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The Impact of Population Growth on Economic Growth and Poverty Reduction in Uganda

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Abstract

The paper examines the link between population and per capita economic growth, and poverty, using the interesting case study of Uganda. Although Uganda has recently experienced excellent economic growth and poverty reduction, it currently has one of the highest population growth rates in the world which, due to the inherent demographic momentum, will persist for some time to come. By combining both a macro and microeconometric approach, using panel data, we are able to consider the impact of population growth on per capita economic growth and poverty. We find both theoretical considerations and strong empirical evidence suggest that the currently high population growth puts a considerable break on per capita growth prospects in Uganda. Moreover, it contributes significantly to low achievement in poverty reduction and is associated with households being persistently poor and moving into poverty. This is therefore likely to make substantial improvements in poverty reduction, and per capita growth, very difficult.

Keywords: Population, poverty, Uganda, household size.

JEL Code: O15, I32, J13.

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1.Introduction

After decades of stagnation and decline, Uganda has enjoyed relatively high rates of per capita economic growth since the late 1980s. The most important factors accounting for this improved performance are a return to peace and stability, significant economic and institutional reforms, and substantial external support. The sustained per capita growth has also led to considerable declines in poverty, from 56% in 1992 to 39% in 2002 (Appleton and Ssewanyana, 2003). However, more recently more recently per capita growth has decelerated and poverty reduction has stalled. The question to be examined in this paper is to what extent the very high (and rising) population growth rate has been (and will be) a constraint to per capita economic growth and poverty reduction in Uganda.

The 2002 Census suggests that Uganda had a population of 24.7 million in that year. The total fertility rate (the number of children that, given current age-specific birth rates, women will have in their lifetime) as estimated by the DHS, stood at 6.9, largely unchanged over the past ten years and much higher than in neighbouring countries (e.g. Kenya: 4.7; Tanzania: 5.6, see UBOS, 2001). Consequently, the population growth rate was about 3.4% per year between 1991 and 2002, which puts Uganda among the countries with the highest population growth rates in the world. The demographic implications of this high population growth rate can be seen in Table 1 below which shows demographic projections from the United Nations Population Division based on the medium (and thus most probable) variant of the 2002 revision.[2]

According to these projections, Uganda's population is expected to reach 103.2 million people in 2050. This projection is based on considerable fertility decline from presently about 7 to only 2.9 in 2045-2050. Whether this will be achieved is far from certain and will likely depend on overall economic development in coming decades as well as government efforts to support a fertility decline. But even with this considerably fertility decline, population growth will still be over 2% per year in 2045-50 and Uganda's population is projected to stabilize at a population of some 200 million only in the 22nd century. The table also shows other relevant demographic projections which will be discussed below.

Table 1: Demographic Projections for Uganda 2000-2050

	Population ('000)	Pop. Growth	Population Density	TFR	Dependency Rate	Pop. Aged 15-64	Growth 15-64	Pop. Aged 5-19
2000	23487	3.30%	100	7.10	110	11164	3.16%	9504
2005	27623	3.62%	117	6.78	112	13044	3.67%	11167
2010	32996	3.58%	140	6.37	111	15621	3.88%	13467
2015	39335	3.46%	167	5.93	108	18894	4.06%	16167
2020	46634	3.31%	198	5.43	102	23051	4.00%	19115
2025	54883	3.11%	233	4.87	96	28051	3.86%	22143
2030	63953	2.84%	271	4.27	89	33894	3.64%	25287
2035	73550	2.53%	312	3.70	82	40522	3.38%	28395
2040	83344	2.27%	353	3.24	74	47844	3.12%	31096
2045	93250	2.06%	395	2.90	67	55801	2.79%	33051
2050	103248		438		61	64039		34326

Note: The Total Fertility Rate (TFR) and the two growth rates refer always to the annual growth rate in the 5-year interval between the row where the data is entered and the subsequent one. The dependency rate refers to the number of dependents (below 15 and above 64) divided by the working age population (times 100). The population density refers to persons per square kilometre. Please note that the population density figures are taken from the United Nations. The Uganda Population Census and the World Bank suggest that the population density in 2000 was higher, at around 120.
Source: United Nations Population Division (2002).

[2] The projections are consistent with the findings from the 2002 Census as far as population size and total fertility is concerned.

The central question investigated here is whether this rapid pace of population growth is likely to affect growth of per capita incomes and thus poverty reduction in Uganda. Based on insights from the theoretical and empirical (cross-country) growth literature, and an assessment of the impact of household size on poverty and inequality in Uganda, this paper investigates if high rates of population growth are likely to undermine efforts to maintain and boost economic growth rates and poverty reduction.

The paper is structured as follows. In the next section we review the economic theory associated with population growth and the impact on economic growth and poverty reduction In section three we focus on the empirical estimates of population growth, by firstly adopting a relatively broad macro approach and then complementing the analysis by using Uganda specific household panel data. In the final sections of the paper we discuss the policy implications of the analysis, before concluding.

2. Population Growth and Economic Growth and Poverty Reduction: Theory and Evidence

a) Preliminary Considerations

Before embarking on an analysis of the impact of population growth on economic growth, two preliminary considerations are critical to bear in mind. First, our analysis will focus on the impact of population growth on *per capita* economic growth (rather than *overall* economic growth), as this is the relevant indicator most responsible for changes in income poverty and many non-monetary measures of deprivation.

