialist system. Yet more information on returns to education, being closely related to functioning of the labour market, could provide further insights to the fail of the Soviet system.

Soviet wage determinants have been studied before but one of the limitations has always been the lack of proper data. In this paper we take advantage of individual-level household income survey data collected in Estonia since 1958. Although in terms of size of population and economy Estonia constituted only a fraction of the USSR, we assume that general trends in wage determination are well reflected in this data. Low returns to education and their rapid increase was found in Estonia during the transition after the fall of the USSR (Noorkoiv *et al.* 1998). The conditions of Soviet system in this country were illustrated by the World Bank report, which analysed Estonia during the first years of re-gained independence in the early 1990s and found earnings to be poorly related to education. Three lowest paid sectors were education, culture and health, although the number of university graduates was the highest in these sectors. On the other hand, the two highest paid sectors were construction and industry, where the majority of work force had no secondary education (World Bank 1993). This article investigates the development of wage differentials by education in Estonia and how the situation of low returns to education, observed at the end of the Soviet period, was reached. Wage function is estimated using data from 1958, 1975 and 1981.

2 Research on Soviet wage determinants

During the Cold War, Soviet Union and its satellite countries constituted an interesting research topic for western economists. Central planning at this scale was unique, but for outside researchers it was difficult to estimate its rate of advancement due to lack of reliable micro- and macro-economic data. Nevertheless some of the research of the Soviet system focused on labour market and income of labourers. This field was related to some of the intriguing aspects, for instance the concept of equality in

pay on the one hand but the problem of work incentives on the other. Since earnings from labour were the main source of income in the USSR after World War II (WWII), wage determinants were largely responsible for income distribution in the society. Labour market and wage formation were pieces of information that could provide valuable insights to the functioning of the Soviet economy.

Western researchers' interest in Soviet wages and their distribution started quite early (e.g. Bergson 1944). It was generally known how wage regulation in the Soviet bloc worked (see, for instance, Adam 1976), but there was little actual data on wages. Outside researchers had to rely on published aggregate figures, without a good knowledge about the mechanism that had created the data. Sometimes numbers had to be read from graphs. Individual level information, when it was collected through surveys in the USSR, was extremely restricted even for Soviet academic studies. Earlier western studies used mostly official Soviet statistics to analyse wage dynamics and differentials (Chapman 1954, Schroeder 1966, Yanowitch 1955; 1960; 1963).

Around the 1970s, results of the Soviet income surveys, such as the one by Rabkina and Rimashevskaya (1972), became available to western scholars (McAuley 1977) and this provided further support to estimates of income distribution (McAuley 1979). Comparisons of income quantile ratios led to a conclusion that, regarding income distribution, the USSR was not much different from the market economies (Bergson 1984). In short, these works demonstrated that inequality of income distribution and wage differentials were also part of the Soviet realism. Yet it was unfeasible to extend this analysis to associations between individual characteristics and wages as the available data was only in aggregate form.

The lack of individual data on wages in the USSR was substantially reduced by surveys of Soviet emigres which asked about people's earnings in the USSR before emigration. Based on the survey of ex-Soviet citizens conducted in Israel, Ofer and Vinokur (2008) estimated an earnings function to investigate wage differentials by sex (first published in 1981). They were able to analyse wage differentials pertaining to years 1972–1974 by occupational status and industrial groups while taking account several individual level variables. Analogously, in the United States the so-called Soviet Interview Project (SIP) was carried out, questioning approximately 2800 people who had immigrated to the US from the USSR in 1979–1982. SIP was an interdisciplinary survey and provided material for several different studies (Millar 1987).

Using SIP data, Vinokur and Ofer (1987) completed another analysis of wage and household income inequality. Gregory and Kohlhase (1988) estimated an earnings function to analyse the effect of education, work experience and political loyalty on personal wage income. Their results reflect the situation in the late 1970s, showing significant positive and negative effect for respectively very high and very low educational attainment. It appeared that higher education increased the earnings of white-collar employees by 22 % compared to the secondary school graduates. For the blue-collar employees, very low education decreased earnings compared to secondary education by one fifth. The authors conclude, quite similarly to Ofer and Vinokur (2008), that the Soviet labour market operated not much differently from

the one in the US, the most obvious contrast being rewards for political loyalty in the USSR. In general, the returns to education were found to be relatively low in the USSR compared to the US, and besides the extremes (higher education and very low education) the other levels of education did not differ from the secondary level (Gregory and Kohlhase 1988).

As access to data became easier after the collapse of the USSR, some later assessments of Soviet wage function already relied on micro-data. Arguing with the studies that suggested negligible or non-existent returns to education in the USSR, Katz (1999) shows wage premium for higher education over the secondary to be 23% for men and 32% for women. These figures are quite close to results of the emigre study done in Israel (Ofer and Vinokur 2008). The data came from a survey and represented one city in the USSR in 1989.

Although studies of Soviet wage determination based on micro-data constituted a noteworthy advancement in the field, there were still several limitations pointed out by the authors. Both emigre surveys represented mostly an ethnic minority that originated from urban areas and had self-selected for emigration. The survey in Israel was limited to two-parent families and both emigre surveys were subject to some educational and occupational bias (Gregory and Kohlhase 1988, Millar 1987, Ofer and Vinokur 2008). The 1989 data used by Katz (1999) is also restricted to urban population, excluding people living in dormitory-type dwellings. Furthermore, it seems that in this case there was a selection within household, one respondent being chosen for more detailed data query. The author acknowledged that estimation of wage equation was possible only for main respondents (one person selected without randomisation from each household), totalling to 935 individuals.

To summarise the limitations of estimates of earnings function for the Soviet Union so far, two main issues arise. First, individual data that would be relatively free of selection effects has been difficult to obtain. Although we may assume that educational differences hold constant for different population groups, nationally representative data is probably a preferred source. Second, no data have been available to analyse longer period of time using consistent methods. Association of income with political and economic processes in the state socialist system can be further facilitated if time trend of returns to education is made available.

3 Problems, data and analytical approach

3.1 Context and questions

In order to extend our grasp on the transition of Soviet bloc countries, the low returns to education observed in the later period of the state socialist regime should be seen in a longer perspective. Given that social and economic changes occurred in the Soviet bloc during the post-WWII period, we are interested in how wage differentials by education developed over time. In the case of Czechoslovakia, for instance, Münich *et al.* (2005) suggest that educational wage differentials did not change much during the state socialist regime. It is expected that the USSR, which was the origin and exporter of communist system, was different in this respect. Let

us sketch some background developments that could be directly or indirectly related to determination of wage differentials.

