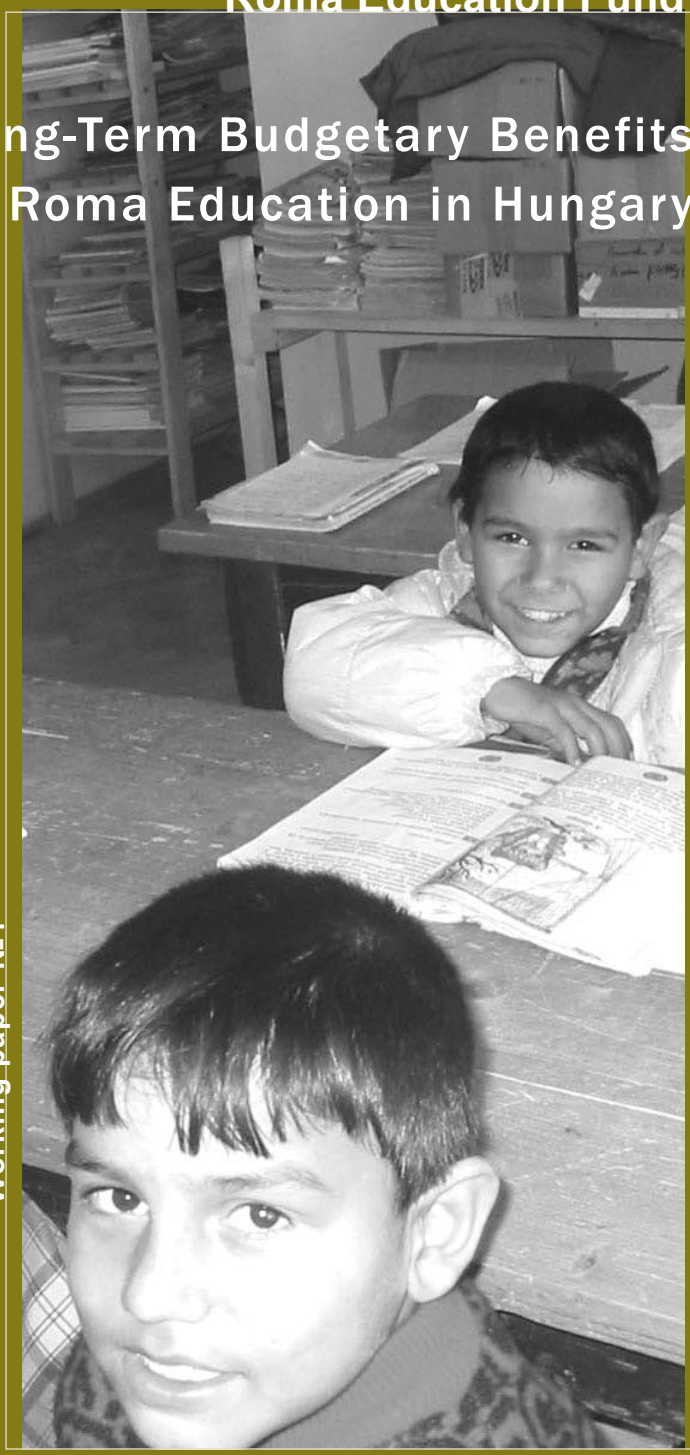
Roma Education Fund

Expected Long-Term Budgetary Benefits to Roma Education in Hungary



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Gábor Kertesi and Gábor Kézdi

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Gábor Kertesi
(Institute of Economics, Hungarian Academy of Sciences)

and

Gábor Kézdi
(Central European University and Institute of Economics, Hungarian Academy of Sciences)

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OVERVIEW

"Expected Long-term Budgetary Benefits to Roma Education in Hungary"

Kertesi and Kezdi

The education deficit of the Roma population has been well documented in all countries participating in the Decade of Roma Inclusion. This legacy of past exclusionary policies not only contributes to continuing social exclusion, it precludes equal participation of Roma in the labor market and thereby perpetuates welfare dependency and dramatically reduces future tax revenues. Research sponsored by the REF and conducted by Gabor Kertesi and Gabor Kezdi[1] using Hungarian data illustrates just how much governments could gain in future budgetary revenues by investing now in measures that would bring Roma education outcomes on par with the non-Roma population. The researchers show that the deficit in Roma education outcomes in Hungary is associated with substantially lower employment earnings and consequently lower lifetime contributions to PIT, social contributions and VAT. By quantifying these potential additional revenue streams on a net basis (allowing for additional education costs incurred following the initial investment) and applying an appropriate discount rate, the researchers show that the present value of investments in Roma education ranges from 30,000 to 70,000 Euro per student. This measure is based solely on increased budgetary revenues and does not include the additional after tax income benefit to the Roma themselves and their families. Because the necessary data to perform such calculations is very scarce, the authors perform numerous sensitivity tests on their results which confirm the robustness of the findings. Indeed due to the likelihood of significant wage growth over time, the results are most likely an underestimate of the true fiscal benefits.

While REF will sponsor additional research to extend these findings to other Decade countries, these findings are sufficiently powerful that Ministries of Finance and Education in all Decade countries should, as a matter of prudent fiscal policy, and consistent with long-term fiscal reforms, immediately reassess their support to improving Roma education outcomes and scale up measures which have demonstrated success in closing the education gap. The REF stands ready to assist willing governments in this endeavor.

[1] *Institute of Economics, Hungarian Academy of Sciences and Central European University/Institute of Economics, Hungarian Academy of Sciences respectively.*

NON-TECHNICAL SUMMARY

This study estimates the expected long-term budgetary benefits to investing into Roma education in Hungary. By budgetary benefits we mean the direct financial benefits to the national budget. The main idea is that investing extra public money into Roma education would pay off even in fiscal terms. In order to be successful, investments should take place in early childhood. Successful investments are also expensive. But if it is done the right way, such investments more than recoup their costs in terms of extra tax benefits in the future. This study looks at the expected budgetary benefits of a successful investment. It does no deal with how to achieve success.

The motivating idea behind our analysis is the notion that investing into somebody's education will lead to benefits not only to the person in question but also to the whole society. We consider these social benefits in a very narrow sense: we make use the fact that in a typical modern society, more education makes people contribute more to the national budget and/or receive less transfers from it. The increased contributions and decreased transfers make up the *net budgetary benefits*. Net budgetary benefits measure a return on investments into education, very much like returns on any other financial investment. If expected returns more than compensate for such investments, it is in the very narrow interest of the government to invest into Roma education, even setting aside other consideration.

We estimate the net benefit of an extra investment (on top of existing pre-school and primary school financing) that enables a young Roma to successfully complete secondary school. We consider an investment that takes place (starts at) at age 4, i.e. we calculate the long-term benefits discounted to age 4. We estimate returns to an investment that makes Roma children complete the maturity examination ("érettsegi") and opens the road to college, instead of stopping at 8 grades of primary school (or dropping out of secondary school).

We consider seven channels: personal income tax on income earned from registered full-time employment, social security contributions paid by employers and employees on earned income, unemployment benefits, means-tested welfare benefits, earning from public employment projects, value added and excise tax on consumption, and incarceration costs. We adjust our estimates by the extra costs of increased secondary and college education. We use large sample surveys, aggregate administrative data, and tax and contribution rules to estimate the necessary parameters.

The analysis is nonexperimental and is based on national estimates adjusted for Roma differences. The lack of detailed Roma data and lack of experimental evidence makes interpretation somewhat problematic. We therefore carry out extensive robustness checks for analyzing alternative assumptions. One should keep in mind that, for lack of appropriate data, we leave out important channels such as old-age pensions, disability

pensions, childcare benefits, and health care costs. Including most of these channels would most likely increase the estimated benefits to educational investments. Our estimates are therefore most likely lower bounds for the expected budgetary benefits.

The results indicate that an investment that makes one young Roma successfully complete secondary school would yield significant direct long-term benefits to the national budget. *According to our benchmark estimate, discounted to age 4 (a possible starting age for such an investment), the present value of the future benefits is about HUF 19M (EUR 70,000) relative to the value the government would collect on the representative person in case if she had not continued her studies after the primary school. The benefits are somewhat smaller if (without the suggested early childhood educational investment), the young Roma person finished vocational training school (HUF 15M, EUR 55,000).* The estimated returns are sensitive to the discount rate, the assumed wage growth, the college completion rate after secondary school, and the race specific employment and wage differentials (to some extent due to labor market discrimination). *But even our most conservative estimates suggest that benefits are least HUF 7M-9M.*

We formulate all results in terms of the benefits of an investment that makes one child successfully complete secondary school, for methodological convenience. Naturally, no investment is certain to bring such a result. When comparing benefits to costs, one has to factor in the success probabilities. For example, if an investment increases the chance of secondary school completion by 20 percentage points, i.e. one child out of five gets there as a result of the investment, benchmark benefits relative to 8 grades are HUF 3.8M (19M/5). *In other words, 3.8M per child investment would therefore break even with a 20% success rate.* Even by looking at our most conservative estimates, any investment with such a success rate is almost sure to yield a positive return if costs are HUF 1.8M or less per child.

Overwhelmingly, the benefits would come from increased government revenues, from personal income tax and employer/employee contributions after earned income. Savings on unemployment insurance, welfare benefits and public employment projects are negligible, and savings on incarceration costs are also small. Larger value added tax benefits on consumption are also sizable.

1. INTRODUCTION

The vast majority of today's young Hungarian Roma drop out of the schooling system without a secondary school degree, and a negligible fraction goes to college. At the same time, the vast majority of non-Roma Hungarians completes secondary school, and 50 per cent go to college. Low education excludes Roma from stable and decently paid employment and is therefore the most important reason for widespread poverty among Roma.

When thinking about investing more into the education of Roma children, social equity is the most often invoked rationale. At the same time, however, such an investment may have solid financial rationale as well. Heckman (2006) argues that "it is a rare public policy initiative that promotes fairness and social justice and at the same time promotes productivity in the economy and in society at large. Investing in disadvantaged young children is such a policy." There is increasing evidence showing that educational investments are most productive if they happen in early childhood, in pre-school and early in elementary school.

In this report we asses the expected long-term budgetary benefits to empower a significant fraction of Roma youth to complete secondary school (with a completed maturity exam). By budgetary benefits we mean the direct financial benefits to the national budget. The motivating idea is that investing into somebody's education will lead to benefits not only to the person in question but also to the whole society. We consider social benefits in a very narrow sense: the possibility that educated people contribute more to the national budget and/or receive less transfers from it. The increased contributions and decreased transfers make up the potential *net budgetary benefits*. To the extent that those benefits are caused by the investment into education, they measure a return on investments, very much like returns on any other financial investment.

In the Hungarian context, secondary school completion (successful maturity examination) is a sensible target for two reasons. First, secondary school completion is the locus where Hungarian Roma accumulated most of their disadvantage. Second, the maturity exam is a gateway to college. Returns to college increased dramatically in post-communist Hungary. We do not consider how one can achieve that goal, what its costs may be, or what may be the most effective strategy. In this paper we simply try to estimate what budgetary benefits such an investment may yield if it attains its goal. The estimates are necessarily sensitive to many assumptions we have to make along the way. We shall therefore provide a range of numbers to which it becomes meaningful to contrast investments.

One should keep in mind that the goal of this analysis is to assess the magnitude of the potential benefits and the relative importance of the different channels. There are numerous caveats to our methodology. As a result, all numbers are to be taken as ballpark estimates. We conduct an extensive sensitivity analysis to see how robust our estimates are to the different assumptions we make along the way.

2. BACKGROUND: ROMA EDUCATIONAL ATTAINMENT IN HUNGARY

Figure 1 shows primary, vocational training and secondary educational attainment trends in Hungary since World War II. The graphs show degrees completed for the adult population, by year of birth, separately for Roma and the entire population. The Roma figures are based on two cross-sectional surveys, the 1993 and 2003 targeted representative Hungarian Roma Surveys. The national average figures were constructed similarly, from cross-sectional data (the 1993 and 2003 Labor Force Surveys). Hungarian national surveys do not contain ethnic markers so Roma figures are compared to national averages here. Naturally, that comparison shows smaller differences than a more meaningful Roma versus non-Roma comparison would. Reconstructing historical trends from cross-sectional data has its drawbacks, primarily because of education-related mortality, but they are still useful for placing Roma developments into the national context.