Secondly, we will examine primarily the causality from population growth to per capita economic growth, it should be stated upfront that the two variables are closely related to each other, with causality going in both directions. Considering the causality from per capita economic growth to population growth first, it is likely that in the short term, high per capita growth in a poor developing country like Uganda will increase population growth, mainly through reducing mortality rates.[3] This is the typical process of a country beginning a demographic transition which initially increases population growth rates.[4] In the long term, however, it is very likely that per capita economic growth will reduce population growth as wealthier parents choose smaller families which will over time reduce population growth. This is well documented in richer countries and has been studied extensively theoretically and empirically (e.g. Becker, 1981). This effect will materialize with a delay due to the demographic momentum that was already described in the previous section.

The focus of this study is, however, on the causality in the other direction, i.e. from population growth to per capita economic growth. If we find that population growth has a negative impact on per capita economic growth in the short term (within 10 years), then we can be quite certain that this is due to the causality running from population growth to per capita economic growth and not the reverse as the reverse causality would predict the opposite. [5]

[3] Population growth (increase in population per 1000 population) is defined as the birth rate (number of births per 1000 population minus the death rate (number of deaths per 1000 population) minus net emigration.

[4] For a discussion of the demographic transition, see for example, Bloom and Williamson (1998).

[5] In fact, since the short-run causality from per capita economic growth to population growth is positive, a negative correlation between population growth and per capita economic growth suggests that we are even underestimating the negative effect of population growth on economic growth. On the other hand, if we find a negative correlation between population growth and per capita economic growth only over the very long term (e.g. over 30-40 years), then we cannot be so sure whether this is due to the impact of population growth on per

In relation to the causality running in both ways, a last point it important to note from a policy perspective. Even we find that population growth negatively affects per capita economic growth, this does not necessarily mean that trying to convince people to have smaller families (or handing out family planning so that they can better control their fertility) is an effective strategy to reduce population growth. Often it is the case that people *choose* large family sizes for perfectly rational reasons. One needs to understand these reasons and then see whether, from society's point of view, there is a case to change the incentive (or power) structure within which families make their fertility decisions. This will be discussed in more detail below.

b) Theory: Population Dynamics and Economic Growth

While Uganda is unlikely to fall into a Malthusian trap of population growth leading to subsistence crises[6], growth theory suggests that there are serious negative impacts of high population growth for Uganda's per capita economic growth. In the most simple growth model, the Harrod-Domar model which assumes a production function with fixed proportions of factors and constant marginal returns to each factor, a one percentage point increase in population growth reduces per capita economic growth by one percentage point.[7] This fixed proportions assumption is also the main criticism of the model which is the reason why it has been largely abandoned, although simple cross-country regressions reveal considerable support for this rather simple formulation (see below).

The standard neo-classical growth model developed by Solow distinguishes between so-called steady state and transitional effects. In the steady state, the higher population growth will reduce income per capita, but will have no impact on per capita income growth. As a result, in the steady state, the economy grows with the rate of population growth (plus technological progress), and per capita growth in the steady state is unrelated to population growth. But in the transition to the steady state, higher population growth has a negative impact on per capita economic growth. The argument for the negative impact of population growth (on steady state income per capita and on the per capita growth in the transition) is essentially the same as in the Harrod-Domar model: population growth forces economies to use their scarce savings to undertake capital widening rather than capital deepening.[8] The impact is smaller though because of declining marginal returns to capital.

In a particular parameterisation of the model (using a Cobb-Douglas economy-wide production function) presented by Mankiw, Roemer, and Weil (1992), find that an increase in the population growth rate of 10% (e.g. 3% to 3.3%) would reduce per capita income in the steady state by 5%. If, however, one considered human capital to be an additional factor of production (which is eminently reasonable), then the negative impact of population growth is larger as population growth now forces economies to use their scarce savings to equip young

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capita growth or due to the reverse impact, both of which would imply a negative correlation. In any case, a negative coefficient would then likely over-estimate the impact of population growth on per capita economic growth.

[6] Both technological progress in agriculture as well as the ability to purchase food using agricultural and non-agricultural exports will ensure that Uganda will (as the entire world has been able to for the past 200 years) escape the Malthusian scenario.

[7] Note that in this model, the impact of population growth on overall (not per capita) economic growth is neutral. Overall growth is entirely determined by the amount of capital available.

[8] In Uganda, gross investment rate have been rising in recent years, mainly due to foreign savings transferred by aid (domestic savings have stagnated as a share of GDP, see Bevan et al. 2003). With this higher investment rate, it was possible to do some capital deepening as the growth in investment was faster than population growth. But had population growth been slower, much fast rates of capital deepening would have been possible.

people with physical and human capital. As a result, a 1% increase in population growth would decrease per capita income by 2%. Conversely, if Uganda achieved a 10% reduction in its population growth rate (from 3.4% to 3.1%), it could expect to boost per capita income by 20% in the long term (called the so-called steady state which countries are expected to approach within 30 years or so), and it would immediately embark on a higher path of per capita economic growth to reach this higher steady-state level of per capita income.

As an important driver of per capita economic growth, technological progress is not endogenously modelled in the Solow growth model, so-called endogenous growth models have emerged in the past 15 years. Most variants of these models predict larger and more permanent negative impacts of population growth on economic growth as high population growth lowers physical and human capital accumulation which in turns slows down technical progress.[9]

Apart from the impact of steady-state population growth on economic growth, the age structure of the population can also matter for economic growth. The age structure of the population is largely determined by the stage of a country in the demographic transition from high to low fertility levels. A population such as Uganda's which has not yet entered the demographic transition has a very young population, comparatively few working age people, and even fewer elderly. This is born out by the dependency rate in Table 1 which shows that each working age person currently has to take care of more than one dependent. Once it enters the demographic transition, the growth rate of the number of young will slow, while that of the working age population will remain high for some time. In that phase of the demographic transition, a country has a particularly low dependency burden. The projections in Table 1 suggest that Uganda will, if fertility decline gets under way in coming years, slowly enter this demographic transition after 2005 and from then on, the growth rate of the working age population will exceed the overall population growth rate by a an increasing margin, and the dependency rate will consequently drop.