A rather strong wage policy was carried out in the USSR since the mid-1950s. The results were characterised by decreasing wage differentials between skill groups, but also reduction of within- and between-industry wage gaps. A major factor of change was the political decision to increase minimum wage (McAuley 1979, Yanowitch 1963). Another wave of minimum wage lifting took place at the end of the 1960s. On a macro level this policy had a significant effect of reducing income differentials. Bergson (1984) summarised that income inequality declined since World War II until the end of the 1960s, although there was some increase in the 1970s. If the difference between well-paid and lower-paid groups was reduced, it is reasonable to expect that wage differentials between educational groups diminished as well.

Not less important is to remind that Soviet ideology and planning system favoured "productive" economic sectors. The practice of giving preference to heavy industry had started already in the early years of the Soviet Union. Similar policy was implemented in Eastern European satellite countries, driving up wages in the preferred sectors (Flanagan 1998, pp. 297–298). In the USSR, preferential development reflected well in wages. For example, employees in trade, health care and education received significantly lower wage than workers in heavy industry and machine-building. This was also found in wage equation produced by Gregory and Kohlhase (1988). Furthermore, one may hypothesise that preferred sectors were more likely to be a subject of soft budget constraint, thus having more resources to hire extra labour and offer more attractive wages. It has been mentioned that typically labour shortage appeared in the less skilled segment and thus pushed the respective wages (Katz 1999, pp. 420–421). Enterprises that exercised certain liberty in hiring labour could achieve plan targets by labour hoarding, which increased the bargaining power of less qualified labour. It would not be surprising if inter-industry wage differentials were self-supporting due to difference in labour demand – an additional unit of labour in industry was probably more helpful for material production plan fulfilment than in service sector. From the perspective of educational differences, the above mentioned factors lead to wage increase in sectors that are less educated, thus reducing the overall wage gap between higher and lower educational levels.

Another development that is only shortly mentioned here is the expansion of education. The post-WWII schooling was described by expansion of secondary education and vocational training. Some argue that increasing supply of skilled labour resulted in decline of returns to education (Katz 1999, p. 429). An analysis of Russia suggests that since the 1960s the possibility to attain secondary level of schooling extended much more than the opportunity to get enrolled at tertiary level, which greatly reduced the proportion of secondary graduates who could continue their studies at university level (Gerber and Hout 1995, p. 650). Some observers noted that together with educational expansion in the USSR, education became a "major determinant of social placement" (Jones 1978, p. 544). Relative abundance of secondary level graduates compared to university degree owners would suggest that wage differentials between the two groups remain substantial to compensate for

the cost and effort of pursuing higher education. Of course, the interest in higher education was not only due to wage expectations, but could have been related to social position and more pleasant job that followed the university degree.

An instructive example of Soviet wage determination is gender wage gap. Studies have estimated male-female wage difference to be between 20 and 30% (Gregory and Kohlhase 1988, p. 33), or even up to 35% (Katz 1997, p. 437). The wage gap is striking considering that the increase of female educational level was comparable to that of men, and in some aspects even exceeded the male level (Gerber and Hout 1995, pp. 640–650). The analysis of (Ofer and Vinokur 2008, p. 129) suggested that due to double burden of home and work, women self-selected themselves to lower-paid and less demanding jobs. Women were more likely to be employed in education, health care, and culture, which were less paid sectors compared to male-dominated industrial branches. Considering that preferential sectors were relying very much on less-qualified labour and large proportion of well-educated women chose lower-paid sectors, one would expect to see increasing discrepancy between higher education and higher wage income.

Based on the described post-WWII wage policy, educational expansion and specific Soviet labour market features, we hypothesise that Soviet returns to education were decreasing in the second half of the 20th century. Speaking of relative wage differences, penalty for low education should decrease considerably due to active policy towards increasing minimum wage. It is more difficult to propose a trend in wage premium for higher education – preferential development of industrial sectors suggests a decrease in premium, but if there appears limited supply of university graduates one would expect the opposite. A new data set has been prepared to estimate wage equation and probably for the first time there is nationally representative income survey data available for one administrative region of the USSR. Another advantage is that the data covers several time points, so we are able to analyse wage determinants at the end of the 1950s, in the mid-1970s, and early 1980s.

3.2 The income survey data

The data for the present study come from household income surveys that were carried out in the USSR since 1958 until the end of 1980s. Among budget and income surveys of the USSR, this one was considered to be the most representative and accurate by Soviet researchers (McAuley 1979, p. 55). Event though researchers in the USSR published based on the data (Matyukha 1973, Rabkina and Rimashevskaya 1972), there were always political restrictions on how detailed results could be made available to the public.

The post-war era of family budget statistics in the USSR began in 1951 when the decision was made to conduct regular budget surveys (Matyukha 1967, p. 206). Problems with the budget survey, mainly sample issues, have been described by Western researchers (McAuley 1977, Wädekin 1975). It was probably due to sample problems of the family budget survey that a new one with considerably larger sample, called household income survey, was initiated. Income surveys collected information on revenues of members of a household in one month. The first income survey was

conducted in 1958 and the subsequent one in 1967. Although continuous family budget surveys were maintained, the income survey was carried out with a 3-year interval for the entire USSR since 1972. The 1958 income survey, which covered only households of workers and employees in the non-agricultural sectors, covered 240 thousand households throughout the USSR (of them 3100 in Estonia). The later Estonian surveys had even larger sample. Collections of statistics based on these surveys were not public but released only for departmental or official use (for example CSU ESSR 1972; 1980; 1986).

The income surveys that were carried out in Estonia have been preserved in the archives in the form of individual questionnaire sheets. The exceptions are the 1967 survey, for which only aggregate tables of certain statistics have been kept, and surveys after 1984. In the present paper, we use the data from years 1958, 1975 and 1981. The information on questionnaire sheets of these years was computerised and the obtained data checked for consistency and quality. Our main concern was with the representativeness, since the survey did not rely on completely random sample (see Appendix). We evaluated the data against the closest census, comparing age composition, average household size, proportion of married, employment rate, and proportion urbanised. The biggest issue is that the 1958 survey deliberately omitted collective farm members. As a result, only small number of agricultural labour is present in 1958 data and urban population is well over-represented. The later surveys do not suffer from this problem.

A possible selection issue is found if wage income of selected respondents and their working household members is compared. The former exhibit about 5–8% higher wage than household members, depending on the survey year. It seems that the selection process was slightly biased towards higher paid enterprises and institutions. It was checked in the course of the present analysis that variables of interest are not affected by this issue. Unfortunately we cannot test this for 1958, as in that year there is no variable to distinguish whether a person in a household was selected from an enterprise or was included in the survey as a household member.

