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**EXTERNALITIES OF EDUCATION
WITHIN THE HOUSEHOLD
THE CASE OF INDONESIA**

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Abstract

This paper assesses the existence and extent of educational externalities at household level. The study has three objectives: firstly, to test the hypothesis that externalities within the household occur. Secondly, to demonstrate that their magnitude depends on the educational level of both the recipient and the source of the externality. Finally, the study attempts to identify the main trends when knowledge diffusion between different members of the household takes place. Using data from the first wave of the Indonesian Family Life Survey, conducted in 1993 the paper tests the hypothesis that knowledge diffusion from a more to a less educated individual in the household will result in a positive and significant effect on the latter's productivity. The result shows that less educated adult workers living in a household, with at least one member having a higher educational level than they possess, will have a higher hourly wage level. The above effect is estimated for different recipients and sources of the externality according to their personal education level and sex. The main findings resulting from the estimation suggest several trends: on the one hand the magnitude is higher when knowledge is diffused between individuals of the same sex. On the other hand, when educational gap between source and recipient increases, so does the effect of the externality.

CHAPTER 1

Introduction

Education is held as being intrinsically important to a country's development and so the extent to which each country invests on it is related to its measured benefits. 'Investment in education is widely recognised as a key component of a country's development strategy' (Bedi and Garg, 2000) The existing empirical research on the potential benefits of education (see Psacharopoulos, 1994; Berhman and Birdsall, 1987) focus only on the private returns of education on an individual's earnings. In most of the papers associated with this topic, the benefits of education referred to as externalities, are not taken into account. However, as proved in this study, externalities of education do exist. Since these positive external effects of education are often neglected in the estimation of returns to education, we face an underestimation of the total benefits of education and of the importance of investing in it. This has of course serious policy implication.

However, externalities of education exist, are significant and should not be neglected (Moretti, 2002; Weir and Knight, 2006). They flow from more to less educated individuals, whether it is because they live in the same city, are attending the same school or are living in the same household. (Lochner and Moretti, 2004; Basu et al., 2002;

Geothals et al., 1999) As demonstrated by a relatively small set of relevant empirical papers, education may affect national income in a way that can not be fully measured solely by changes in wages. A common finding observed in all these studies is that when more educated individuals interact with less educated ones, the latter benefits from this interaction. Therefore, the benefits of education are spread beyond the ones that have actually been educated.

Of particular interest is the case of externalities within the household. These are more likely to occur and be distributed between the different members due to the daily close interaction. Nevertheless, this kind of externalities are neglected or only partially estimated. Relevant papers show that education indeed has an external significant effect within the family. (Basu et al., 2002; Magnus, 2004; Del Rey and Del Mar Racionero, 2002). Despite the fact that the household is the basic micro unit of the society, where observed effects could be reflected in a further macro level, not enough research has been carried out considering the importance of the estimation of such effects.

1.2. Purpose of the paper

The purpose of this paper is to examine whether there are intra-household educational spillovers. The main hypothesis that is tested is that externalities of education within the household do exist and their magnitude differs for different recipients and sources of these externalities. Taking the empirical research of Basu et al. (2002), on whether literacy is shared within the household, as a starting point, this paper examines educational externalities at household level in a more detailed way. Starting from the estimation of the effect of externalities for illiterate individuals, this study goes deeper, disaggregating the effect for different types or recipients and sources of externalities.

In this paper, the source of an externality is defined as the person that has the maximum level of education in his/her household. A recipient is a less educated individual that benefits from this externality. For the estimation of these externalities, cross section data from the first wave of the Indonesian Family Life Survey conducted in 1993 has been used. The estimation is on the hour wage level of adult-working individuals from 13 different Indonesian provinces.

Proving that externalities of education within the household exist enables this paper to improve on the existing empirical research of educational externalities at household level.

Furthermore, by proving that these externalities take place and that they have a high impact, underlines the importance of taking them into account when measuring the total benefits of education. Finally, disaggregating the effects between the recipients and the sources of these externalities enables us to detect by whom they occur and whom they affect.

1.3. Limitations

The main limitations towards the accomplishment of this paper are related to the use of empirical approach. The data used are obtained from a complicated dataset that provides detailed information at both individual and household level. Two main problems have occurred: First, certain effects could not be estimated because of the high disaggregation of information. This made too few observations available for the estimation and no reliable conclusions could be drawn. Second, important variables (such as years of schooling, working hours) were missing for certain households. Although the estimation has been done using cross section, the initial purpose was the use of panel data to detect casual effects using all the different waves of IFLS. Due to lack of availability of the monthly wage in the dataset of the second wave that has limited the estimation into cross section. . Although the initial idea was the disaggregation of the effects for recipients from different sectors of employment and different types of education (whether practical, or more academic knowledge) that was not possible due to limitations during the research.

1.4. Paper structure

The paper is structured as follows: Chapter 2 summarises relevant empirical studies on the private returns of education and externalities. Chapter 3 introduces the main ideas and concepts that are used to interpret the results. In the same chapter the paper of Basu et al. (2002) is discussed and the main differences from it and this paper are presented. The above theoretical chapters structure a base for the further interpretation of the estimated results. The existence of educational externalities is also demonstrated. Chapter 4 gives information about the dataset used and with descriptive statistics explains the basic characteristics of the sample. The chapter also presents the methodology and model

specification estimated in this paper. In chapter 5 the main results are presented and analysed. In the last chapter, the main conclusions resulting from the empirical estimation are summarised. Finally in this chapter implications that those results may have are presented.

CHAPTER 2 Literature review

Education is one of the most important determinants of an individual's income level and the development of a country. Therefore, the estimation of the educational benefits has been a researched topic in micro and macro level. At macro level the human capital is a crucial factor for the development of a country. The average or initial human capital of a country is one of the determinants of growth. In micro level, education is associated with an individual's higher income level. Individuals with a higher educational level or more years of schooling tend to have higher incomes. In the present chapter the general findings of empirical papers on the private returns of education and the main conclusions of the more limited literature on the externalities of education are presented.

2.1 Returns of education in macro and micro literature

The starting point for the estimation of the returns of education is the classical Mincer wage equation developed in 1974.

$$\ln W_i = \beta_0 + \beta_1 S_i + \beta_2 X_i + \beta_3 X_i^2 + \varepsilon_i$$

According to Mincer, an individual's wage depends on that individual's years of schooling controlling for his/her years of experience. A macro-level Mincer model shows that 'the change in a country's average level of schooling should be the key determinant of income growth' (Krueger and Lindhal, 2001) for the country. In the empirical work that followed, using Mincer's equation to estimate the returns of education and adjusting it in macro or micro level, differences occur but still the main conclusion remains the same: Education matters in the determination of an individual's income level and in the majority of the cases it is the factor having the higher magnitude.

Consistent with the effect that Krueger and Lindhal (2001) refer to, are the results of many other papers. In his paper Psacharopoulos (1994) summarises different findings from a numerous papers across many countries and across many years. The magnitude and significance of these returns, as he present them, differ for gender, sector of

employment and level of education. As he concludes, the magnitude is higher for females rather than males. Also, individuals working in the more 'competitive'¹ sector of employment have higher returns and 'primary education is the number one priority for developing countries' (Psacharopoulos, 1994). Still the main idea remains the same, namely 'investment in education continues to be a very attractive investment opportunity in the world today' (Psacharopoulos, 1994).

Psacharopoulos (1994) states that, the returns of education differ for different type of individuals. This is further supported by findings of the micro literature. Examples are provided by Lang (1993) and Card (1995) that state that individuals from more disadvantaged backgrounds tend to have higher returns from an additional year of schooling rather than the ones from more advanced backgrounds.

Despite evidences that differences in the returns of education exist², not that much has been written on a further effect of education known as externalities. Most of the studies, which investigate the returns of education, do not take into consideration the existence of these externalities. What they fail to detect most of the times are the benefits that occur due to those externalities and may further increase the returns of education. In some cases, the main reason why social returns to education occur in the first place is explained by the existence of these externalities. As a result, by neglecting them, the total importance of education tends to be underestimated.

2.2 Externalities of education

An externality is defined as 'a situation in which the private cost or benefit for the one that produce it differs from the total social cost or benefit. An externality exists whenever one individual's actions affect the well-being of another individual - whether for the better or for the worse - in ways that need not be paid for according to the existing definition of property rights in the society.' (Johnson, 1994) In the studies so far, all the detected externalities of education are positive, spreading the benefits of education beyond the educated individuals.

¹ By competitive sector Psacharopoulos (1994) refers to the private sector ,while public sector is considered as less competitive and individuals occupied in that having lower returns of education

² This differences can not be explained only by estimating the effect on the wage of individuals as a result of their personal educational level only

Recently, more and more papers have included the social aspect, parallel with the private returns of education, and explained why these returns may occur. In the majority of the empirical studies that try to estimate the externalities of education, three main types of externalities are detected – there are presented below. The first is an economic/income externality for people within a close geographical proximity. The second refers to social externality of education in city or country level. The third, which is the main focus of this paper, is the income/productivity externality in household level.

2.2.1 Economic externalities in city level

That first type of externalities is detected among individuals living in the same city or area. It arises if the presence of educated individuals in a society makes lesser educated people more productive. However, although not to a great extent, there is empirical literature on the estimation of those spillover effects. Moretti (2002) and Lochner and Moretti (2004) have made sufficient attempts to detect different types of ‘neglected’ spillovers of education. In his paper Moretti (2002) finds productivity spillovers where the presence of educated workers makes other workers more productive due to their interaction. In his estimation in a firm or city level among workers, he detects significant positive spillovers for the less educated. (Moretti, 2002) To summarise their results, they conclude that the social benefits of education may well exceed the private ones and so therefore should not be neglected.

Externalities in productivity are detected also in other sectors except from urban workers such as the agricultural sector. In their research, Weir and Knight (2006) estimate the spillovers of education between farmers in rural Ethiopia. They found ‘substantial and significant externality benefits of education in increasing average production and shifting out the frontier. External benefits of schooling may be several times as high as internal benefits in this regard.’ (Weir and Knight, 2006) The main conclusions here are the same as the one of Lochner and Moretti (2004): returns due to externalities may actually exceed the private ones.

2.2.2 Externalities in city /country level

The second type of externalities refers to more social ones that are detected in city or country level. One of the aspects of those types of educational spillovers is the potential positive effects that education may have on crime reduction. In their work Lochner

(1999), Moretti (2002) and Lochner and Moretti (2004) try to estimate the educational spillovers due to criminality reduction. 'Considering crime as a negative externality with enormous social costs, if education reduces crime, then schooling will have social benefits that are not taken into account by individuals' (Lochner and Moretti, 2004).

Given the large social costs of crime even small reduction may be economically important and should be taken into account. Summarising their findings, 'education reduces significantly the probability of engagement in activities that generate negative externalities such as crime. As a consequence, those cities with a better educated population will enjoy lower crime rates' (Lochner and Moretti, 2004) As argued by Arrow (1997) 'school both engage the major part of child's day but moreover education influences values' (Arrow, 1997). Another reasoning given by Becker and Mulligan (1997) is that 'schooling may increase a persons risk aversion and patience' (Becker and Mulligan, 1997).

A further interesting finding detected by Lochner and Moretti (2004) is how much the externalities of education on crime reduction actually account for the whole benefits of education. The externality is above 14-26% of the private return suggesting that 'a significant part of the social return to competing high school comes in the form of externalities from the crime reduction' (Lochner and Moretti, 2004).

Further papers at a micro level detect spillovers between advanced and less advanced students, as a result of their interaction in school level³. In their paper, Geothals et al. (1999) refer to the results of Robertson and Simons study where, 'by using British data they found clear evidence that peer effects were positive and non linear where weak student were helped more than strong student were hurt' (Geothals et al., 1999) as a result of their classroom interaction. The study of Rangvid (2003) concludes that the positive and significant peer level effect is stronger for weak students using data from Denmark. Further studies such as the one by Dale and Krueger (1998) find that 'college students form more disadvantaged families benefit more from attending elite schools than do students form advantaged families' (Dale and Krueger, 1998). What all the above studies demonstrate is that underprivileged individuals tend to benefit more from educational externalities having as a result the increase of their welfare.

³ A fact that is referred to in the literature as peer effect

2.2.3 Externalities in household level

The third type of externalities occurs in the household level. These can be either economic or reflected in other sectors where individuals that live in the same household enjoy the benefits not only of their own education but of the education of the rest of the household members.

For the non economic externalities, some relevant studies detect a positive effect of education in the household on health and children welfare. Using data from Mozambique and focusing on maternity services and child immunization, Magnus (2004) finds that ‘utilization of health services is determined not solely by an individual's own education, but rather by a notion of effective education, which incorporates the educational attainment of other household members’.(Magnus, 2004). A further non economic aspect of intra household externalities of education that has been empirically researched is the effect of parental education on child welfare. ‘The educational attainments of the child are enhanced by having better educated parents’ as argued by Del Rey and Del Mar Racionero (2002) but ‘sharing knowledge with children is more obvious than among adults’ (Del Rey and Del Mar Racionero, 2002).

Combining the observed results in all the above mentioned cases, it is obvious that there are externalities of education and knowledge tends to be diffused further than the ones that actually obtain it, causing positive externalities for the less educated individuals. Therefore, there must be diffusion of knowledge between more and less educated individuals in the family that may cause a potential positive effect on the productivity of the latter.