Nationwide primary school completion rate has been above 97 per cent for all cohorts born after 1950. The Roma approached that slowly, with males born after 1960 reaching 80 per cent. Females got up to the same rate 20 years later. In order to meet the increasing demand for skilled blue-collar workers, vocational training expanded dramatically in Hungary, especially among men. The ratio of vocational training degrees among men reached a 40 per cent national average for the 1950 cohort. Roma men took part in the expansion as well, albeit with a delay and at a smaller scale: the relevant ratio for them peaked at 20 per cent 20 years later. Cohorts born after the mid-1970's experienced a downward trend in the national average of vocational training as demand for blue-collar workers dropped sharply from the late 1980's. The mirror image of that decrease shows in the more valuable secondary education rates. Starting from around 1990, when cohorts born in the mid 1970 have finished primary school, national average secondary school rates started to increase. Roma education rates did not follow this pattern, neither the decrease in vocational training nor the increase in secondary education.

Secondary schooling rates are the ones that show the most dramatic differences. Throughout most of the communist era, 40 per cent of men and 50 per cent of women reached the maturity level in Hungarian education. The corresponding rates for the Roma stayed negligible for the whole period. College education is open for those who completed a secondary school maturity examination. Accordingly, college educated Roma were extremely rare in Hungary. Even if Hungarian universities privileged Roma students (which they did not, of course), the Roma would have had no chance of getting there. The major divide is therefore the secondary school degree.

Since the fall of communism primary school completion rates continued to converge but the gap in further education has widened. Ironically, by the time the Roma achieved virtually full primary school completion it lost its market value. Table 1 shows education

and enrollment rates in 1993 and 2003. The figures show a significant, 18 percentage point increase in completed primary school rates for the Roma (part of which is due to earlier completion). At the same time, their overall vocational and secondary education decreased by 4 percentage points (18 percentage points if we condition on completed primary school). This slight decrease is in contrast to the national average rates that increased by 5 percentage points, so that 92 per cent – i.e. virtually all non-Roma – continued in some school.

The widening educational gap is even more striking if we look at secondary education with the perspective of a maturity exam. Much of vocational education became obsolete with the fall of the communist economy and the labor-intensive technology it tended to use. As a result, national vocational education rates dropped by 27 percentage points. Increased enrollment into secondary schools with maturity more than compensated for this drop, producing a 32 percentage point increase at the national level. Roma vocational education dropped as well, although to a smaller extent. Roma secondary school enrollment, however, did not increase enough to compensate for that. As a result, by 2003, still a mere 14 per cent of the young Roma continued education towards a maturity degree, compared to an 80 per cent national average (16 versus 83 per cent conditional on primary school completion). Thus between 1993 and 2003 the gap between vocational and more valued secondary schooling widened by an additional 27 percentage points.

3. INTERNATIONAL EVIDENCE

A growing literature in the U.S. focuses on the expected benefits to investments into children. A thorough review of the evidence is beyond the scope of this study. James Heckman, a Nobel laureate economist, summarizes our current knowledge the following way. "A large body of research in social science, psychology and neuroscience shows that skill begets skill; that learniaptionng begets learning. The earlier the seed is planted and watered, the faster and larger it grows. There is substantial evidence of critical or sensitive periods in the lives of young children. Environments that do not stimulate the young and fail to cultivate both cognitive and noncognitive skills place children at an early disadvantage. Once a child falls behind, he or she is likely to remain behind. (…) Impoverishment is not so much about the lack of money as it is about the lack of cognitive and noncognitive stimulation given to young children. Experimental interventions that enrich early childhood environments produce more successful adults. These interventions raise both cognitive and noncognitive skills." (Heckman, 2006)

One piece of evidence comes from the Perry Preschool Program of the United States. It was an experimental intervention in the lives of disadvantaged African American children, in the 1960's. By age 40, the Perry treatment children had higher achievement test scores than did the control children. In adulthood, treatment group members had significantly higher earnings, more of them owned a home, less were on welfare or in prisons. The economic benefits of the Perry Program were substantial. Yearly rates of return were 15-17%. (See Schweinhart et al 2005, Rolnick and Grunewald, 2003) The benefit-cost ratio was eight to one. Similar returns are obtained for other early intervention programs (Karoly et al 2005, Heckman 2006). Part of the returns is realized by the participants, but an even larger part goes to society in general, mostly in terms of extra budgetary benefits. Note that the corresponding budgetary returns are likely to be considerably larger in countries with more progressive taxes, such as Hungary.

4. CONCEPTUAL FRAMEWORK

We estimate the net benefit of an investment that enables a hypothetical young Roma *to complete secondary school*. Completing secondary school makes college a possibility. We assume that without the investment, she/he would complete 8 grades or get a vocational training degree of 11 grades.

When assessing the future benefits of an investment, one has to estimate discounted present values to the time of the investment. In this paper the particular form of the investment is not discussed. Therefore the age at which the investment occurs is left open as well. In the benchmark case investment starts from age 4 or later. In the sensitivity analysis we allow for lower starting age (even from the birth). We shall estimate net present values of potential benefits discounted to alternative ages.

We consider several "accounts" through which the individual contributes to or receives transfers from the central budget (or social security). Let Y_{sj} denote net contributions of a hypothetical individual of educational attainment *s* on account *j* throughout his/her lifetime. As we think about the sum of lifetime contributions as returns to an investment, it is most naturally modeled as a discounted sum (present value) of yearly net contributions on the given account:

$$Y_{sj} = \Sigma_{t=t0}^{T} Y_{sjt}/(1+r)^t$$

The discount rate r should be the interest rate the government pays after its debt (baseline specification is r=0.02). t0 is the time of the investment and T is set to age 65. Note that that the oldest age considered, 65, is discounted by $1/(1+r)^{65-t0}$, which is about 0.3 with the baseline r=2% if t0=4. Contributions to and transfers from the national budget past age 65 would therefore be heavily discounted.

Total budgetary benefits are the sum of the benefits on each account:

$$Y_s = \Sigma_{j=1}^{J} Y_{sj}$$

We consider five educational attainment categories: sϵ{0,A,B,C,D}. The first one we denote by 0 because we use it only for auxiliary calculations. These labels denote

0. Without completed elementary school (i.e. maximum 7 completed grades)
A. Completed elementary school (8 grades) but nothing more
B. Completed vocational training school (10-11 grades) but no maturity exam
C. Completed secondary school (with maturity exam) but no higher education
D. Completed college or more

The benefits to the maturity exam are the weighted sum of benefits from s=C and s=D, where the weights are the probability that the young Roma – who gets to the maturity

exam as a result of the extra investment – goes to and completes college or stops after secondary school. We denote these probabilities as $P_{D|C}$ and $1\text{-}P_{D|C}$, respectively. This should be contrasted to the net benefits government collects from the young Roma if he/she stops at education level A or B:

$$B_A = [\ (1\text{-}P_{D|C})Y_C + P_{D|C}Y_D\ ] - Y_A$$
$$B_B = [\ (1\text{-}P_{D|C})Y_C + P_{D|C}Y_D\ ] - Y_B$$

In this document, we consider the following accounts

1. Personal income tax paid after earned income (from registered full-time employment)
2. Social security contributions after earned income (from registered full-time employment) paid by the employer or the employee (payments into PAYG social security, health insurance, and unemployment insurance fund)
3. Receipt of unemployment insurance,
4. Receipt of means-tested welfare benefits ("rendszeres szociális segély")
5. Participation in public employment projects
6. Value added and excise tax paid after consumption
7. Incarceration costs if sentenced to prison

Accounts 3, 4, 5, and 7 enter the sum with a negative sign.

As a result of a successful investment, the young Roma spends more time in secondary schools and may also continue go to college. But this extra schooling cost taxpayers' money. One could argue that financing secondary schooling is the constitutional obligation of the government and thus should not be included as extra costs here. On the other hand, from a pure budgetary point of view, these are extra costs and we shall therefore include them in the analysis. Costs of college are also extra costs to a successful investment to the extent they are financed by the government. We therefore add an additional account, with a negative sign:

8. Government expenditures due to extra secondary schooling and college

In order to estimate the expected contributions on each account, we estimate the probabilities of being in some labor market state (say, full-time wage employment for a year) and multiply that probability by the contribution conditional on being in the given state (say, personal income tax). Formally, for a state denoted by E:

$Y_{sjt} = \Pr(\text{in state E})_{sjt} \times E(Y_{sjt} \mid \text{in state E})$, or, with simplified notation,

$Y_{sjt} = P_{sjt} \times E(Y_{sjt} \mid E)$.

Typically we estimate the P_{sjt} from individual data, and use formulae (e.g. for social security contributions on earned income) or average payments (e.g. for unemployment benefits) for $E(Y_{sjt} \mid E)$.

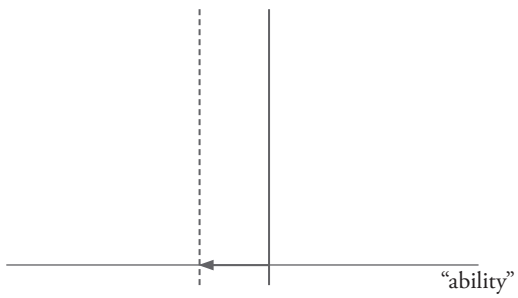
5. METHODOLOGICAL ISSUES

5.1 Causality and unobserved heterogeneity

By investing into Roma education, the policy goal is to make more Roma students successfully complete secondary school. The investment will most likely help the best of those young Roma who would not complete secondary school without the investment.

In this project (similarly to any empirical research on nonexperimental data) we measure differences between average, low- and high-educated people. But the best of the low-educated (who are more likely to benefit from the investment) may do better than average if remained low-educated. At the same time, they may perform below the average high-educated. The following figure illustrates the logic of argumentation. For this sake consider the case where only a one-dimensional "ability" matters for both school performance and later success (and thus contribution to government budget). The bell curve represents the distribution of people with respect to their "ability". Without further investment, the continuous vertical line shows the divide between those who will receive more education and those who will not. With more investment, the new divide is the dashed line. The gain is due to the educational investment that people on the margin, i.e. those between the two vertical lines, received. In terms of "ability", "marginal" people are better than average low-educated people (being on the left side of the solid vertical line) but worse than the average high-educated person (being on the right side of the solid line). If the returns to the investment are also a function of the same "ability", the returns will be lower than what one would predict by simply comparing the pre-investment averages. In other words, our method would overestimate the expected returns.

Although the problem is serious in principle, recent evidence shows that the bias may not be as severe as previously thought. In fact, the most recent estimates of returns to schooling for the least educated indicate that causal effects are probably as large as simple differences. In plain English, this means that comparing two people with different educational attainment may provide a surprisingly good estimate for the benefit the lower educated may gain if attained the level of the higher educated. See Card (1999) for a review of the evidence.



In order to minimize the bias, we shall concentrate on the best of the less educated. We exclude primary school dropouts, and in our alternative measure we compare secondary school graduates to vocational training school graduates. In robustness checks we also allow for lower than average school completion probabilities (secondary and college completion rates) when calculating the benefits.

5.2 Returns to extra investment into Roma education versus education of poor Hungarians

The methodology used in this analysis is not restricted to investment into Roma education. In fact, as we shall see in the next sub-section, we have better estimates for the potential benefits for an average Hungarian regardless of her/his ethnicity.

5.3 Estimating Roma figures

Our measurement strategy relies on estimates for P_{sjt} from micro-level data. Unfortunately, there are no reliable large-scale microdata for the Hungarian Roma population. Nationally representative surveys do not contain ethnic markers of any kind, and the Hungarian census bureau does not produce publicly available microsamples. The only available source is the 2003 Roma survey by Istvan Kemeny, which is too small for detailed estimates. Our strategy is therefore to have as good estimates for national probabilities as possible, and then use whatever scarce evidence we have on the Roma to adjust the national figures. In most cases we have estimates for the overall fraction of the Roma in the given state but not by age and education. For the estimation of the Roma figures, we used

1. the fraction of Roma in the specific state (estimated from various sources);
2. the national and Roma educational distribution, see Table 3. (estimated from the 2001 census and the 2003 Roma survey by Istvan Kemeny); and
3. the fraction of Roma in the population (estimated to be 7% of the 16-65 year old population, from the 2003 Roma survey, 480,000 people together).

