Determinants of education attainment and development goals in Yemen [1]

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Abstract

Yemen is off track to achieve universal basic education by 2015 with a net enrolment rate that is far from being satisfactory, especially for females. Educational attainment is particularly low in the higher educational cycles. The empirical analysis of this paper suggests that there is ample scope for the Government to intervene and ensure attainment of education goals. Development of rural public infrastructure would facilitate travel to school, which would prove remarkably effective in increasing enrolment in basic and higher education. Faster progress in building more schools and hiring more teachers would strongly increase the probability of entry, especially for females. Interventions that improve children's health would also raise enrolment of students in basic education. Finally, it is shown that achievement of education goals would be faster with improved economic conditions, especially at the higher levels of education.

JEL Classification: H52 (Government Expenditures and Education), I21 (Analysis of Education), O12 (Microeconomic Analyses of Economic Development).

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1. Introduction

The Development Policy an Analysis Division of the United Nations Department of Economic and Social Affairs (DPAD/UN-DESA) is currently implementing the project "Assessing Development Strategies to Achieve the Millennium Development Goals (MDGs) in the Arab region", in close collaboration with UNDP's Regional Bureau for Arab States and the World Bank. This project relies on the application of an economy-wide model system, known as the *Maquette* for MDGs simulation (MAMS).[3] This is an innovative type of dynamic computable general equilibrium (CGE) model that has been especially designed by the World Bank to analyse the impact of public investments and interventions on MDG achievements, sectoral economic growth, employment, and income distribution, among other potential areas of analysis. The model has been extended and improved through its application in 18 countries of the Latin American and Caribbean (LAC) region, among other countries.[4]

MAMS includes a special module that, through well specified production functions, defines that provision of MDG-related services and generates MDG indicators. As such, MAMS takes account of the achievement of universal primary education (MDG 2), though this is more strictly measured by calculating the percentage of boys and girls that enrol in primary education on time and complete the cycle without failing any of its grades — instead of just using the net enrolment rate for primary education. The speed at which this goal is achieved is of fundamental importance as it affects enrolment in the subsequent education cycles and the participation in the labour market. In the longer run, it is expected to have a positive impact on factor productivity and hence on wages and growth.

The demand for primary and other levels of schooling is a function of student behaviour (enrolment, graduation, repetition, and drop-out) in MAMS. Student behaviour, in turn, depends on the following determinants: quality of education, income incentives, the under-five mortality rate, household consumption per capita, and the level of public

[3] For more details on MAMS, see: Lofgren and Diaz-Bonilla (2009).
[4] For the application of MAMS in the LAC region, see forthcoming volume in 2009 on *Public Policies for Human Development. Feasible Financing Strategies for Achieving the MDGs in Latin America and the Caribbean*, edited by Rob Vos, Enrique Ganuza, Hans Lofgren, Marco V. Sánchez and Carolina Díaz-Bonilla. The volume reflects outcomes of a joint project of UNDP, UN/DESA, and the World Bank.

infrastructure. Obviously, the number of determinants of student behaviour may be much larger than that one would be able to capture in a CGE model like MAMS.

The magnitude by which student behaviour is affected by the different determinants in MAMS is measured by a set of elasticities. Thus, the application of MAMS for modelling the economy of a particular country, entails performing econometric estimation of these elasticities using micro datasets, with a view to calibrate the model in the most plausible way for that country.

This paper describes and analyses the main empirical results obtained from an econometric estimation of enrolment behaviour for the case of Yemen's public education system. The analysis enables drawing conclusions on the implications of public policies on achieving education-related development goals. Yemen is one of the countries participating in the aforementioned project, and this paper is part of the technical backstopping that DPAD/UN-DESA is providing to the Yemeni country team that is participating in the project. Its elaboration is justified and proves quite relevant for two reasons. On the one hand, Yemen faces overwhelming challenges to achieve universal primary education (MDG 2) and reduce gender disparities in education (MDG 3) on time by 2015. According to the official United Nations site for the MDG indicators[5], Yemen's net enrolment ratio in primary education was only 75.4% in 2005, having climbed up from less than 50% in the early-1990s. In spite of this progress, gender disparities are striking at all educational levels and the fact that basic education—which is the first educational cycle in the Yemeni context—comprises 9 grades actually makes it very difficult to achieve MDG 2 by 2015. Therefore, a clear understanding of enrolment behaviour and its main determinants is required with a view to identify the extent to which Government interventions may improve the prospects to achieve MDGs 2 and 3 in Yemen. On the other hand, there is insufficient literature providing empirical evidence on the determinants of educational behaviour for Yemen. To our knowledge, only Al-Qudsi (2003) and Keiichi (2004) have made an attempt to analyse Yemeni education data. Al-Qudsi applied a probit analysis using a dataset for 1994. The second study, on the other hand, does not develop any econometric analysis, though it presents interesting

[5] For more details, see: http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=589&crid=887

descriptive statistics for data collected up until 2001. Therefore, in addition to enabling the technical assistance that DPAD/UN-DESA is providing to Yemen's country team in the project, this paper also provides a contribution by presenting a detailed empirical analysis of enrolment behaviour in the Yemeni public schooling system. In terms of number of enrolled students, the public schooling system represents 97% of the whole schooling system, according to Yemen's Household Budget Survey for 2005/2006.

Our econometric estimations cover the three cycles of the Yemeni public schooling system. The first educational cycle, or "basic education", is comprised of nine years or grades of schooling, of which the first six match the most conventional definition of primary education whereas the other three cover vocational education. Students are expected to enrol in this first cycle at the age of 6, in order to complete it when they are 14. The second educational cycle is high school and requires three years of schooling for completion before the student joins the higher cycle. The latter is university for which most faculties require 4 years of study before the student is granted a diploma.

The Household Budget Survey for 2005/2006 is the micro dataset we use to carry out the estimations. This survey was conducted by the Central Statistical Organization of the Ministry of Planning and International Cooperation of the Republic of Yemen. Education-related data in this survey are very detailed in indicating if boys and girls attended school and what educational level they have achieved. They are also fairly informative as to why boys and girls did not attend school during the survey reference period, and this kind of detail was found to be very informative to expose interesting aspects of enrolment behaviour in Yemen. A clear limitation of the survey, however, is that it does not take into account whether or not the student passed (or failed) the immediate past grade in which he/she was enrolled or whether the student is repeating the grade of current enrolment during the survey reference period.

The remainder of the paper is structured in four more sections. Section 2 starts with a review of literature on the main determinants of enrolment behaviour. Before presenting the econometric specification and analysing the empirical results in section 4, some summary statistics that help understand the profile of enrolled individuals in each of the three cycles of Yemen's public education system are analysed in section 3. Lastly,

section 5 summarizes the conclusions of the paper and presents some policy recommendations.

2. Determinants of enrolment behaviour: what do we know?

It is generally accepted that education constitutes the main means by which a country invests in human capital and that the main gain of this investment is a higher living standard for a more literate population and more development for the country. Unsurprisingly, therefore, many developing countries still experience low levels of education attainment. For these countries, in particular, it then becomes relevant to investigate what are the main determinants of enrolment behaviour, with a view to assist policy makers in designing policies that may lead to increased educational attainment. The literature that focuses on this issue is vast so it is not straightforward to come to grips with a consensual theoretical and empirical view. In this section, we review some of the most important issues addressed by the existing literature.