One of the few empirical studies that tries to estimate the productivity spillovers of education at household level is the research of Basu et al. (2002) .Using theory and evidence form Bangladesh they estimate the external effects of education on illiterate individuals’ earnings when living in a household with at least one literate member. After presenting the reasons why literacy may or may not be shared, they conclude that literate members of the household, through interacting with the rest of the members, are transferring part of their knowledge to the illiterate members. This sharing is costless for the literate and by sharing he/she may increase the income level of the illiterate member of the household. As they all live within the same household setting, these benefits will extend beyond solely the illiterate member, through for example, the common goods that will be afforded through potential higher earnings.

Further relevant researches have been conducted in terms of literacy sharing within the household, although the large literature on literacy says very little about intra-household externalities. One such example is the research of Green and Nesman (1985) where they show that 'having a literate family member conveys many of the benefits of being literate oneself' (Green and Nesman, 1985). There is further evidence that literacy or general education has an external effect within the family. Basu and Foster (1998) argue that 'an illiterate person living in a household with at least one literate member will be better off than an illiterate person that lives in a family where all the members are illiterate as well'. Moreover, Foster, A.D. and Rosenzweig, M.R. (1995); Yang, D.T., (1997) show evidence that farm household's total income depends on the highest educational level achieved rather than the mean educational level of the household or even the level of the head of the family.

As shown above, externalities of education do exist and can be important, sometimes even bigger than the private returns. This paper aims to contribute to the limited empirical literature on income externalities of education at the household level and highlight the importance of taking into account these spillovers when the total benefits of education are to be measured. For that the intra household spillovers of education are estimated, when they flow from different sources aiming different recipients. If there are indeed significant externalities of education on different individuals, conditional the different educational level they obtain, this could have important implications that should not be neglected. Before going to the actual estimation of the effect, the following chapter presents the analytical framework used to explain the existence of externalities within the household and interpret their magnitude. Moreover the way that a household operates is presented to give a possible explanation on why there may or may not be knowledge diffusion within the household.

CHAPTER 3 Analytical framework

The present paper, takes as its starting point the estimation of the same effect as in the empirical study of Basu et al. (2002), further extending the analysis of the productivity externalities of education within the household. In their empirical estimation Basu et al. (2002) limit the possible scope of their findings by solely estimating the effect on the wage of an illiterate adult if living in a literate household rather than among illiterates. By that, they neglect the importance of accounting for the literate member's exact educational level as a further factor of the magnitude of the externalities effect. Their hypothesis that literacy is shared is explained and proven by two different ways: First using theory about household behaviour and secondly estimating the spillovers using data from Bangladesh. In their empirical analysis they estimate the externality effect on the wage of rural and urban males and females occupied in the non agricultural sector. Their main conclusion is that literacy has positive externalities on the earnings of illiterate members of the household with females appearing to be better recipients than males.

Before going to the actual contrast between the estimation methods used in this paper to the one of Basu et al (2002) it is important to briefly describe the way that the household operates. Understanding the dynamics and structure of the household, will explain why externalities of education occur in the household and why they are important.

As both the results of Basu et al (2002) and the ones obtained in this paper state, different individuals have different incentive to share and receive the spillovers of knowledge in the family. That makes it important before drawing any conclusion to understand why these differences exist and what determines the extent of knowledge diffusion between individuals living in the same household. There are some controversial reasons why an educated individual will decide to share or to exclude others from his/her knowledge that are becoming more obvious when looking closer the structure of the household.

3.1 What determines the sharing of knowledge within the household?

Individuals living in the same household interact in their daily life with each other. At first level, that interaction may be expected to lead to knowledge diffusion. Although as starting point should be taken that the knowledge will be shared between household members, still knowledge can and may be excludable. Considering knowledge as

excludable, an educated individual may have reasons not to share that knowledge with the rest of the family members. One of those reasons is that higher knowledge is related with higher income. The individual gaining the higher income level in the household is considered as the one who has more power in the decision making process. That power obtained by the educated person, may shift when sharing knowledge. If the preferences of the educated and non/less educated members of the same household differ sufficiently-taking into account the potential shift of power- the educated individual may be less willing to share his/her knowledge.

Before turning to the empirical part of this paper, it is important to specify and describe the intra-household dynamics that may determine the extent of knowledge diffusion. Doing this, it is easier to realise the power relations that exist in a family and the potential consequences when power is shifted. That gives a further idea and explains more the reason why an educated individual may decide to share or not share his/her knowledge with different members and why some individuals may be better recipients of educational externalities than others.

3.1.1 The household structure

Despite the fact that the household is the basic unit of a country, it was neglected in previous years. Literature that was arisen out of the New Household Economics movement, occurring after 1950, and other literature on household behaviour highlight the importance of looking more close at this micro unit of the economy. A household is 'an economy in microcosm, a system of exchanges, entitlements, and responsibilities allocated among members in a group whose boundaries are far from clear' (Rogers, 1990) , consisting 'a particularly dense centre in a network of exchange relationships'(Guyer, 1980).

In the micro literature there are two main approaches to analyse intra-household behaviour. These approaches stand for different views that explain the dynamics within a household and the relations between family members. The first approach is the neoclassical unified household preference model that sees the household as a 'black box' (Becker, 1981; Folbre, 1986). According to the unitary approach, the household has a single utility function which is maximized subject to the budget constraints that this household faces. The optimal for the family is the maximisation of that utility function that pools in the needs of the whole family rather than the needs of the individuals that

comprise of the family. Under this perception of the household, altruism should have been the main power driving the different individuals of the same household to share their knowledge with the rest of their family members.

This model has been heavily criticised throughout the years. The main reason is that a household consists of different individuals with different preferences and so therefore have different utility functions. Given these different preferences, a more suitable model to describe intra household behaviour may be a bargaining model, according to which 'individual members pursue their own interests, given their relative bargaining positions inside the household' (Manser and Brown, 1980; McElroy and Homey, 1981). Bargaining models are one type of collective models. What they present is that a multi person household consists of several members. According to the bargaining model theory, an individual's desires are captured by her/his preferences that are represented by a fixed utility function. If these desires differ between members, then an intra-household bargaining will take place. The optimal according to this approach is the maximisation of the personal utility function. In attempting this maximisation the individual preferences of the different members will be contrasted, given the budget constrain of the household, leading to the members trying to impose their preferences.

In a bargaining model, 'each agent negotiates towards a household compromise in the allocation of work, leisure and consumption goods. In case of there is a failure to reach an agreement, conflict may ensue' (Alexander and Baden, 2000). However, not all members possess the same power in a family, meaning that in the household, there is a hierarchy that is followed. What the different members will try to attempt, is to improve their position within this hierarchy in order to be able to take a more active part in the decision making process.

The bargaining type model has been broadly used in researches concerning the decision making process in the household. Still, inadequate attention has been paid on some further critical aspects of the intra-household dynamics, namely that of gender dynamics. What is not examined in detail is what determines that power and what kind of members are the ones capturing that power within their household. Most of the existing papers 'define bargaining power in terms of fall-back position' (Agarwal, 1997) and characterise as more powerful the member that has the highest income level. Although this paper bases on the assumption that higher income level is reflected in higher power in the family, it should be mentioned that there are other factors that can determine the relative

position of an individual alongside the rest of his/her family members. These are both intra and extra- household and can also be beyond income.

The determination of all the factors that empower different members in the household is beyond the scope of this paper. However is important for the analysis of the results the fact that the distribution of power in the household matters when an individual is to share or not share his/her knowledge. What is common in some papers is that they fail to explain the consequences of different members possessing power in the decision making process. For them whether the one having more power is men or women has no difference and is not examined separately. Studies related to gender economics (see Agarwal, 1997) demonstrate that who has the power in a household actually matters. Those differences in the desires are significant not only for the couple but they may also influence the rest of the household members.

3.2 Merging the theory with empirical estimation

As mentioned above more educated individuals⁴ may have a bigger power in the decision making process in their household. If that is the case, when the household collectively chooses its consumption, educated members can restrict less or uneducated members from their knowledge depending on their utility gains. That will depend on the extent that two opposite effects take place as mentioned in Basu et al. (2002). One is a positive income effect and the second is a potential negative effect due to shift of power.

The positive income effect for the whole household will take place if educated and less educated members have similar consumption preferences. If that is so, then educated individuals will expect that by sharing their knowledge with the rest of the household members, their incomes will increase having as a result the maximisation of the household utility function since it is similar. Borrowing the argument of Basu et al. (2002) it is expected that 'if individual *i* decides to share its knowledge with individual *j* from the household and raise *j*'s income, part of that gain will come back to *i* though the sharing process'. (Basu et al., 2002)

However, there might be a negative effect if preferences of more and less educated members of the household differ. Basing on the theory about power relations presented

⁴ It is assumed that individuals with higher educational level earn more. IV estimation of the private returns of education that (not included in this paper) showed higher returns for individuals with higher levels of education

above, although knowledge sharing should be considered as costless, still it can be excludable by the person obtaining it. If preferences differ sufficiently, then sharing of knowledge with others in the family may not be that obvious. By sharing his/her knowledge, an educated individual, may cause an increase on the income level of the recipient of that knowledge. That increase in the income level will empower the recipient of that educational externality. This empowerment may have a potentially negative effect for the source of knowledge, caused by shift of the power within the family in favour of the less educated recipient. For that and in order to keep his/her position in the family hierarchy the more educated individual may restrict the others from his/her knowledge.

‘The households are arenas of consumption, constituting of multiple actors, with varying preferences and interests and different abilities to pursue and realize those interests’ (Agarwal, 1997). Different members will have incentives to cooperate only if the gains from cooperating for each one individually are bigger than if not cooperating. At the end that will dominate in the decision making process will more likely be the one of the more powerful individual. Power relations and the potential shift of that power within the household will give incentives to the different household members to be more selective on how and with whom they share their knowledge. In this sense knowledge can be excludable.

The existence of difference in preferences and the subsequent conflict associated with this difference will appear in the relationship between different type of household members depending in their sex and educational level. For this reason, the estimation of the externalities in this paper goes beyond the one of Basu et al. (2002) testing the further hypothesis that the magnitude of the externality will differ for different sources and recipients of that externality according to their sex and their level of education.

Considering the above presented theory and in an attempt to put this theory on household structure and an empirical approach together the present paper differs in few crucial points from the estimation used by Basu et al. (2002). Although their research contributed to the relatively poor empirical literature on intrahousehold spillovers of education, it did not consider the effect on different household members obtaining different levels of education.

Starting from the estimation of the same externalities as Basu et al. (2002) using equation (1), the empirical analysis in this paper extends to some further aspects. Externalities of education are estimated in their paper as follows:

$$\log W_j = \alpha LIT_j + X_j \beta + \varepsilon_j \quad (1)$$

In their empirical approach Basu et al. (2002) are estimating (1) where the wage of an illiterate individual depends on his/her individual characteristics and on whether that individual live in a literate or illiterate household. The later effect is obtained by the coefficient of the dummy variable LIT, that takes the value 1 if the household of the individual is literate and 0 if illiterate. Their main finding is that ‘holding a range of personal attributes constant, a less educated adult earns significantly more when living in a family with at least one educated member’ (Basu et al., 2002).

The estimation in this paper differs from the one of Basu et al. (2002) in three main points. Firstly, more individual and family characteristics are included in order to increase the reliability of the results. Secondly, the estimation of the effects does not stop in the case of the illiterate individuals on whether they live in a literate or not literate household. The effect of educational externalities is further estimated for educated adults that are leaving in a household that at least one other member has a higher educational level than they do. As in the case of private returns of education, what matters more is the highest level of education obtained rather than the fact if someone is literate or not. Therefore, when estimating the externalities of education at household level, the effect should be disaggregated for different levels of education of both the recipient and the source of this externality. Finally, the per se existence and magnitude of externalities is examined for different sexes of both the recipient and the source.

The combination of the last two aspects will allow an examination of the difference in the incentives of different types of sources to share their knowledge. Furthermore this detailed estimation will allow the detection of interesting trends in the process of knowledge diffusion at household level.

CHAPTER 4 Data and Methodology

The data used to estimate the externalities of education are obtained from the Indonesian Family Life Survey 1 conducted in 1993. The IFLS1 contains information of approximately 83% of the Indonesian population. IFLS wave 1 is a very detailed household survey containing information at both individual and household level. The individuals that took part in it are over 30,000 living in 13 of the 27 provinces in Indonesia: four on Sumatra (North Sumatra, West Sumatra, South Sumatra, and Lampung), all five Javanese provinces (DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java), and four provinces covering the remaining major island groups (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi). Provinces' sample distribution is presented in table1. The total sample of IFLS1 consists of 3,780 urban (48.9%) and 3,950 rural (51.1%) households.