We have chosen to assign a constant adjustment factor to the corresponding national figures. The adjustment works in such a way the odds ratio for more versus less educated people is kept the same for Roma and non-Roma. For example, if less educated people are six times as likely to be on welfare benefits in the national sample, we adjusted the Roma welfare recipience probabilities so that the less educated Roma are also six times more likely to be on welfare than the more educated. The logic behind our strategy was that aggregate Roma figures may be different partly because of a composition effect (the Roma are less educated), but partly due to some Roma-specific effect (e.g. labor market discrimination).

Formally, let N_{sN} be the total number of people with education level s, and let N_{sR} be the number of Roma people with education level s. $\Sigma_s N_{sN}=N_N$, $\Sigma_s N_{sR}=N_R$. We have

estimates for each N_{sN} and N_{sR}. Let E_{sN} be the number of people in the labor market state in question (say, unemployed) with education level s, and let E_{sR} the corresponding Roma number. $\Sigma_s E_{sN}=E_N$, $\Sigma_s E_{sR}=E_R$. We have estimates for each E_{sN} but not for E_{sR}, only for E_R/E_N. The parameters of interest are the probabilities of being in the given state:

$P_{sN} = E_{sN} / N_{sN}$ (can be estimated from data)
$P_{sR} = E_{sR} / N_{sR}$ (cannot be estimated from data as E_{sR} is unknown)

In order to estimate P_{sR}, we assume that the relative odds between different schooling levels are the same for Roma and non-Roma:

$$P_{sN} / P_{s'N} = P_{sR} / P_{s'R} \text{ for any s and s' = 0,A,B,C, or D.}$$

Therefore Roma probabilities by education are a constant adjustment factor times the corresponding national probabilities:

$$P_{sR} = aP_{sN}$$

This assumption allows us to estimate *a* and thus P_{sR} using N_{sR} and E_R because

$$E_R/N_R = \Sigma_s[(N_{sR}/N_R)\times P_{sR}] = \Sigma_s[(N_{sR}/N_R)\times aP_{sN}] = a\Sigma_s[(N_{sR}/N_R)\times P_{sN}]$$

So that

$$a = (E_R/N_R) / \Sigma_s[(N_{sR}/N_R)\times P_{sN}]$$

and we have estimates for everything on the right-hand side. In some cases, in the absence of such estimates, we shall directly assume specific values for a and simulate the effect of different choices as part of our robustness checks.

To give an example, about 17,000 people are in prison in Hungary, and 40 per cent is estimated to be Roma. The education-specific national incarceration probabilities are P_0=0.8%, P_A=0.5%, P_B=0.2%, P_C=0.1%, and P_D=0.0% (see later for the references).

Then

$E_R = 0.4*17{,}000 = 7000$
$E_R/N_R = 7000 / 480{,}000 = 0.014$
$a = 0.014 / [0.28* 0.009+0.54* 0.005+0.15* 0.002+0.03* 0.001] = 2.8$

so that within each education category, the Roma are estimated to be over-represented in prisons by a factor of 2.8. As a result, the Roma are 2.8 times over-represented relative to what their number would be given their (the *Roma*) educational composition, and given education-specific *national* incarceration rates.

5.4 Discounting and the use of cross-sectional age-contribution profiles

When contrasting costs of investments to a future flow of benefits, one has to look at the sum of total flows discounted back to the time of investment. In what follows, we shall discount flows back to age 4. The discount rate reflects the fact that today's costs may need to be finance from loans, which need to be repaid with interests. A natural candidate for discount rate is thus the real interest rate on long-term government bonds. Current interests are 8 per cent nominal, and current inflation is around 4 per cent, which give a real interest rate of 4 per cent. As to our *though experiment*, the government wants to create a self-financing system of Roma education: covers the expenses by issuing long term government bonds, invests in early childhood educational programs, and pays back when children of the target group become adults and start to pay *higher* taxes and social security benefits than those persons who had not been part of the same educational investments when they were young.

On the other hand, we use cross-sectional profiles for forecasting employment, earnings, consumption etc. for the future. We assume that wages of current 50 year old are good estimates for wages of our hypothetical 4 year-old when they turn to be 50. However, growth in real wages will increase wages for all. If real wages increase by the same rate for all people (and thus for people with different educational attainment), the percentage difference between less educated and more educated would not change. On the other hand, the absolute difference would increase by the real wage growth rate. The returns on the investment are measured in terms of extra contributions and savings on transfers, all measured in money terms and therefore absolute terms. The future benefits are, therefore, larger if there is real wage growth even if wages of the less educated and the more educated grow by the same rate.

In fact, the effect of real wage growth (if the same for everybody) is a mirror image of the effect of the discount rate. Therefore the most straightforward way to incorporate real wage growth into our analysis is to subtract it from the discount rate. Real wage growth is extremely uncertain but historical average is around 2% in developed countries. If we take interest to be paid for 4%, the two give our benchmark discount rate of 2%.

As we shall see, the main results are very sensitive to the choice of the discount rate. In order to show more conservative estimates as well, we shall report all results with discount rates of 3% and 4%, as well. Note that the experimental studies in the U.S. usually use a 3 per cent discount rate (Karoly, 2005). Those studies are based on longitudinal data as opposed to our cross-sectional estimates. Our benchmark 2 per cent discount rate is therefore still quite moderate, and the 3 and 4 per cent rates are certainly conservative.

5.5 Cross-sectional differences by education and the future consequences of expansion

It is very likely that the age-employment probability and age-earning profiles are steeper for a given young individual than what cross-sectional estimates show. It is also very likely

that the bias is larger for the more educated. As a result, we expect that the young will have higher employment probability and expected wages when they turn, say, 50, than the current 50 years old. If educational differences grow as well (for example because they are stable proportionally), we underestimate the future benefits to education.

5.6 Expected time spent in labor market states

Recall that we look at four hypothetical individuals, each with a given educational attainment and estimate their yearly contributions to each account. This way we discretize the lifetime of the individuals. Out goal is to estimate the expected contribution (transfer) at each account. These contributions (transfers) are paid only if the individual is in a specific state, say, is unemployed. The expected contribution then is the expected time the individual spends in the given state in the given year, multiplied by the expected transfer value conditional on being in the state per time unit. The expected time spent in a given state is nothing else than the probability that the individual spends some time in the given state in year t, multiplied by the average duration of the state within the given year.

The transfer related to state k would be:

$$Y_{kt} = P(k \text{ anytime in t}) \times E(k \text{ duration, in months}) \times E(\text{transfers related to k, per month})$$

Unfortunately, we have no estimates for the probability that an individual would be unemployed at any point in a given year. Instead, we have a one-point cross section in each year. But under some assumptions (no heterogeneity in the duration and no seasonality being sufficient conditions), this probability is a good approximation.

$$P(k \text{ on a given day in t}) = P(k \text{ anytime in t}) \times E(k \text{ duration in months}) / 12$$

For example, if unemployment duration is one day for everyone, than the probability that someone is unemployed on a particular day is 1/365 times the probability that she is unemployed on some day during the year. In terms of months, duration is 1/30, and therefore P(u particular day) = P(u any day)/(30*12).

As a result,

$$P(k \text{ anytime in t}) \times E(k \text{ duration in months}) = P(k \text{ on a given day in t}) \times 12$$

and so

$$Y_{kt} = P(k \text{ on a given day in t}) \times 12 \times E(\text{transfers related to k, per month})$$

In what follows, we simply denote P(s on a given day in t) by P_{kt} or dropping the index referring to transfer k, simply P_t.

5.7 Ignored equilibrium consequences

Throughout the analysis we assume that the investment would not change the wage and employment probability premium on education. The justification lies in the fact that young Roma are a minority in Hungary. Even if a successful investment makes many more complete general secondary school, the increased inflow of more educated people to the labor market would probably have at most a small effect on equilibrium employment probabilities and wages.

5.8 Omitted dimensions

We omit some important channels through which increased education may increase or decrease net contribution to the national budget. A few examples are:

1. Old-age social security pensions (and the fact those who do not accumulate enough on funded retirement savings account will have pensions financed from social security)
2. Disability pensions
3. Other government sponsored employment projects (other than public employment projects: közmunka, közhasznú, közcélú munka)
4. Health care costs
5. Child-care benefits and inter-generational effects

Except perhaps for health expenditures, the more educated are expected to contribute more to (receive less transfers from) the national budget through these omitted channels. Their omission therefore makes the estimated returns smaller than they may be in reality.

6. ESTIMATION DETAILS

Before turning to the accounts themselves, we present some auxiliary results. Most accounts are directly related to some labor market status. We consider five of these statuses: employed full-time, registered unemployed, registered welfare recipient, registered public project employee, and incarcerated. We estimate the probability that a person with given educational attainment (A through D) and given age is in the particular state on one particular day of the year.

Employment probabilities are estimated from the pooled cross sections of the 2004 Hungarian Labor Force Survey (HLFS), using the data for 216 thousand individuals between age 16 and 65. The other labor market status probabilities are estimated by taking total numbers from administrative data and dividing them by population estimates (to 2001). The estimated probabilities are presented in Table 3 and Figure 2.

Appendix A and B give a detailed picture of the data sources we relied on and the calculation methods we used in the estimation of costs, expenses borne by the national budget and taxes and contribution paid by our representative individuals A, B, C, D. First we go through the main accounts (see Appendix A).

6.1 Personal income tax on earned income (Appendix A, Account PIT)

The formula is given by

$$Y_{st} = P(\text{ft employed})_{st} \times \Sigma_{b=1}^{4} \{ P(b|\text{ft employed})_{st} \times \text{Mean}(\text{yearly wage}|b)_{st} \times \text{Taxrate}_{b} \}$$

Where ft employed are full-time employed, and b means tax bracket. Employed are those who are full-term employees. There are four tax brackets with different marginal tax rates.

In our benchmark estimates, we assumed that Roma employment full-time probabilities are 15 per cent lower for each education category. Similarly, we assumed that if employed, a Roma would earn 15 per cent less than a fellow Hungarian worker (average of Roma *and* non-Roma figures). These assumptions represent rather strong labor market inequalities which is due partly to labor market discrimination.

6.2 Other contributions on earned income (Appendix A, Account SSC)

34 per cent payment in levied on the gross (before-PIT) earnings as social security contribution which is paid by the employers. This is coupled by a 6 per cent payment by employees.

$$Y_{st} = P(\text{employed})_{st} \times \text{Mean}(\text{wage}|\text{ft employed})_{st} \times \text{Taxrate}$$

Roma employment and wages are estimated by the same adjustment as above (-15%).

6.3 Unemployment benefits, welfare benefits, public employment projects

$$Y(1)_{st} = P(\text{unemployed})_{st} \times \text{Mean}(\text{monthly UI})_{s} \times 12$$
$$Y(2)_{st} = P(\text{welfare rec})_{st} \times \text{Mean}(\text{monthly welfare benefit}) \times 12$$
$$Y(3)_{st} = P(\text{pub. emp.project})_{st} \times \text{Mean}(\text{monthly min.wage}) \times 12$$

The source of unemployment benefit recipients is the total number of recipients in the unemployment registry on 20 October 2005, by age groups and educational attainment. Monthly UI benefits are calculated from the same registry, using data on Sep. 20-Oct. 20 recipients. The mean benefit amounts are estimated by education category. Data of registered unemployed from the year 2001 prove that mean benefits are roughly the same across ages. *(Appendix A, Account UI)*

Number of recipients of the means-tested welfare benefits ("rendszeres szociális segély") are from the same registry. Their monthly average is fixed (to and extremely low amount). *(Appendix A, Account RWB)*. (Data on public employment projects stem from the same registry (20 October 2005). Three types of public employment programs are taken into account: közmunka, közhasznú, közcélú munka) *(Appendix A, Account PEP)*

Adjustments to the Roma population were made with the assumption that over-representation is constant by educational category. We had estimates about overall over-representation in each pool, and that, combined with the educational distribution of the Roma (relative to the national distribution) gave the ratios. Data source of Roma adjustment factors was a special survey on Roma unemployment conducted by the Employment Office and the ILO in 2001.

6.4 Value added tax on consumption (Appendix A, Account CT)

This account contains tax contributions paid after consumption, regardless of the source of income. Consumption is a household-level concept so we assign average household level consumption to each adult member of the household, in order to get person- (and therefore education- and age-) specific consumption estimates. Consumption is disaggregated into categories with different tax rates. Per capita consumption is defined as total household consumption divided by the number of adults. This method assumes that only adults make consumption decisions and they do so with equal share in the decision.

$$Y_{st} = \text{Mean}(\text{consumption})_{st} \times \text{Taxrate}$$

$\text{Mean}(c)_{st}$ is the average per adult consumption of households where st type adults live.