Low levels of education in developing countries are generally associated with high levels of child labour. Very poor families with children at schooling age cannot afford foregoing the income that these children may bring home if they participate in the labour market and use other sources of income to invest in their education. For these families, education (as well as leisure) may be considered a "luxury" good. The theoretical paper of Basu and Van (1998) shows that a ban on child labour may even reduce welfare for a poor family when poverty is the main cause of child labour. For India, Jayachandran (2002) finds that poverty is among the key factors that explain why parents cannot afford sending their children to school. Unsurprisingly, then, evidence for Egypt suggests that family wealth has a strong positive effect on education attainment (Roushdy and Namora, 2007) and that expenditure per capita as a proxy of income has a positive and significant impact on child enrolment (Dancer and Rammohan, 2007). The empirical analysis of Psacharopoulos (1997) suggests that labour force participation of individuals under the legal working age or who are supposed to be in school reduces educational attainment in Bolivia and Venezuela. On the contrary, Ravallion and Wodon (2000) question that child labour displaces schooling for the case of Bangladesh. They have found that a reduction in child labour only leads to a very small increase in school

enrolment. Another contribution that tests and rejects the "luxury axiom" is provided by Ray (2000), in the context of Pakistan. Also, Bhalotra (2007) does not find a consistent relationship between child labour and household income.

Despite these conflicting views and evidence, poverty by and large remains one of the possible explanations for low attendance in developing countries' schooling system. Moreover, other determinants to school enrolment need to be accounted for. Schultz (1999), for example, identifies three key socioeconomic determinants of household demand for schooling: public expenditure on education, education of the parents, and (again) wealth of the family.

Public expenditure on education is obviously of fundamental relevance to increase the enrolment rate ratio, especially for countries where the level of school and other public infrastructure is deficient, and this is well emphasized in the literature. Duflo (2001), for example, focuses on the case of Indonesia where a massive school construction programme was implemented by the national government during the 1970s. She noted that, as a result of the programme, the enrolment rate went to 83% in 1978 up from 69% in 1973. Furthermore, the years of education for enrolled students and wages were also observed to increase in the same period. Glewwe and Ilias (1996) noted that the economic decline of the late 1970s and early 1980s in Ghana led to a reduction in public spending in education and, as a consequence, enrolment rates were shown to be on the decline. The importance of public expenditure in education has also been highlighted by Handa (2002) who claims that, in the context of Mozambique, building more schools has a larger impact on primary school enrolment rates compared with public interventions that raise household income. Similar results are also found in Handa and Simler (2005) for the same country. School building campaigns have also been proven effective to foster school enrolment in Egypt in the 1990s, as observed by Ahlburg et al. (2004). There is little evidence indicating otherwise. Al-Samarrai (2006), for example, argues that the link between educational access (and performance) and public education expenditure is weak, but this is not because such expenditure is unnecessary but because this is usually scaled up insufficiently.

Another stream of literature focuses on the quality of education. The main discussion started in Hanushek (1986). The author used a dataset for the United States to

claim that school quality factors such as class size or level of infrastructure do not really have an impact on student behaviour and that the latter is more effectively influenced by the skills of the teacher. Hanushek's paper has been strongly criticized by subsequent contributors to this debate. Krueger (1999), for example, has offered strong evidence for the United States that students in small classes score much higher than students attending in regularly-sized classes. Angrist and Lavy (1999) similarly find that the size of the class is a crucial determinant of pupil's performance in Israel. Using a dataset for South Africa during the apartheid, Case and Deaton (1999) found a strong and significant effect of the pupil/teacher ratio on enrolment and educational achievement, especially among black children belonging to poorer families. The pupil/teacher ratio has also been found to be a significant determinant of educational achievement in Latin American countries. For example, Vos and Ponce (2004) and Hammill (2006) offer evidence of this for Ecuador and Nicaragua, respectively. More recently, Hanushek et al. (2008) have shown that the quality of schools does influence enrolment and drop out in Egypt's primary education.

Parental education is unquestionably a fundamental factor in explaining education, especially in developing countries. An educated parent most likely understands more the importance of achieving basic education and would be more willing to send the offspring to school than a parent with none or little education. Educated parents are more prepared to evaluate the investment in human capital that would increase the wage expectations for their children. On the contrary, a parent that started to work at an early age and did not study as a consequence may not see school as a crucial investment. Wahba (2006) has for example found that, on average, 10% of a sample of Egyptian parents who were child labourers would most likely send their children to work. To this some other evidence can be added. Tansel (2000) for Turkey and Al-Qudsi (2003) for the cases of Kuwait, Jordan, Gaza, and Yemen, for instance, coincide in that parental education and income are the most important determinants of education. Roushdy and Namora (2007) also provide evidence on the importance of parents' educational level for enrolment and drop out in Egypt's primary education.

The study by Tansel (2000) further points to gender as one dimension that should not be neglected when analyzing the determinants of education. He noted that the effect of income on the schooling of girls was more marked than that of boys. In addition, the

parental education effect on schooling was seen to be larger for girls. The gender issue is also raised by Ahlburg et al. (2004) in the context of Egypt's education. These authors note that the enrolment rate of rural girls aged 6-14 was only 72% of that of rural boys in 1988. Al-Samarrai and Peasgood (1998) find that household characteristics such as parental education may have a totally different impact on the education of females and males in Tanzania. Recent empirical evidence for Egypt emphasizes the gender issue, too. For example, Roushdy and Namora (2007) and Rammohan and Dancer (2008) show that boys are more likely to get more education than girls, and Hanushek el al. (2008) note that girls' drop out rate is 0.06 higher than boys' in elementary schools.

Another interesting issue discussed in the empirical literature on enrolment behaviour in developing countries is the delay in school enrolment which may be due to different reasons, some of which have already been discussed above. For example, Jacoby (1994) shows that Peruvians' entry into school may be delayed due to liquidity constraints faced by the household. In other words, Peruvian children at entry age may need to work first in order to save sufficiently and be able to pay for their own schooling expenses later on. For Glewwe and Jacoby (1994) malnutrition is seen as the main factor driving late enrolment in Ghana as this reduces the child's ability to learn and thus the likelihood of high returns to schooling. But late entry into the school system might also be correlated with the rationing of the supply of schools, according to the study of Bommier and Lambert (2000). Furthermore, children who do not live near a school may not be considered mature enough to walk to school on their own. Also, late entry into school may also be the result of a portfolio choice in the household, as suggested by De Vreyer et al. (1998). As will be shown further on in our empirical analysis, some of the determinants of enrolment behaviour discussed in this section prove to be important in the context of Yemen.

3. Public education in Yemen [6]

Basic education

The second goal of the MDG agenda pursuits the achievement of universal primary education by 2015. Yemen's progress towards this goal can be evaluated through the rate of enrolment in basic education. As indicated, basic education is the first educational cycle in the context of Yemen. The fact that this cycle is comprised of 9 grades puts a Least Developed Country (LDC) like Yemen in a difficult position to achieve MDG 2 by 2015. In fact, using the survey dataset we find that Yemen is off track of achieving the primary education goal as only 66% of individuals pertaining to the relevant age cohort (that is, from 6 to 14 years of age) attended basic education in 2005/2006. This number is surprisingly low considering that basic education is compulsory in Yemen. The completion rate is even expected to be much lower. Unfortunately, repetition rates are not available in the survey dataset, though it is possible to observe that drop-out rates are relatively large for some ages of the cohort.