3.3 Variables used in the analysis

The dependent variable in the following analysis is individual gross wage income for the month of September in the survey year. Wages were not self-reported but an interviewer obtained them from the accounting department of the workplace. Wages were recorded as gross income and therefore included also extra income, bonuses, single lump-sum incentives, accommodation benefit from an enterprise (including housing and utilities provided by workplace), income tax withheld by the enterprise, tax on childlessness, and alimony (which was also withheld by workplace in favour of the beneficiary). As a result wage income represents all gross benefits received from labour. A positive side of this is that comparison of different sectors is more plausible as housing benefits provided by enterprises were more common in industrial and mining sector, or in towns which were established around some specific industrial production. We do not attempt to calculate net wage income or disposable income in this analysis.

The analysis takes into account only wages for entire month. Wages for less than a month were registered in questionnaire and marked as such, but number of actually worked days was not always registered. The system did not encourage part-time work, so this is not likely to be a serious shortcoming. If there was non-monetary income, for example products from a collective farm, it was calculated into money terms by interviewers who were provided with the necessary price sheets.

For the analysis nominal wage income is adjusted using money income deflator suggested by G. Schroeder and B. Severin as cited in (McAuley 1979, p. 326). This series is extended from 1975 to 1981 assuming similar rate of income inflation as in 1970–75, resulting in 1.63% increase per year. The 1961 re-denomination of the currency, which basically deleted one zero from the nominal value, is taken into account. Using the income deflator, 1958 and 1981 wages are adjusted to 1975 price level and then used in regression models.

Predictor variables include educational attainment and a number of socio-demographic variables such as age, sex, partnership status, nativity, and residence type. The level of education was recorded in surveys as follows:

- higher education – completion of an institution of higher education. Higher education includes also those who completed post-secondary technical education that was at the level of university education;
- incomplete higher education – person had completed at least half of the required period of study in an institution of higher education;
- specialised secondary – completion of technical school, specialised or vocational secondary school. If a person attended but had not completed one of these institutions, previous level of schooling was recorded (incomplete secondary or general secondary);
- general secondary – completion of 9, 10, or 11 grade secondary school, pre-war gymnasium or any other general school of secondary level;
- incomplete secondary – person had completed 7 (only if before 1961) or 8 years of schooling, pre-war pro-gymnasium or any other pre-war school of at least 7 years;
- primary – person had completed some primary school, length varying from 3 years to as long as 7 (only if after 1962) depending on the period;
- without primary.

Distance learning and attendance at evening schools was equated with daytime study according to the survey instructions. In 1958 the lack of primary education in the Soviet Union was still frequent and the survey of that year included a question whether an individual was able to read and write, only read, or was illiterate. For the analysis these cases were recoded to being without primary education. In the later surveys, the lack of primary education was recorded as the lowest level of education.

The educational attainment variable that is used in modelling exercise keeps all above described seven categories of education.

Occupation and the name of their workplace were recorded for working household members. Neither was subject to classification or coding during the surveys. Internationally comparable International Standard Classification of Occupations, ISCO-88 (International Labour Office 1991) codes were attached to individuals during the data input. For the analysis we use only the first digit of the classification number, resulting in 10 categories: 1 – legislators, senior officials and managers; 2 – professionals; 3 – technicians and associate professionals; 4 – clerks; 5 – service workers and shop and market sales workers; 6 – skilled agricultural and fishery workers; 7 – craft and related workers; 8 – plant and machine operators and assemblers; 9 – elementary occupations; 0 – armed forces. The number of employees in armed forces is, however, very low and this category is omitted from analysis. Branch of economy was derived from the name of enterprise/institution during data input and coded using Soviet classification. In the analysis some of the groups have been aggregated (e.g. government institutions are grouped together with finance institutions, people employed in the field of art are joined with education and culture) and this results in 19 categories.

Other variables include gender, age, place of residence (urban-rural), partnership information and nativity. While most of them are quite common variables in a wage equation, nativity is less frequently used. The importance of this variable appears in the Estonian setting, where massive inflow of migrants from other parts of the Soviet Union was organised by central authorities of the USSR (see Katus *et al.* 2003). During the Soviet period in Estonia the proportion of foreign origin population increased to about 40% of the total population, an order of magnitude higher of what it had been before the WWII. The immigrants were largely of Russian origin and were often employed in regions of heavy industry and mining. Thus native and foreign origin population appeared rather segregated in terms of rural-urban divide or economic sector distribution.

3.4 Analytical strategy

Soviet wage income is analysed analogously to modelling of earnings function in market economies (Mincer 1974). However, our data do not allow inclusion of work experience in the equation. Also, schooling is not measured in years but as a level of educational attainment. The dependent variable, logarithm of gross wage income, is regressed using the above described predictor variables. First we estimate a set of simple linear models using the entire data set and also each survey year separately.

Considering preferential treatment of economic sectors and that some wage determination occurred at the level of economic branch, it is expected that we observe some clustering at branch level. Occupational class is another variable that introduces heterogeneity in individual earnings. Therefore, in the second set of models we allow random effects due to branch of economy and occupational class. In the random effects model the logarithm of wage income of a person in occupational group $_i$ and economic branch $_j$ is estimated as (subscript for individual is dropped):

$$y_{ij} = \beta_0 + \beta_1 \mathbf{X}'_{ij} + \zeta_{1i} + \zeta_{2j} + \epsilon_{ij} \quad (1)$$

where X is the vector of independent variables, ζ_{1i} and ζ_{2j} are random intercepts for occupation and branch respectively, and ϵ_{ij} is the residual error term. Two random effects variables are include in the model simultaneously but they are not nested. As almost any, but not all, combination of occupational class and economic branch may occur in the data, random effects are treated as partially crossed. We use **lme4** package (Bates *et al.* 2012) written for R program. Fitting crossed random effects model with **lme4** and evaluation of parameter estimates' significance level using Markov chain Monte Carlo sampling is described in Baayen *et al.* (2008).

It is usual that person's age does not have a linear effect on wage income, but follows a concave shape. One solution is to include a polynomial of age term in the equation to allow non-linearity. In the present analysis age is modelled by adding a quadratic age term to predictors. Both age variables are centred to the mean. Besides age and survey year, other control variables (gender, partnership status, nativity and residence type) are coded as dummy variables.