We considered two kinds of tax: value added tax and excise tax on alcohol, tobacco and gasoline. We used the year 2003 Hungarian Household Budget Survey to estimate per adult consumption levels for goods by tax brackets. No Roma adjustment were made here.

6.5 Incarceration costs (Appendix A, Account PR)

$$Y_{st} = P(\text{in prison})_{st} \times \text{Mean}(\text{cost per prisoner})$$

Number of incarcerated by education and age group were obtained from the Hungarian Statistical Office. The source of the figures is the census of year 2001. Incarceration costs are per prisoner variables costs, received by prison facilities (and excluding central administration and investment costs). According to Poczik (2003), the Roma are vastly overrepresented in Hungarian prisons. They make up 30-50% of total prison population (the range reflects different definitions of ethnic origin). We adjust Roma probabilities so that they make up 40% of total prison population.

6.6 Extra schooling costs (Appendix B)

We have to take into account two sources of additional costs if an investment makes children complete secondary school. These are (1) four years of extra secondary schools, and (2) five years of higher education costs are taken into account if the given individual is admitted to college. Using current yearly per capita cost (including dormitory) estimates, we assume that a student with maturity exam may go to college with probability $P_{D|C}$, and if does so spends 5 years there on taxpayers' money.

7. RESULTS

7.1 Benchmark results

Benchmark parameters (not estimated but assumed)
Discount rate = 0.02
Discounted to age = 4
Roma employment adjustment = -15%
Roma wage adjustment = -15%
P(college | maturity exam) = 0.5 (same for Roma and non-Roma)

Table 3 summarizes the P_s estimates. These are the labor market status probabilities for each education group, averaged over age 16 to 65. Figure 2 shows the same by age. Note that we do not account for more than 40 per cent of the national population (almost 60 per cent of the Roma population). These are people who are neither full-time employed, nor in any of the other registered inactive states. They are part-time employed, self-employed, or inactives not covered by the above welfare forms. Implicitly, we assume that their net contribution to the national budget is zero (apart from consumption). In other words, we restrict ourselves to assume that all net benefits come from the registered economy, and don't look at possible benefits coming from non-registered activities.

Tables 4 summarizes the final results for the benchmark and the conservative discount rate. It shows total net contributions to the national budget over all accounts, and computes the differences that show the extra budgetary benefits. Table 4 focuses on the Roma investments. Tables 5 and 6 show the results of the corresponding calculations in more detail. They contain the national and the Roma estimates, the value of each account, their sum, the differences across education groups, and also the relative contribution of each account to the total net benefits.

The results indicate that an investment that makes one young Roma successfully complete secondary school would yield significant direct long-term benefits to the national budget. According to our benchmark estimate, discounted to age 4 (a possible starting age for such an investment), the present value of the future benefits is about HUF 19M (EUR 70,000) relative to the value the government would collect on the representative person in case if she had not continued her studies after the primary school. The benefits are somewhat smaller if (without the suggested early childhood educational investment), the young Roma person finished vocational training school (HUF 15M, EUR 55,000). The estimated returns are most sensitive to the discount rate, the assumed wage growth, the college completion rate after secondary school, and the race specific employment and wage differentials (to some extent due to labor market discrimination). But even for our most conservative estimates, it is about HUF 9M.

Overwhelmingly, the benefits would come from increased government revenues, from personal income tax and employer/employee contributions after earned income. Savings on unemployment insurance, welfare benefits and public employment projects are negligible, and savings on incarceration costs are also small. Larger value added tax benefits on consumption are also sizable.

Estimated Roma benefits are smaller than estimated national benefits because for the same educational level (and age), the Roma have lower employment chances and if employed, lower expected earnings. These assumptions reflect the combined results of labor market discrimination and possibly lower productivity. Naturally, labor market discrimination decreases the benefits of investment into education because those benefits are expected to come from increased employment and wages, as comparing national and Roma estimates show dramatically.

7.2 Sensitivity Analysis (Appendix C)

In this section we try to check the robustness of our results by changing some of the key parameters. These are: discount rate, discount age, general secondary school completion rate (if enrolled), Roma adjustment factor for finishing college, Roma employment and wage adjustment ratios.

Our result are quite robust: there is room for educational intervention, – sensitivity analysis clearly proves this. Fiscal benefits are most sensitive to the change of the discount rate (Chart 1). But even in the highly unrealistic case of a 4 per cent discount rate there is a HUF 7-9 M fund to cover the costs of an early educational program for Roma children. Discount age (Chart 2) also matters but matters much less. Recent trends of early educational initiatives (Rolnick and Grunewald 2003, Minnesota 2000, Heckman 2006)) recall that programs must start as early as possible, particularly for kids of disadvantaged families. In case of starting these programs right from the birth onwards would provide planners with at least HUF 15-17 M if disadvantaged Roma kids are targeted.

Professional competence of early educational programs enter in the calculation of fiscal benefits in two ways. The better the programs the more they cost, but the better they are the higher is the probability they achieve their goal: the completion of the general secondary school and passing through the maturity exam (the gateway to higher education). Thus: assuming that children who were part of some early educational program enroll in a general secondary school they may complete it with different probability gives different sums of fiscal benefits. Chart 4 and 5 report these differences in case of a representative Hungarian target child and of a representative Roma child. Choosing as benchmarks the maturity exam completion rate (if enrolled) at the 90 per cent in the national case and 70 per cent in the Roma case (most realistic present numbers), we find that even a 10 per cent deterioration in this respect would provide about HUF 10 M (9.5-11.1) for an educational program in the Roma case (Chart 4). The same is true if we are taking off the

unrealistic assumption that each Roma child who acquired maturity exam and enrolled in a higher educational institution will really finish their studies. Even if we assume that the probability that a Roma young will complete her studies is only the half of the probability that an average Hungarian young does it the fiscal benefits accumulated over the lifetime will be still high enough: HUF 10-13 M (Chart 5). Employment and wage adjustment factors affect net fiscal benefits quite severely. But even if we double them (using parameters of 0.3 instead of 0.15 for both) we receive still huge funds: HUF 11-14 M (Charts 6-7).

If these dimensions are combined net benefits will decrease (Charts 8-13) but they stay still quite large. Highest (4 per cent) discount rate plus lowest discount age (birth age) provide with still a HUF 6-7 M fund in the Roma case (Charts 10-11). With parameters of pessimistic (low) Roma maturity completion rate (60 per cent) *and* high employment discrimination factor (30 per cent) we have still a substantial (HUF 8-9 M) fund to invest in Roma children (Charts 12-13).

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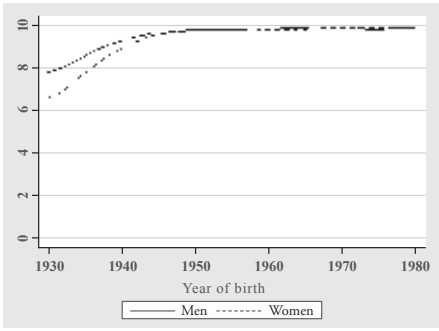
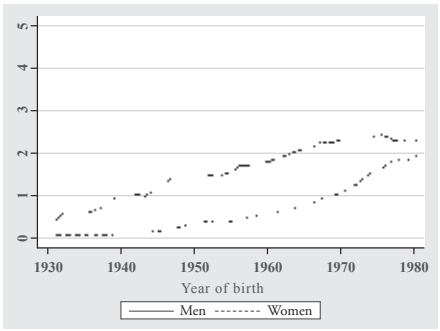
Figure 1. Schooling in Hungary: national and Roma educational attainment

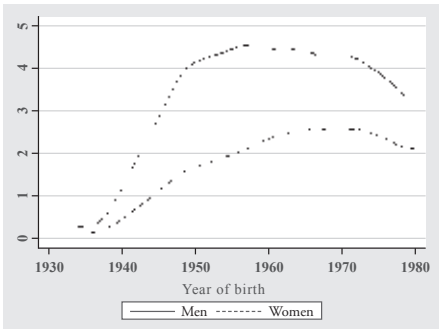
Roma: primary school



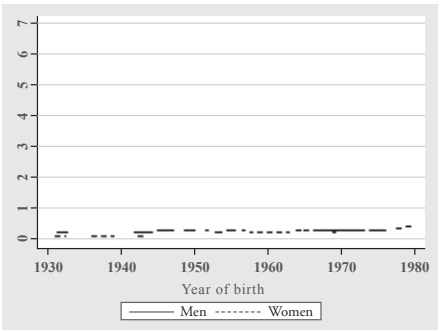
National: primary school



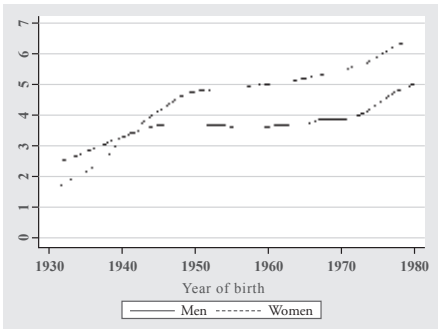
Roma: vocational school



National: vocational school



Roma: secondary school maturity exam



National: secondary school maturity exam

Figure 1
Educational attainment of the adult population, (Roma and national)

Sources: Roma: Hungarian Roma Surveys of 1993 and 2003, and Hungarian Labor Force Surveys of 1993/4 and 2003/ 4. Educational attainment rates of the 1930-1940 cohorts are computed from the 1993 surveys; those of the 1941-70 cohorts were computed as an average of the 1993 and 2003 surveys; those of the 1971-80 cohorts were computed from the 2003 surveys. The figures show smoothed series by taking ±5-year moving averages (appropriately adjusted at the endpoints).

Table 1
Educational attainment of the 16-17 year old (Roma: 17-18) population in 1993 and 2003 (per cent)

	Completes primary school by age 17 (approx.)	Continues studies in		Total
		Vocational school	Secondary school	
Roma population				
1993	68	33	9	42
2003	86	24	14	38
Change	+18	-9	+5	-4
National average				
1993	96	39	48	87
2003	96	12	80	92
Change	0	-27	+32	+5
Roma – National difference in differences				
	+18	+18	-27	-9

Note: The category of continuing studies covers those who studied in vocational or secondary schools or completed any of those. Continuing rates are underestimated by dropout rates.

Sources: Hungarian Roma Surveys of 1993 and 2003, and Hungarian Labor Force Surveys of 1993/4 and 2003/ 4.