The summary statistics presented in Table 1 help to establish a profile for enrolled Yemenis in basic education pertaining to the relevant age cohort. A total of 22,973 individuals aged 6 to 14 are fairly well distributed by sex, but this is not the case for those individuals who are enrolled. More than 80% of the males in the cohort (that is, 42% out of 52%) attended basic school whereas this share drops to about 60% for females. The majority of students have educated parents so their household's per-capita income is on average 1,107 Riyals higher than that of the households of individuals that did not attend basic school. For the enrolled students, the number of educated heads outnumbers that of educated spouses. Almost 80% of the cohort expected to be enrolled in basic education lived in the rural area. Not only is this an indication of the demographical concentration of Yemen by area, but it further suggests that achieving MDG 2 would fundamentally demand making relatively more progress in rural area's education. More than 85% (20%

[6] As indicated in the introduction, public education in Yemen accounted for 97% of the number of enrolled students in the Yemeni education system in 2005/2006. Private education is negligible in this country as measured by the number of enrolled students.

out of 23%) of urban boys and girls pertaining to the cohort attended school compared with only 66% for boys and girls living in the rural areas.

Table 1. Characteristics of individuals pertaining to the relevant age cohort for basic education by enrolment status

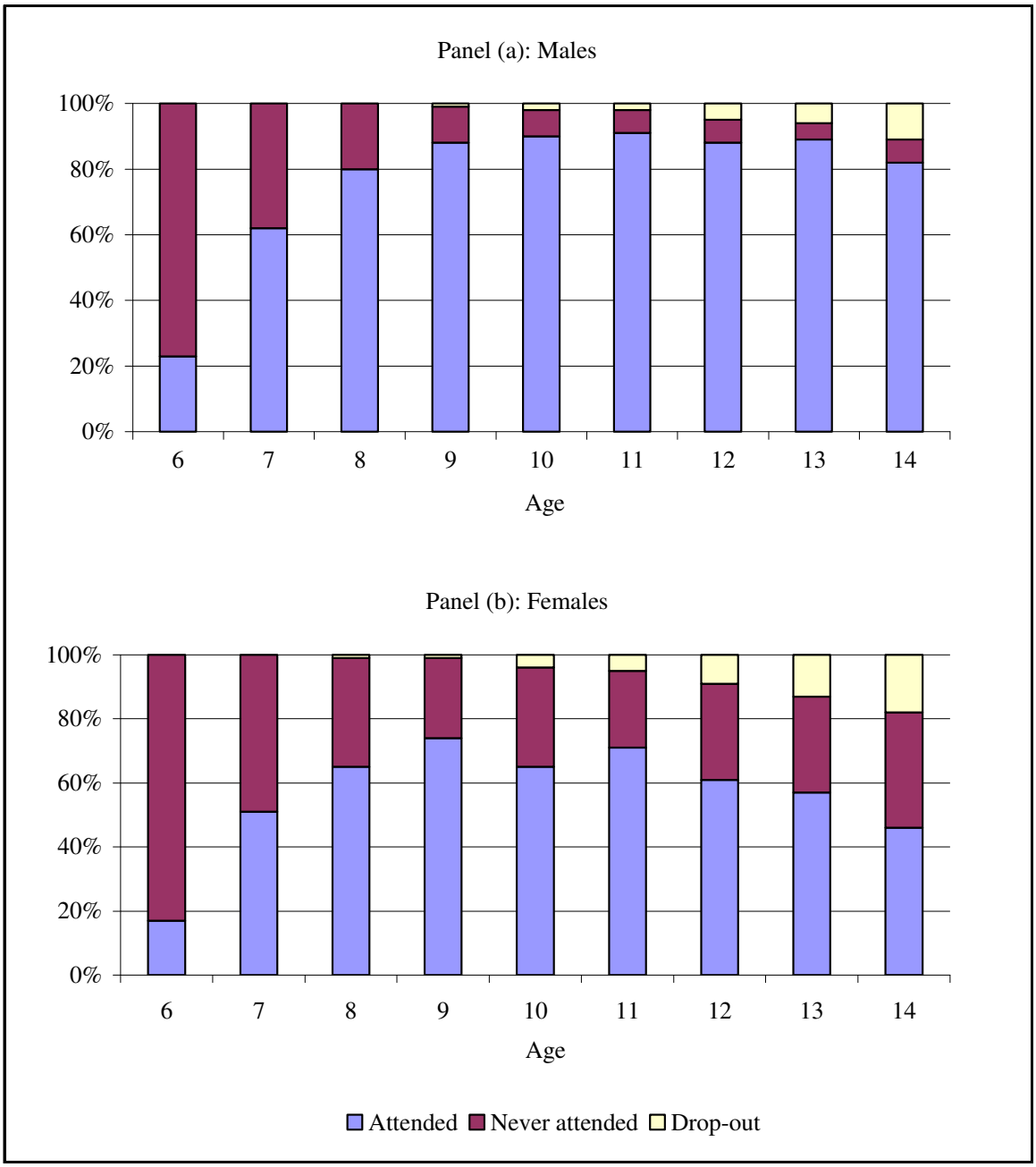
	Enrolled (a)	Not enrolled (b)	Total (a + b)
Male (% in cohort)	43	9	52
Female (% in cohort)	29	19	48
Educated head (% in cohort) [1/]	33	8	41
Educated spouse (% in cohort) [1/]	12	1	13
Rural area (% in cohort)	51	26	77
Urban area (% in cohort)	20	3	23
Average per-capita household income (Rials)	2,515	1,408	2,215

Source: Authors' estimates based on data from the Household Budget Survey for 2005/2006.
[1/] Educated household heads and spouses have attended school.

The MDG agenda also aims at eliminating gender inequalities in primary and secondary education, preferably by 2005, and for all levels of education before the end of 2015 (MDG 3, target 4). Yemen faces another challenge in this respect, as the ratio of girls to boys attending basic education is only 0.67. That is, for every two girls enrolled in basic school there are three boys enrolled. This disparity had already come clear in the evidence above that indicates that males enrolled in basic education outnumber the females. The gender gap in basic education widens as students turn 10 years old, fundamentally because girls tend to drop out proportionally more than boys and a large percentage of them never attend basic school (see Figure 1).

The drop-out rate is negligible before girls and boys turn 11 and 12, respectively, but this reaches 19% and 11% at the age of 14. Again, this evidence is indicative of the relative less success of girls relative to boys in completing basic education. Moreover, it is even more striking to observe that a larger share of boys and girls never attended basic school and, again, this is especially true for females (see Figure 1). In the cohort from 7 to 14 years of age, for example, on average 33% of the girls never attended school and this is a percentage than more than triples that of males. Individuals aged 6 were deliberately excluded from this computation because the percentage of them that never attended basic school is overwhelmingly higher than that of subsequent ages.

Figure 1. Distribution of individuals that attended, never attended or dropped out from basic education in 2005/2006 by sex and age



Source: Authors' construction based on data from the Household Budget Survey for 2005/2006.