Table 1 Provinces' sample distribution

<i>Province</i>	<i>code</i>	<i>frequency</i>	<i>percentage</i>
<i>North Sumatra</i>	12	620	8.02
<i>West Sumatra</i>	13	360	4.66
<i>South Sumatra</i>	16	370	4.79
<i>Lampung</i>	18	300	3.88
<i>DKI Jakarta</i>	31	800	10.35
<i>West Java</i>	32	1,250	16.17
<i>Central Java</i>	33	920	11.9
<i>DI Yogyakarta</i>	34	500	6.47
<i>East java</i>	35	1,120	14.49
<i>Bali</i>	51	350	4.53
<i>West Nusa Tenggara</i>	52	420	5.43
<i>South Kalimantan</i>	63	330	4.27
<i>South Sulewasi</i>	73	390	5.05
<i>total</i>		7,730	

The estimation of the externalities in this paper is for adult workers aged between 15 and 78. The variables used to estimate the externalities of education within the household are obtained by combining information from different books of IFLS1. The wage and rest of individual characteristics of the workers as well as the detection of the maximum level of education in their household were obtained from both book3 (about adult information) and book1 (household roster and characteristics). Information about household and family

characteristics was taken from book1. Before proceeding with the description of the above data, a short description of the Indonesian society is made using information given by the IFLS data.

4.1 The Indonesian society through the lens of IFLS

Using descriptive statistics for the total sample will allow giving a short description of the aspect of education in the Indonesian society. The main focus of this analysis is to see how the educational trends according to different sexes are.

4.1.1 Education in Indonesia and the Convergence in the Gender Gap

The educational system in Indonesia is divided in 6 year of primary education⁵, 3 years of junior secondary school⁶, 3 years of senior high school and higher education that includes college and university. The data provide disaggregate information for different types of school like vocational and general. However due to insufficient number of observations the educational variable has been aggregated in the 4 broad categories presented, namely elementary, junior high, senior high and university⁷. Table 2 and 3 present the education of adult and children respectively⁸.

Table 2 Educational of adult individuals

<i>Education</i>	<i>abs. value</i>			<i>percentage</i>		
	<i>total</i>	<i>male</i>	<i>female</i>	<i>total</i>	<i>male</i>	<i>female</i>
Illiterate	3,798	1,081	2,717	17.6	10.56	23.97
Elementary	9,357	4,514	4,843	43.3	44.08	42.72
Junior high	3,128	1,691	1,437	14.5	16.51	12.68
Senior high	4,185	2,294	1,891	19.39	22.4	16.68
University	1,110	661	449	5.14	6.45	3.96

Table 2 presents the distribution among education level of the adult population in working age (age between 15 and 65 years). The majority of the individuals have

⁵ Primary education is referred to as elementary in this paper

⁶ Named junior high including both vocational and general

⁷ In the last category college and phd are included

⁸ As mentioned before, this tables contain information about all the sample included in IFLS1 and not only the one use in my estimation

obtained elementary education while 17.6% is completely illiterate⁹ only 5.14% of them attended university. Looking at gender differences, we see that female adults are less educated than male. The number of illiterate women is more than twice as much as men and only 3.96% of the female population has attended tertiary education in contrast with the 6.45% of males. Although at all different level of education there is a gap between females and males, still that gap is not significantly large for lower level of education. That gap increases for higher levels of education showing that in Indonesia female tend to receive on average less education than male.

Table 3 shows the distribution of children aged between 7 and 14 in the different educational levels. Since school enrolment starts at the age of 7, children below this age are not included.

Table 3 Education of children between 7 and 14 years

<i>Education</i>	<i>abs. value</i>			<i>percentage</i>		
	<i>total</i>	<i>male</i>	<i>female</i>	<i>total</i>	<i>male</i>	<i>female</i>
Illiterate	240	115	125	3.68	3.53	3.83
Elementary	5,136	2,566	2,570	78.79	78.78	78.79
Junior high	1,143	578	565	17.53	17.73	17.33

Source IFLS1 :BUKKAR2

Young girls appear to be less likely to receive education: the proportion of girls that have not started elementary school is slightly bigger than that of the boys. Still it is positive that if girls are compared with the females of an older age the gender gap seem to be significantly smaller meaning that importance of education for both sexes has been realised in a bigger extend. As the level of education increases the female participation is almost equal to the male. Comparing these data with those in table 2 we observe that the educational gender gap becomes smaller and smaller for younger generations.

⁹ Illiterate are characterised the individuals that have never attended any level of education

4.1.2 Who has the highest educational level in the household?

As the following chapter will show, it is important to disaggregate the effect when estimating externalities. That desegregation in this paper is made for different levels of education for both the recipient and the source. It is important to detect which member has the maximum level of education in the household, since she/he is considered in our estimations as the source of externalities, it is important to detect from whom this externalities tent to flow.

Table 4 Literate - Illiterate households

	<i>abs. value</i>	<i>percentage</i>
Illiterate households	409	5.66
Literate households	6,812	94.34

Source:IFLS1 book II

From the total sample 5.66% of the households are completely illiterate meaning that all the members of those households have never attended any level of schooling. The rest 6,812 households have at least one member with some level of education.¹⁰ Disaggregating the source of externalities over the different levels of education, we observe the following distribution (table 5).

Table 5 Maximum level of education in the household

<i>Education</i>	<i>total</i>		<i>male</i>		<i>female</i>	
	<i>abs. value</i>	<i>percentage</i>	<i>abs. value</i>	<i>percentage</i>	<i>abs. value</i>	<i>percentage</i>
Elementary	2,679	39.33	1,380	51.51	1,299	48.49
Junior high	1,430	20.99	855	59.79	575	40.21
Senior high	1,963	28.82	1,187	60.47	776	39.53
University	740	10.86	466	62.97	274	37.03

Source:IFLS1 book I

For almost all levels of education, we can see that the most educated members in their household are males. A gender gap is clearly identifiable and becomes more obvious for

¹⁰ The limited number of illiterate households that the sample contains, is going to be further restricted when controlling for other household characteristics

higher levels of education. In the case that the maximum level obtained by a member of the household is university education, in 62.97% of the households that individual is a male and only in 37% it is a female. That makes sense and is further supported by the fact demonstrated above that in average female are less educated than males especially in the case of higher level of education.

4.2 Adult workers

After shortly presenting some general, relevant for the research, variables for the whole sample in the part that follows, the characteristics of the individual for whom the effect are estimated, are presented. As mentioned above, the effect of externalities has been estimated for adult workers aged 15 – 78 years old¹¹. The sample used to estimate the externalities of education contains 3,431 adult working individuals.. In table 6 the distribution of our sample in different households is presented. As we can see, 2.42% of the adult workers live in a complete illiterate household while 3,346 live in a household that at least one of the members is literate. From the latter, the vast, majority lives in a household where the maximum educational level is senior high. Finally 16.42% of the sample lives in a household with at least one member having university education.

Table 6 Households maximum educational level

	total	
	<i>abs. value</i>	<i>percentage</i>
illiterate	83	2.42
Literate	3,346	97.58
Desegregation		
Elementary	1,041	30.36
Junior high	610	17.79
Senior high	1,132	33.01
University	563	16.42

Source: IFLS1 book1,3

¹¹ As strange at may seem, there indeed appear individuals of 78 years as working individuals

4.2.1. Wages of adult workers

The sample for which externalities have been estimated consists of only working individuals that do have a monthly salary and are currently occupied in the private or public sector of Indonesia (although the vast majority is concentrated in the private sector). There are some individuals that have a secondary, additional job. For reasons of simplicity and in order to not create a potential bias for the results, the wage of those individuals that do have a secondary job is not included in the present research. Table 7 presents the hourly wage¹² level of these individuals according to their educational level. The use of hourly wage will allow the estimation of changes in the wage level of the individuals due to changes in his/her productivity and not related with his/her motivation to work more or less hours per month.

Table 7 Hourly wages (in thousand rupiahs)

<i>Education</i>	<i>total sample</i>		<i>male</i>		<i>female</i>	
	<i>mean</i>	<i>st. deviation</i>	<i>mean</i>	<i>st. deviation</i>	<i>mean</i>	<i>st. deviation</i>
Total	1.038	1.569	1.141	1.713	0.799	1.133
Illiterate	0.298	0.333	0.370	0.436	0.243	0.205
Elementary	0.566	0.763	0.656	0.851	0.326	0.359
Junior high	0.87	0.825	0.911	0.860	0.663	0.586
Senior high	1.481	1.473	1.486	1.521	1.470	1.350
University	2.849	3.155	3.126	3.571	2.209	1.716

As table 7 shows, the average hourly wage level of an Indonesian worker is 1.038 thousand Indonesian rupiahs. The wage increases for higher levels of education. Moreover on average male workers have a higher hour wage level than female. Although in the case of senior high education, there seems to be a convergence in the wage gap of the two sexes, still in all other cases there is a quite significant difference.

¹² The way that the hourly wage was obtained is as follows: the monthly wage of each individual was divided by the hours that that individual has worked per month

4.2.2.. Further individual and household characteristics

Further individual and household characteristics that are included and controlled for in the estimation of the externalities of education are shortly presented in table 8. In order to avoid having numerous dummies that may cause confusion in the estimation of the spillovers, some of the variables have been grouped in bigger categories (see footnote). The vast majority of the sample is Muslim, since Indonesia is the country with the highest number of Muslims in the world. The rest of the individuals are distributed mostly among Christianity and Hinduism while the sample contains only a small proportion of Buddhists and people of other religions. The fact that the proportion of males and females are almost the same in the case of the religion should not be strange as due to the fact that individuals living in the same household tend to have the same religion. The average Indonesian household consists of 4 individuals, usually the couple and 2 children, with some of them reaching a household size of 20 people.

A further variable that has been included in the estimation is the dependency ratio: this is the ratio of the individuals that are not in working¹³ age to the total size of the household. Both the dependency ratio and the size of the household variables are included in the estimation model in order to control for further factors that can influence the wage level of a person.

The importance of the inclusion of the dependency ratio can be explained with the following reasons. The more people depend on a working individual, the more pressure there will be on him/her to find a job and generate incomes. Those persons having several individuals depending on them have bigger pressure to work immediately and less time to search for the most remunerative job. Furthermore in some cases having many children, means having a bigger dependency ratio: this can represent a constraint for both finding a good job and for making career. This is due to the fact that employers prefer people that seem more dedicated to higher positions and those people are either single ones or employees that are more flexible. Having a sufficient amount of people depending on an individual, makes that person 'less' flexible.

¹³ Non working individuals are considered the one younger than 15 and older than 60 without considering individuals above 60 that are still working

Although this ratio is not always significant, when significant it is negative and reflects the above mentioned facts. Controlling for those further characteristics, both their magnitude and the significance should not be interpreted directly due to the fact that side job salaries and incomes from the informal sector that a person with a high dependence ration maybe involved are not included.

For my analysis, a useful further variable is the one that states the relation of the individual to the head of the household. Due to the fact that in 95% of the cases the head is a male in the estimation the female heads have been excluded.

Table 7 Individual and household characteristics

	abs. value			percentage		
	<i>total</i>	<i>male</i>	<i>female</i>	<i>total</i>	<i>male</i>	<i>female</i>
Marital status						
Married	3,037	2,250	787	88.52	93.75	76.33
Other ¹⁴	394	150	244	11.48	6.25	23.67
Religion						
Islam	3,033	2,121	912	88.76	88.74	88.80
Christian ¹⁵	215	144	71	6.29	6.03	6.91
Hinduism	134	95	39	3.92	3.97	3.80
Other ¹⁶	35	30	5	1.02	1.26	0.49
Gender						
Male	2,400			30.05		
Female	1,031			69.95		
Hsh location						
Urban	2,168	1,562	606	63.19	65.08	58.78
Rural	1,263	838	425	36.81	34.92	41.22
Position in the hsh						
Head ¹⁷	2,464			71.82		
Spouse	733			21.36		

Source IFLS1.bukkar3

Controlling for the above individuals and household characteristics is quite essential in the case of Indonesia. 'Indonesia is extremely diverse ethnically, which means there are a variety of traditions with respect to the organization of family and community life.'(Frankenberg E, Thomas D. 1998). At household level, the way it operates differ significantly depending on the place it is located. One example is the case of the Minangkabau family (West Sumatra) who is matrilineal. It is logical that the ways power

¹⁴ Other includes: unmarried, divorced, widow/er , separated and other

¹⁵ Christian includes : 1,796 protestant(5.43%) and 718 catholic(2.17%)

¹⁶ Other includes: 437 Buddhists (1.32%) and 135 individuals that stated another religion(0.41%)

¹⁷ for simplicity reasons only the male heads are included since in 95% of the cases the head is a male

is distributed and consumption decisions are taken in the household are going to be considerably different than in the case of the Batak of North Sumatra who are patrilineal. For the above reasons, when drawing any kind of conclusions, it is essential to acknowledge Indonesia's diverse environment. For that reason, including the above variables in the estimation of the externalities of education, helps controlling for some of the above differences between households located in different provinces.

4.3 .Methodology and Econometric Specification

The estimation method used for all the below mentioned log linear models is Ordinary Least Squares (OLS). Although as mentioned in the introductory part the optimal would have been the use of panel data, due to data limitations in this paper the estimation is done using cross section. In all the cases the effect is estimated for adult working individuals whose characteristics are explained above.