Table 2
Distribution by educational attainment between age 16 and 65

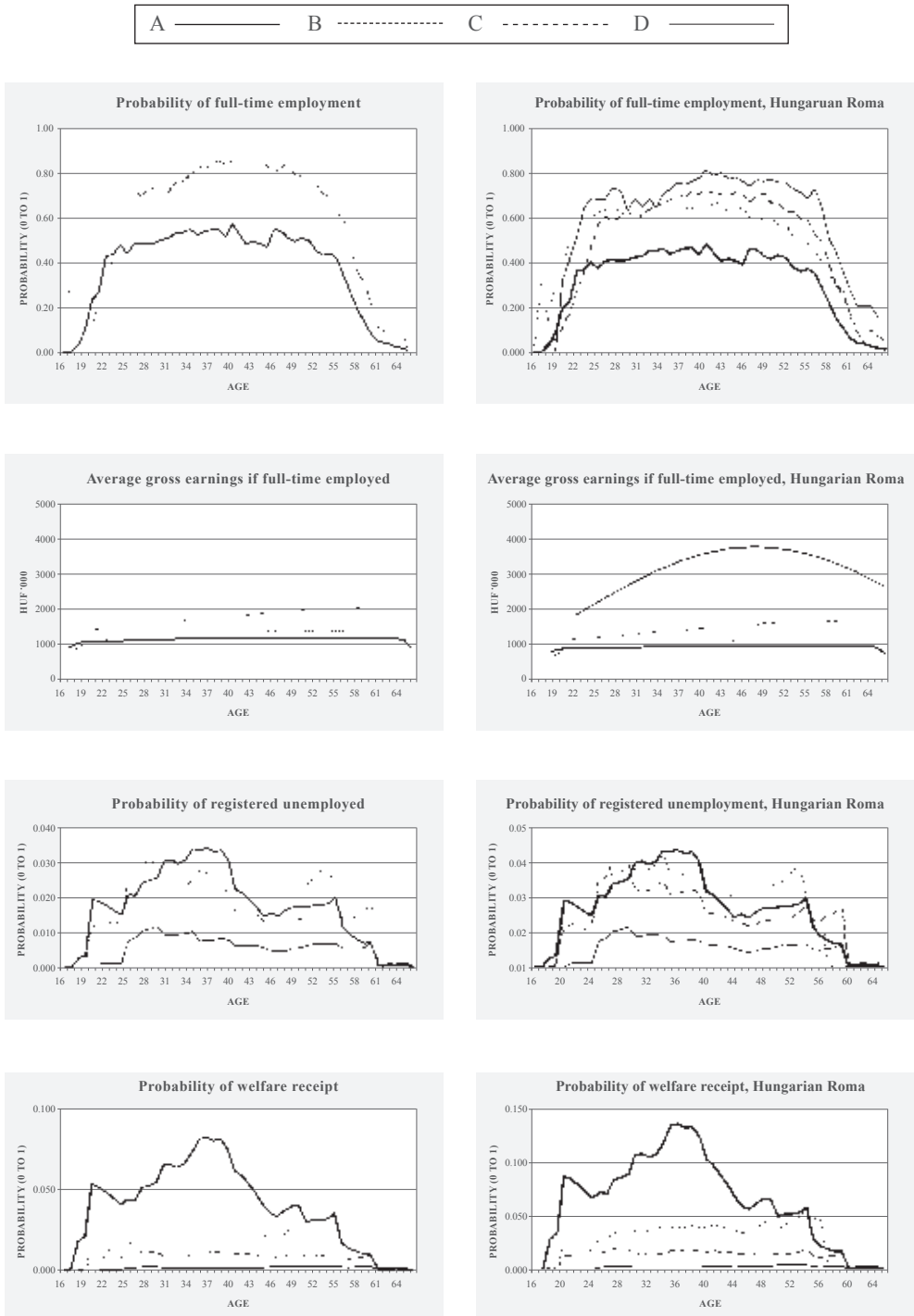
	NATIONAL	ROMA
0	0.028	0.280
A	0.303	0.540
B	0.273	0.150
C	0.285	0.027
D	0.111	0.003
Sum	1.000	1.000

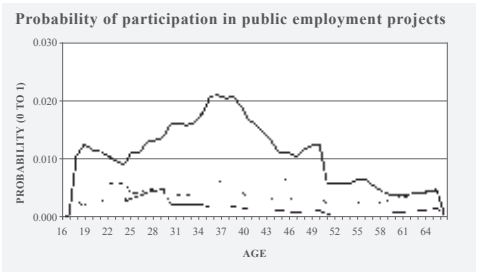
Table 3
Labor market status probabilities by education. Age 16-65

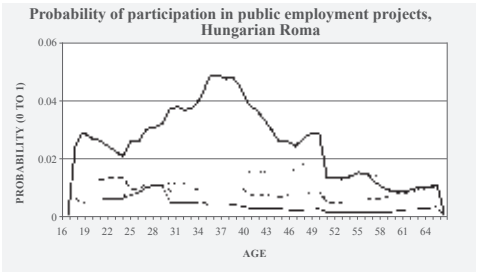
National	Full-time employed	Regist UI recipient	Registered welfare recipient	Registered in public employment project	Incarcerated	TOTAL
0	0.08	0.006	0.063	0.015	0.009	0.17
A	0.34	0.014	0.032	0.009	0.005	0.40
B	0.62	0.019	0.017	0.005	0.002	0.67
C	0.61	0.015	0.008	0.003	0.001	0.64
D	0.74	0.006	0.001	0.002	0.000	0.75
TOTAL	0.532	0.015	0.018	0.006	0.003	0.574

Roma	Full-time employed	Regist UI recipient	Registered welfare recipient	Registered in public employment project	Incarcerated	TOTAL
0	0.07	0.002	0.012	0.007	0.011	0.10
A	0.29	0.038	0.091	0.029	0.042	0.49
B	0.53	0.043	0.036	0.010	0.011	0.63
C	0.52	0.045	0.019	0.010	0.005	0.59
D	0.63	0.017	0.004	0.010	0.001	0.66
TOTAL	0.272	0.029	0.058	0.019	0.028	0.406

Figure 2
Estimated national and Roma series







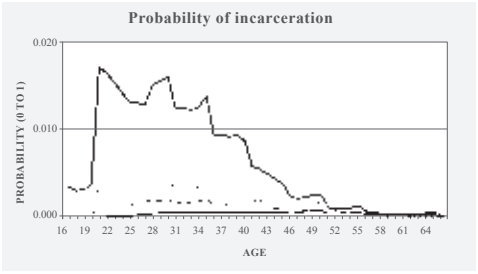
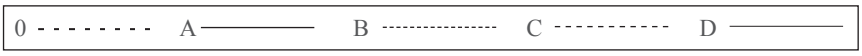
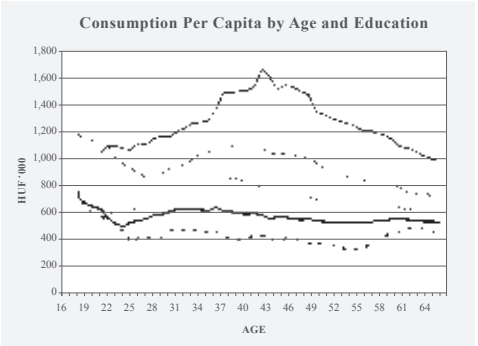


Figure 3
Estimated consumption series





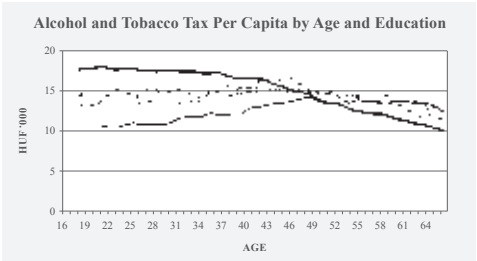


Table 4
Main results
Total discounted contriubutions for each education group, and their differences
Roma estimates only. Benchmark and conservative discount rate.

	Discount rate	
	2%	4%
Total net contributions by educational attainment (HUF million)		
A	4.9	2.6
B	8.3	4.1
C	13.0	6.4
D	34.1	16.0
Net benefit estimates (HUF million)		
Maturity versus A	18.7	8.6
Maturity versus B	15.3	7.1

Table 5
Main results
Discounted sums on each account, by educational attainment
Benchmark discount rate

Discounte to age 4
Discount rate: 2%

NATIONAL										
	Education	**PIT**	**Employment Contribution**	**V.A.T.**	**Alcohol +Tobacco**	**UI**	**Welfare**	**Pubemp**	**Incarceration**	**SUM**
A		808	4,034	2,270	363	-210	-213	-72	-276	6,705
B	-1,274	1,847	6,899	3,022	338	-216	-84	-59	-71	10,402
C	-1,274	4,035	9,013	4,265	323	-182	-37	-26	-35	16,081
D	-4,554	17,754	24,377	5,267	269	-67	-6	0	-12	43,027
Versus A	-2,914	10,086	12,660	2,497	-67	86	191	59	252	22,849
Versus B	-1,640	9,048	9,796	1,744	-42	91	62	46	47	19,152
As fraction of total contribution										
Versus A	-13%	44%	55%	11%	0%	0%	1%	0%	1%	100%
Versus B	-9%	47%	51%	9%	0%	0%	0%	0%	0%	100%

ROMA										
	Education	PIT	Employment Contribution	V.A.T.	Alcohol +Tobacco	UI	Welfare	Pubemp	Incarceration	SUM
A		420	3,464	2,270	363	-316	-362	-151	-753	4,934
B	-1,274	1,048	5,923	3,022	338	-325	-143	-124	-194	8,272
C	-1,274	2,528	7,738	4,265	323	-274	-64	-55	-97	13,091
D	-4,554	12,315	20,930	5,267	269	-100	-11	0	-33	34,082
Versus A	-4,554	11,895	17,466	2,997	-94	216	351	151	720	18,653
Versus B	-3,279	11,267	15,006	2,245	-69	224	132	124	161	15,314
As fraction of total contribution										
Versus A	-24%	64%	94%	16%	-1%	1%	2%	1%	4%	100%
Versus B	-21%	74%	98%	15%	0%	1%	1%	1%	1%	100%

Table 6
Main results
Discounted sums on each account, by educational attainment
Very conservative discount rate

Discounte to age 4
Discount rate: 4%

NATIONAL										
	Education	PIT	Employment Contribution	V.A.T.	Alcohol +Tobacco	UI	Welfare	Pubemp	Incarceration	SUM
A		427	2,168	1,244	201	-117	-120	-38	-171	3,595
B	-1,020	968	3,757	1,638	182	-116	-44	-33	-42	5,290
C	-1,020	2,020	4,619	2,334	172	-100	-20	-15	-20	7,969
D	-3,426	8,836	12,244	2,696	138	-35	-3	0	-6	20,442
Versus A	-2,223	5,001	6,263	1,271	-46	49	108	30	158	10,611
Versus B	-1,203	4,459	4,675	877	-27	48	33	25	29	8,916
As fraction of total contribution										
Versus A	-21%	47%	59%	12%	0%	0%	1%	0%	1%	100%
Versus B	-13%	50%	52%	10%	0%	1%	0%	0%	0%	100%

Table 6 *(Continued)*
Main results
Discounted sums on each account, by educational attainment
Very conservative discount rate

Discounte to age 4
Discount rate: 4%

ROMA										
	Education	PIT	Employment Contribution	V.A.T.	Alcohol +Tobacco	UI	Welfare	Pubemp	Incarceration	SUM
A		221	1,862	1,244	201	-175	-204	-80	-467	2,601
B	-1,020	548	3,225	1,638	182	-174	-75	-69	-115	4,139
C	-1,020	1,262	3,966	2,334	172	-151	-34	-32	-56	6,441
D	-3,426	6,117	10,513	2,696	138	-53	-5	0	-17	15,962
Versus A	-3,426	5,896	8,651	1,452	-63	122	199	80	450	8,601
Versus B	-2,406	5,569	7,287	1,058	-44	121	70	69	98	7,062
As fraction of total contribution										
Versus A	-40%	69%	101%	17%	-1%	1%	2%	1%	5%	100%
Versus B	-34%	79%	103%	15%	-1%	2%	1%	1%	1%	100%

APPENDIX A:
Data sources and calculation methods for different accounts

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Personal Income Tax (PIT)	**National**	
	Personal income tax	Calculated based on PIT law (1995/ CXVII., 30.§ and 33.§ – on PIT rate and tax credit, as of 2006-05-29). 4 income brackets were applied to the wages, thresholds (in thsHUF): 1000, 1550, 2100. For PIT formula: see end of doc.
	Full-time employment & bracket probabilities	Dataset: LFS 2002 (do-file: PIT06.do). Definition: those who are employed (KSH definition) and are full-time employed (details: ftemp.do). The full-time prob. is estimated for both people (A-B-C-D) and age (16-65). If positive, assumption: the person worked for the whole year (due to tax credit – adójóváírás). The bracket probs are conditional on ft probs.
	Expected wages per bracket	Dataset: FH Bértarifa-felvétel 2002 (do-file: PIT06.do), with a correction of all wages by 20%. Estimated separately by brackets (see above) people and age. Note: these are gross wages!
	Overall PIT	Calculated for each age and person. For formula used: see end of doc.
	Roma	
	No direct data, corrections were used on the national averages.	
	Full-time employment & bracket probabilities	Full-time roma employment probs are computed indirectly: the national averages are multiplied by 0.85. The bracket probs (conditional on ft probs) were assumed to be identical to the national average.
	Expected wages per bracket	Multiplier for expected wages (each bracket): 0.85.

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Social Security Contributions (SSC)	**National**	
	Full-time employment probabilities	Auxiliary (from the PIT account)
	Expected wages	Dataset: FH Bértarifa-felvétel 2002 (PIT06.do). Estimated separately by people and age.
	Employer contributions	Based on the following acts (as of 2006.05.29): 1997/LXXX. 18.§, 2003/LXXXVI. 3.§, 1991/IV. 40.§. Altogether 33.5%, the contribution (by age and person) is this ratio multiplied by the expected wages. For the exact references on laws see Internet references (end of doc).
	Employee contributions	Based on the following acts (as of 2006.05.29): 1997/LXXX. 18.§, 1991/IV. 41.§. Altogether 5.5%, the contribution (by age and person) is this ratio multiplied by the expected wages. For the exact references see Internet references (end of doc).
	Overall contributions	The sum of the employer & employee contributions multiplied the full-time employment prob.
	Roma No direct data, corrections were used on the national averages.	
	Full-time employment probabilities	Multiplier for full-time employment probabilities is same as in the PIT account: 0.85.
	Expected wages	Similarly, multiplier for expected wages is same as for PIT: 0.85.