Bloom and Williamson (1998) adjust a neo-classical growth model to show that this second phase of the demographic transition is associated with particularly high growth, while the first phase leads to high growth. Therefore they call the first phase (in which Uganda is currently in) a 'demographic burden' and the second phase a 'demographic gift'. The quicker the fertility decline in that phase, the larger the demographic gift. East Asian countries achieved a particularly quick fertility decline in the 1960s to 1980s and thus had a particularly large demographic gift and up to 50% of their high per capita growth in these decades has been traced by Bloom and Williamson (1998) to the demographic gift. The mechanisms for high growth in the demographic gift phase relate to a higher share of workers to the total population (thus mechanically lifting per capita growth rates), higher savings rates in that phase as the working age population can build up capital and has to spend relatively few resources on the declining numbers of young people (and the still small number of elderly), and an investment-demand led boom for housing, infrastructure, and other adult population-sensitive services (see Bloom and Williamson, 1998 and ADB, 1997 for a detailed discussion).

The demographic gift, particularly the high savings and investment rates, are not automatic but will depend on sound economic policy that ensures high employment. Also, it is clear

[9] One variant of an endogenous growth model (e.g. Kremer, 1993) would, conversely, suggest that population growth might lead to higher growth as a larger population increases the number of innovators, and with innovations being a public good and thus available to everyone, would boost technical change in a society. This model and its relevance to Uganda will be discussed below.

that the phase of the 'demographic gift' will be temporary and it will be replaced by another phase of a demographic burden when the share of workers is falling and that of the elderly rising. But in the case of Uganda 'temporary' refers to a period of 30-40 years so that there is ample time to capitalize on this opportunity while preparing for the inevitable ageing of society that will begin in mid-century.

c) Population Growth and Poverty

Recently, the linkages between population growth, poverty (and inequality) have received increasing attention. For example, two recent papers by Kremer and Chen (2002) and de la Croix and Doepke (2003) emphasize the distributional dynamics inherent in high population growth and large fertility differentials between the rich and the poor. Kremer and Chen (2002) show theoretically and empirically that countries with high income inequality will have a high fertility differential between the educated rich and the uneducated poor. The few children of the educated rich will have a much greater likelihood to become educated themselves, while the many children of the uneducated poor have a much lower chance. This then reproduces (and possibly worsens) inequality over time. The clear policy implication would be to push for high education of the poor to allow them to break out of this poverty trap. Bourguignon (2001) has shown that the income distribution dynamics in Latin American countries are heavily influenced by differential fertility. De la Croix and Doepke (2003) additionally show that this mechanism of differential fertility is, according to them, a major reason why such large inequality appears to reduce economic growth. If the poor continue to have such large families, improvements in the (average) human capital of the population are difficult, and growth will be lower as a result. Uganda has an unusually large differential in fertility between the highly educated (3.9) and the women with low education (7.8) and is therefore particularly prone to this dynamic of the poor being caught in a demographic poverty trap which keeps poverty high, widens inequality and reduces economic growth. This is one of the reasons why Eastwood and Lipton have suggested that sustained reductions in fertility are one of the most important ways to generate pro-poor growth in countries such as Uganda (Eastwood and Lipton, 2001, see also Klasen, 2004).

Of the general poverty dynamics literature, other things being equal, increased household size has been found to also consistently place extra burden on a household's asset/resource base and in general is positively related to chronic poverty (McCulloch and Baulch 2000, Jalan and Ravallion 1999, 2000, and Aliber 2001). A similar logic applies for increased dependency ratios, number of children (McCulloch and Baulch, 2000, Jalan and Ravallion, 1999, 2000). We examine such relationships in a Uganda specific environment in this next section.

d) Population Growth and Non-Income Indicators

So far, we have focused on the impact of population growth on per capita economic growth and poverty reduction. But high population growth is also likely to affect other development goals other than economic growth. Most importantly, high fertility is likely to reduce progress on achieving mortality reductions and education improvements. At the household level, a large number of children are associated with low human capital investment in each child. This is what Becker called the quantity-quality trade-off. As a result of many children, households have fewer resources to send children to school, they have fewer resources to afford health care, and they have even fewer resources to save or invest in productive activities.

This is not only true at the household level, but similarly applies to the provision of public services. In a high population growth environment, it is extremely difficult to extend services

to the rapidly rising population. This is particularly the case for education and health services for children. As shown in Table 1, in 2000 there were about 9 million children for whom one would need to provide education to ensure universal primary and secondary education. By 2050, this number will have increased to over 34 million. At the same time, the tax base in a country with many young people is particularly small as only working age people are contributing to taxes (particularly income and consumption taxes). Thus in a high growth scenario, the state will be hard-pressed to assist parents in investing in human capital. Uganda has embarked on a policy of free universal primary education. The costs of this will mount rapidly and options to extent it to secondary education will not be fiscally possible given current population growth rates. Thus not only households, but also public services, will face a quantity-quality trade-off.