4.3.1. Externalities of education on illiterate individuals

The first effect that is estimated in the present paper is the effect of education on the hourly wage of an illiterate individual when living in a household with at least one literate member. It is estimated with the following model:

$$\ln wage_{ij} = \beta_1 + \beta_2 Age_{ij} + \beta_3 Age_{ij}^2 + \beta_4 X_{ij} + \beta_5 HC_j + \beta_6 Lit_j + \varphi_{ij} \quad (2a)$$

In equation (2a) the dependent variable is the natural logarithm of the hourly wage of an illiterate person. It is treated as a function of that individual's age and age square which are used as proxies for experience. The fact that an individual is living in a literate or illiterate household is represented by the variable LIT: it is a dummy taking the value 1 if the household in which the individual is living has at least one literate member and 0 if all the members of the same household are illiterate. Variable X and HC control for individual and household characteristics respectively. Individual characteristics X include the sex of the individual, 4 dummies for the religion, a dummy for the marital status (0 married, 1 if other). HC includes characteristics for the whole household, namely 13 dummies for the province where household is located, a dummy that takes the value 1 if

the household is in a urban area and 0 if the area is rural, the size of the household and the dependency ratio.

As mentioned in chapter 3, one important difference in the estimation of the educational spillovers in the present paper from the one of Basu et al. (2002), is that the effect on less educated individuals are estimated in a first aggregate and then disaggregated level.

Furthermore, the estimation of the externalities on illiterate individuals goes deeper: we disaggregate the effect for different recipients and sources of the externality. Both recipients and sources are disaggregated for sex and level of education they obtain. As shown in the following chapter, estimating the effect only on whether the households is literate or illiterate, may hide important information that can only be obtained when the source of the externalities are individuals that have different educational levels. For that reason the further step is estimation of equation (2b)

$$\ln wage_y = \beta_1 + \beta_2 Age_y + \beta_3 Age_y^2 + \beta_4 X_y + \beta_5 HC_j + \beta_6 Emaxel_j + \beta_7 Emaxjr_j + \beta_8 Emaxsr_j + \beta_9 Emaxuni_j + \varphi_y \quad (2b)$$

In equation 2b the variables are as described above, with the difference that instead of aggregating the effect on whether an illiterate person *i* lives in a literate or illiterate household *j*, the effect is estimated for the four different cases reflected in the four dummies. Firstly when illiterate individual *i* lives in a household with at least one person having elementary, secondly junior high, thirdly senior high and finally university education. The dummy variables *Emaxel*, *Emaxjr*, *Emaxsr* and *Emaxuni* are dummies that reflect that different maximum levels of education achieved in a household. The estimated effect is the change in the hourly wage of the illiterate adult worker if he is living in one of those household if compared with an illiterate that is living in a illiterate household. Using this specification it is possible to estimate the effect of externalities flowing from different levels of education. This allows estimation of the source of educational externalities and identification of the level of education that tends to have a higher effect.

4.3.2. Externalities of education on less educated individuals

As mentioned above, in this paper, in contrast to the previous empirical research on the externalities of education, including the work of Basu et al. (2002), a further innovation is the estimation of the externalities of education on less educated individuals and not only illiterates. To estimate this effect, model (3a) and (3b), specified below, differ in two ways from model (2). The ‘target’ group in (3a, 3b) are no longer the illiterate individuals but the ones that have an education level lower than the highest achieved in the household in which they live. Namely (3a) estimates the effect for individuals having elementary education and living in a household with maximum level higher than elementary.

$$\ln wage_{ij} = \delta_1 + \delta_2 Age_{ij} + \delta_3 Age_{ij}^2 + \delta_4 X_{ij} + \delta_5 HC_j + \delta_6 Emax jr_j + \delta_7 Emax sr_j + \delta_8 Emax uni_j + \vartheta_{ij} \quad (3a)$$

Again here 3 dummies for maximum level of education are included: the effect is estimated on the log hour wage of an adult worker that has elementary education when living in a household with firstly junior high, secondly senior high or finally university education. The estimated effect is the change in that individual’s hourly wage in comparison with an individual having elementary education but living in a household where the max level of education is elementary. Here the maximum level is presented by 3 dummies (Emaxjr , Emaxsr, Emaxuni) that take the value 0 and 1 and state whether the maximum level of education in the household is junior high, senior high or college/university.

In the same sense, equation 3b is estimated and measures the effect for individuals that have junior high education when living in a household with a higher level of education.

$$\ln wage_{ij} = \delta_1 + \delta_2 Age_{ij} + \delta_3 Age_{ij}^2 + \delta_4 X_{ij} + \delta_5 HC_j + \delta_6 Emax sr_j + \delta_7 Emax uni_j + \vartheta_{ij} \quad (3b)$$

Here the dummy variables Emaxsr for senior high education and Emaxuni for university education represent the level of higher education achieved in the household in which the individual in question is living.

In both the cases of estimation of (2) and (3) the effect is estimated for the whole sample and then male and female. In the case of 3 the effect is further estimated for that head of the household and the spouse. Moreover for equations 3a, 3b externalities are further estimated for different sources of that externality. Estimation of these specifications will provide answers to questions such as who is the better recipient of educational externalities within the household conditional on the source of externalities and who is the better source conditional on the level of education that he/she obtains

CHAPTER 5 The Externalities of Education

This chapter presents the main findings of the empirical analysis and is structured as follows. First, the externalities of education on changes in the hourly wage of adult workers are estimated. Specifically, the paper distinguishes between illiterate and literate recipients, but finds that it is more useful to decompose by level of education. Then, it is checked whether the externalities from the source are different for individuals having elementary education and for individuals with junior high education. In all cases, the effect is estimated for different recipients and for different sources of the externality.

5.1. Illiterate individuals

Here, the externalities of education are estimated for illiterate recipients living in an illiterate or literate household, to see whether there are differences in externalities transferred. That is, equation 2a is estimated. Then, the paper disaggregates for different levels of education, and estimates equation 2b. It is verified whether the externalities of education differ between male, female recipients and whether the recipient is the head of the household or the spouse.

5.1.1. Illiterate vs. Literate households

The results¹⁸ suggest that there is no evidence of externalities for illiterates living in illiterate and literate households. The coefficient of the dummy variable LIT_i in equation 2a is positive but not statistically significant for the total sample of illiterates. This does not change when estimating externalities for the sexes. If the paper would have concluded at this point, it would have said that there are no externalities for illiterate adults if they live in a household with a source of education. However, the paper will argue that disaggregating for educational levels in equation 2b sheds a completely different light on the question of externalities of education within the household.

¹⁸ The results can be found in the Appendices

5.1.2. Disaggregate into levels of education

The results differ considerably once the maximum educational achievement in the household is accounted for. The paper controls for four levels of education: elementary school, junior high, senior high and university. Now it is checked whether there are externalities of education to the illiterate recipient from the educated source, and whether the level of education has any explanatory power. In Table 9, the results are shown. Note that the sample includes only households where the lowest level of education is at least elementary school. That is, households without any education are excluded. Also, the differentiation of sex is made.

Table 9 Externalities of education on illiterates

Maximum education level	(1)	(2)	(3)
	Total	Male	Female
<i>Elementary</i>	0.07284 [0.18981]	0.14667 [0.26369]	-0.00051 [0.26810]
<i>Junior high</i>	0.66594** [0.25160]	0.76087* [0.34827]	0.65555+ [0.35657]
<i>Senior high</i>	0.62260* [0.26647]	0.02833 [0.39496]	0.92958* [0.36642]
<i>University</i>	0.70864+ [0.42340]	1.59459 [1.01445]	0.70053 [0.51529]
Observations	554	238	316

Standard errors in brackets.
+ significant at 10%, * significant 5%, ** significant at 1%

A first interesting observation is that now that the levels of education enter equation 2b, there seem to be positive and significant externalities of education from the educated source to the illiterate recipient. For the whole sample, there are significant and positive externalities. Second, the externalities seem to increase with higher maximum levels of education of the source. The externalities do not, however, increase from junior high to senior high schooling of the source, but in general the higher the level of education of the source, the higher the externalities for the recipient.

The externality ranges from a 7% increase in hourly wage if the source has elementary education to a spectacular 70% in wage increase if the source is a university graduate. This latter result is significant at the 10% level. Note that the junior and senior high effects are significant at the 1% and 5% levels, respectively. The externality is very

large indeed, but it is not surprising that the fact that an illiterate interacts on a daily basis with a university graduate will have an enormous impact on that person's income. Much more so than for an individual living in a household where elementary school is the highest education.

Generally the externalities of education are significantly positive in the case that the source has at least a junior high level of education. There is no significant evidence that there are externalities if the source has only elementary, but the coefficient has the right sign. One possible explanation that this result is not significant could be that people with elementary education have relatively little knowledge to offer. Also, the theory on power relations states might help explain that individuals with elementary education are reluctant to share their knowledge with illiterates because the knowledge difference is not high enough to assure that their position in the household is unaffected if they choose to share. Once the gap in education is larger, and the source takes the consumption decisions this threat of sharing knowledge with the illiterate is diminished and there may be more incentives to share knowledge.

Males appear to be recipients of the externalities only in the case that the source has a junior high level of education. Female illiterate workers are recipients when the source has junior high or senior high education. For an illiterate female that lives in a household where the source is a senior high graduate, the hourly wage rate may increase by approximately 92%. There is some evidence that illiterate women are better recipients of the externality.

It would have been interesting to further disaggregate the effect and estimate the externalities for different positions within the household. Unfortunately, the relatively small number of observations per sample this disaggregation implies does not allow us to investigate this.

5.2. Elementary education

The above demonstrates that it is essential to decompose the effect on the recipient by level of education. But so far, only illiterate recipients have been analysed. Now, the magnitude and effect of externalities is estimated only for recipients with elementary education.

The results of equation 3a are presented in Table 10. The coefficients represent percentage increases in the hourly wage level when living in a household with a source

that has a higher education than elementary school. The externality is estimated in four different ways. First, it is investigated how large the externality is from the source with different levels of education, but without defining what the sex of the source is or what position in the household he or she takes. Second, the source of the externality is confined to adults (aged 15 years or over) with an education above elementary school. Third, when the source is a woman, and finally, when the source is a man. For that reason the number of observations differ per case because as source of externality was selected the one that has the highest maximum educational level in the household. From the number of observations we can conclude that there are 623 individuals are living in a household where the one that actually has the highest level of education is a female.

As column (1) shows, there are significant positive externalities for recipient with elementary education if living in a household with a source that has junior high, senior high or university level education. An interesting finding is that the higher the maximum level of education of the source, the bigger the magnitude of the externality. In the case that the source of the externality obtains university education the externality on the recipient implies a 78% increase in the hourly wage. When the source is an adult, the externalities are only a little bit smaller, but this could be due to the smaller sample. But they are still significant and positive.

Table 10 Externalities for recipients with elementary education

Externalities	Education	(1) total	(2) male	(3) female	(4) head	(5) spouse
The source can be any member of the household	<i>Junior high</i>	0.20267** [0.05860]	0.27804** [0.06694]	0.00308 [0.12274]	0.26216** [0.06839]	-0.00043 [0.13894]
	<i>Senior high</i>	0.42141** [0.06995]	0.39779** [0.07961]	0.50193** [0.14909]	0.44248** [0.08218]	0.45842** [0.16458]
	<i>University</i>	0.78351** [0.15376]	0.77657** [0.16917]	0.79160* [0.37755]	0.85603** [0.17144]	0.67004 [0.47358]
	observations	1355	986	369	991	280
DECOMPOSITION:						
i. The source is an adult						
	<i>Junior high</i>	0.17834** [0.06542]	0.24698** [0.07556]	0.04172 [0.13375]	0.24164** [0.07677]	0.07116 [0.15152]
	<i>Senior high</i>	0.39525** [0.06995]	0.36061** [0.07980]	0.51719** [0.14832]	0.40960** [0.08229]	0.48516** [0.16314]
	<i>University</i>	0.75717** [0.15385]	0.74117** [0.16972]	0.80281* [0.37713]	0.82556** [0.17175]	0.68954 [0.47340]
	observations	1355	986	369	991	280
ii. The source is female						
	<i>Junior high</i>	0.28893** [0.08589]	0.29500** [0.08924]	0.264 [0.21900]	0.28974** [0.09439]	0.44822 [0.30007]
	<i>Senior high</i>	0.51129** [0.10608]	0.40370** [0.10707]	0.84942** [0.31675]	0.48104** [0.11455]	0.84803* [0.36877]
	<i>University</i>	0.65656** [0.23408]	0.3805 [0.24944]	1.16785* [0.56378]	0.64448* [0.25140]	1.68705+ [0.97646]
	observations	623	439	184	464	118
iii. The source is male						
	<i>Junior high</i>	0.18996* [0.08230]	0.29710** [0.09943]	-0.09676 [0.15793]	0.29026** [0.10294]	-0.18231 [0.16959]
	<i>Senior high</i>	0.37071** [0.09512]	0.35329** [0.11672]	0.33418+ [0.17614]	0.38023** [0.12069]	0.22329 [0.19321]
	<i>University</i>	0.80199** [0.20476]	0.89544** [0.22786]	0.20099 [0.55202]	0.93776** [0.23805]	-0.09741 [0.58781]
	Observations	721	528	193	508	161

Standard errors in brackets

+ significant at 10%; * significant 5%; ** significant at 1%

5.2.1. Men vs. women

Controlling for sex, it can be seen that in general there are positive externalities for both men and women. However, there are some interesting differences, presented in columns (2) and (3).