4 Results

4.1 Descriptive statistics

Educational expansion that took place in Estonia can be described using census data from 1989 (Katus *et al.* 2005) as presented in Figure 1. Especially for women, the rapid increase in secondary and tertiary education is well observed and one can speak about reversed gender gap since the birth cohorts of 1930s. Figure 6 in the Appendix shows the proportion of population with tertiary, specialised secondary, and general secondary education at different census points by age group and gender. While the data show increase in the proportions of highly educated, it also points out increasing share of highly educated women. In 1959, highly educated women outnumber men in age groups below 35–39 and relatively few older women have tertiary education. In 1989, there is proportionally more highly educated women in all age groups up to age group 50–54.

(figure 1 about here)

Differences in education by nativity must be mentioned as well. Estonia was incorporated into the USSR in 1940, after two decades of independent government and development of own educational system. Since the end of World War II the central administration of the USSR supported massive immigration from other parts of the USSR and the share of immigrant population in Estonia increased rapidly. Immigrant population's earlier birth cohorts had generally lower level of education as one can observe from comparison of women in Figure 2. In another way the native-foreign distinction in education was maintained even for the second generation immigrants. Namely, immigrant population in Estonia attended different schooling system – Russian-speaking schools that used the school program of the Russian SFSR. Leaving aside difference in learning subjects, the most obvious quantitative

difference was in the length of secondary education. The 1958 all-union educational reform extended secondary education from 10 to 11 years, but this was reversed in 1965, except for the native language education in the Baltic states. As a result secondary education in Russian schools in Estonia remained one year shorter than in Estonian schools.

(figure 2 about here)

As of general developments in education, compulsory basic education was extended from seven grades to eight as a result of the 1958 reform. The political establishment saw universal secondary education as one of the goals, enrolment in secondary schools was encouraged and it increased considerably in the 1970s. This did not apply only to general secondary but also to specialised and vocational secondary education, which were promoted. Specialised secondary education was designed as preparation for employment and graduates from these schools rarely continued their studies. Majority of candidates for tertiary education came from general secondary schools (Saar 2008, pp. 236–238).

Knowing that certain sectors of economy were prioritised by the state in the USSR, we make an effort to quantify the distribution of education in economic sectors. Average level of education in each sector of economy is calculated using the scale of educational attainment variable (1 stands for tertiary education and 7 denotes the lowest level, without primary) and plotted as a heat-map with dendrogram. The results are shown in Figure 3. The dendrogram on the left side clusters sectors of economy that are similar in terms of average educational level. It appears from the figure that average educational level is higher in sectors such as governing and finances, education-science-culture, publishing, and health care. Machine building, construction and wood-paper industry emerge as somewhat more educated branches of material production. The overall average educational level is increasing in all sectors over time.

(figure 3 about here)

Against the backdrop of increasing level of education, the difference in wage income by educational attainment became only smaller over the decades. Table 1 shows mean nominal and inflation adjusted wages by educational attainment. For many educational groups nominal wage more than doubled in 23 years, exceptions being tertiary and incomplete tertiary education. The twofold difference in the wage income between the highest and lowest earning educational group in 1958 shrinks to about 40% difference in 1981. Thus, equalisation of wages was carried over to income differences between educational levels.

(table 1 about here)

In a market economy one would assume some sort of educational gradient in income, higher education usually resulting in higher wages. Average wages by education in our data evidently differ from such expectation. In the 1950s there was still relatively clear distinction in rewarding of education, although quite high income of incomplete secondary and primary education holders does not permit a perfectly ascending gradient. In the next decades, however, there is a striking increase in wages of people with incomplete secondary education, surpassing that of general secondary, specialised secondary, and even tertiary education holders. Even primary

education appears as providing better wage income than specialised secondary. One explanation to this is probably found in the introduction of this article – higher wage income concentrated to economic sectors that generally employed relatively less qualified labour.

(figure 4 about here)

Economic sectors by average size of pay are presented in Figure 4 in the same way as educational level of economic sectors was illustrated above. Agriculture, construction, forestry and several industrial branches are among highly paid sectors. Branches that appeared on average more educated belong to lower wage income group (government, health care, education, publishing). Trade, services, and light industry fall also among lower-paid sectors. Figures 3 and 4 describe how education and higher wages concentrated in different sectors of economy.

4.2 Results of model fitting

Two sets of models were fitted, both include one model with pooled data and a separate regressions for each survey year. The first set includes only individual specific variables and ignores heterogeneity due to sector of economy or occupational status. The results are presented in Table 2. M1 fits data pooled from all surveys and in this case educational attainment coefficients suggest that educational categories distinguish well from the reference group (general secondary education). There is an overall positive relationship between earnings and educational level. As an exception to this, we observe the same feature as seen in the comparison of mean wages, that is, incomplete secondary education returns higher income than general secondary. Columns labelled M2 to M4 in Table 2 represent separate regressions for each survey year. Some lower educational attainment levels change the sign from one year to another – in 1975 primary and incomplete secondary education return higher income than general secondary. It is also evident that the positive relationship between wage income and educational level appears best in 1958. Compared to 1958, higher education loses its positive impact and lower education gains positive effect in the next survey years. In 1981 incomplete higher education becomes even less advantageous than general secondary. Premium for tertiary education declines from 54% in 1958 to 8.7% in 1981, resulting in much lower returns than seen in previous analyses. It is possible that some of these questionable effects are due to model not being conditioned by economic branch and occupation.

Control variables show the following associations. There is a considerable gender wage gap which only slightly decreases over time (female wage is 64% of male wage in 1958 and 66% in 1981). Partnership status does not appear to be significant predictor of wage income although the sign of the coefficient is in the expected direction (married or cohabiting individuals are often found to be earning higher income). Rural wages differentiate positively from urban wages in the last two surveys, which may be attributed to increasing wage income in collective farming and agricultural sector in general. Nativity coefficient changes from positive to negative. Due to employment segregation by nativity this effect is likely to be biased without including sector of economy in the estimation.

(table 2 about here)

In the second set of models sector of economy and occupational class are included as random effects. In the mixed effects model both act as random intercepts for which we estimate only standard deviation. The results are presented in Table 3 where columns represent the same subsets of data as in the fixed effects models. In model M1, which pools all survey years, educational attainment exhibits a clear graduated effect, each level of education increases wage income compared to lower level. Only incomplete secondary education does not differ significantly from general secondary. Also, models of single survey years appear to be free from issues that caused inconsistent signs in fixed effect models. The effect of tertiary education becomes smaller over time, but the drop in coefficient size is moderate compared to what was seen in fixed effect models. Wage premium for tertiary education decreases from 49% in 1958 to 30% in 1975 and 23% in 1981. Incomplete higher education loses its importance by 1981, but does not become negative as seen previously. Primary education does not become positive in any year.