If large families are poorer and worse off in terms of health and savings, the obvious question arises why families choose to have many children given that they appear to be well aware of these connections (MFPED 2003). To some extent, they may not have chosen such large families if access to family planning is not available (at costs affordable to the poor). In Uganda, the findings from the DHS suggest that this is playing a role. It shows that the Wanted Fertility Rate (based on fertility preferences) stood at 5.3 in 2000, compared to an actual TFR of 6.9 (UBOS, 2001). This differential (or 'unmet need') is particularly large among poorly educated women in rural areas. In addition, there are other factors that relate to the importance of children as 'investment goods.' Parents want a certain number of surviving children to ensure support as workers and in old age. Given the high prevailing infant and child mortality, they must, ex ante, plan to have large numbers of children to achieve their reproductive goal with a high degree of certainty.[10] Ex post, however, many parents will find themselves with more surviving children than anticipated. So the number of children ex post is too high for many families.[11] It may also be the case that social norms maintain high fertility rates even if everyone would be better off if all couples simultaneously chose smaller family sizes.[12]

e) **Potential Counterarguments**

While most theories suggest a negative impact of population growth on per capita economic growth, there are also a number of theoretical arguments that suggest that population growth might have a positive impact on per capita economic growth. But these arguments are often not so much about population growth per se, but about the resulting increase in population or population density. The relevance of these arguments for the Ugandan case will be discussed below.

Population and Technical Change: Demand Side Arguments

One powerful counterargument to the discussion above is a theory put forward by Esther Boserup (1965) arguing that high population growth increases the pressure to use available resources more efficiently and innovate in order to be able to supply the population with food and other necessary resources. While this argument is likely to have some force in the very long term in many contexts, it is unlikely to play a large role currently in Uganda. Unlike

[10] See Ray (1998) for a discussion and some illustrative calculations.

[11] A third reason for having large families, despite the negative effects, are externalities. Parents can, to some degree, pass on the costs of raising children to others within the larger household (e.g. older relatives) and thus will have more children than is optimal, if they themselves had to incur all the costs.

[12] Parents will rationally adjust their fertility behaviour to prevailing patterns, particularly in the case of rationed resources where each child is like a 'lottery ticket' for access to scarce public and private resources. If all parents decided to lower the number of children, they would collectively be better off. Thus in this sense, high fertility persists due to a failure of coordination (in which case a family planning program can help to establish new norms).

other African countries, Uganda already uses its agricultural resources quite intensively (there is little extensive livestock farming) and the gains from further intensification are not as large as elsewhere. Second, it is doubtful that technological innovations materialize in the short term just because of population pressure particularly if most of these people are too poor to be able to purchase new technologies, let alone engage in costly innovations themselves.[13]

The Population Density Argument

Countries with low population density have their own problems.[14] Innovations spread very slowly, there is little contact between population groups (allowing ethnic diversity to persist for longer), interaction with the world economy is difficult and costly, and the provision of infrastructure (such as roads, grid electricity, etc) is particularly costly on a per capita basis. Gallup, Sachs, and Mellinger (1998) argue that not all types of population density have the same beneficial effect. In fact, while they show that coastal population density boosts per capita growth, they find that interior population density (i.e. high population density far away from the coast or in a landlocked country) is associated with lower per capita GDP growth which they attribute to the fact that population density is particularly beneficial when it helps to increase interaction with the outside world through trade and technology transfer. Inland density does not carry these benefits and may in fact divert a country from greater integration with the world economy.

While the positive growth impacts of higher population density may again be relevant for many African countries (including some of Uganda's neighbours such as Tanzania), they are unlikely to be of great relevance in today's Uganda. As shown in Table 1, Uganda's population density in 2000 is, at about 100 people per square kilometre, already much higher than the average population density prevailing in industrialized countries (31 people/square kilometre in 2000, see World Bank 2002) or in Europe (32 person/square kilometre in 2000, see United Nations (2003)), and it will rapidly become a very densely populated country.[15] Moreover, in today's age, the spread of technologies is no longer greatly determined by physical distance as it is by means of communications. In addition, all of Uganda's population density is inland density which has been found, if anything, to reduce, rather than increase economic growth.

Market Size Arguments

As higher population growth will, in time, deliver a higher population, the question arises whether the resulting larger market will be a benefit for Uganda. In particular, a larger market is likely to increase foreign direct investments that want to service such a market. In addition, the scope for import-competing industries might be larger if the domestic market to be served is bigger. While these arguments are of some relevance, a few points are worth noting. First, market size depends more on the purchasing power of the people, rather than their numbers.

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[13] There is a variant of this argument proposed by Kremer (1993). If innovations are a public good, a country with a large population innovates more and the country benefits as a result. While this might also have been a factor in explaining technological change over the very long haul (Kremer's time horizon is from 10 million B.C. to 1990), in today's world technological change does not primarily depend on population, but is much more related with the level of economic development, technology policies, etc. Moreover, technological development is increasingly a public good at the global level so that a country like Uganda can benefit from technological improvements elsewhere.

[14] See, for example, Klasen and Woltermann (2004) which find that sparsely populated Mozambique might benefit from greater densification.

[15] In 2000, Uganda had the population density of France. By 2030 it will have surpassed Britain and Germany, and by 2050 will have reached the density of Europe's most densely populated country, the Netherlands. See World Bank (2002). To be sure, I do not foresee that this high population density will generate great problems per se, but clearly Uganda is unlikely to be suffering from the problems associated with being a low density country.