Men are recipients of knowledge from recipients with all levels of education. As was the case before, the magnitude becomes bigger when the gap in education between the recipient and the source is bigger. Moreover, men appear to be recipients of externalities from all different sources, male, female and adults. The highest externality is from a male source with university education to a male recipient, and increases the latter's hourly wage by 89%

Females are recipients of externalities only when the source has an educational level equal to or higher than senior high. The highest externality for the female workers with elementary education is from a female source with university education which increases the recipient's wage by 116%. Although in general, men are more often recipients of externalities, the magnitude of the externality is bigger for women once it is significant.

When the source is a man, the externalities of education only reach other men in the household, but the results suggest that there are no effects on women in the household. This differs for a female source. Women do share their knowledge with the other sex, although the effects are much larger between women.

5.2.2. Head of the household vs. spouse

The effects for the head of the household as recipient of the externality are very similar to the results for men in general. This makes sense, because the vast majority of household heads is male. The coefficients display similar significance, but are larger in the case the recipient is the household head.

Heads of household benefit from other household member's education for all levels of education, irrespective of what position the source takes up in the household. The head seems to capture most of the externalities. If a male source in the household is a university graduate, this increases the hourly wage of the head of household by approximately 93%.

For the spouse as recipient, there are significant and positive externalities only in the case that the source has a senior high education. Although spouses appear less often as

recipients of the externalities, the magnitude is higher for them as compared to the average for females in general. Note that there does not seem to be any externality for the spouse if the source is a male. The spouse captures the knowledge from other women better, especially if that source is a university graduate.

5.3. Junior high

The next step is the estimation of (3b) which estimates the externalities of education on recipients that have a junior high school degree. (Table 11) Note that in this estimation, the whole sample will be composed by adults because senior high school graduates are over 14 years of age.

Table 11 Externalities for recipients with junior high education

Externalities	Education	(1) total	(2) male	(3) female	(4) head	(5) spouse
The source can be any member of the household	<i>Senior high</i>	0.17554* [0.08554]	0.15167 [0.09422]	0.31131 [0.21261]	0.14772 [0.09779]	0.12868 [0.21869]
	<i>University</i>	0.42170* [0.17367]	0.47096* [0.19068]	0.18128 [0.47878]	0.48141* [0.19851]	0.99023+ [0.56037]
observations		432	361	71	346	51
DECOMPOSITION:						
i. The source is female						
	<i>Senior high</i>	0.08626 [0.12086]	0.01704 [0.12827]	1.06671+ [0.54712]	0.07943 [0.13387]	-2.70599 [1.47681]
	<i>University</i>	0.29105 [0.25040]	0.20912 [0.25679]	1.23833 [0.91011]	0.18532 [0.26990]	0.51949 [0.93077]
observations		173	132	41	133	27
ii. The source is male						
	<i>Senior high</i>	0.20535 [0.13343]	0.30539* [0.14870]	-0.23724 [0.24433]	0.28923+ [0.15539]	-0.77014* [0.28956]
	<i>University</i>	0.62237* [0.26399]	0.71369* [0.29020]	1.08033 [0.76758]	0.78590* [0.30545]	-0.21381 [0.79661]
observations		268	244	24	226	21

Standard errors in brackets.

+ significant at 10%. * significant 5%. ** significant at 1%

Again, there are significant positive externalities for the recipient adult workers. As in almost all other cases, the higher the educational level of the source, the bigger the effect on the recipient. A recipient worker with junior high education that lives in a household with a source that obtained a university degree, will on average have a 42% higher income as compared to the a worker with the same of education living in a household where the source's education is junior high.

5.3.1. Gender revisited

Male workers with junior high education appear to be better recipients of the externality than women with the same education. The actual impact on their incomes is approximately 47% in the hour wage level if the source has a university degree. As in the case of elementary education, the highest externality for male recipients comes from a male source.

Female workers with junior high education do not appear to receive any benefits from externalities except in the case that the source is another female of the same household with a senior high degree. This externality is exceptionally large, as it increases the female worker's income by 106% on average, with significance at the 1% level. It is of note that there appear to be no externalities between individuals of different sex.

5.3.2. The head and the spouse

Again, the head of household's benefits follow the trends of those for males in general, but have larger coefficients. When there is a male source with university level education in the household, the head's hourly wage will increase by 78% on average.

Although there do not seem to be any effects of externalities for women as a whole, this is not true for the spouse. When the spouse is the recipient, and the source is another female, there is a large positive and significant effect on the wage level of the spouse. But this is only between women, because for the other cases there do not seem to be any externalities of education for the spouse

5.4. What does it all mean?

Below the main findings are generalised. Note that in general, the externalities of education on other members of the household were very high, sometimes implying a 100% or more increase in the hourly wage level of the less educated recipient. The magnitude of the effect should not surprise us too much, since Basu et al. (2002) find that the externalities of a literate source in households with illiterate recipients increases the wage of the latter by 60%. In light of this finding, the effects of a university degree can be expected to exceed the 60% impact on the wage level considerably.

5.4.1. Who are the better recipients?

Men in general are recipients more often than women meaning that estimated coefficient of externalities is more often statistically significant in the case of male recipients. This is true for almost all the levels of education the source may have obtained, and especially apparent when the recipient has only elementary education. However, it is very interesting to see that when women are impacted by the education of a household member¹⁹, the magnitude of the effect is often larger than for men. This seems to point us at the following: Women are more constrained in their access to the knowledge of household members, but once they get access to it, they benefit to a much larger extent. In that sense, women make better recipients of educational externalities than men. This could be seen as being a result of women's subordination within society as well as within the household: i.e. because they are less likely to receive the same levels of education as males, in the case that they do become recipients of the knowledge process, it becomes something sacred and so they try to benefit from it.

5.4.2. Educational gap

The higher the educational level of the source, the higher the impact on the recipient. What's more, as the gap between the recipient and the source increases, so does the externality for the recipient. How can this be explained? On the one side, individuals with a higher level of education have more knowledge to share with the rest of the members of their family. On the other side they will be less inclined to do so with family members that have similar levels of education because they will fear for their position in the household. If the dominant person within the household has a University education but the potential recipient has an elementary level of education, then there is little risk of this person achieving a dominant position within the household, even if there is knowledge diffusion. Therefore, the dominant person will not be afraid of a power shift within the household, and so will have less incentive to constrain his/her knowledge. However, when this gap declines, for example between a University-educated person and someone who has received a senior-high level of education, there is a potential threat of power shifting in favour of the less-educated. If the consumption preferences of the individuals in the latter case differ sufficiently, the dominant person will have more incentive to constrain his/her knowledge. This is what the bargaining household theory tells us (see Manser and Brown, 1980; McElroy and Homey, 1981). Similarly, as the

¹⁹ Impacted implies a statistically significant coefficient

educational gap between the recipient and the source increases, there will be fewer problems with sharing the knowledge because the source's position is relatively 'safe'. This may be a reason for the externality of education to be higher for household members with much lower educational status than the source.

5.4.3. Same Sex Sharing

Men share knowledge with other men, and women with other women. Sharing knowledge between sexes does not happen often and if it does the externality from man to woman or woman to man is much smaller. An explanation for the lack of inter-sex sharing of knowledge may partly be found in the bargaining models. Same sex sharing of knowledge leads to the highest externalities of all, which could imply not only that sharing is larger but also the capability of receiving. This might have to do with inter-sex communication, in the sense that men understand other men better than women. What is striking is that women on average are more inclined to share knowledge with the other sex, than are men. The results found that when inter-sex sharing of knowledge takes place, this will typically be from a female source to a male recipient instead of the other way round.

According to Scott (1999) gender is defined as being an element of social relations based on perceived differences between the sexes. The fact that the transferring of knowledge generally occurs within one sex (male to male/ female to female) can be seen as being a result of these perceived differences between the sexes. This could be explained in several ways: Firstly, the social construction of perceived differences between the sexes can be seen as influencing the peer groups those men and women find themselves in. For example, common social activities are largely separated along lines of gender. Therefore individuals of the same sex interact more often with each other in their intra or extra-household activities.

Secondly, people of the same sex appear to respect the opinion of someone of their sex, rather than the opposite. Finally, combining Scott's theory with the theory about bargaining power can explain the fact that as people of the same sex have a more proximity with each other their preferences tend to be more similar. Therefore the more educated individual will prefer to share his/her knowledge with another member of the same sex. Even if that sharing will lead to empowerment of the recipient still due to the fact that their consumption patterns will not differ that much potential shift of power will not lead to a deterioration of their utility.

All the above findings are of a great interest and set more light on the neglected aspect of educational externalities within the household. Still it should be mentioned that all the above effects refer only to adult working individuals and in that sense can not be generalised for the whole Indonesian population. However the fact that there are externalities for those individuals can give the motivation to look for externality of education within the household for the case of individuals that have further sources of income generation.

CHAPTER 6 CONCLUSIONS

6.1. Summary of Findings

The main purpose of the paper was to test whether there are externalities of education within the household and to estimate their magnitude. The main hypothesis that there are externalities of education at household level is proven. Estimation of the impact on the hourly wage of Indonesian workers when living in a household with higher education level than theirs shows that there are significant positive externalities of education within the household. There are significant externalities flowing from all the sources that have different levels of education but mostly from individuals with higher levels of education (senior high and college/university). These externalities result in an increase in the hourly wage level of the recipient. Due to those externalities, workers living in households where at least one other member has a higher educational level than theirs, tend to be better off than workers that live amongst individuals with lower or the same level of education as they do.

Although there seems not to be significant externalities when estimating the effect for illiterates depending on whether or not they live in a literate or illiterate household, when disaggregating the effect for sources with different levels of education, these externalities occur and are significant and positive. The magnitude of these externalities that flow from more to less educated individuals, highly depends on the level of education that both the source of knowledge and the recipient obtain, and differ for different levels of education. In order to detect those differences, the need to disaggregate the effect is highlighted.

Men in general are recipients more often than women, while the latter tend to benefit more from externalities coming from sources with higher levels of education. Women appear to be more constrained in their access to knowledge, but once they get access to it, they benefit to a much larger extent which is reflected in a higher magnitude of the effect. In this sense, women make better recipients of educational externalities than men. The externalities flowing to the head of the household and the spouse seem to follow the same patterns as male and female respectfully. Still, the magnitude on the head and spouse recipient appear to be of a higher magnitude.

In general, the magnitude of externalities increases when the educational gap between recipient and source is bigger. There is more obvious and higher knowledge diffusion between same sexes, although externalities between males and females do occur. In both the case of males and females, the higher externality for them comes when the source is a person of the same sex as them, possessing a university education. However, females seem to be better sources of externalities than males when sharing knowledge with the opposite sex.

The presented empirical literature in the previous chapters gives the clue that education has spillovers on further individuals. The results obtained prove that there is knowledge diffusion between individuals with different levels of education when living in the same household, and so therefore, externalities of education do exist. The estimation of those externalities should not be limited to only a superficial level but should go deeper. As shown by the results, by decomposing these externalities, it is possible to further understand by whom they occur and for whom they matter.

In contrast with the paper of Basu et al. (2002), where the estimation of the externalities is limited to an aggregate level, the empirical analysis in this paper goes deeper, setting more light on the empirical estimation of externalities within the household (a quite neglected subject). Proving that these externalities actually exist, and do have a big impact on less educated people, is a very important finding. The existence of positive externalities of education state, that there are further returns of education than the private. In this way the benefits of education are spread beyond the people that actually have that education.

6.2 Implications

Concluding, this paper is one of the few empirical researches that try to estimate the educational externalities on household level. The findings obtained in this paper have important implications for political decisions. When political decisions are made concerning investment in education, the total benefits of education are measured. Usually these benefits are limited in the private returns of education. Not including the further positive effects that occur due to externalities in the total benefits of education, will result in underestimating the overall importance of education.

One further important aspect of the externalities that is not taken into account is that they aim at the less or uneducated people. Usually, less educated people are underprivileged individuals either in economic or social terms. An example is women. This can be seen by the average lower earnings and education of women within Indonesian society. The results show significant, and on average, higher externalities for less educated working females. Therefore, although social reasons may constrain women to earn more, externalities of education compensate to some extent for these losses. Consequentially, one of the recommendations could be a further investment towards achieving a higher level education of females, thus enabling more women to be a good source of externalities for other women. In that way both the average level of educated women as well as their incomes would rise.

Still based on aggregate conclusions, the process of designing an education related policy may lead to wrong decisions. For this reason, the need for further research on the externalities of education in general and on household level in particular, is highlighted. This further research should estimate in more detail the flow and magnitude of these externalities, disaggregating further for different recipients and sources. There is a need to separately estimate the effects accounting for different sectors of employment, and also to differentiate between externalities occurring from both practical and academic knowledge.

Finally, what the paper presented here shows is the following: when we look at education we must go beyond the preconceived notion of our gaze and we must realise that the known world may in fact be unknown. Externalities are the 'unknown' aspect of education that is gradually revealed. This paper is an attempt to expose a part of that 'unknown' namely in relation to household externalities.