The decision not to enrol seems to be associated with cultural factors and gender. The survey data indicates that 81% of parents of children aged 6 who did not attend school considered their sons were "too young" to enrol in the schooling system. This phenomenon is even observed at ages other than that of entry—for example, about 50%

and 20% of the children aged 7 and 8 who did not attend school, respectively, were considered as "too young" to attend school. Figure 1 above suggests that the lack of attendance at the first ages is a fundamental problem. Our empirical analysis below suggests that a lack of education and other public infrastructure, which extends the time and the distance to travel to school, may affect enrolment at the entry age, particularly for females. Similar results are presented in Bommier and Lambert (2000) who found that Tanzanian boys leaving far form school may be considered young to walk to school alone, although these authors do not offer similar findings for girls.

Unfortunately, the lack of attendance at the early ages is associated with gender since the majority of individuals not attending basic school are girls (see Table 1 and also compare the two panels of Figure 1). Presumably, parents would not want to send their daughters to school because they have to play a role at home or they would feel their daughters are safer by staying at home rather than travelling to and attending school. In either case, these parents are not seeing the education of their daughters as a real human-capital investment for the future. The high degree of poverty and the lack of economic opportunities may also discourage them to send their offspring to school—as some of our estimations below also tend to suggest. These are all gender-, cultural-, and economic-related factors of fundamental importance since, by postponing entry into basic education, particularly for females, they are actually altering the normal course of the entire education process in Yemen and putting at stake the achievement of MDGs 2 and 3. Complementarily, notable progress would need to be made in terms of reaching target 4 of MDG 3, as huge gender disparities are still observed in Yemen's basic education system.

Some of the problems underlined above aggravate because enrolled students start to fail making progress as they become older. Students from grades 1 to 2 "succeed" because the law mandates to do so since the mid-1990s, as it has already been noted by Keiichi (2004). From Table 2 one can see that the proportion of students progressing regularly is already below 90% at the age of 10, and it levels off at about 66% at the age of 15—considering here students that due to late entry did attend basic education instead of starting the first grade of high school. Males also score better than females in terms of

progress in basic school, and this thus poses more challenges to reduce gender disparities in that cycle.

Table 2. Proportion of students progressing regularly in basic school by age and sex (*Percentage*)

	Age								
	7	8	9	10	11	12	13	14	15 [1/]
Female	100	100	92	82	82	70	69	70	67
Male	100	100	95	87	83	77	77	74	66
Total	100	100	94	85	82	74	74	73	66

Source: Authors' construction based on data from the Household Budget Survey for 2005/2006.
[1/] This age group includes students that due to late entry attended basic education at the age at which they were supposed to start high school.

High school and university

Yemeni boys and girls are expected to be enrolled in high school at the ages of 15 to 17 or 18 for students that started basic education when they were 7. The survey accounts for 10,800 individuals in this age cohort of which only 21% attended high school, whereas 24% were still attending basic school and the remaining 55% did not attend school at all or dropped out. The drop-out rate was about 30% for this cohort.

Late entry is also observed for the secondary cycle. Only 53% of the individuals aged 15 or 16 attended (basic or high) school and 24% of the individuals at this age dropped out when they attended basic school—and the remaining 23% never attended school. Among individuals aged 15 or 16 that attended school, only 29% were enrolled in the first grade of high school.

Low enrolment, high drop-out rates, and late entry in high school are a reflection—if not an indirect result—of the cultural and socio-economic issues that also result in low enrolment and high drop-out rates seen for basic education. These are all problems that would also make it very challenging for Yemen to achieve goals for high school education.

Our descriptive statistics here and the econometric analysis further on for high school exclude the 24% of individuals aged 15 to 18 who attended basic school. As a consequence, the relevant cohort for high school that we use only includes 7,879 individuals. Table 3 below provides some summary statistics for this sample of which only 2,238 individuals (that is, 28%) attended high school, mostly in the rural areas.

Nearly 43% of these individuals had an educated head (that is, 12/ (19+9)) compared with only 26% for individuals that did not enrol in high school. Unsurprisingly, then, the family of a high school student on average earned about 1,126 Rials per capita more than the family of an individual not being enrolled in high school.

Gender disparities are also observed for high school, meaning essentially they are an inherent characteristic of Yemen´ school system. Focusing on Table 3, it is remarkable to note the high percentage of females not being enrolled in high school. Furthermore, for every two males enrolled in high school, there was only a female enrolled in the cycle such that the girl-to-boy ratio was only 0.48. All of this is clear evidence that high school education is even less equal than basic education in terms of enrolment by gender.

Table 3. Characteristics of individuals pertaining to the relevant age cohort for high school by enrolment status [1/]

	Enrolled (a)	Not enrolled (b)	Total (a + b)
Male (% in cohort)	19	25	44
Female (% in cohort)	9	47	56
Educated head (% in cohort) [2/]	12	19	31
Educated spouse (% in cohort) [2/]	5	4	9
Rural area (% in cohort)	16	59	75
Urban area (% in cohort)	11	14	25
Average per-capita household income (Rials)	3,085	1,959	2,272

Source: Authors' estimates based on data from the Household Budget Survey for 2005/2006.
[1/] The sample excludes individuals pertaining to the age cohort for high school that during the survey reference period attended basic school.
[2/] Educated household heads and spouses have attended school.

Interestingly, 40% of the parents of individuals aged 15 to 18 who did not attend high school claimed that the family was not interested in school. Of this share, about 85% of the non-attending individuals were girls. Only 6% of the parents of individuals that did not attend school surprisingly claimed that work was the reason for their son not to attend school. This hints at the hypothesis that, if a large number of families are not interested in the school of their youngsters—who are mostly females—and only a minority of these work and do not attend school, an overwhelming number of girls aged 15 to 18 just stay at home to help with the house keeping either of their parents´ house or of their own house in the event they got married when they were still young.

Lack of achievement and gender disparities are even more worrisome at the university level, but this is unsurprising if one considers that past failures seen in basic education and high school would most likely translate into meagre achievement at the highest school level. Students are supposed to start attending university at the age of 18 or 19 in order to obtain a diploma at the age of 22 or 23. For this age cohort there is a sample of 13,474 individuals of which only a staggeringly low 5% went to university. Little more than 12% of the individuals in this age cohort attended high school, and even 3% were still attending basic school. Of the remaining individuals, a share of 50% abandoned school and 29% never enrolled in the school system. Among those who never attended school, 88% are females.

Table 4 corroborates what has been observed for basic education and high school in the sense that a student enrolled in university most likely is a male and the family of this on average earns more than that of an individual of the same age cohort who did not go to university. The low enrolment rate, however, makes it more difficult to draw a line by geographical area. Past failure no doubt translates into a notable lack of enrolment in tertiary studies, but the wellbeing of the family weighs much more for an individual to make it all the way to university, compared with individuals that are enrolled in any of the previous cycles. Notice that the percentage of individuals living with educated parents is not lower for those who did not attend university (see Table 4), which is not observed for the two previous cycles. Even so, individuals enrolled in university tend to live in a household whose income per capita was 1,729 Rials above that of the household of a non-enrolled individual. For high school and basic education, this gap was equivalent to 1,126 and 1,107 Rials, respectively. In absolute terms, furthermore, the per-capita income of the household of an individual that attended university was fairly high (4,443 Rials) compared to that of and individual that was enrolled in high school or basic education (2,721 and 2,335, respectively). This suggests that only the higher income families can afford sending their youngsters to university in the case of Yemen—regardless of the education of the parents. This evidence as well as that that was provided for the previous cycles is further substantiated by the empirical results of the next section.