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Unemployment Insurance (UI)	**National**	
	Distribution of population	Dataset: Census 2001 (nepsz_orsz_javitott_041027_OK.dta) plus the prison population (see account prison).
	Registered unemployment probabilities	Dataset: FH Segélyregiszter, date: 2005.10.20. Definition: registered unemployed receiving unemployment insurance on the above date. Assumptions: ranges below 19 and above 60 were taken as ranges 18-19 and 60-64, resp., and the registered unemployed in all ranges were equally divided among the corresponding ages. The denominator is the distribution of population (see above).
	Unemployment insurance - UI	Dataset: FH Segélyregiszter, between 2005.09.20 and 2005.10.20. (so the 2005 amounts are used). It is separated by only schooling, so to all ages these UIs were applied. Note: this is monthly insurance!
	Overall UI	UI in each age (by people): registered unemployment probs multiplied by UI and by 12.
	Roma No direct data, corrections were used on the national averages.	
	Registered unemployment probabilities	Fraction of Roma among the registered unemployed is estimated to be 9% (Source: Lukács György Róbert, „Roma munkaerőpiaci programok." In: Csongor Anna – Lukács György Róbert (eds): „Roma munkaerőpiaci programok." Autonómia Alapítvány, Budapest, 2003. This implies an adjustment factor of 1.40.

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Regular Welfare Benefits (RWB)	**National**	
	Full-time employment probabilities	Auxiliary (from the PIT account)
	Expected wages	Dataset: FH Bértarifa-felvétel 2002 (PIT06.do). Estimated separately by people and age.
	Employer contributions	Based on the following acts (as of 2006.05.29): 1997/LXXX. 18.§, 2003/LXXXVI. 3.§, 1991/IV. 40.§. Altogether 33.5%, the contribution (by age and person) is this ratio multiplied by the expected wages. For the exact references on laws see Internet references (end of doc).
	Employee contributions	Based on the following acts (as of 2006.05.29): 1997/LXXX. 18.§, 1991/IV. 41.§. Altogether 5.5%, the contribution (by age and person) is this ratio multiplied by the expected wages. For the exact references see Internet references (end of doc).
	Overall contributions	The sum of the employer & employee contributions multiplied the full-time employment prob.
	Roma No direct data, corrections were used on the national averages.	
	Full-time employment probabilities	Multiplier for full-time employment probabilities is same as in the PIT account: 0.85.
	Expected wages	Similarly, multiplier for expected wages is same as for PIT: 0.85.

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Public Employ-ment Projects (PEP)	**National**	
	Distribution of population	See account UI.
	Probabilities of public employment	The nominator is the aggregated sum of three parts: közhasznú, közcélú, közmunka. Direct data are only available for közhasznú (source: FH Segélyregiszter, date: 2005.10.20.), for the others: see Kertesi (2005). For közhasznú, the age distribution of person A is computed as: it is 80% of the people with not more than 8 grades in every age. Further, ranges below 19 and above 50 were taken as ranges 18-19 and 50-64, resp., and the registered unemployed in all ranges were equally divided among the corresponding ages. The distribution of közcélú and közmunka is assumed to be identical with közhasznú by age and schooling. The denominator is the distribution of population (see above).
	Wage	Uniformly 57 ths HUF per month (minimum wage in 2005).
	Overall publ. empl. wage	Probability of public employment multiplied by wage and 12.
	Roma No direct data, corrections were used on the national averages.	
	Probabilities of public employment	Fraction of Roma among participants of „kozhasznu munka" is estimated to be 22%. Their estimated fraction for „kozcelu munka" is 28%, and 44% for „kozmunka. This gives a weighted fraction of 26%. (Source: Lukács György Róbert, „Roma munkaerőpiaci programok." In: Csongor Anna – Lukács György Róbert (eds): „Roma munkaerőpiaci programok." Autonómia Alapítvány, Budapest, 2003. The implied adjustment factor is 1.90.

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Consumption Taxes (CT)	**National**	
	VAT	Dataset: HKF 2003 (note: household level data!). Four categories were used based on 1992/LXXIV and 2005/XCVII (as of 2006.05.29.). In the hholds the number, age, schooling of members plus the number of below 16 and above 16 (nappalis diak) were taken into account. The various categories of VAT were added up.
	Excise duty	Dataset: HKF 2003 (note: household level data!). The labelling is based on 2003/CXXVII (as of 2006.05.29.). In the hholds the number, age, schooling of members plus the number of below 16 and above 16 (nappalis diak) were taken into account. For the exact tax levels see Internet references or the law.
	Overall consumption	The VAT and excise duty contributions were added up.
	Roma No changes were applied to the national averages.	

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Prison (PR)	**National**	
	Distribution of population	See account UI.
	Probabilities of imprisonment	Dataset: Census 2001. The range above 60 were taken as between 60-64, and the imprisoned people in all ranges were equally divided among the corresponding ages. Assumption: those, who are imprisoned spend the whole year in prison (see 2004 Annual Report of BVOP, Table 12.). The denominator is the distribution of population (see above).
	Daily average cost of incarceration	Data: 2004 Annual Report of BVOP. The cost is the realized annual budget support (Table 22. of the annual report, only the institutes themselves – expenses of the headquarter excluded) divided by the number of imprisoned (at the end of the year, Table 9. of the annual report) and by 365, and is rounded to 4.1 thsHUF.
	Overall cost	The daily average cost multiplied by 365 and the probabilities of imprisonment.
	Roma No direct data, corrections were used on the national averages.	
	Probabilities of imprisonment	Fraction of people who considere themselves Roma is 29% in Hungarian prisons. An additional 21% can be considered as „assimilated Roma". We took a middle estimate of 40% for the fraction of Roma in prisons (Source: Póczik Szilveszter: Cigány integrációs problémák. Kölcsey Intézet, Budapest, 2003). The implied adjustment factor is 2.81.

PIT

PIT law:
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=99500117.TV

Employer & employee contributions

All the contributions:
http://www.fn.hu/szakerto.php?id=58&fid=1451&kulcs=11xx6994

Employer contributions:
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=99700080.TV
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=A0300086.TV
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=99100004.TV

Employee contributions:
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=99700080.TV
http://net.jogtar.hu/jr/gen/getdoc.cgi?docid=99100004.TV

Regular welfare bernefit

Amount:
http://www.icsszem.hu/main.php?folderID=1055&articleID=5422&ctag=articlelist&iid=1

Public employment

Kertesi Gábor (2005): A társadalom peremén, Osiris, p183. table 6.7.

Consumption

VAT:
http://www.apeh.hu/cgi-bin/lap.php?id=informacio/afaklcs

Excise duty
Overview of the 2005 amendments:
http://vam.gov.hu/viewBase.do?elementId=4583

The law (click on a link):
http://www.magyarorszag.hu/ugyintezo/ugyleirasok/adovam/jovterh/jovedekelj#paragr3

Education

Berlinger Edina (2006): Nem csak népszerűtlen, Magyar Narancs, XVIII/23., p58.

„Jelentes a magyar kozoktatasrol 2003":
http://www.oki.hu/oldal.php?tipus=cikk&kod=Jelentes2003-Fuggelek-Finanszirozas

Formulas:

PIT

PIT (in thsHUF)	
Income between 0-756:	no PIT
756-1000:	(income – 756) * 0.18
1000-1550:	income * 0.18 + ((income – 1000) * 0.05 - 136.08)
1550-2100:	279 + (income – 1550) * 0.36 + ((income – 1500) * 0.18-108)
above 2100:	477 + (income – 2100) * 0.36

overall PIT

$$P_{ft} * \sum_{i=1}^{4} \mathrm{P}(bracket_i) * \mathrm{PIT}(bracket_i)$$

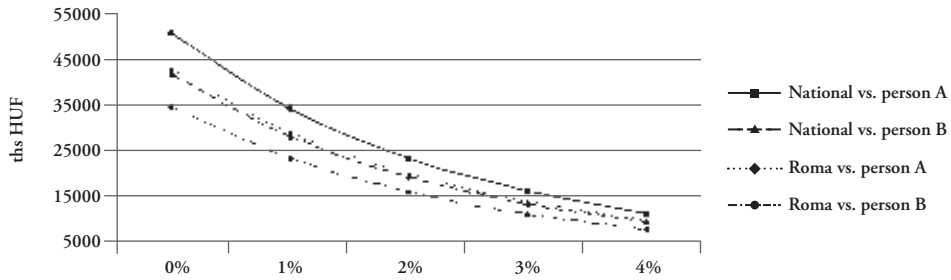
APPENDIX B:
Data sources and calculation methods for educational expenses

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Extra secondary education	**National** **Roma** No changes were applied to the national average.	Assumed to be HUF 400,000 Total educational expenses were million HUF 410,000 in 2001. Of that, some 40% are assumed to be spent on secondary education (this was the average fraction up to 1996, the last year separate secondary school expenses data were collected), which gives million HUF 164,000. Number of students in seconday school was about 450,000 in 2001/2. We get HUF 360,000 as a per capita per year cost for year 2001. That cost we inflate to HUF 400,000. Source: „Jelentes a magayr kozoktatasrol 2003", OKI, Budapest (downloadable; see link among references). Tables 3.1 and 4.3

ACCOUNTS	ELEMENTS OF THE ACCOUNTS	DESCRIPTION
Higher education	**National**	
	State support per student	Assumed to be 500ths HUF a year in 2004 HUFs.
	Dormitory costs	Assumed to be 200ths HUF a year in 2004 HUFs.
	Probability of dormitory	Assumed to be 0.5, and if one gets it, stays there for the whole academic year.
	Other costs	Assumed to be 300ths HUF a year in 2004 HUFs.
	Overall higher education costs	The above elements are weighted by the probabilities (if there) and added up. Altogether 5 years of higher education is assumed. The overall costs are in line with current estimates for a Master's program (see references).
	Roma No changes were applied to the national average.	

APPENDIX C:
Figures and Tables of the Sensitivity Analysis

Chart 1
Total net fiscal benefits of maturity exam by discount rate
National and Roma

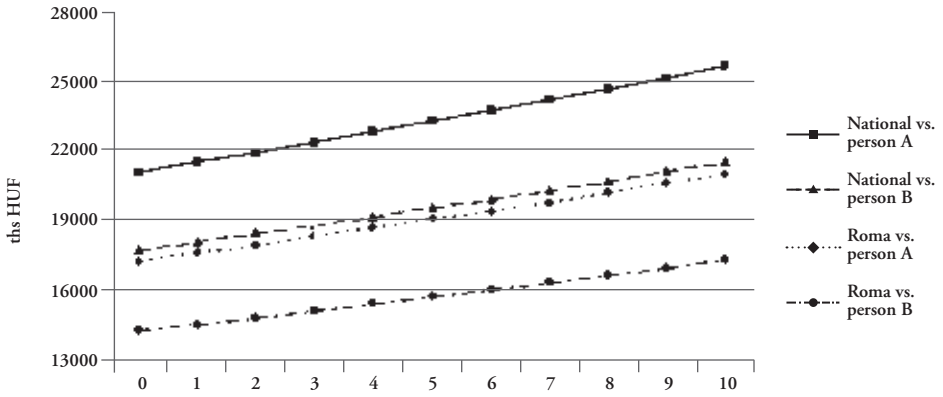


Description: The net fiscal benefits are calculated based on the formula used in **PAGE** 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the discount age – are set to their benchmark value.

Total net fiscal benefits of maturity exam by discount rate (ths HUF)					
	0%	1%	2%	3%	4%
National vs. Person A	50,874	33,929	22,849	15,517	10,611
National vs. Person B	42,773	28,470	19,152	13,011	8,916
Roma vs. Person A	41,660	27,752	18,653	12,631	8,601
Roma vs. Person B	34,410	22,841	15,314	10,360	7,062

Description: The net fiscal benefits are calculated based on the formula used in **PAGE** 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the discount age – are set to their benchmark value.