(table 3 about here)

As of the control variables, the gender wage gap is smaller than in fixed effect models (ratio to male wage is 73% in 1958 and 75% in 1981). Partnership status has significant effect only in the pooled data model. Nativity variable confirms what we saw earlier – foreign origin population earns higher wages than native population in the 1950s, but this relationship turns around in the later period. It is difficult to say what is the reason behind this. Age has a very similar outcome to the fixed effects models and the squared term is again very small. Variation in wage income due to branch of economy is highest in 1958 and declines over time. Even more variation can be attributed to occupational class, the share of which in the overall variation remains stable over time.

The change in returns to education over different time points is better estimated using pooled data. We fit another model similar to the first mixed effect model, but this time include an interaction between survey year and educational attainment. For better comparison between educational levels, predicted wage size is then expressed as a ratio to wage received by people with general secondary education. The results are shown in Figure 5.

(figure 5 about here)

As already seen in regression coefficients of separate models, the difference between wage income of the highly educated and less educated is largest in 1958. All educational categories above general secondary increase wage income from 20 to 60% in that year. By 1975, the differences has reduced considerably and tertiary education provides only about 30% higher wage compared to general secondary. The wage gap between primary and general secondary is also reduced during the observed period. Between 1975 and 1981, there is a notable decline in relative earnings for those with incomplete higher education and those lacking primary education. Yet, the reliability of estimates of these two categories is not high as both groups are already quite small in 1981 (67 individuals with incomplete higher and 43 without primary).

5 Conclusions

Studies of transition from state socialist system to market economy generally agree about relatively low returns to education in the Central and Eastern European countries during the Soviet period. Less information has been available on the USSR. Moreover, so far Soviet wage data has not permitted investigation of the question whether low returns were the norm throughout the post-WWII decades or something that were only observed not long before the fall of the USSR. The results of the present analysis indicate that Soviet returns to education were not stagnant in time. Although our data in the present analysis includes only three time points, a rather clear pattern emerges from modelling results. Earnings differentials due to schooling declined throughout the observed period. Returns to education were subject to compression as relative wages of the lower educated increased. Such a development was seen both in the comparison of average wages and in modelling results. The only emerging divergence from this pattern is the specialised secondary education, which seems to increase the difference relative to the general secondary level between 1975 and 1981.

Earlier studies of the USSR wage differentials reported wage premium for higher education over general secondary to be in the range of 20–30%. The present analysis tends to agree with these results, considering the outcome of mixed effects regression models. We estimated wage premium for tertiary education to be 23% over general secondary education in 1981, which is a close match to 22% that was estimated for the late-1970s by (Gregory and Kohlhase 1988, p. 30) or 19% estimated for Czechoslovak males in the late 1980s (Flanagan 1998, p. 304). It is also comparable to the results by Katz (1999) which exhibit 23% wage premium for tertiary educated men, but much higher for women, in 1989. However, our data show that in the case of Estonia, wage premium for a university degree had decreased considerably during the previous decades. In 1975 the wage premium for university degree had been 30% and in 1958 the figure was 49% according to the present analysis. Thus, there was approximately twofold reduction in relative earnings of the highly educated and this happened in about two decades. During the same period we see gradually diminishing wage premium for incomplete higher education and specialised secondary education. Labourers with below general secondary education seem to have mostly benefitted from the observed trend of wage differentials.

This article did not elaborate much the reasons behind wage differentials nor discussed the possible implications of declining returns to education. However, some parallels between our results and general trends may be drawn. Already quite early some scholars had pointed out a considerable decline in wage difference between qualified (engineering) personnel and workers in the USSR. It was also commented that decline in wage differentials was a plausible outcome of educational expansion which was about to increase the supply of better educated workers in a situation where the labour shortage concentrated in sectors employing less qualified workforce (Yanowitch 1963). Labour shortage implies better bargaining conditions for less qualified labour; at a very general level this was supported by policy decisions to prefer heavy industry and other "productive" branches. Concentration of higher

wages in the preferred sectors was also observed in the data used in the present analysis. Agriculture, forestry, mining and some industrial branches, which on average employed less educated workforce, enjoyed relatively high average wage income. It is beyond this text to discuss the reasons of this development, whether it was more due to preferential development of some economic branches, direct wage policy, or quasi-market response to labour shortage. However, it seems that these factors supported the entrenchment of the state socialist system which valued more the contribution of workers and agricultural labourers, at least as far as wage income is concerned. The results are well reflected in the changing wage differentials by education. It is perhaps safe to conclude that rewarding of human capital, if measured by educational attainment, was not on the rise in the USSR but the opposite was happening. Rewarding and wage expectations may be further associated with human capital formation, for instance to explain the reversed gender gap in tertiary and specialised secondary education that is observed at the end of the Soviet period.

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6 Appendix

6.1 A note on sample selection

We use 1967 and 1978 survey instructions to describe the sampling process of the Soviet household income survey. According to the wording of Soviet statistics, the sample was "mechanically" selected in two phases: in the first phase enterprises and institutions were selected, and in the second phase respondents were chosen from each of them. A card which contained information on the number of employees and average salary was created for each enterprise, institution and organisation by economic sectors. Industrial enterprises were subdivided into groups according to the number of employees in order to identify large enterprises. The cards were sorted by average salary and number of employees and the participating enterprises were selected according to a predetermined interval. It was thereby ensured that the full salary scale, from the highest to the lowest-paying, was represented among the selected enterprises and institutions. The selection was carried out by local statistics organisations in cooperation with the republican statistical office; the final inclusion decision was made by the town or county executive committee. For instance, the sample for the 1958 survey was comprised of 150 enterprises and institutions, from which 3,100 households of workers ("blue-collar") and employees ("white-collar") were selected. No collective farmers or only-pensioner households were included in the 1958 survey.

The principles for selecting individuals from the designated enterprises, institutions and organisations were relatively simple. The selection processes of workers-employees and collective farmers were different. Initially, a service record was created for each worker and employee working in an enterprise's principal activity. The record included the individual's wages for April of that year. Temporarily employed persons were excluded, but students employed by the company were included as working in the field of principle activity. The second criterion for a service record was that the individual had received wages for the entire month of April. The service records were compiled from information obtained from the enterprise's accounting department.

Workers' service records were sorted in descending order according to salaries, and those to be included in the survey were selected at equal intervals, which were calculated by dividing the number of employees by the number to be selected. The first name was drawn from the middle of the highest interval, so that the most highly paid person was not selected. This ensured that the entire pay scale was represented in the sample.