Table 4. Characteristics of individuals pertaining to the relevant age cohort for university by enrolment status [1/]

	Enrolled (a)	Not enrolled (b)	Total (a + b)
Male (% in cohort)	4	40	44
Female (% in cohort)	2	54	56
Educated head (% in cohort) [2/]	3	34	37
Educated spouse (% in cohort) [2/]	1	11	12
Rural area (% in cohort)	3	68	71
Urban area (% in cohort)	3	26	29
Average per-capita household income (Rials)	4,443	2,714	2,823

Source: Authors' estimates based on data from the Household Budget Survey for 2005/2006.
[1/] The sample excludes individuals pertaining to the age cohort for university studies that during the survey reference period attended any of the preceding cycles of education.
[2/] Educated household heads and spouses have attended school.

4. Econometric specification and empirical results

This section focuses on the determinants of enrolment behaviour as estimated for Yemen using the Household Budget Survey for 2005/2006. Our choice of the estimable specification is based on the main findings of the above-discussed literature and it also follows the specification of the MAMS model for student behaviour. The latter includes determinants of student behaviour such as the quality of education (identified by education spending per student), income incentives (the expected wage premium from education), the under-five mortality rate (a proxy for the health status of the potential student population), household consumption per capita (a proxy for the capacity to pay for education and for opportunity costs), and the level of public infrastructure (a proxy for the effective distance to school). Student behaviour is defined for entry and graduation rates in the three cycles of the educational system. The survey dataset allowed us to estimate student behaviour by cycle only for entry (or enrolling for the first time) and enrolment rates since the survey dataset lacks detail on students passing, failing or repeating. Even so, the empirical results can provide a good reference point to assign initial elasticity values to the MAMS model, as indicated further below.

Logistic regressions for enrolment behaviour in Yemen's public education system were run using the specification presented below. Enrolment behaviour accounts for the

factors that, given the relevant age cohorts for each cycle[7], do affect the probability of enrolling in each cycle for the first time (that is, attending the first grade of the cycle) and the probability of attending school for all the grades in each cycle (that is, for the cycle as a whole).[8] In other words, six different behavioural equations for enrolment in the entire public education system of Yemen were estimated. The following initial specification was used for the six cases, which includes the expected signs for the coefficients of the explanatory variables or determinants:

$$y = \alpha_1\ Area + \alpha_2\ Sex + \alpha_3\ Head\_edu + \alpha_4\ Spouse\_edu + \alpha_5\ Health + \alpha_6\ Inc\_pc + \alpha_7\ Inf + \alpha_7\ Edu\_qual + \alpha_8\ Wage\_prem$$

where,

y: dependent variable that takes a value of 1 if the individual—of the relevant age cohort for the cycle—attended school at the time when the survey was conducted, or 0 otherwise.

Area: variable denoting whether the individual lives in the urban (1) or in the rural (0) areas.

Head_edu: variable being equal to 1 if the head of the household—of which the individual studied is part—attended school, or 0 otherwise.

Spouse_edu: variable corresponding to 1 if the spouse of the head of the household—of which the individual studied is part—attended school, or 0 otherwise.

Health: variable defining if the student suffers from any disability or chronic illness for which 1 is given, or 0 otherwise—a proxy for the health status of the potential student population.

Sex: defines if the individual is a male (1) or a female (0).

Inc_pc: income per capita.[9]

[7] Some exceptions are made in respect to the "theoretical" age cohorts of each cycle as discussed further below.

[8] Estimating enrolment behaviour for individuals enrolling in high school and university for the first time is equivalent to measuring student behaviour for those that, respectively, graduated from the last grade of basic school and high school. This clarification is relevant to understand how our estimations can be used to feed up MAMS with education behaviour elasticities as estimated in this paper.

[9] This is a proxy for the household consumption per capita variable used in MAMS. We used the following linear transformation for the logarithm of the household income per capita of each individual (y_i):

Inf: accounts for the level of public infrastructure, taking the following values: 0, if the individual is not enrolled because it is too difficult to travel to school (meaning there are no roads or the distance to school is too long) and the household is not provided with electricity supply from a public network; 1, if just one of the previous sources of public infrastructure is available; and 2, if the two sources of public infrastructure are available.[10]

Edu_qual: measures the quality of education by looking at the supply of schools and teachers by governorate.[11] It basically accounts for governorate-specific average proportions for individuals claiming they do not go to school because either there is no school or there is no teacher available.[12]

Wage_prem: measures the ratio of the average wage of individuals that have achieved certain education level to the average wage of those individuals that have only attained an immediately lower education level in each governorate. In other words, this variable stands for the governorate-specific wage premium that students could expect if they graduate and continue to the

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$$\frac{y_i - y^{min}}{y^{\max} - y^{min}}$$

where, y^{min} and y^{max} are, respectively, the minimum and maximum logarithm of incomes observed in the sample. This transformation allows the logarithm of household income per capita to range between 0 and 1, which are the two extreme values that the binary dependent variable can take. This is a transformation that does not affect in any way the original household income distribution.

[10] This is a proxy for "other public infrastructure" in MAMS, which essentially accounts for all other public infrastructure not pertaining to the MDG-related sectors (that is, education, health, and water and sanitation). More often than not this includes electricity and transport (roads, bridges, airports, and so on).

[11] This is a proxy for real education services per student in MAMS

[12] This variable was set up as follows. First, the governorate-specific percentage of individuals claiming there is no school or teacher was created (that is, p_i, where subscript i represents each governorate). The percentage of individuals that are presumably "satisfied" with the availability of schools and teachers was subsequently computed as $g_i=(1-p_i)$, such that:

$$Edu\_qual_i = \frac{g_i - g^{min}}{g^{max} - g^{min}}$$

where, g^{min} and g^{max} represent the governorates with, respectively, the minimum and the maximum satisfaction values in regard to the availability of schools and teachers. Hence, the variable ranges between 0 (for the governorate with the higher percentage of people claiming there is a lack of school or teachers) and 1 (for the governorate with no people complaining about the availability of schools and teachers). In other words, *Edu_qual* essentially represents an indicator of satisfaction with respect to school infrastructure in each governorate and its meaning is fundamentally the same as that of the variable g_i to the extent that it is just a linear transformation of that variable.

next cycle.[13] The variable assumes different values depending on the cycle. For the first cycle, in particular, the comparison of average wages by governorate is between those who have completed basic education and those who have not yet completed any education cycle.[14]

Area, parental education, and sex are not determinants of education goals in MAMS. Nevertheless, these variables have been widely employed in several of the empirical studies discussed in section 2. Our specification does, however, include a relatively small number of explanatory variables compared with other empirical studies. This choice is made deliberately in order for us to focus exclusively on the key determinants to enrolment behaviour and keep our specification not too overloaded with dummy variables that may invalidate the regressions results. All estimation results are provided below for samples of individuals of the following size, for entry and attendance, respectively: 3,946 and 22,973 in basic education, 3,225 and 7,879 in high school, and 3,498 and 11,158 in university. Equations for both entry and attendance were estimated for the three cycles. The following estimation results are reported in the tables below: the value of the estimated parameter; the z-statistics in brackets; the marginal effects, which measure how much the probability of entering or attending a cycle would change as a result of a chance in the determinant; and, the implicit elasticities, which indicate the percentage change of the probability of entering or attending a cycle given a 1% change in the determinant.