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APPENDICES

APPENDIX A

Estimation of externalities for illiterates using equation (2a)

	total	male	female
	(1)	(2)	(3)
	OLS	OLS	OLS
SEX	0.72650** [0.13346]	0.00000 [0.00000]	0.00000 [0.00000]
AGE OF HH MEMBER (YEAR)	0.04052+ [0.02402]	0.01375 [0.03410]	0.05640 [0.03555]
MARITAL STATUS	-0.05516 [0.14105]	-0.79320** [0.28744]	0.25054 [0.17281]
agesq	-0.00061* [0.00027]	-0.00035 [0.00037]	-0.00082* [0.00041]
ar15 ²⁰ = 2.0000	-0.18311 [0.61313]	0.08309 [0.65864]	-0.76429 [1.55885]
ar15 = 3.0000	0.19449 [0.66540]	0.37648 [0.85075]	-0.44785 [1.15387]
ar15 = 4.0000	-0.02317 [0.73553]	0.69390 [0.97067]	-1.00488 [1.08747]
TOTAL # OF HOUSEHOLD MEMBERS	0.01181 [0.03177]	-0.05165 [0.04608]	0.06638 [0.04449]
URBAN/RURAL AREA	0.55287** [0.14426]	0.90123** [0.21949]	0.33374+ [0.19536]
sc01 ²¹ = 12.0000	0.58581+ [0.34104]	-0.13769 [0.52718]	1.27660** [0.46251]
sc01 = 13.0000	0.52252 [0.72461]	0.57898 [0.99346]	0.38296 [1.04907]
sc01 = 16.0000	-0.52010 [0.58792]	-0.59838 [0.96822]	-0.04658 [0.75896]
sc01 = 18.0000	-0.10689 [0.46058]	-0.85366 [0.76649]	0.39736 [0.58201]
sc01 = 31.0000	0.47028+ [0.27510]	0.35408 [0.39830]	0.41534 [0.37659]
sc01 = 32.0000	0.07851 [0.18320]	-0.14347 [0.25328]	0.15311 [0.25806]
sc01 = 33.0000	-0.17820 [0.19449]	-0.56729+ [0.28964]	0.02381 [0.26101]
sc01 = 34.0000	-0.04954 [0.30765]	-0.30416 [0.43851]	0.13082 [0.42623]
sc01 = 51.0000	0.34692 [0.66788]	-0.21021 [0.77507]	1.38654 [1.22742]
sc01 = 52.0000	-0.30467 [0.25041]	-0.19293 [0.33105]	-0.56574 [0.36944]
sc01 = 63.0000	-0.03797 [0.42505]	-0.19693 [0.66883]	-0.01030 [0.55010]
sc01 = 73.0000	-0.51114 [0.35626]	-0.65318 [0.48512]	-0.40090 [0.54963]
depratio	-0.48947+ [0.26928]	-0.89545* [0.40859]	-0.39165 [0.36246]
literatehsh	0.18183 [0.18925]	0.17280 [0.26311]	0.16544 [0.26908]
Constant	4.54686** [0.58399]	6.62664** [0.83990]	3.82953** [0.82852]
Observations	554	238	316
R-squared	0.16	0.20	0.14

Standard errors in brackets

+ significant at 10%, * significant at 5%, ** significant at 1%

²⁰ ar15 represents the religion : 2 Christians , 3 Hinduism and 4: Budhism and other²¹ sc01 stands for province and the codes are explained in chapter 4

APPENDIX B

Estimation of externalities for illiterates using equation (2b)

	total	male	female
	(1)	(2)	(3)
	OLS	OLS	OLS
SEX	0.75406** [0.13246]		
AGE OF HH MEMBER (YEAR)	0.04444+ [0.02412]	0.00570 [0.03484]	0.05850 [0.03577]
MARITAL STATUS	-0.09836 [0.14130]	-0.80019** [0.28522]	0.17737 [0.17297]
agesq	-0.00068* [0.00027]	-0.00028 [0.00038]	-0.00089* [0.00041]
ar15== 2.0000	-0.13383 [0.60671]	0.05774 [0.65101]	-0.48367 [1.53560]
ar15== 3.0000	0.11746 [0.65881]	0.21576 [0.84571]	-0.15698 [1.13941]
ar15== 4.0000	-0.11975 [0.72932]	0.51915 [0.96107]	-0.99056 [1.06983]
TOTAL # OF HOUSEHOLD MEMBERS	-0.02379 [0.03282]	-0.08927+ [0.04847]	0.02610 [0.04514]
URBAN/RURAL AREA	0.50250** [0.14397]	0.95619** [0.21804]	0.19676 [0.19550]
sc01== 12.0000	0.59915+ [0.33795]	-0.11855 [0.52101]	1.17837* [0.45670]
sc01== 13.0000	0.29184 [0.72004]	0.75263 [0.99108]	0.04521 [1.05288]
sc01== 16.0000	-0.63157 [0.58405]	-0.64319 [0.96791]	-0.16193 [0.74796]
sc01== 18.0000	-0.08357 [0.45618]	-0.89416 [0.75851]	0.40036 [0.57416]
sc01== 31.0000	0.39379 [0.28548]	0.20326 [0.40730]	0.27356 [0.39575]
sc01== 32.0000	0.15400 [0.18230]	-0.09457 [0.25107]	0.28297 [0.25597]
sc01== 33.0000	-0.13486 [0.19276]	-0.50847+ [0.28704]	0.08516 [0.25698]
sc01== 34.0000	-0.13206 [0.30532]	-0.34771 [0.43774]	0.09153 [0.42054]
sc01== 51.0000	0.27759 [0.66122]	-0.16903 [0.76610]	0.86354 [1.21852]
sc01== 52.0000	-0.27494 [0.24834]	-0.21878 [0.32733]	-0.46759 [0.36466]
sc01== 63.0000	-0.12659 [0.42158]	-0.24640 [0.66424]	-0.11388 [0.54158]
sc01== 73.0000	-0.53378 [0.35415]	-0.74127 [0.48091]	-0.49241 [0.54611]
depratio	-0.66821* [0.27215]	-1.01193* [0.41618]	-0.61032+ [0.36330]
edumax== 1.0000	0.07284 [0.18981]	0.14667 [0.26369]	-0.00051 [0.26810]
edumax== 2.0000	0.66594** [0.25160]	0.76087* [0.34827]	0.65555+ [0.35657]
edumax== 3.0000	0.62260* [0.26647]	0.02833 [0.39496]	0.92958* [0.36642]
edumax== 4.0000	0.70864+ [0.42340]	1.59459 [1.01445]	0.70053 [0.51529]
Constant	4.76213** [0.58394]	6.99707** [0.84104]	4.21647** [0.83366]
Observations	554	238	316
R-squared	0.18	0.23	0.18

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

APPENDIX F

Table a3 For individuals with elementary education using equation (3a) when source can be anyone

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.66205**				
	[0.05081]				
AGE OF HH MEMBER (YEAR)	0.02055+	0.03149*	0.00121	0.04268**	-0.06475+
	[0.01067]	[0.01353]	[0.01938]	[0.01455]	[0.03770]
MARITAL STATUS	-0.13660+	-0.04760	-0.21729+	-0.51640**	0.00000
	[0.08191]	[0.11874]	[0.12537]	[0.10175]	[0.00000]
agesq	-0.00034**	-0.00045**	-0.00017	-0.00057**	0.00070
	[0.00012]	[0.00015]	[0.00024]	[0.00016]	[0.00048]
ar15= 2.0000	0.11014	0.15034	-0.00825	0.07446	0.10508
	[0.14851]	[0.17043]	[0.30614]	[0.17082]	[0.33937]
ar15= 3.0000	-0.28246	-0.16613	-0.49020	-0.26061	-0.31802
	[0.27939]	[0.32148]	[0.58028]	[0.34899]	[0.71094]
ar15= 4.0000	0.39723	0.38154	0.73393	0.40844	0.77900
	[0.25484]	[0.26140]	[0.86921]	[0.28336]	[0.86594]
TOTAL # OF HOUSEHOLD MEMBERS	0.00490	0.00764	-0.01773	-0.00262	0.01641
	[0.01277]	[0.01453]	[0.02793]	[0.01566]	[0.03530]
URBAN/RURAL AREA	0.18138**	0.20047**	0.12723	0.20640**	0.14631
	[0.04893]	[0.05638]	[0.09955]	[0.05708]	[0.11513]
sc01= 12.0000	0.22351*	0.23406*	0.27162	0.22588*	0.33641+
	[0.09512]	[0.11268]	[0.18096]	[0.11476]	[0.19843]
sc01= 13.0000	0.31906**	0.29511*	0.41517*	0.30285*	0.27968
	[0.10387]	[0.12275]	[0.20197]	[0.12173]	[0.24224]
sc01= 16.0000	0.25356+	0.13600	0.62115*	0.18498	0.48177
	[0.14619]	[0.16545]	[0.30980]	[0.16435]	[0.34896]
sc01= 18.0000	0.07184	-0.09189	0.60337*	0.06138	0.36462
	[0.14808]	[0.16880]	[0.30583]	[0.16947]	[0.34775]
sc01= 31.0000	0.67383**	0.73772**	0.40023*	0.73338**	0.50151*
	[0.08723]	[0.09813]	[0.19815]	[0.09938]	[0.23228]
sc01= 32.0000	0.16112*	0.19531*	0.07970	0.12095	0.06726
	[0.07374]	[0.08398]	[0.15710]	[0.08488]	[0.18552]
sc01= 33.0000	-0.13133+	-0.09009	-0.26922+	-0.16146+	-0.19502
	[0.07598]	[0.08843]	[0.15007]	[0.09187]	[0.16638]
sc01= 34.0000	-0.01717	0.01246	-0.05960	-0.02721	0.04642
	[0.10393]	[0.12134]	[0.20592]	[0.12404]	[0.24533]
sc01= 51.0000	0.53075*	0.45686	0.64714	0.54964+	0.65645
	[0.25974]	[0.30122]	[0.52902]	[0.32924]	[0.65482]
sc01= 52.0000	-0.21740+	-0.14353	-0.50756+	-0.13081	-0.38426
	[0.12459]	[0.13986]	[0.27285]	[0.14342]	[0.35007]
sc01= 63.0000	0.48867**	0.59880**	0.21036	0.48536**	0.34205
	[0.13049]	[0.15252]	[0.25510]	[0.15003]	[0.29992]
sc01= 73.0000	-0.18948	-0.29283	0.00848	-0.31362	-0.03253
	[0.17516]	[0.19853]	[0.36849]	[0.20231]	[0.44554]
depratio	-0.05844	-0.10108	-0.02412	-0.16902	-0.11482
	[0.11814]	[0.13929]	[0.23160]	[0.13842]	[0.29704]
edumax= 2.0000	0.20267**	0.27804**	0.00308	0.26216**	-0.00043
	[0.05860]	[0.06694]	[0.12274]	[0.06839]	[0.13894]
edumax= 3.0000	0.42141**	0.39779**	0.50193**	0.44248**	0.45842**
	[0.06995]	[0.07961]	[0.14909]	[0.08218]	[0.16458]
edumax= 4.0000	0.78351**	0.77657**	0.79160*	0.85603**	0.67004
	[0.15376]	[0.16917]	[0.37755]	[0.17144]	[0.47358]
Constant	-2.09695**	-1.71618**	-1.44611**	-1.85698**	-0.38982
	[0.23541]	[0.29435]	[0.42752]	[0.30497]	[0.73712]
Observations	1355	986	369	991	280
R-squared	0.30	0.25	0.19	0.27	0.16

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

APPENDIX A

Table a4 For individuals with elementary education using equation (3a) when source is adult