Chart 2
Total net fiscal benefits of maturity exam by discount rate
National and Roma

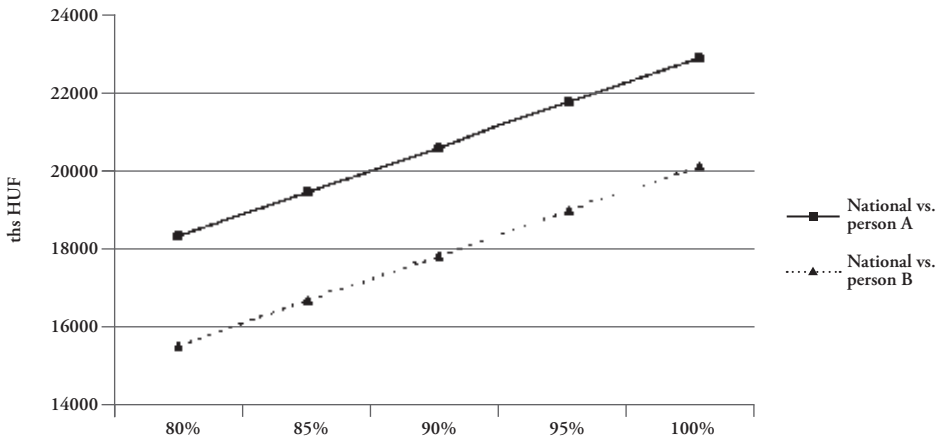


Description: The net fiscal benefits are calculated based on the formula used in **PAGE 7**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the discount age – are set to their benchmark value.

Total net fiscal benefits of maturity exam by discount age (ths HUF)											
	0	1	2	3	4	5	6	7	8	9	10
National vs. Person A	21,109	21,531	21,962	22,401	22,849	23,306	23,772	24,248	24,733	25,228	25,732
National vs. Person B	17,694	18,048	18,409	18,777	19,152	19,535	19,926	20,325	20,731	21,146	21,569
Roma vs. Person A	17,232	17,577	17,929	18,287	18,653	19,026	19,406	19,795	20,190	20,594	21,006
Roma vs. Person B	14,148	14,431	14,720	15,014	15,314	15,621	15,933	16,252	16,577	16,908	17,246

Description: The net fiscal benefits are calculated based on the formula used in **PAGE 7**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the discount age – are set to their benchmark value.

Chart 3
Total net benefits of maturity exam
by National maturity exam completion rate



Description: The net fiscal benefits are calculated based on the formula used on **PAGE 36**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the National maturity exam CR (completion rate) and the National vocational school completion rate, which is set to 0.75 – are set to their benchmark value.

Total net fiscal benefits of maturity exam by National maturity exam CR (ths HUF)					
	80%	85%	90%	95%	100%
National vs. Person A	18,279	19,422	20,564	21,707	22,849
National vs. Person B	15,507	16,649	17,792	18,934	20,077

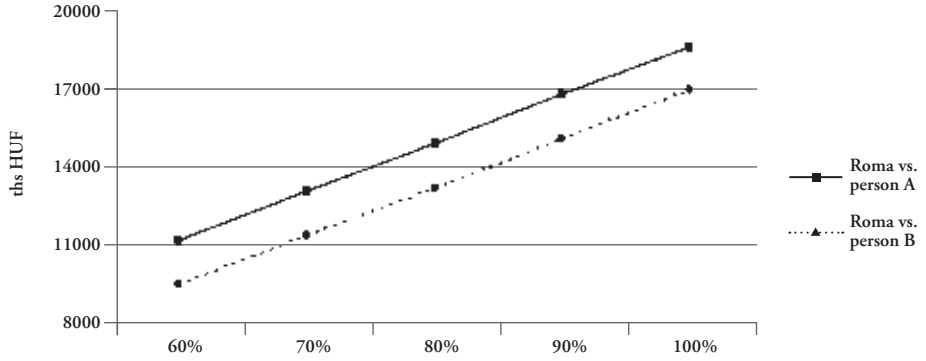
Description: The net fiscal benefits are calculated based on the formula below, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation - except for the National maturity exam CR (completion rate) and the National vocational school completion rate, which is set to 0.75 – are set to their benchmark value.

$$B_A = \left\{\left(1-\beta P_C^N\right)Y_A + \beta P_C^N\left[\alpha P_{D|C}^N Y_D + \left(1-\alpha P_{D|C}^N\right)Y_C\right]\right\} - Y_A$$

$$B_B = \left\{\left(1-\beta P_C^N\right)Y_A + \beta P_C^N\left[\alpha P_{D|C}^N Y_D + \left(1-\alpha P_{D|C}^N\right)Y_C\right]\right\} - \left[\gamma P_B^N Y_B + \left(1-\gamma P_B^N\right)Y_A\right]$$

alfa = Roma adjustment factor for¬ college completion
beta = Roma adjustment factor for general secondary school completion
gamma = Roma adjustment factor for vocational school completion
alfa, beta, gamma < 1

Chart 4
Total net benefits of maturity exam
by Roma maturity exam completion rate

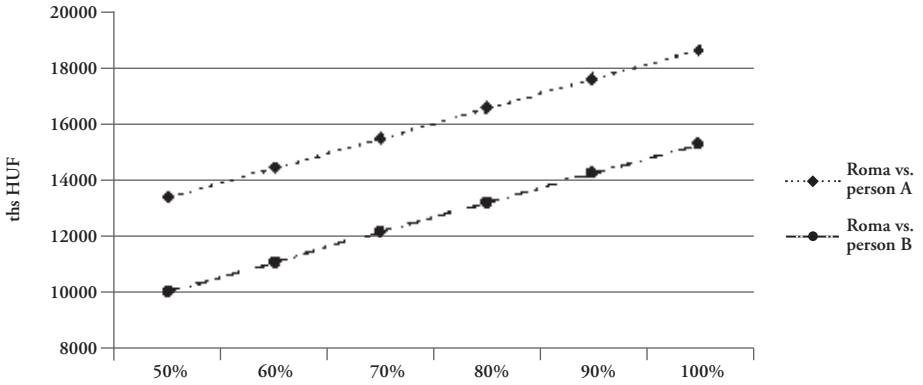


Description: The net fiscal benefits are calculated based on the formula used on **PAGE 36**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the Roma maturity exam CR (completion rate) and the Roma vocational school completion rate, which is set to 0.5 – are set to their benchmark value.

Total net fiscal benefits of maturity exam by Roma maturity exam CR (ths HUF)					
	60%	70%	80%	90%	100%
Roma vs. Person A	11192	13057	14922	16788	18653
Roma vs. Person B	9522	11388	13253	15118	16984

Description: The net fiscal benefits are calculated based on the formula used on **PAGE 36**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the Roma maturity exam CR (completion rate) and the Roma vocational school completion rate, which is set to 0.5 – are set to their benchmark value.

Chart 5
Total net fiscal benefits by Roma adjustment factor for finishing college

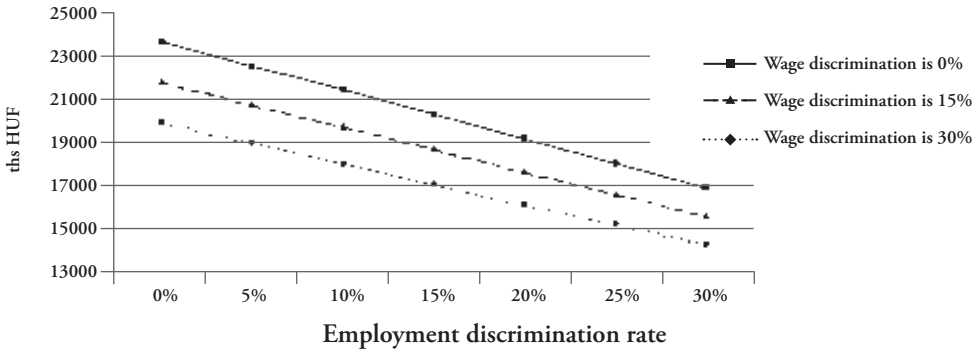


Description: The net fiscal benefits are calculated based on the formula used on **PAGE 36**, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the Roma adjustment factor for finishing college – are set to their benchmark value.

Total net fiscal benefits of maturity exam by Roma college CR (ths HUF)						
	50%	60%	70%	80%	90%	100%
Roma vs. Person A	13405	14455	15504	16554	17603	18653
Roma vs. Person B	10067	11116	12166	13215	14265	15314

Description: The net fiscal benefits are calculated based on the formula used on page 36, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A or B. The parameters of the calculation – except for the Roma adjustment factor for finishing college – are set to their benchmark value.

Chart 6
Total net fiscal benefits of maturity exam compared to person A by employment dscrimination rate, Roma

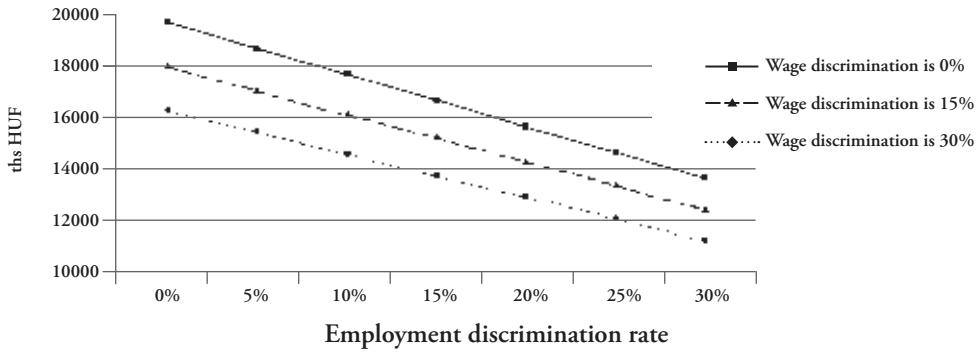


Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the wage & employment discrimination rate – are set to their benchmark value.

Total net fiscal benefits of maturity exam compared to person A by EDR (for Romas) (ths HUF)							
	0%	5%	10%	15%	20%	25%	30%
Wage discrimination is 0%	23720	22573	21426	20279	19132	17985	16838
Wage discrimination is 15%	21807	20755	19704	18653	17602	16550	15499
Wage discrimination is 30%	19876	18922	17967	17012	16057	15103	14148

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the wage & employment discrimination rate (EDR) – are set to their benchmark value.

Chart 7
Total net fiscal benefits of maturity exam compared to person B by employment dscrimination rate, Roma

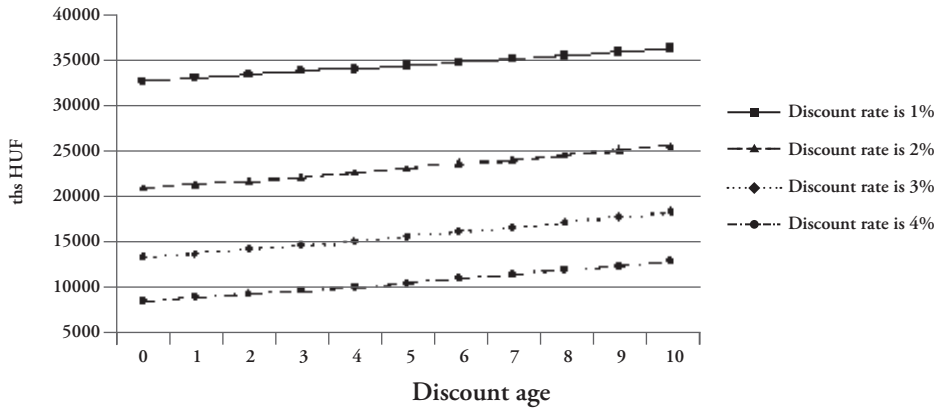


Description: The net fiscal benefits are calculated based on the formula used in **PAGE** 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the wage & employment discrimination rate (EDR) – are set to their benchmark value.

Total net fiscal benefits of maturity exam compared to person B by EDR (ths HUF)							
	0%	5%	10%	15%	20%	25%	30%
Wage discrimination is 0%	19512	18562	17613	16664	15715	14766	13817
Wage discrimination is 15%	17923	17054	16184	15314	14445	13575	12705
Wage discrimination is 30%	16316	15527	14737	13948	13159	12370	11580

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation - except for the wage & employment discrimination rate (EDR) - are set to their benchmark value.