Basic education

Table 5 reports the estimation results for the entry and attendance equations for basic education. Education quality and the wage premium are not statistically significant determinants of the probability of entering in the basic education cycle. The first variable is found to be statistically significant for the attendance equation, though. Interestingly,

[13] This goes pretty much along the lines of what MAMS defines as the wage premium to determine education behaviour by cycle.

[14] According to the survey dataset, individuals who have not yet completed any education cycle earned on average about 9,000 Riyals per month in 2005/2006. Those who attained basic education or completed high school on average earned 13,500 and 19,000 Riyals per month, respectively. The small proportion of individuals who have achieved higher education earned nearly 33,100 Riyals per month.

the area is significant only at the entry level and has a negative marginal effect meaning that living in the urban area by and large does not increase the probability of being enrolled in basic education. These results are not surprising considering that the majority of individuals who attend basic school live in the rural areas. At entry, boys and girls do not seem to be too concerned about the quality of basic education which is not the case for students that are already enrolled in the cycle. This is a reasonable result to the extent that at the entry age the family is more concerned about either getting the offspring enrolled in the system for the first time or just keeping her/him at home, regardless of the quality of schooling infrastructure—as measured by the availability of schools and teachers. The probability of entering and attending basic school is not driven by the wage premium either, presumably because boys and girls at the ages of 6 to 14 are still too young to realize that the more the education they received, the more the chances they will accrue higher wages in the labour market.

The public infrastructure variable is estimated to have the strongest marginal effects and elasticities in both equations. An increase of public infrastructure raises the probability of entry and attendance by, respectively, 33% and 22%. Therefore, spending in more public infrastructure would likely enable basic education reach a larger number of students enrolled in Yemen. This spending would be more cost-effective compared to investing in building more schools and hiring more teachers.

Next to public infrastructure is income per capita as the other key determinant of entry and attendance in basic education. The marginal effect of income per capita is fairly high, reaching 29% and 25% for, respectively, entry and attendance. These results reveal that wealth (as simplistically measured by income) is also important for Yemenis to be sent to basic school. Not surprisingly, then, the average income per capita of families with individuals attending basic school nearly doubles that of families with non-enrolled individuals (see Table 1).

The presence of a chronic illness or disability reduces the probability of entry and attendance by, respectively, 19% and 20%. The implicit elasticities are found to be close to 0, though. It is worth noting that only 3% of the individuals aged to be enrolled in basic education suffered from a chronic illness or disability during the survey reference period. These results suggest that any policy targeting improvements in child health will

increase the probability that more boys and girls enrol in basic education. They further help substantiate that, for the application of MAMS with Yemeni data, the synergy between reducing the under-five mortality rate (MDG 4) and educational behaviour is statistically significant.

Table 5. Estimation results for entry and attendance in basic education [1/]

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Sex	0.503 (4.04***)	0.120	0.105	1.300 (20.3***)	0.217	0.140
Area	-0.597 (-3.91***)	-0.146	-0.057	-0.046 (-0.60)		
Head_edu	0.455 (3.29***)	0.109	0.086	0.551 (7.86***)	0.089	0.052
Spouse_edu	0.454 (2.33**)	0.105	0.030	0.582 (5.13***)	0.084	0.018
Edu_ qual	0.251 (1.26)			0.987 (9.14***)	0.162	0.148
Inc_pc	1.210 (3.35***)	0.291	0.485	1.510 (8.05***)	0.247	0.312
Inf	1.386 (1.26***)	0.333	0.726	1.350 (19.03***)	0.223	0.394
Health	-0.750 (-1.77*)	-0.187	-0.008	-0.978 (-4.68***)	-0.201	-0.005
Wage_prem	-0.089 (-0.36)			-0.353 (-2.90***)		

[1/] The following notes apply to this and subsequent tables in this section: (i) z-statistics are presented in brackets; (ii) the statistical significance is at the 1%, 5%, or 10% level if, respectively, three, two, or one asterisks are added, or there is no statistical significance otherwise; (iii) the marginal effects are defined as $\Delta y/\Delta x$, where Δ denotes change, y is the value of the dependent variable, and x represents the value of the determinant (s); and, the elasticity is computed as follows: $(\Delta y/y)/(\Delta x/x)$. The marginal effect and the elasticity are not provided when the explanatory variable is not statistically significant at least at the 10% level.

Also, the more the education of the parents, the higher the probability their children will enter and attend basic education. This is consistent with the evidence that 70% and 92% of, respectively, the heads and the spouses of households of individuals that did not enrol in basic education had not completed any education cycle. On the other hand, most students in basic school tend to be parented by at least one educated

individual (see Table 1). This is in line with the literature that hints at the importance of the role of the parents in deciding on the enrolment of their offspring.

Last but not least is the gender of the individual entering or attending basic education. As noted above, females are less likely to go to school compared with males. This is confirmed by the estimated marginal effects which indicate that the probability of an individual entering or attending basic school is higher for boys by, respectively, 12% and 22%. To understand more in depth how gender plays a role in defining enrolment behaviour in Yemen, the two equations for entry and attendance were also estimated by gender. This led to interesting results that are summarized in Tables A1.1 and A1.2 in Appendix A1.

First of all, income per capita has the strongest marginal effects (36%) in the estimations for females which are above the national marginal effects. For males, on the other hand, the marginal effects of income per capita are below the national marginal effects. As a consequence, to be a member of a wealthy family will influence the decision to enter or attend basic education for females more than for males. Parental education is also on the whole more important for girls to be enrolled in basic education. In fact, the education of the spouse, which in most cases is the mother, turns particularly important for females and not important at all for males.

A girl would also less likely enrol in basic education if the quality of education is poor, which does not seem to be of great concern for boys when they make their entry decision. In fact, the quality of education was not found to affect boys' entry decision in any statistically significant way. A 1% increase in the quality of education, on the contrary, would increase the probability of entry of a girl by about 22%. This result comes hand in hand with the fact that, among those individuals who claimed they were not enrolled in basic school because there were neither schools nor teachers available, 70% of them are females. As indicated earlier, the quality of education is measured here through the availability of schools and teachers. Presumably, then, a large percentage of girls claimed there was no school available because they are not able (or allowed) to travel some relatively long distance to school—which does not seem to be a problem for boys. Parents are most likely less willing to send their daughters to school if this would take them to walk a long distance or travel a long time by public transportation. It is

unsurprisingly, then, that most of the non-enrolled individuals are females and these mostly live in the rural areas (see Table 1). The general belief that living in the urban areas increases the probability of being enrolled mostly holds for females attending basic school. Related to the above, also, is public infrastructure, the improvement of which could also help to reduce the distance and the time that a girl would have to spend in travelling to school. The probability of entry and of attendance in basic education would be expected to increase as a result of an improvement in public infrastructure for girls more than for boys. More public investment in basic education and public infrastructure appears to be a crucial requirement for the Government of Yemen to increase the enrolment rate and make basic education a universally attainable service, especially for females.

High school and university

The empirical results of the logistic regressions for entry and attendance in high school (Table 6) support the descriptive analysis presented in section 3. Household income per capita and parental education are two statistically significant determinants of the decision of an individual to enter or attend high school education. The marginal effects of these two variables are found to be higher than for basic education. Obviously, the higher the educational cycle, the more costly it becomes for a Yemeni family to keep its boy or girl at school, such that family income becomes a fairly important determinant. The marginal effects of the household income per capita variable are very high, respectively, 39% and 23% for entry and attendance. The student's decision to be enrolled is highly elastic to per-capita income changes such that high school education may to a large extent be considered nearly as a "luxury" rather than as "normal" good in Yemen. Furthermore, parental education has an important influence on enrolment in high school, meaning that parents consider the education of their boy or girl attending as an important investment for his/her future. The marginal effects of parental education exceed 9% in all cases.