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.66107** [0.05092]				
AGE OF HH MEMBER (YEAR)	0.02299* [0.01064]	0.03608** [0.01349]	0.00108 [0.01930]	0.04744** [0.01450]	-0.06529+ [0.03755]
MARITAL STATUS	-0.13293 [0.08211]	-0.02667 [0.11935]	-0.21795+ [0.12537]	-0.51541** [0.10207]	0.00000 [0.00000]
agesq	-0.00036** [0.00012]	-0.00050** [0.00015]	-0.00017 [0.00024]	-0.00062** [0.00016]	0.00071 [0.00048]
ar15== 2.0000	0.10273 [0.14912]	0.13447 [0.17146]	-0.01582 [0.30653]	0.06024 [0.17165]	0.08890 [0.34026]
ar15== 3.0000	-0.26943 [0.27993]	-0.13328 [0.32251]	-0.49576 [0.58034]	-0.23385 [0.34987]	-0.33086 [0.71034]
ar15== 4.0000	0.38084 [0.25540]	0.36005 [0.26251]	0.73979 [0.86895]	0.38554 [0.28440]	0.78785 [0.86540]
TOTAL # OF HOUSEHOLD MEMBERS	0.00677 [0.01284]	0.00953 [0.01464]	-0.01998 [0.02814]	-0.00143 [0.01578]	0.01259 [0.03554]
URBAN/RURAL AREA	0.18571** [0.04898]	0.20975** [0.05651]	0.12637 [0.09958]	0.21765** [0.05712]	0.14230 [0.11538]
sc01== 12.0000	0.23084* [0.09524]	0.24004* [0.11309]	0.26771 [0.18024]	0.23026* [0.11509]	0.33030+ [0.19729]
sc01== 13.0000	0.33234** [0.10398]	0.31535* [0.12307]	0.41185* [0.20175]	0.31484* [0.12223]	0.27653 [0.24188]
sc01== 16.0000	0.26906+ [0.14632]	0.15660 [0.16586]	0.62389* [0.30982]	0.20153 [0.16465]	0.48387 [0.34849]
sc01== 18.0000	0.07022 [0.14850]	-0.10293 [0.16972]	0.59933+ [0.30528]	0.04849 [0.17025]	0.35008 [0.34658]
sc01== 31.0000	0.68914** [0.08715]	0.75266** [0.09832]	0.39697* [0.19650]	0.74646** [0.09948]	0.49975* [0.23019]
sc01== 32.0000	0.16122* [0.07389]	0.19375* [0.08429]	0.08329 [0.15736]	0.12001 [0.08513]	0.07544 [0.18584]
sc01== 33.0000	-0.11925 [0.07618]	-0.07102 [0.08870]	-0.26492+ [0.15047]	-0.14406 [0.09203]	-0.18548 [0.16689]
sc01== 34.0000	-0.00752 [0.10407]	0.01857 [0.12180]	-0.05433 [0.20658]	-0.02427 [0.12441]	0.05525 [0.24582]
sc01== 51.0000	0.52391* [0.26030]	0.43169 [0.30224]	0.65253 [0.52918]	0.53001 [0.33011]	0.66582 [0.65448]
sc01== 52.0000	-0.22024+ [0.12487]	-0.14927 [0.14048]	-0.50441+ [0.27274]	-0.13599 [0.14391]	-0.37719 [0.34960]
sc01== 63.0000	0.50010** [0.13066]	0.61451** [0.15298]	0.20627 [0.25483]	0.49939** [0.15035]	0.33614 [0.29935]
sc01== 73.0000	-0.19378 [0.17554]	-0.30046 [0.19949]	0.01592 [0.36877]	-0.32455 [0.20318]	-0.01543 [0.44595]
depratio	-0.09466 [0.12106]	-0.15456 [0.14345]	-0.03789 [0.23545]	-0.22057 [0.14223]	-0.14300 [0.30248]
edumaxadulktat== 2.0000	0.17834** [0.06542]	0.24698** [0.07556]	0.04172 [0.13375]	0.24164** [0.07677]	0.07116 [0.15152]
edumaxadulktat== 3.0000	0.39525** [0.06995]	0.36061** [0.07980]	0.51719** [0.14832]	0.40960** [0.08229]	0.48516** [0.16314]
edumaxadulktat== 4.0000	0.75717** [0.15385]	0.74117** [0.16972]	0.80281* [0.37713]	0.82556** [0.17175]	0.68954 [0.47340]
Constant	-2.12450** [0.23576]	-1.77993** [0.29477]	-1.43227** [0.42758]	-1.92419** [0.30452]	-0.36213 [0.73620]
Observations	1355	986	369	991	280
R-squared	0.30	0.25	0.19	0.27	0.17

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

APPENDIX E

Individuals with elementary education using equation (3a) when source is female

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.66098** [0.07655]				
AGE OF HH MEMBER (YEAR)	0.05076** [0.01619]	0.08702** [0.02309]	0.01125 [0.02595]	0.08879** [0.02358]	-0.11706+ [0.06910]
MARITAL STATUS	-0.05157 [0.11586]	-0.14121 [0.18647]	-0.05520 [0.17755]	-0.55875** [0.13577]	0.00000 [0.00000]
agesq	-0.00072** [0.00019]	-0.00114** [0.00028]	-0.00031 [0.00030]	-0.00116** [0.00027]	0.00131 [0.00088]
ar15== 2.0000	-0.21680 [0.22242]	-0.30995 [0.25259]	-0.14660 [0.44989]	-0.45436+ [0.25768]	-0.12904 [0.48762]
ar15== 3.0000	0.24491 [0.50232]	0.28295 [0.54855]	0.61548 [1.15221]	0.22461 [0.58849]	0.69400 [1.14167]
ar15== 4.0000	0.40686 [0.36047]	0.31506 [0.37103]	0.67933 [0.92573]	0.52219 [0.45770]	0.82920 [0.91387]
TOTAL # OF HOUSEHOLD MEMBERS	0.01075 [0.02022]	0.01695 [0.02278]	-0.00740 [0.04834]	0.01399 [0.02507]	-0.01193 [0.06762]
URBAN/RURAL AREA	0.16747* [0.07323]	0.24265** [0.08115]	0.00495 [0.15149]	0.19635* [0.08409]	-0.08734 [0.20213]
sc01== 12.0000	0.23960+ [0.14342]	0.29931+ [0.16226]	0.19267 [0.28702]	0.30003+ [0.17084]	0.45221 [0.33985]
sc01== 13.0000	0.30103* [0.14373]	0.51477** [0.16220]	0.01264 [0.29879]	0.47274** [0.16550]	-0.22382 [0.37699]
sc01== 16.0000	0.19767 [0.19752]	0.10961 [0.20535]	0.80108 [0.50570]	0.13340 [0.20874]	1.05514 [0.67831]
sc01== 18.0000	0.20081 [0.25294]	-0.12361 [0.27485]	1.32585* [0.55228]	0.24301 [0.27742]	1.22798 [0.94794]
sc01== 31.0000	0.47160** [0.12992]	0.63699** [0.14048]	-0.10290 [0.30578]	0.66196** [0.14447]	-0.20668 [0.39504]
sc01== 32.0000	0.09997 [0.11011]	0.25148* [0.12274]	-0.22817 [0.22847]	0.15956 [0.12585]	-0.27282 [0.28468]
sc01== 33.0000	-0.10187 [0.11314]	-0.00413 [0.12974]	-0.28914 [0.21741]	-0.08620 [0.13623]	-0.26468 [0.26206]
sc01== 34.0000	0.05879 [0.14723]	0.13253 [0.17046]	-0.00950 [0.27959]	0.03007 [0.17851]	0.36910 [0.35909]
sc01== 51.0000	0.08224 [0.46645]	0.08611 [0.51991]	0.16182 [0.92369]	0.09775 [0.55707]	0.38512 [0.91783]
sc01== 52.0000	-0.51026** [0.18702]	-0.31451 [0.20397]	-0.89087* [0.39773]	-0.39029+ [0.21010]	-1.00171+ [0.54366]
sc01== 63.0000	0.36052+ [0.20503]	0.66310** [0.22271]	-0.33955 [0.45258]	0.53161* [0.21731]	-0.49429 [0.67455]
sc01== 73.0000	-0.41094 [0.26489]	-0.62360* [0.27596]	0.55843 [0.65729]	-0.69797* [0.29118]	0.27461 [0.95033]
depratio	0.07415 [0.18444]	0.22215 [0.22616]	-0.08095 [0.35594]	0.16572 [0.21176]	-0.39987 [0.50775]
edumaxfemale== 2.0000	0.28893** [0.08589]	0.29500** [0.08924]	0.26400 [0.21900]	0.28974** [0.09439]	0.44822 [0.30007]
edumaxfemale== 3.0000	0.51129** [0.10608]	0.40370** [0.10707]	0.84942** [0.31675]	0.48104** [0.11455]	0.84803* [0.36877]
edumaxfemale== 4.0000	0.65656** [0.23408]	0.38050 [0.24944]	1.16785* [0.56378]	0.64448* [0.25140]	1.68705+ [0.97646]
Constant	-2.74385** [0.36087]	-3.03294** [0.50294]	-1.53799* [0.62680]	-2.99371** [0.47767]	1.08323 [1.35678]
Observations	623	439	184	464	118
R-squared	0.35	0.29	0.26	0.33	0.29

Standard errors in brackets

+ significant at 10%, * significant at 5%, ** significant at 1%

APPENDIX Z

Table a6 Individuals with elementary education using equation (3a) when source is male

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.63266** [0.07056]				
AGE OF HH MEMBER (YEAR)	0.01589 [0.01502]	0.02845 [0.01858]	0.03132 [0.03547]	0.03663+ [0.02132]	-0.05794 [0.05033]
MARITAL STATUS	-0.17268 [0.12038]	0.01082 [0.16282]	-0.31782 [0.19472]	-0.36980* [0.16248]	0.00000 [0.00000]
agesq	-0.00027 [0.00017]	-0.00039+ [0.00020]	-0.00060 [0.00045]	-0.00049* [0.00023]	0.00056 [0.00063]
ar15== 2.0000	0.32652 [0.20876]	0.43185+ [0.25250]	-0.00694 [0.41451]	0.46596+ [0.25738]	0.20694 [0.42687]
ar15== 3.0000	-0.31332 [0.33496]	-0.07928 [0.39317]	-1.26285+ [0.75079]	-0.16295 [0.43284]	-1.53440 [1.04887]
ar15== 4.0000	0.28385 [0.35513]	0.14577 [0.39470]	0.52579 [0.83860]	0.14701 [0.40229]	0.50673 [0.81782]
URBAN/RURAL AREA	0.23362** [0.06669]	0.27934** [0.07756]	0.13765 [0.13652]	0.30683** [0.08036]	0.10911 [0.14676]
TOTAL # OF HOUSEHOLD MEMBERS	0.01974 [0.01650]	0.01216 [0.01902]	0.03356 [0.03733]	0.00259 [0.02096]	0.06068 [0.04197]
sc01== 12.0000	0.25200* [0.12589]	0.29613+ [0.15159]	0.24908 [0.23353]	0.27849+ [0.15550]	0.32006 [0.24413]
sc01== 13.0000	0.45534** [0.14735]	0.42648* [0.18235]	0.52251* [0.26137]	0.41157* [0.18388]	0.50003+ [0.28977]
sc01== 16.0000	0.30299 [0.18854]	0.25092 [0.22904]	0.45689 [0.34484]	0.27457 [0.22114]	0.16772 [0.38869]
sc01== 18.0000	0.04182 [0.18436]	-0.04704 [0.21570]	0.35734 [0.36818]	0.03388 [0.22675]	0.38188 [0.36437]
sc01== 31.0000	0.83157** [0.12074]	0.84838** [0.13888]	0.66352* [0.25701]	0.79402** [0.14379]	0.83828** [0.27782]
sc01== 32.0000	0.19385+ [0.10050]	0.22184+ [0.11444]	0.18404 [0.22102]	0.14289 [0.11754]	0.07645 [0.23716]
sc01== 33.0000	-0.05414 [0.09953]	-0.03679 [0.11535]	-0.12310 [0.20399]	-0.09379 [0.12262]	0.02177 [0.20742]
sc01== 34.0000	-0.13928 [0.14853]	-0.06306 [0.16744]	-0.41821 [0.33035]	-0.09602 [0.17370]	-0.56168 [0.39840]
sc01== 51.0000	0.60630+ [0.30970]	0.44735 [0.36102]	1.34144+ [0.71223]	0.52680 [0.40407]	1.87404+ [0.99466]
sc01== 52.0000	-0.08844 [0.16304]	-0.10331 [0.18457]	-0.13341 [0.37011]	-0.07642 [0.19491]	0.11054 [0.44697]
sc01== 63.0000	0.47099* [0.20038]	0.55413* [0.24066]	0.18491 [0.37698]	0.44201+ [0.24590]	0.38103 [0.40440]
sc01== 73.0000	-0.12677 [0.22325]	-0.16740 [0.25055]	-0.10836 [0.50318]	-0.27220 [0.26555]	0.05337 [0.58295]
depratio	-0.15819 [0.15614]	-0.28652 [0.18132]	0.25427 [0.33163]	-0.23592 [0.18989]	-0.06251 [0.36784]
edumaxmale== 2.0000	0.18996* [0.08230]	0.29710** [0.09943]	-0.09676 [0.15793]	0.29026** [0.10294]	-0.18231 [0.16959]
edumaxmale== 3.0000	0.37071** [0.09512]	0.35329** [0.11672]	0.33418+ [0.17614]	0.38023** [0.12069]	0.22329 [0.19321]
edumaxmale== 4.0000	0.80199** [0.20476]	0.89544** [0.22786]	0.20099 [0.55202]	0.93776** [0.23805]	-0.09741 [0.58781]
Constant	-2.09501** [0.32033]	-1.71662** [0.40442]	-2.29888** [0.71792]	-1.85084** [0.44844]	-0.59019 [0.98460]
Observations	721	528	193	508	161
R-squared	0.32	0.30	0.25	0.30	0.23

Standard errors in brackets
+ significant at 10%, * significant at 5%, ** significant at 1%

APPENDIX H

Table a7 Individuals with junior high education using equation (3b) when source can be everyone