The selection of collective farmers was restricted by household characteristics. A card similar to that of workers and employees was created for each collective farm

household. The next step in the selection process was to determine whether or not the families of collective farmers owned cattle. Households were divided into two groups – those with cattle and those without. The household cards of both groups were then arranged in descending order by the number of person-days worked on a collective farm. The cards were selected at intervals, similar to the selection process for workers and employees. However, if a household was selected that had no members able to work, it was replaced with a household that had the least person-days worked on a collective farm.

6.2 Figures and tables

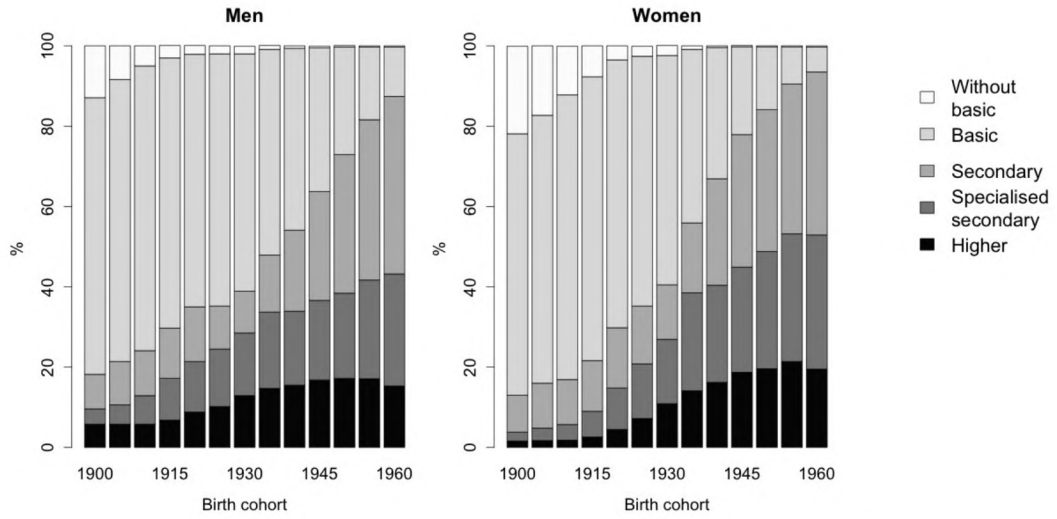

Figure 1: Educational attainment by 5-year birth cohort, 1900–1960
Source: Estonian census 1989, own calculations

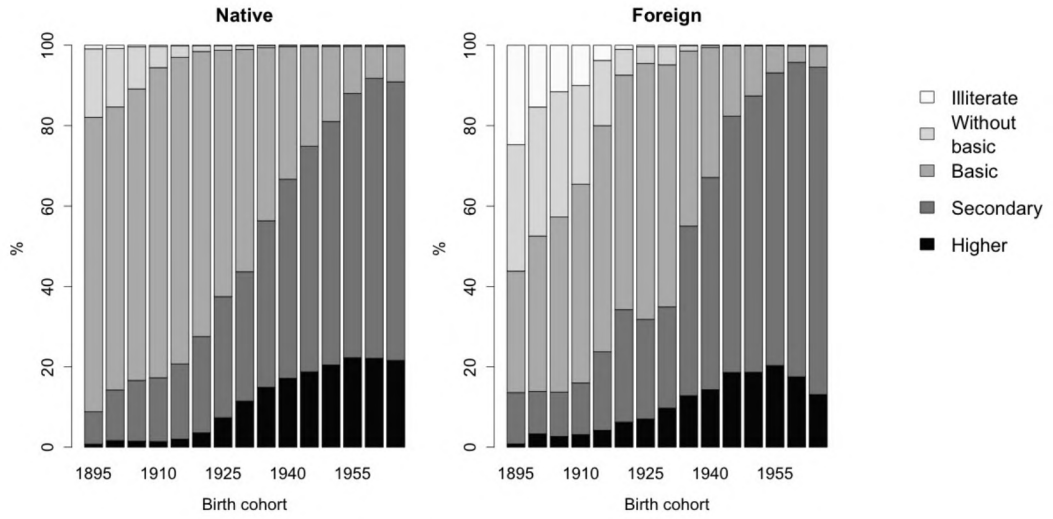

Figure 2: Female educational attainment by 5-year birth cohort, 1895–1965
Source: Estonian Family and Fertility Survey 1994, own calculations

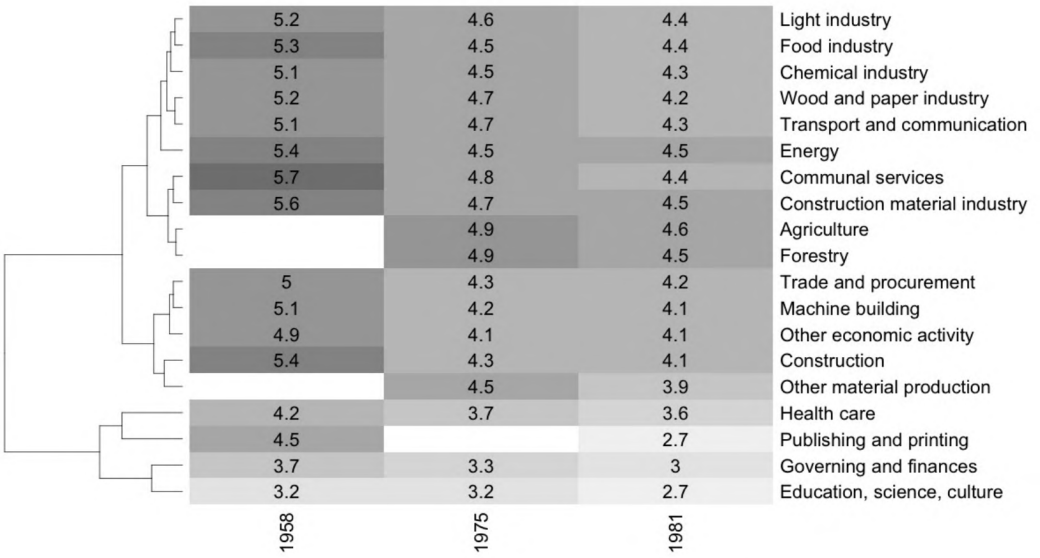

Figure 3: Average educational level by branch of economy
Note: 1 - highest education, 7 - lowest.
Source: income surveys, own calculations