All other determinants of enrolment in high school but health (at the attendance level) and the wage premium (at both the entry and attendance levels) are statistically significant at least at the 5% level. The probability of entry in high school is 12% higher if the individual is healthy. Similar evidence could not been found through the attendance

equation since the probability of attending remains the same whether or not the individual is affected by a chronical illness. Surprisingly, individuals do not seem to be concerned about wage differentials when making their entry and attendance decisions for high school.

Table 6. Estimation results for entry and attendance in high school

	Entry			Attendance		
	Parameters estimates	Marginal effects	Elasticities	Parameters estimates	Marginal effects	Elasticities
Sex	1.740 (11.96***)	0.290	0.624	1.377 (15.00***)	0.254	0.489
Area	0.755 (4.26***)	0.132	0.164	0.306 (2.80***)	0.057	0.066
Head_edu	0.534 (2.98***)	0.089	0.138	0.537 (5.04***)	0.102	0.135
Spouse_edu	0.888 (3.67***)	0.169	0.078	0.510 (3.79***)	0.102	0.041
Edu_ qual	1.320 (4.74***)	0.210	0.704	1.115 (7.07***)	0.203	0.503
Inc_pc	2.430 (5.25***)	0.387	1.950	1.260 (4.62***)	0.230	0.962
Inf	0.392 (2.16**)	0.060	0.439	0.564 (4.91***)	0.103	0.610
Health	-1.040 (-2.66***)	-0.120	-0.019	-0.357 (-1.16)		
Wage_prem	0.000 (0.01)			0.031 (0.76)		

The probability of entry and attendance for high school is, respectively, 13% and 6% higher for an individual that lives in the urban area. This is presumably because both education quality and public infrastructure tend to be higher in the cities. In fact, the latter are two variables that also turn out to be statistically significant determinants of entry and attendance in high school. Good education quality would increase the probability of entry and attendance by little more than 20% which is reasonable considering that 20% of the individuals that did not attend high school claimed there was no school or no teacher available. The marginal effects of public infrastructure are much less, but still close to

10%. Therefore, scaling up public spending to invest more in education and improve the public infrastructure network would favourably impact on enrolment in high school education in Yemen. From a cost-effectiveness point of view, however, the priority should be to spend more in building schools and hiring more teachers. This is different with respect to what we claim above for primary education as the number of learning centres and teachers in basic education is presumably larger than that in high school.

Again, the importance of the variable "sex" also deserves separate elaboration for enrolment in high school. The probability of both entering and attending high school would be more than 25% higher for boys relative to girls. As found for basic education, interesting results are also obtained when the entry and attendance equations are estimated by gender (see Tables A1.3-A1.4 in Appendix A1). For example, living in the urban areas increases substantially the probability of being enrolled for females, particularly for entry for which the marginal effect is about 16%. On the contrary, the area of residence makes no difference for the enrolment of males, as it was also the case for basic education. Males would also be indifferent if public infrastructure improves whereas, on the contrary, females' entry rate would increase in response to an improvement in public infrastructure. According to the implicit elasticities, a 1% increase in public infrastructure spending—leading presumably to shortening the time and distance that the student spends in travelling to school, particularly in the rural areas—would raise females' entry and attendance rates in high school more than proportionately. What seems to be a problem of concern for both males and females to increase their enrolment in high school is the lack of schools and teachers which can only be shrunk by scaling up public spending in education. As also found for basic education, the other evident difference by sex is the impact of income per capita. Both entry and attendance are highly elastic to changes in income per capita for all individuals, but the implicit elasticities for males are essentially half of those that have been estimated for females. As a consequence, also high school can be regarded as a "luxury" good for Yemeni females, so the wealth of the family weighs more for girls than for boys in explaining their enrolment in high school.

In an LDC like Yemen, the gender issue affecting enrolment in basic education and high school need to be urgently addressed if this country seriously intents to achieve

the agreed MDGs in the area of education. This would most likely consequentially increase the number of potential students entering in university.

Estimation results for the university level are reported in Table 7. It can be noted that improving education quality (that is, spending in building more schools and hiring more teachers) and public infrastructure would essentially have little impact on attendance and no impact whatsoever at the entry level. The marginal effects for the estimated coefficients that are statistically significant for the other determinants are by and large fairly low. In fact, with only one exception (that is, household income per capita), none of the determinants increases the probability of entering or attending university by more than 5%.

Table 7. Estimation results for entry and attendance in university

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Sex	1.260 (4.68***)	0.015	0.544	1.010 (8.39***)	0.040	0.434
Area	0.860 (1.66*)	0.011	0.230	0.768 (4.55***)	0.033	0.229
Head_edu	0.720 (2.13**)	0.009	0.226	0.443 (3.05***)	0.017	0.163
Spouse_edu	0.641 (2.07**)	0.009	0.060	0.171 (1.24)		
Edu_ qual	-0.188 (-0.36)			0.659 (2.80***)	0.024	0.366
Inc_pc	1.440 (1.23)			1.55 (3.20***)	0.057	1.500
Inf	1.040 (1.76*)	0.011	1.450	0.540 (2.68***)	0.019	0.792
Health	0.943 (1.06)			-0.353 (-1.20)		
Wage_prem	0.850 (2.22**)	0.009	1.430	0.294 (2.24**)	0.011	0.480

Income per capita is, again, the most influential determinant on the probability that an individual would enrol in university studies: with an estimated implicit elasticity of 1.5

in the attendance equation. Also for this cycle, education is unquestionably a "luxury" good for both sexes. Unlike the findings for the two preceding cycles, we find that the "small elite" that can afford to enrol in university is driven by the wage premium, especially for entry—for which the implicit elasticity is found to be 1.43. Yemenis enrolled in university most likely know that their parents can afford to send them to this highest level of education because they are wealthy (see Table 4).

5. Conclusions and policy recommendations

In spite of observed progress, it is safe to argue that Yemen is off track to achieve universal primary education by 2015 (MDG 2). More than 30% of individuals pertaining to the age cohort for basic education were not enrolled in 2005/2006, which is surprisingly low considering that entry and attendance are compulsory. Completion on time in basic education is substantially lower owing to late entry, poor performance, and high drop-out rates. Furthermore, basic education in Yemen is a 9-grade cycle, so it would take up to the year 2018 to get all boys and girls of the relevant age to complete it on time, assuming they are all enrolled by 2010. Against this backdrop, Yemen's Government should perhaps set a less ambitious target for 2015; for example, ensure that all boys and girls complete the first five grades of education on time. There is ample scope for the Government to intervene and ensure that education goals are attained.

More than 70% of students in basic school live in the rural areas where, nonetheless, enrolment per student pertaining to the relevant cohort is relatively lower than in the urban areas. Faster progress towards MDG 2 will require major policy efforts to get more children enrolled in the rural areas—and, of course, to ensure they complete the cycle on time. But achievement of MDG 2 will also require a higher enrolment of girls and the elimination of gender disparities—that is, attaining MDG 3 for basic education. For every two girls enrolled in basic school there are three boys enrolled and the gender gap widens notably as students turn 10 years old. Girls drop out relatively more than boys and the percentage of them that never attend basic school basically triples that of boys. This paper's empirical results indicate that the probability that an individual enters and attends basic school is, respectively, 12% and 22% higher for boys.