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.21827*	0.00000	0.00000	-0.04855	0.00000
	[0.09817]	[0.00000]	[0.00000]	[0.30611]	[0.00000]
AGE OF HH MEMBER (YEAR)	0.08097**	0.08904**	0.04614	0.05473+	-0.01084
	[0.02340]	[0.02890]	[0.04739]	[0.03003]	[0.11036]
MARITAL STATUS	-0.14481	-0.29450	-0.22957	-0.16928	0.00000
	[0.14102]	[0.19232]	[0.24238]	[0.24771]	[0.00000]
agesq	-0.00085**	-0.00095**	-0.00045	-0.00055	-0.00033
	[0.00030]	[0.00036]	[0.00063]	[0.00037]	[0.00151]
ar15== 2.0000	0.03894	-0.09532	0.33424	-0.00964	-0.36443
	[0.15002]	[0.16510]	[0.37125]	[0.16489]	[0.39487]
ar15== 3.0000	-0.57593	-0.61834	-0.42095	-0.56846	-1.04459
	[0.40224]	[0.44449]	[0.91013]	[0.44642]	[0.80376]
ar15== 4.0000	-0.00022	0.08886	-0.33322	0.03132	-0.43983
	[0.22795]	[0.24785]	[0.55292]	[0.25093]	[0.63497]
TOTAL # OF HOUSEHOLD MEMBERS	-0.02868	-0.01442	-0.16251*	-0.00784	-0.19349*
	[0.01808]	[0.01890]	[0.06368]	[0.02243]	[0.07641]
URBAN/RURAL AREA	-0.02170	-0.03981	0.19973	-0.01025	-0.01715
	[0.09164]	[0.09978]	[0.26716]	[0.10424]	[0.26487]
sc01== 12.0000	0.11426	0.10257	0.22312	0.15021	0.06864
	[0.14739]	[0.15405]	[0.49682]	[0.15984]	[0.49146]
sc01== 13.0000	0.12815	0.13819	0.47967	0.21421	0.77095+
	[0.15089]	[0.16205]	[0.40769]	[0.17247]	[0.38072]
sc01== 16.0000	0.32013+	0.31703+	0.08049	0.37804*	-0.28921
	[0.16299]	[0.16979]	[0.57115]	[0.17888]	[0.63906]
sc01== 18.0000	-0.58485	-0.20615	-1.39462+	-0.22006	-1.52731*
	[0.37731]	[0.42818]	[0.76781]	[0.43265]	[0.67638]
sc01== 31.0000	0.66362**	0.66600**	0.69929*	0.68811**	0.88848**
	[0.12803]	[0.13845]	[0.32169]	[0.14092]	[0.29233]
sc01== 32.0000	0.08624	-0.00924	0.46881	0.00686	0.75516*
	[0.14643]	[0.15968]	[0.34773]	[0.16105]	[0.36630]
sc01== 33.0000	0.14007	0.19250	0.23186	0.17143	0.67262+
	[0.15096]	[0.16475]	[0.39670]	[0.16696]	[0.38362]
sc01== 34.0000	-0.15483	-0.10664	-0.09571	-0.11022	0.21984
	[0.16686]	[0.18726]	[0.35970]	[0.20149]	[0.38795]
sc01== 51.0000	0.36374	0.44192	0.09955	0.40683	0.88242
	[0.35721]	[0.39238]	[0.80750]	[0.39353]	[0.73328]
sc01== 52.0000	0.06128	-0.13128	1.26131*	-0.12883	0.64192
	[0.22644]	[0.25093]	[0.55658]	[0.25520]	[0.78874]
sc01== 63.0000	0.39714+	0.52992*	-0.56669	0.47370*	-0.32931
	[0.22528]	[0.24286]	[0.55580]	[0.24034]	[0.66080]
sc01== 73.0000	0.05334	-0.11071	1.93499*	-0.16334	0.00000
	[0.24362]	[0.25337]	[0.88709]	[0.26436]	[0.00000]
depratio	-0.00812	-0.06304	0.15919	-0.10166	-0.32883
	[0.21228]	[0.23098]	[0.59140]	[0.23966]	[0.81442]
edumax== 3.0000	0.17554*	0.15167	0.31131	0.14772	0.12868
	[0.08554]	[0.09422]	[0.21261]	[0.09779]	[0.21869]
edumax== 4.0000	0.42170*	0.47096*	0.18128	0.48141*	0.99023+
	[0.17367]	[0.19068]	[0.47878]	[0.19851]	[0.56037]
Constant	-2.47065**	-2.39811**	-1.69325	-1.70341*	-0.20893
	[0.50295]	[0.59812]	[1.11508]	[0.69452]	[2.30869]
Observations	432	361	71	346	51
R-squared	0.24	0.26	0.49	0.20	0.65

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

APPENDIX Ø

Table a8 Individuals with junior high education using equation (3b) when source is female

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.34454*				
	[0.14521]				
AGE OF HH MEMBER (YEAR)	0.03780	0.03580	-0.18501	0.02576	-0.05451
	[0.03625]	[0.04364]	[0.11448]	[0.04203]	[0.15368]
MARITAL STATUS	0.19043	-0.20611	-0.54342	0.05726	0.00000
	[0.21096]	[0.37338]	[0.43391]	[0.27953]	[0.00000]
agesq	-0.00028	-0.00027	0.00296+	-0.00015	0.00179
	[0.00046]	[0.00053]	[0.00168]	[0.00052]	[0.00213]
ar15== 2.0000	0.16828	0.00902	-0.09009	0.20431	-1.48109*
	[0.20642]	[0.23448]	[0.58025]	[0.23645]	[0.60309]
ar15== 3.0000	-0.97821	-0.95602	-0.62442	-0.84777	-0.36525
	[0.59660]	[0.60628]	[0.77414]	[0.63416]	[0.64496]
ar15== 4.0000	-0.20902	-0.18630	0.00000	-0.30059	0.00000
	[0.49037]	[0.47307]	[0.00000]	[0.49636]	[0.00000]
TOTAL # OF HOUSEHOLD MEMBERS	-0.00450	0.01964	-0.29457*	0.00664	0.08014
	[0.02638]	[0.02926]	[0.11846]	[0.03277]	[0.19628]
URBAN/RURAL AREA	0.05641	-0.07665	0.19133	0.14375	0.15684
	[0.13915]	[0.15899]	[0.35855]	[0.17294]	[0.35202]
sc01== 12.0000	0.23645	0.26229	-0.24276	0.22676	0.48516
	[0.20701]	[0.22146]	[0.54900]	[0.23361]	[0.46786]
sc01== 13.0000	0.23015	0.22131	0.87678	0.18504	1.14136*
	[0.20817]	[0.22268]	[0.52759]	[0.24018]	[0.44653]
sc01== 16.0000	0.29913	0.37445	0.00000	0.38752	0.00000
	[0.24029]	[0.24379]	[0.00000]	[0.26638]	[0.00000]
sc01== 18.0000	-0.59563	-0.05805	-1.55797+	-0.12462	-0.84649
	[0.42188]	[0.49641]	[0.78260]	[0.52227]	[0.64556]
sc01== 31.0000	0.62505**	0.58769**	0.92023*	0.48859*	0.83681+
	[0.19754]	[0.21860]	[0.44114]	[0.22424]	[0.38447]
sc01== 32.0000	0.06573	-0.02402	0.42498	-0.09006	1.22219*
	[0.21871]	[0.25423]	[0.43800]	[0.25924]	[0.46433]
sc01== 33.0000	0.09674	0.26703	-0.70463	0.11381	0.09160
	[0.22028]	[0.24396]	[0.56201]	[0.25659]	[0.53655]
sc01== 34.0000	-0.00453	0.16569	-0.16508	0.06062	0.42451
	[0.25444]	[0.33126]	[0.43868]	[0.32390]	[0.45729]
sc01== 51.0000	0.63103	0.76564	0.00000	0.62335	0.00000
	[0.51082]	[0.50454]	[0.00000]	[0.52506]	[0.00000]
sc01== 52.0000	-0.52611	-0.46774	0.46553	-0.54809	0.00000
	[0.37137]	[0.41600]	[0.96537]	[0.42740]	[0.00000]
sc01== 63.0000	0.26475	0.54618	-1.04691	0.36633	2.10951
	[0.31963]	[0.37652]	[0.62726]	[0.37015]	[1.39037]
sc01== 73.0000	0.56920	0.47024	1.72410+	0.40410	0.00000
	[0.39389]	[0.45977]	[0.97285]	[0.53122]	[0.00000]
depratio	-0.20422	-0.37876	-1.52129	-0.11877	1.98633
	[0.32595]	[0.38968]	[0.99211]	[0.38638]	[1.57409]
edumaxfemale== 3.0000	0.08626	0.01704	1.06671+	0.07943	-2.70599
	[0.12086]	[0.12827]	[0.54712]	[0.13387]	[1.47681]
edumaxfemale== 4.0000	0.29105	0.20912	1.23833	0.18532	0.51949
	[0.25040]	[0.25679]	[0.91011]	[0.26990]	[0.93077]
Constant	-1.82759*	-1.29771	3.64206	-1.35901	-3.06275
	[0.78575]	[0.89635]	[2.66105]	[0.89669]	[3.57927]
Observations	173	132	41	133	27
R-squared	0.30	0.22	0.70	0.19	0.85

Standard errors in brackets
 + significant at 10%, * significant at 5%, ** significant at 1%

APPENDIX I

Individuals with junior high education using equation (3b) when source is male

	total	male	female	head	spouse
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
SEX	0.13062 [0.17433]				
AGE OF HH MEMBER (YEAR)	0.08966** [0.03241]	0.09524* [0.03895]	0.06998 [0.05133]	0.05881 [0.04197]	-0.31845 [0.16541]
MARITAL STATUS	-0.35551+ [0.20008]	-0.31088 [0.22698]	0.32272 [0.81747]	-0.33101 [0.26168]	0.00000 [0.00000]
agesq	-0.00106* [0.00041]	-0.00113* [0.00049]	-0.00123 [0.00067]	-0.00072 [0.00052]	0.00449 [0.00242]
arl5== 2.0000	-0.16152 [0.21387]	-0.12356 [0.22467]	0.00000 [0.00000]	-0.13643 [0.22841]	0.01011 [0.40191]
arl5== 3.0000	-0.33421 [0.81147]	-0.23864 [0.83696]	-0.15159 [0.39491]	-0.28665 [0.83633]	-0.00570 [0.30950]
arl5== 4.0000	0.14230 [0.32556]	0.17746 [0.35774]	-0.07267 [0.89662]	0.07080 [0.35685]	0.00000 [0.00000]
URBAN/RURAL AREA	-0.04347 [0.11992]	-0.07315 [0.12925]	-0.13102 [0.28159]	-0.06289 [0.13390]	-0.35443 [0.23535]
TOTAL # OF HOUSEHOLD MEMBERS	-0.02979 [0.02407]	-0.03093 [0.02545]	-0.33173** [0.07756]	-0.02840 [0.02952]	-0.18260+ [0.08578]
sc01== 12.0000	0.03232 [0.19936]	-0.03132 [0.20686]	0.00000 [0.00000]	0.09462 [0.21592]	0.00000 [0.00000]
sc01== 13.0000	0.02850 [0.19679]	-0.06591 [0.21170]	1.33836* [0.42197]	0.11424 [0.22630]	0.56861 [0.45448]
sc01== 16.0000	0.43670+ [0.22728]	0.37503 [0.23288]	0.00000 [0.00000]	0.43691+ [0.23499]	0.00000 [0.00000]
sc01== 18.0000	-0.40616 [0.75207]	-0.47830 [0.76266]	0.00000 [0.00000]	-0.48899 [0.75743]	0.00000 [0.00000]
sc01== 31.0000	0.61623** [0.15874]	0.61013** [0.16985]	0.55453 [0.29323]	0.67978** [0.17469]	0.64920* [0.22878]
sc01== 32.0000	-0.03566 [0.18543]	-0.12426 [0.19520]	1.43278* [0.41693]	-0.10079 [0.20051]	0.73949 [0.43003]
sc01== 33.0000	0.11172 [0.18927]	0.05745 [0.20517]	1.40013* [0.41045]	0.13334 [0.20790]	0.72521 [0.42126]
sc01== 34.0000	-0.18746 [0.21934]	-0.19653 [0.23230]	0.30564 [0.49809]	-0.14656 [0.26436]	0.00000 [0.00000]
sc01== 51.0000	0.05673 [0.78119]	-0.08312 [0.79532]	0.00000 [0.00000]	0.01163 [0.79590]	0.00000 [0.00000]
sc01== 52.0000	-0.13990 [0.29264]	-0.25532 [0.31522]	0.91296 [0.63969]	-0.22694 [0.31844]	1.18073+ [0.50404]
sc01== 63.0000	0.21541 [0.35954]	0.17587 [0.36714]	0.00000 [0.00000]	0.16865 [0.36851]	0.00000 [0.00000]
sc01== 73.0000	-0.30468 [0.33472]	-0.35380 [0.34264]	0.00000 [0.00000]	-0.38038 [0.36216]	0.00000 [0.00000]
depratio	-0.05872 [0.28169]	-0.21459 [0.30618]	0.76528 [0.65257]	-0.30556 [0.31995]	-0.93672 [0.86434]
edumaxmale== 3.0000	0.20535 [0.13343]	0.30539* [0.14870]	-0.23724 [0.24433]	0.28923+ [0.15539]	-0.77014* [0.28956]
edumaxmale== 4.0000	0.62237* [0.26399]	0.71369* [0.29020]	1.08033 [0.76758]	0.78590* [0.30545]	-0.21381 [0.79661]
Constant	-2.29067** [0.66494]	-2.11646** [0.79349]	-0.93985 [1.21830]	-1.38629 [0.84975]	6.58630+ [3.25040]
Observations	268	244	24	226	21
R-squared	0.25	0.26	0.90	0.22	0.95

Standard errors in brackets

+ significant at 10%; * significant at 5%; ** significant at