Having 100 million poor people is not much of an inducement to set up industries to serve that market. Second, with falling trade barriers all across the world, the relevance of a national market for foreign direct investment is becoming smaller as such markets can be well-served through imports. Third, regional integration provides another means to enhance market size and the East African Community is one such way to enhance the attractiveness for foreign direct investment and import-competing industries to locate in the region. Thus it is far from clear that there are great benefits to be had from increasing population size, esp. given the costs involved. Clearly, these three most important counterarguments are not particularly relevant in the Ugandan case.

3. Empirical Estimates: Effects of Population Growth on Economic Growth and Poverty

a)Economic Growth

In principle, one could investigate the linkage between population growth and economic growth in a time series analysis for a single country such as Uganda, in a cross-section analysis, or, in a combination of the two, a panel analysis. The first type of estimation is extremely difficult as one has to deal with severe conceptual and econometric problems, among them the high fluctuation of income growth on an annual basis (in contrast to the great inertia of population growth), the long-term nature of the impact of population growth on economic growth, the problem of non-stationarity of dependent and independent variables, the identification problem of separating influences due to population growth and due to other extraneous factors.[16] Uganda is a perfect example of such problems. Per capita economic growth has fluctuated wildly over the past 40 years in Uganda, on average being low and negative throughout most of the 1970s and 1980s, and being highly positive throughout the 1990s. Disentangling the long-term impact of population growth on economic growth from other more short-term influences (such as presence or absence of conflict, economic policies, coffee prices, etc.) would be very difficult indeed. As a result, virtually all of the studies on such long-term determinants of economic growth are done in a cross-section framework or in a panel framework where the dependent variable is usually growth over a 5-10 year interval.

The results from cross-country and panel regressions mostly show a negative impact of population growth (or related variables) on economic growth. In Table 2, a set of very simple cross-section and panel regressions are presented for illustration. The left-hand panel of the table shows tests of the Harrod-Domar Model, the right-hand panel tests of the transitional dynamics of the Solow Model with human capital. Each time, there are cross-section regressions which treat the entire time period 1960-2000 as one observation, and panel regressions that are based on one observation per decade, thus yielding four observations per country. Several issues are worth noting.

[16] A potential (partial) solution to this would be to run a regression based on five-year intervals of growth and population growth. But then one would only have 5-8 observations from which one could not properly estimate a multivariate regression model.

Table 2: Population Growth and Economic Growth in the Harrod-Domar and Solow Model (1960-2000)

	Harrod-Domar Model				Solow Model							
	Cross-Section		Panel		Cross-Section				Panel			
Dependent Variable	Growth	Per Cap. Growth	Growth	Per Cap. Growth	Growth	Per Cap. Growth	Per Cap. Growth	Per Cap. Growth	Growth	Per Cap. Growth	Per Cap. Growth	Per Cap. Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.28 (0.6)	0.33 (0.6)	0.17 (0.3)	-0.59 (1.2)	7.32*** (3.1)	7.25*** (3.2)	7.96*** (3.4)	8.36*** (4.3)	12.98** (2.2)	7.22** (2.2)	7.28** (2.3)	5.84** (2.3)
Log (Initial GDP)					-1.90*** (3.0)	-1.87*** (3.0)	-2.10*** (3.6)	-2.08*** (4.2)	-3.49*** (2.5)	-2.01*** (2.6)	-2.03*** (2.6)	-1.69*** (2.5)
Population Growth	0.46** (2.4)	-0.55*** (2.9)	0.56** (2.1)	-0.33** (1.8)	0.39** (1.9)	-0.62*** (3.2)	-0.51*** (2.5)	-3.02*** (5.7)	0.37 (1.1)	-0.52*** (3.3)	-0.51*** (3.4)	-1.41*** (4.7)
Labour Force Growth								2.51*** (5.3)				0.98*** (3.5)
Investment Rate	0.12*** (5.2)	0.11*** (5.6)	0.11*** (5.0)	0.12*** (7.3)	0.10*** (4.0)	0.09*** (4.0)	0.10*** (4.6)	0.07*** (3.6)	0.12*** (4.6)	0.10*** (6.0)	0.10*** (6.2)	0.11*** (6.4)
Growth of Human Capital					12.6*** (2.5)	12.4*** (2.5)	13.2*** (3.1)	8.56** (2.0)	0.25*** (2.5)	0.13** (2.1)	0.13** (2.1)	0.08* (1.3)
Sub-Saharan Africa	0.47 (0.53)	0.45 (0.9)	0.38 (0.6)	0.25 (0.6)	-0.97 (1.0)	-0.96 (0.9)	0.77 (0.4)	-1.30** (2.1)	-0.99 (0.7)	-0.69 (0.9)	-0.52 (0.3)	0.60 (1.0)
Pop. Gr.* Sub-Saharan Africa							-0.79 (1.0)				-0.08 (0.1)	
South Asia	1.75*** (3.5)	1.70*** (3.4)	1.61*** (2.7)	1.41*** (3.0)	-0.16 (0.2)	-0.18 (0.2)	-0.51 (0.8)	-0.73 (1.1)	-0.23 (0.2)	0.18 (0.2)	0.15 (0.2)	0.19 (0.3)
Eastern Europe & Central Asia	1.15*** (2.7)	1.13*** (2.7)	0.99 (0.6)	0.17 (0.3)	-0.35 (0.8)	-0.33 (0.8)	-0.53 (0.7)	-0.64 (1.1)	3.27 (1.1)	0.64 (1.1)	0.62 (1.1)	0.45 (0.9)
Latin Am. & Caribbean	0.67* (1.5)	0.65* (1.5)	1.02** (2.0)	0.69** (2.1)	-0.21 (0.5)	-0.21 (-0.4)	-0.43 (0.9)	-1.17 (2.5)	0.28 (0.4)	0.00 (0.0)	-0.02 (0.0)	-0.36 (0.9)
Middle East & North Africa	1.87*** (3.3)	1.81*** (3.3)	1.80*** (2.5)	1.46*** (2.8)	0.05 (0.1)	0.03 (0.1)	-0.34 (0.5)	-0.75 (1.2)	1.49 (1.4)	1.18** (1.8)	1.15** (1.8)	0.79* (1.3)
East Asia and the Pacific	2.50*** (4.8)	2.44*** (4.8)	-2.47*** (5.3)	1.97*** (5.3)	1.00* (1.4)	0.97* (1.4)	0.67 (1.0)	-0.54 (0.9)	1.70** (2.1)	1.58*** (3.0)	1.55*** (3.0)	0.97** (2.1)
1960s			1.40*** (3.3)	1.55*** (5.6)					0.56 (0.9)	1.22*** (3.2)	1.21** (3.2)	1.63*** (4.9)
1970s			0.33 (0.8)	0.71** (2.4)					-0.08 (0.2)	0.64** (1.8)	0.64** (1.8)	0.74*** (2.4)
1980s			-0.52* (1.3)	-0.11 (0.3)					-1.20*** (2.4)	-0.40* (1.3)	-0.40* (1.3)	-0.34* (1.3)
Adj. R-Squared	0.463	0.557	0.179	0.303	0.536	0.605	0.610	0.712	0.24	0.347	0.345	0.381
N	115	115	460	488	95	95	95	95	349	365	365	350