Chart 8
Total net benefits of maturity exam compared to person A by discount age & rate, National

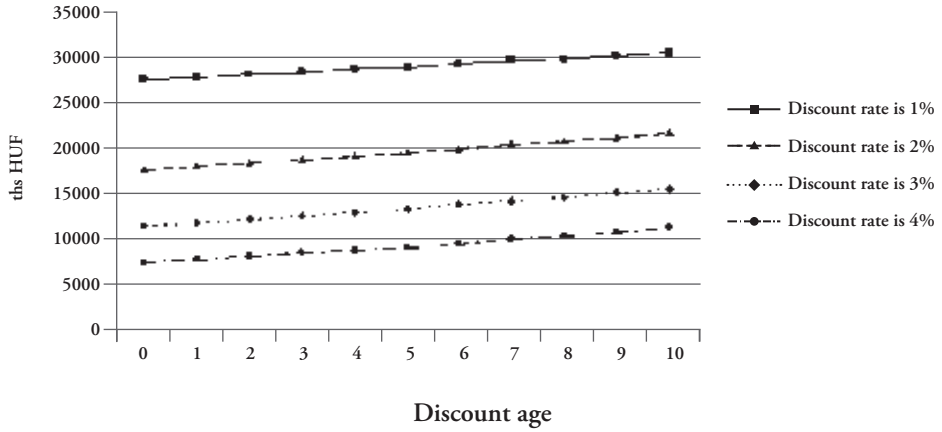


Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Total net benefits of maturity exam compared to person A by discount age & rate (ths HUF)											
Rate/age	0	1	2	3	4	5	6	7	8	9	10
0%	50,874	50,874	50,874	50,874	50,874	50,874	50,874	50,874	50,874	50,874	50,874
1%	32,606	32,932	33,261	33,594	33,929	34,269	34,611	34,958	35,307	35,660	36,017
2%	21,109	21,531	21,962	22,401	22,849	23,306	23,772	24,248	24,733	25,228	25,732
3%	13,787	14,201	14,627	15,065	15,517	15,983	16,462	16,956	17,465	17,989	18,529
4%	9,070	9,433	9,810	10,203	10,611	11,035	11,476	11,936	12,413	12,909	13,426

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Chart 9
Total net benefits of maturity exam compared to person B by discount age & rate, National

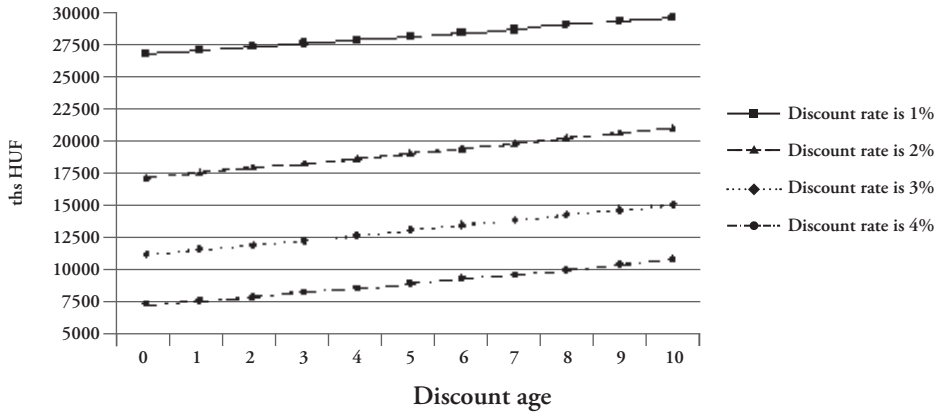


Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Total net benefits of maturity exam compared to person B by discount age & rate, National (ths HUF)											
Rate\Age	0	1	2	3	4	5	6	7	8	9	10
0%	42,773	42,773	42,773	42,773	42,773	42,773	42,773	42,773	42,773	42,773	42,773
1%	27,359	27,632	27,909	28,188	28,470	28,754	29,042	29,332	29,626	29,922	30,221
2%	17,694	18,048	18,409	18,777	19,152	19,535	19,926	20,325	20,731	21,146	21,569
3%	11,560	11,907	12,264	12,632	13,011	13,401	13,803	14,217	14,644	15,083	15,535
4%	7,621	7,926	8,243	8,573	8,916	9,272	9,643	10,029	10,430	10,847	11,281

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Chart 10
Total net benefits of maturity exam compared to person A by discount age & rate, Roma

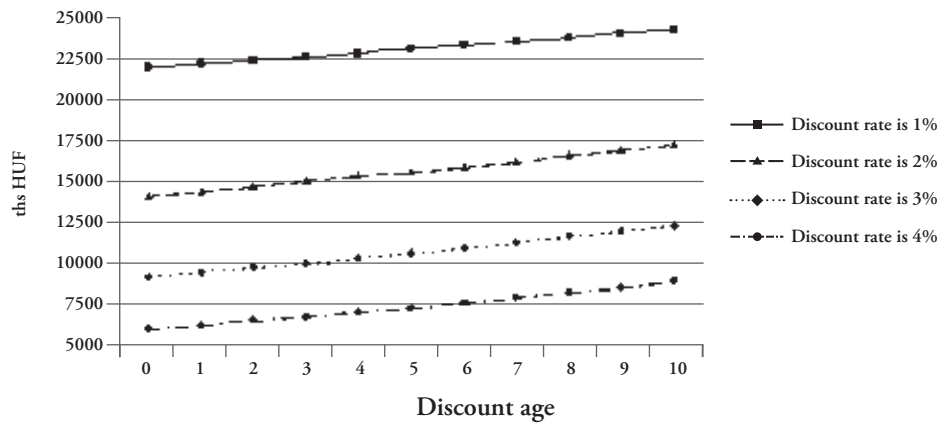


Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Total net benefits of maturity exam compared to person A by discount age & rate, Roma (ths HUF)											
Rate/Age	0	1	2	3	4	5	6	7	8	9	10
0%	41,660	41,660	41,660	41,660	41,660	41,660	41,660	41,660	41,660	41,660	41,660
1%	26,669	26,936	27,205	27,477	27,752	28,029	28,309	28,593	28,879	29,167	29,459
2%	17,232	17,577	17,929	18,287	18,653	19,026	19,406	19,795	20,190	20,594	21,006
3%	11,222	11,559	11,906	12,263	12,631	13,009	13,400	13,802	14,216	14,642	15,082
4%	7,352	7,646	7,952	8,270	8,601	8,945	9,302	9,674	10,061	10,464	10,882

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Chart 11
Total net benefits of maturity exam compared to person B by discount age & rate, Roma

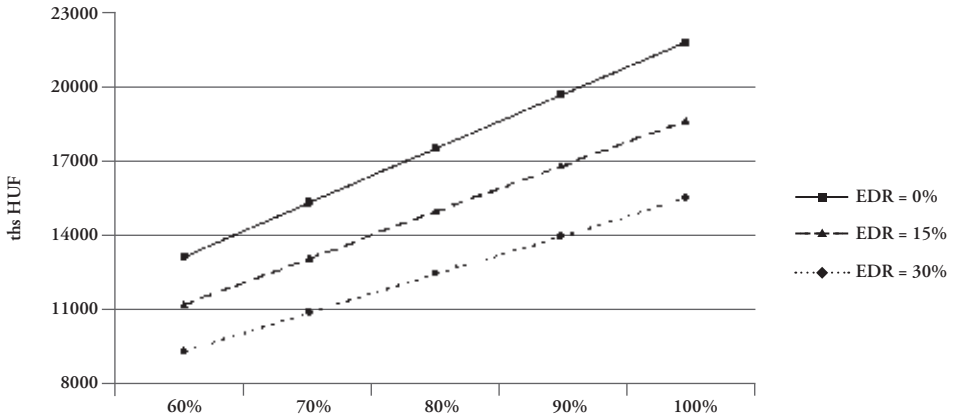


Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Total net benefits of maturity exam compared to person B by discount age & rate, Roma (ths HUF)											
Rate\Age	0	1	2	3	4	5	6	7	8	9	10
0%	34,410	34,410	34,410	34,410	34,410	34,410	34,410	34,410	34,410	34,410	34,410
1%	21,950	22,170	22,391	22,615	22,841	23,070	23,301	23,534	23,769	24,007	24,247
2%	14,148	14,431	14,720	15,014	15,314	15,621	15,933	16,252	16,577	16,908	17,246
3%	9,204	9,481	9,765	10,058	10,360	10,670	10,991	11,320	11,660	12,010	12,370
4%	6,037	6,278	6,529	6,791	7,062	7,345	7,638	7,944	8,262	8,592	8,936

Description: The net fiscal benefits are calculated based on the formula used in page 7, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the discount age & rate – are set to their benchmark value.

Chart 12
Total net benefits of maturity exam compared to person A by EDR and Roma maturity exam CR

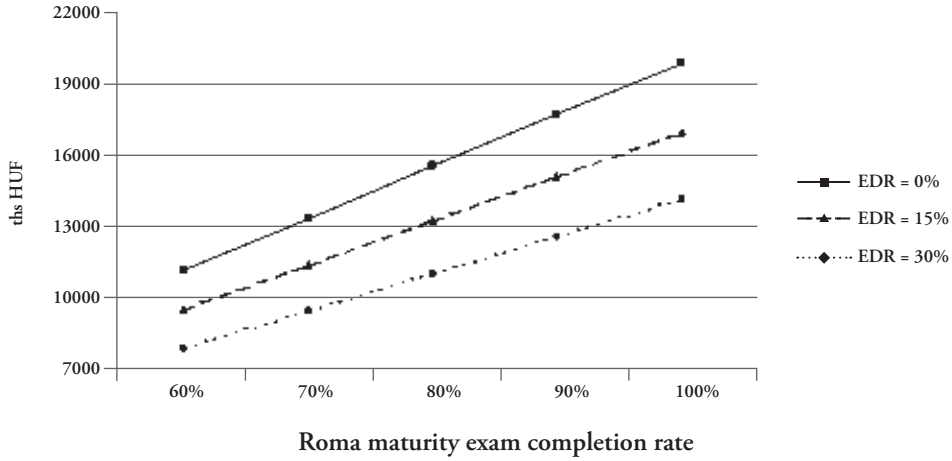


Description: The net fiscal benefits are calculated based on the formula used on page 36, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the EDR, Roma maturity exam CR and the Roma vocational CR (which is set to 0.5) – are set to their benchmark value. Note, that the chart is only for Romas.

Total net benefits of maturity exam compared to person A (ths HUF)					
EDR\Roma maturity CR	60%	70%	80%	90%	100%
0%	13,084	15,265	17,445	19,626	21,807
15%	11,192	13,057	14,922	16,788	18,653
30%	9,299	10,849	12,399	13,949	15,499

Description: The net fiscal benefits are calculated based on the formula used on page 36, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person A. The parameters of the calculation – except for the EDR, Roma maturity exam CR and the Roma vocational CR (which is set to 0.5) – are set to their benchmark value. Note, that the table is only for Romas.

Chart 13
Total net benefits of maturity exam compared to person B by EDR and Roma maturity exam CR



Description: The net fiscal benefits are calculated based on the formula used on page 36, therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except for the EDR, Roma maturity exam CR and the Roma vocational CR (which is set to 0.5) – are set to their benchmark value. Note, that the chart is only for Romas.

Total net benefits of maturity exam compared to person B (ths HUF)					
EDR\Roma maturity CR	**60%**	**70%**	**80%**	**90%**	**100%**
0%	11,142	13,323	15,504	17,684	19,865
15%	9,522	11388	13,253	15118	16,984
30%	7,903	9452	11,002	12,552	14,102

Description: The net fiscal benefits are calculated based on the formula used on page 36 , therefore it is the weighted net fiscal benefits of person C and D minus the fiscal benefits of person B. The parameters of the calculation – except- for the EDR, Roma maturity exam CR and the Roma vocational CR (which is set to 0.5) – are set to their benchmark value. Note, that the table is only for Romas.

ROMA EDUCATION FUND (REF)

The goal of the Roma Education Fund is to contribute to closing the gap in educational outcomes between Roma and non-Roma, through policies and programs to support quality education for Roma including desegregation of educational systems. The Roma Education Fund was created in the framework of the Decade of Roma Inclusion. Therefore it also shares the goals of the Decade.

For information contact:

Roma Education Fund
Hungary
Váci Str. 63
1056 Budapest
Telephone: +36-1-235-8030
Fax: +36-1-235-8031
E-mail: info@romaeducationfund.org
Website: www.romaeducationfund.org