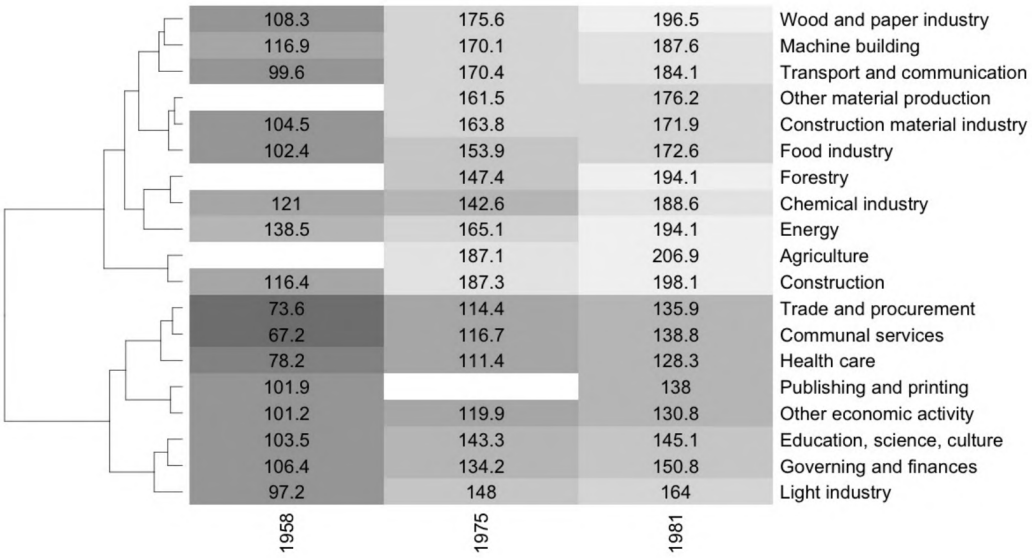

Figure 4: Mean wage in branch of economy
Note: sectors with less than 35 cases not shown.
Source: income surveys, own calculations

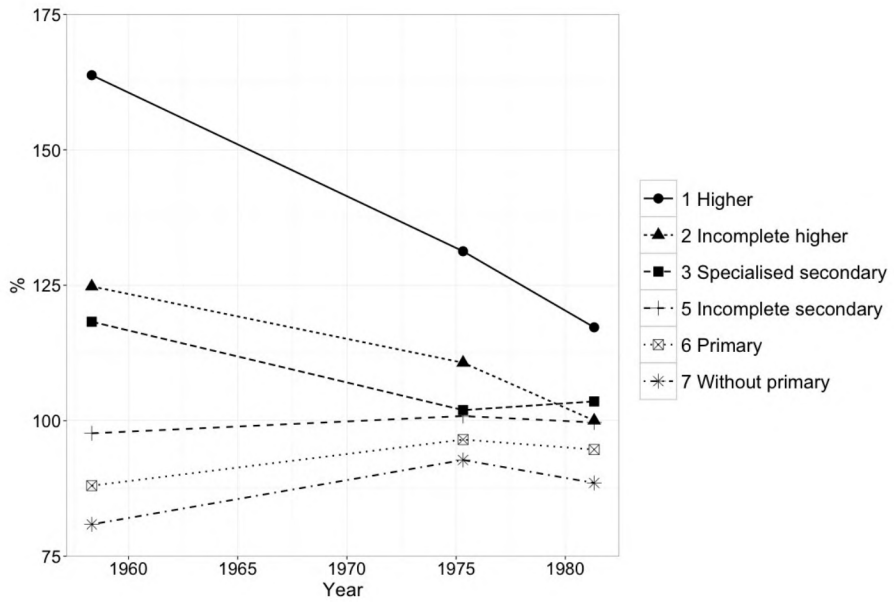

Figure 5: Relative differences in wage income by education, general secondary=100

Source: income surveys, own calculations.

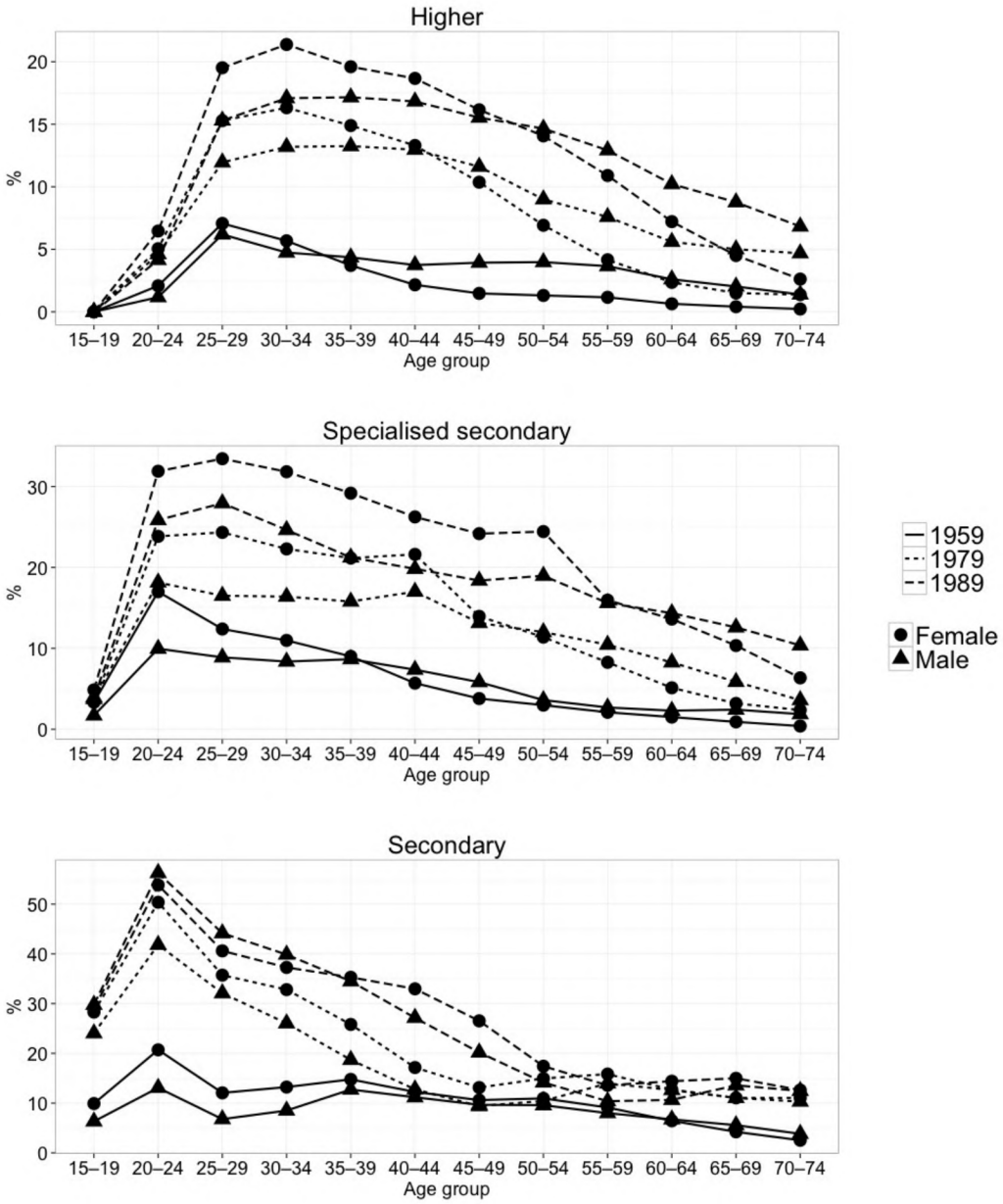

Figure 6: Educational attainment by age group, %
Source: Estonian census 1959, 1979, and 1989, own calculations