Notes: Heteroscedasticity adjusted T-ratios in brackets. *** refer to 99%, ** to 95%, and * to 90% significance (one-tailed test). These regressions are based on data from the Penn World Tables and the Barro-Lee education data (2000). In the cross-section regression, the growth rate of human capital refers to the (average annual) increase in the average number of years of schooling in the adult population between 1960 and 2000. In the panel regressions, it is the average years of schooling of the adult population at the beginning of the decade. The dependent variable is the average annual (compound) rate of PPP-adjusted GDP per capita in 1996$. The choice of countries is dictated by data availability. The left-out category is OECD countries.

First population growth has a positive impact on *overall* economic growth. This is true in the Harrod-Domar or the (more plausible) Solow specification, in cross-section and in panel data. But the coefficient is always smaller than 1 suggesting that the additional people have a less than proportionate influence on economic growth. As a result, all of the regressions of *per capita* economic growth that are shown in the table suggest that population growth has a highly significant *negative* influence on *per capita* economic growth. Third, this negative impact of population growth depends on the specification. In the cross-section specification, the impact is generally larger than in the panel specifications. From the discussion above, this is to be expected since the (positive short-term) impact of income growth on population growth is likely to reduce the negative coefficient in the panel specification. [17] Fourth, the impact of population growth on economic growth does not appear to be different in Sub Saharan Africa from elsewhere. An interaction term of population growth and Sub-Saharan Africa is never significant. Fifth, the impact of the dynamics of population growth is much more dramatic. If we additionally include labour force growth in the regression, the negative impact of population growth is now much larger, while there is a positive influence of labour force growth on per capita economic growth, supporting the claim by Bloom and Williamson (1998).

What do these estimates mean for Uganda? Focusing on the more plausible Solow Model estimates, they suggest that if Uganda succeeded in reducing its population growth rate from the current 3.4% to 2.4% (which, given the inherent demographic momentum, would only be possible in the medium term), its annual growth of per capita GDP could rise by between 0.5-0.6%. If we additionally consider the impact of the population dynamics such a reduction would entail, per capita economic growth could increase by between 1.4 and 3.0 percentage points per year as long as Uganda would be in the phase of the 'demographic gift' with falling population growth but still substantial labour force growth.

Turning to results from other studies, they largely confirm the findings shown here. Using a Solow Model framework, Mankiw, Roemer, and Weil estimate that in a regression including investment, population growth, and human capital, a 10% increase in population growth (e.g. in the case of Uganda from 3% to 3.3%) reduces the steady-state per capita income by about 17%. This is close to the prediction of the augmented Solow model and shows a sizable negative impact of population growth. In a regression using economic growth as the dependent variable (and controlling for conditional convergence), they find that a 10% increase in population growth (from, say 3 to 3.3%) would reduce annual capita economic growth by 5% (e.g. from 2% to 1.9%), quite similar to the findings above. Barro (1991) does not use population growth per se, but a so called net fertility rate which is the number of children that survive to age 5. He also finds a negative impact in his cross-country analysis which is loosely based on the Solow framework. An increase in the net fertility rate of one child will lower economic growth by about 0.4% per year. These are just two typical results of many similar findings.