The decision not to enrol in basic school is associated with cultural factors and gender. Little more than 80% of the parents of children aged 6 who did not attend basic school in 2005/2006 considered their offspring was "too young" to enrol in the schooling system. This phenomenon is observed at ages other than that of entry and mostly affects girls. An important number of parents seem to be unwilling to send their daughters to school because they have to play a role at home or they feel their daughters would be safer by staying at home rather than travelling to and attending school.

Students also make less progress in school as they become older, especially females. Therefore, improving educational performance is also crucial to reduce gender disparities in education. Students also lose interest in education as they see little income incentive from getting educated. The expected wage premium from education was found not to have any significant influence on the student's decision to attend basic school.

Low enrolment, late entry, high drop-out rates, poor performance, and gender disparities are also present in the higher cycles of education. In high school, in particular, only 6% of the parents of individuals that did not attend school in 2005/2006 claimed that work was the reason for their boy or girl not to attend school. This is because an overwhelming number of the individuals staying at home are girls. In the case of university, past failure translates into a notable lack of enrolment, too, but the wellbeing of the family weighs much more for an individual to afford tertiary studies. As a consequence, only 5% of individuals at entry age do enrol in tertiary education.

With the majority of individuals not attending basic school living in the rural areas, development of rural public infrastructure becomes crucial to improve the prospects of achieving MDGs 2 and 3, and further experience better educational outcomes in high school. Improving the public infrastructure network to facilitate and reduce the time needed to travel to school would remarkably raise the probability of entry and attendance in basic education by, respectively, 33% and 22%—and by around 10% for entry and attendance in high school. This probability is found to be higher for females as parents would be more willing to send their daughters to school if improved public infrastructure shortens considerably the distance and the time to travel to school. Spending in public infrastructure would be more cost-effective than spending more to build more schools and hire more teachers for basic education. The latter type of

spending, nonetheless, could be particularly important for females whose probability of entry in basic school would increase by about 22% and it would also increase the probability of enrolment by a slightly lower percentage in high school where the deficit of teachers and teaching centres is more pronounced.

Scaling up public spending to improve children's health would make it more likely for boys and girls to enrol in basic education and progress to high school. We have found that a chronic illness or disability reduces the probability of entry and attendance in basic school by about 20% and by about half this percentage for attendance in high school.

In addition to spending, wealth is also important for Yemenis to be sent to basic school. This study finds that the higher the income per capita, the more the likelihood that a girl mainly, but also a boy to a lower extent, will attend basic school. As a consequence, not only will it be important for the Yemeni Government to ensure that economic growth remains high and sustained to make progress towards MDGs 2 and 3, but also that this growth trickles down to poor parents who otherwise could not send their children to school. Improved wellbeing of families and skilled workers would also help to increase the number of students that enter and stay enrolled in the higher levels of education, too, as these may be considered "luxury" goods in the Yemeni context, especially university.

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Appendix A1: Supplementary estimation results for entry and attendance by sex

Table A1.1. Estimated results for entry and attendance in basic education for females [1/]

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Area	-0.456 (-2.11**)	-0.113	-0.049	0.281 (3.06***)	0.061	0.024
Head_edu	0.411 (2.07**)	0.101	0.090	0.557 (6.19***)	0.122	0.084
Spouse_edu	0.669 (2.30**)	0.159	0.055	0.750 (5.18***)	0.149	0.038
Edu_ qual	0.908 (3.08***)	0.225	0.293	1.040 (7.03***)	0.232	0.250
Inc_pc	1.460 (2.81***)	0.364	0.667	1.610 (6.46***)	0.357	0.534
Inf	1.423 (8.19***)	0.353	0.845	1.230 (15.07***)	0.273	0.57
Health	-0.576 (-.78)			-0.732 (-2.62***)	-0.176	-0.005
Wage_prem	-0.494 (-1.37)			-0.447 (-2.82)		

[1/] The following notes apply to this and subsequent tables in this appendix: (i) z-statistics are presented in brackets; (ii) the statistical significance is at the 1%, 5%, or 10% level if, respectively, three, two, or one asterisks are added, or there is no statistical significance otherwise; (iii) the marginal effects are defined as $\Delta y/\Delta x$, where Δ denotes change, y is the value of the dependent variable, and x represents the value of the determinant (s); and the elasticity is computed as follows $(\Delta y/y)/(\Delta x/x)$. The marginal effect and the elasticity are not provided when the explanatory variable is not statistically significant at least at the 10% level.

Table A1.2. Estimated results for entry and attendance in basic education for males

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Area	-0.722 (-3.31***)	-0.171	-0.061	-0.590 (-4.50***)	-0.074	0.019
Head_edu	0.523 (2.69***)	0.118	0.085	0.554 (4.92***)	0.061	0.032
Spouse_edu	0.141 (0.54)			0.279 (1.59)		
Edu_ qual	-0.385 (-1.36)			0.911 (5.74***)	0.102	0.085
Inc_pc	0.968 (1.95*)	0.221	0.341	1.350 (4.72***)	0.152	0.174
Inf	1.400 (7.69***)	0.321	0.649	1.570 (12.01***)	0.176	0.283
Health	-0.803 (-1.80*)	-0.196	-0.008	-1.180 (-4.08***)	-0.192	-0.003
Wage_prem	-1.860 (-3.27***)			-0.250 (-1.28)		

Table A3. Estimation results for entry and attendance in high school for females

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Area	1.690 (5.63***)	0.158	0.402	0.794 (4.41***)	0.095	0.196
Head_edu	0.417 (1.54)	-	-	0.448 (2.82***)	0.049	0.135
Spouse_edu	1.164 (3.13***)	0.109	0.112	0.678 (3.50***)	0.086	0.062
Edu_ qual	1.350 (4.01***)	0.084	0.841	1.380 (6.23***)	0.144	0.730
Inc_pc	3.000 (3.41***)	0.187	2.800	1.350 (2.97***)	0.141	1.190
Inf	0.717 (2.18***)	0.044	0.928	0.829 (4.10***)	0.080	1.028
Health	-0.599 (-1.03)	-	-	0.132 (.29)	-	-
Wage_prem	-0.215 (-0.87)	-	-	-0.029 (-0.19)	-	-

Table A4. Estimation results for entry and attendance in high school for males

	Entry			Attendance		
	Parameter estimates	Marginal effects	Elasticities	Parameter estimates	Marginal effects	Elasticities
Area	-0.067 (-0.27)	-	-	-0.130 (-0.91)	-	-
Head_edu	0.711 (2.97***)	0.172	0.136	0.618 (4.35***)	0.150	0.118
Spouse_edu	0.533 (1.66*)	0.131	0.038	0.304 (1.68*)	0.074	0.020
Edu_ qual	1.290 (3.43***)	0.309	0.520	0.991 (4.64***)	0.238	0.352
Inc_pc	2.390 (4.08***)	0.570	1.453	1.200 (3.41***)	0.288	0.721
Inf	0.367 (1.40)	-	-	0.478 (3.15***)	0.114	0.412
Health	-1.490 (-3.09***)	-0.270	-0.021	-0.694 (-1.88*)	-0.151	-0.010
Wage_prem	0.055 (0.30)	-	-	0.020 (0.22)	-	-