Table 1: Mean wage by educational attainment

	Nominal			Inflation adjusted		
	1958	1975	1981	1958	1975	1981
Higher	125.6	186.7	207.5	157.1	186.2	188.3
Incomplete higher	99.5	161.6	170.7	122.5	161.6	155.2
Specialised secondary	86.1	146.6	188.5	108.6	146.4	170.9
General secondary	76.0	137.9	183.9	95.6	137.9	166.9
Incomplete secondary	79.5	166.1	210.1	100.3	166.1	190.8
Primary	76.6	162.4	193.0	96.7	162.4	175.1
Without primary	61.3	127.0	148.0	77.4	127.0	134.3

Note: sectors with less than 35 cases not shown.
Source: income surveys, own calculations.

Table 2: Linear models of wage income

	M1	M2: 1958	M3: 1975	M4: 1981
(Intercept)	5.1219^{***}	4.7308^{***}	5.1057^{***}	5.2493^{***}
	(0.0095)	(0.0173)	(0.0142)	(0.0144)
Higher	0.2142^{***}	0.4324^{***}	0.2228^{***}	0.0839^{***}
	(0.0123)	(0.0270)	(0.0197)	(0.0192)
Incomplete higher	0.0669^{**}	0.1640^{***}	0.0667	-0.0803^{*}
	(0.0261)	(0.0446)	(0.0427)	(0.0480)
Specialised secondary	0.0410^{***}	0.1342^{***}	0.0165	0.0074
	(0.0107)	(0.0237)	(0.0172)	(0.0163)
Incomplete secondary	0.0374^{***}	−0.0094	0.0640^{***}	0.0169
	(0.0095)	(0.0196)	(0.0151)	(0.0157)
Primary	-0.0282^{***}	-0.0806^{***}	0.0343^{**}	-0.0377^{**}
	(0.0099)	(0.0177)	(0.0165)	(0.0181)
Without primary	-0.1911^{***}	-0.2241^{***}	−0.0347	-0.1605^{***}
	(0.0232)	(0.0303)	(0.0540)	(0.0605)
Female	-0.4316^{***}	-0.4511^{***}	-0.4293^{***}	-0.4190^{***}
	(0.0062)	(0.0117)	(0.0099)	(0.0103)
Not in partnership	−0.0118	−0.0152	−0.0131	−0.0000
	(0.0072)	(0.0129)	(0.0119)	(0.0125)
Rural	0.0604^{***}	−0.0103	0.0555^{***}	0.0710^{***}
	(0.0069)	(0.0155)	(0.0108)	(0.0114)
Foreign origin	0.0200^{***}	0.0675^{***}	−0.0041	0.0044
	(0.0069)	(0.0123)	(0.0119)	(0.0121)
Age	0.0531^{***}	0.0493^{***}	0.0538^{***}	0.0590^{***}
	(0.0015)	(0.0028)	(0.0025)	(0.0025)
Age squared	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1958	-0.4032^{***}			
	(0.0078)			
1981	0.1083^{***}			
	(0.0072)			
Adj. R^2	0.4474	0.3452	0.3117	0.3113
Num. obs.	17310	5072	6581	5657

Standard errors in parentheses. Source: income survey data, own calculations.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 3: Linear mixed models of wage income

	M1	M2: 1958	M3: 1975	M4: 1981
(Intercept)	5.0529^{***}	4.6436^{***}	5.0327^{***}	5.1492^{***}
	(0.0499)	(0.0612)	(0.0520)	(0.0526)
Higher	0.2652^{***}	0.3972^{***}	0.2664^{***}	0.2099^{***}
	(0.0137)	(0.0350)	(0.0210)	(0.0214)
Incomplete higher	0.1119^{***}	0.1544^{***}	0.1012^{**}	0.0327
	(0.0246)	(0.0434)	(0.0400)	(0.0451)
Specialised secondary	0.0524^{***}	0.1501^{***}	0.0291^{*}	0.0436^{***}
	(0.0101)	(0.0220)	(0.0163)	(0.0156)
Incomplete secondary	−0.0059	0.0097	0.0024	−0.0237
	(0.0090)	(0.0185)	(0.0144)	(0.0149)
Primary	-0.0851^{***}	-0.0712^{***}	-0.0388^{**}	-0.0911^{***}
	(0.0097)	(0.0179)	(0.0160)	(0.0173)
Without primary	-0.1862^{***}	-0.1582^{***}	−0.0701	-0.1679^{***}
	(0.0219)	(0.0293)	(0.0502)	(0.0565)
Female	-0.2952^{***}	-0.3175^{***}	-0.2885^{***}	-0.2822^{***}
	(0.0068)	(0.0124)	(0.0110)	(0.0116)
Not in partnership	-0.0139^{**}	-0.0206^{*}	-0.0189^{*}	−0.0000
	(0.0067)	(0.0117)	(0.0110)	(0.0116)
Rural	−0.0082	−0.0129	-0.0205^{*}	−0.0057
	(0.0077)	(0.0142)	(0.0125)	(0.0139)
Foreign origin	0.0000	0.0275^{**}	-0.0260^{**}	−0.0163
	(0.0067)	(0.0114)	(0.0116)	(0.0118)
Age	0.0474^{***}	0.0430^{***}	0.0483^{***}	0.0530^{***}
	(0.0014)	(0.0026)	(0.0023)	(0.0024)
Age squared	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}	-0.0000^{***}
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
1958	-0.3809^{***}			
	(0.0075)			
1981	0.0905^{***}			
	(0.0067)			
σ Branch of economy	0.0872	0.1311	0.0902	0.0865
σ Occupational class	0.1340	0.1477	0.1360	0.1389
σ residual error	0.3648	0.3608	0.3618	0.3528
Log Likelihood	−7222	−2115	−2735	−2219
Number of observations	17310	5072	6581	5657

Standard errors in parentheses. Source: income survey data, own calculations.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$