Similar to Table 2, stronger results come from regressions that include the dynamics of the fertility transition. This is done by including the population growth rate as well as the growth rate of the working age population to explicitly test whether demographic burden (high

[17] Conversely, one may argue that the cross-section coefficient is overestimating the impact of population growth as it is affected be the long-run negative impact of income growth on population growth. Thus one may argue that the panel regressions, which largely control for this, are to be preferred. Clearly, other factors also play a role as seen by the significant regional dummy variables. The perhaps surprisingly high negative coefficient on OECD countries merely suggests that controlling for investment rates and population growth rates, OECD countries grew by about 2 percentage points slower than East Asia and the Pacific, the left-out category.

population growth and relatively low labour force growth) and demographic gift (high labour force growth and relatively low population growth) affect economic growth.[18]

If Uganda succeeded in reducing its fertility rate, it would be able to reduce its population growth rate without affecting its growth rate of the labour force for the coming decades and thus reap significant benefits. Based on the cross-country evidence presented above a reduction in the population growth rate of 1 percentage point could boost economic growth in the medium term by about 0.6-2.8 percentage points per year. While there are reasons to be cautious about the point estimates emanating from such cross-country regressions due to well-known econometric problems (e.g. omitted variable bias, endogeneity, lack of robustness), the evidence presented here overwhelmingly points to a negative impact of high population growth, such as the one Uganda is experiencing, on per capita economic growth. Nevertheless, it is useful to turn to microeconomic and Uganda-specific evidence to explore these effects further.

b) Poverty

Analyses of household surveys from many African, and other developing, countries have shown that larger families are generally poorer. We can see this is generally the case for Uganda, Angemi (2003) finding that large families, which consist of many dependent children, face an additional increase in poverty. For example, a reduction in fertility of one child would reduce the likelihood of a household to fall below the poverty line by 3-4%. In addition, it would lower the dependency burden that would have the effect of reducing household poverty by another 1%. To some extent, such quantitative findings are also supported by Uganda's Participatory Poverty Assessment found that a large share of respondents saw large families as one of the most important causes of poverty (MFPED, 2003).

However, given the wealth of Uganda's household data, we have the potential to substantially add to this analysis by using panel data. In particular, we can establish if household size and changes in household size, relative to other important characteristics, are associated with movements into poverty, persistent poverty, or slower per adult equivalent growth levels.

Considering the descriptive data in Table 3, we notice that those households persistently below the poverty line have a higher average household size in both 1992 and 1999 (6.2 and 6.7 persons respectively, compared to an overall average of 5.48 and 6.07). However, perhaps most noticeable are the changes in household size over the period. Households that move into poverty have household size increases of almost 35%, compared with a decline for those households that have moved out of poverty. In addition, on average almost 50% of each

[18] For example, Sachs, Radelet and Lee in ADB (1997) find a negative coefficient of population growth of 0.77 and a positive one for labour force growth of 1.13 in a growth regression that also controls for many of the commonly found determinants of economic growth. They also test one channel of this link and particularly find that high dependency rates lead to greatly reduced savings rates, with further implications for economic growth. Bloom and Williamson (1998) find a positive coefficient for labour force growth of about 1.95 and a negative coefficient for population growth of 1.87. Klasen (2002) finds a positive coefficient on labour force growth of 0.55 and a negative one for population growth of 0.62. In each case, both are highly significant and control for many other variables typically included in cross-country regressions. They all refer to a period between 1960 or 1965 to 1985 or 1990. In Klasen and Lamanna (2003), the time period 1960-2000 is considered and the impact is largest of all. Population growth has a negative coefficient of 2.8, labour force growth a positive coefficient of 2.33, suggesting that the impact of the demographic transition on economic growth has increased in the 1990s. It is interesting to note that the measured impact of population growth on per capita economic growth has increased considerably over the past few decades which may be due to the impact of population dynamics on economic growth in the developing countries that have entered the fertility transition.

household that is persistently poor (chronic poverty) is made up of children below the age of 15 years. There appears therefore, to be both a link between family size and static based poverty measures and an association between having larger families being more likely to be chronically poor, or move into poverty.

Examining the aforementioned trends econometrically allows us to establish with greater certainty the statistical association between the aforementioned variables. We provide a complementary approach to poverty analysis by adopting both a continuous dependant variable and multinomial logit approach. Furthermore, given that a change in the household size could intuitively arise as a result of change in poverty or income growth, or be the causal factor, we confront this endogeneity issue by adopting an instrumental variables approach.

Table 3: Poverty Dynamics and Demographics

			1992/99		
	Chronic Poor	**Moving Out of Poverty**	**Moving Into Poverty**	**Never In Poverty**	**All**
Actual Household Size					
Size of Household at 1992	6.24	5.91	5.06	4.95	5.48
Size of Household at 1999	6.7	5.74	6.79	5.84	6.07
Age Compositions of HH					
Proportion of Household 0-5 years at 1992	23.7%	20.0%	22.3%	20.7%	21.2%
Proportion of Household 0-14 years at 1992	49.9%	44.4%	43.5%	41.6%	44.2%
Proportion of Household > 60 years at 1992	4.7%	7.5%	8.0%	6.0%	6.4%
Proportion of Household 15-60 years at 1992	45.4%	48.1%	48.5%	52.4%	49.4%
Dependency Ratio at 1992	1.40	1.36	1.26	1.35	1.36
Proportion of Household are 'dependants'	54.7%	51.7%	51.5%	47.6%	50.6%
Changes in Household Size					
Change in Household Size	7.4%	-2.9%	34.2%	18.0%	10.8%

Note: Dependants are those aged<15 or >60 years of age; Pae = per adult equivalent

Tables 4 and 5 show the impact of household size, and change in household size, relative to other variables on both the change in log welfare (per adult equivalent) and change in poverty status at the household level. In line with prior expectations, we can see from the first of these tables that a higher household size in the original period is strongly associated with slower income growth over the period. This is also the case for households that have experienced larger increases in household size, with a strong negative association with change in log welfare. For example for every extra person added to the household over the period, consumption reduces by approximately 5-6%. Perhaps rather surprisingly, such a marginal effect means ranks alongside the importance of having land available to cultivate.

If we consider the somewhat more restrictive multinomial logit model framework, we also see that original household size, and change, is important in the context of poverty over time. This is particularly the case for household persistently below the poverty line and those moving into poverty. In the latter case, for every person added to a household, it raises the likelihood of moving into poverty by 3% and being in persistent poverty by 2.5%, relative to never being poor. Therefore, although household size and changes in household size are important, other factors such as the region and the types of job have a greater marginal impact.

The importance of the impact of population growth is exemplified by other Uganda specific evidence. For example, MFPED (2004) projected that approximately 28% of the total population will live below the poverty line by the year 2013, assuming the current population growth rate of 3.4% p.a. In addition, Ssewanyana et al. (2004) found that the differential family size between rich and poor had an impact on widening inequality in Uganda (as shown by the impact of household size on poverty in Uganda has increased between 1992 and 2002). As a result, differential fertility and its effects are responsible for about 10-12% of the *level* of inequality in 1992 and in 2002, and for about 20% of the *increase* in inequality between 1992 and 2002. Moreover, there is a close linkage between large families and high infant and child mortality. For example, Klasen (2003a) found that high fertility is one of the main reasons for high child mortality in Africa. This has also been found to be the case in Uganda (MFPED, 2002). In fact, the non-improvement in infant mortality is to a large extent driven by the strong fertility-infant mortality linkage (MFPED, 2002). MFPED (2002) find that a reduction of one birth (within a five year period) would reduce the risk of infant mortality by about 30%. It would therefore appear that high fertility is preventing improvements in the human capital of the Uganda's population.

4. Policy Implications and Conclusion

The summary of research above suggests that there appear to be significant pay-offs to reducing fertility levels in Uganda. It would assist households and the public sector in improving education and health outcomes and would lead to significantly higher economic growth. What type of interventions might bring about such a change?

The literature on the determinants of fertility is large and, on the whole, quite conclusive. Among the most important factors affecting fertility levels are, in order of importance, female education, female employment opportunities, greater female bargaining power at the household level, higher incomes, good access to reproductive health services, and a family planning effort that tries to establish norms of smaller families and assists in making reproductive and family planning services available at low cost to everyone in society (e.g. Schultz, 1994, 1997; Summers, 1994; Murthi and Dreze, 2001, ADB, 1997; Pritchett, 1995). In the longer term, policies that generate alternative old-age security arrangements (e.g. financial markets and the build-up of pension systems) are also likely to help. It is no coincidence that South Africa's fertility decline appears to have accelerated markedly in recent years after a non-contributory social pension was introduced. In addition, there appears to be societal influences that affect fertility decline that are not well-understood, such as the role of the media that project positive images of small families.

These factors are also the most important ones that ensured rapid fertility decline in East Asia, and the onset of the demographic transition in some of Uganda's neighbours, such as Tanzania and Kenya. In most countries of East Asia, it was the early commitment to universal public education at the primary and secondary level that sharply increased female education at both levels (and thus quickly reduced the existing gender gaps). This was combined with great efforts to improve access to reproductive and family planning services in all countries and a strong government leadership in most countries promoting smaller families (ADB, 1997).[19] In Kenya and Tanzania, the rapid fertility decline also appears to have been

[19] This represents the typical experience. Two individual country experiences should be highlighted. First Bangladesh had a particularly strong focus on family planning initiatives (including mostly information, education and the spread of low-cost reproductive and family planning services) and was able to achieve a more rapid fertility decline than it would have been expected given the slower expansion of female education and the low income growth. China has also generated a very rapid fertility decline, supported by a coercive one-child policy with great penalties for parents who exceed this target. While this policy has accelerated the already

mostly due to an early commitment to mass education (including female education), strong improvements in reproductive and other health services, rapid urbanization and rising female wage employment, and a determined government effort to make family planning services widely available (e.g. Blacker, 2002; APPRC, 1998, Mturi and Hinde, 2001)

In the Ugandan case, there is also a strong impact of female education on fertility. As shown by the DHS, women with no education have 7.8, those with some primary education have 7.3, and those with some secondary education or more 3.9 children (UBOS, 2001). This clearly shows that the impact of education on fertility is relatively small below completed primary education and some secondary education. Similarly, more educated women have better access to family planning information and services, have a much lower likelihood for teenage pregnancies (this is already true for girls with only some primary education) and have a lower 'unmet need' for family planning services. Here it is interesting to note that the desired number of children is at 5.9 for those women with no education, 4.8 of those with some primary education, and 3.8 with some secondary education. This suggests that the relatively small fertility difference between women with no and with some primary education is largely due to the unmet need for family planning services in the latter group. Higher incomes and greater urbanization also affect fertility levels. Moreover, greater female status and decision-making within the household is associated with reduced fertility levels. As discussed in Klasen (2003b), here Uganda is lagging behind with women having little control over resources and decision-making within the household. Lastly, there is a remarkably strong linkage between high fertility and high child mortality. This suggests that parents in Uganda are replacing lost children and 'hoarding' children in anticipation of loss.

Through its UPE policy, Uganda is already embarking on a strategy to promote female education. While this is likely to assist with fertility decline, it must be accompanied by great efforts to reduce drop-out rates, and particularly ensure completion of primary education and continuation to secondary education. As shown by the DHS and the 2002 household survey, there remain large persistent problems (UBOS 2002).

In addition, greater efforts must be made to ensure better access to female income-earning opportunities within and beyond subsistence agriculture. Women make up a small share of formal sector employment, they have poorer access to credit, they have little control over land and worse access to inputs, and have less capital to work with. As a result, their opportunity cost of time is still quite low, which enables large numbers of children. In addition, such policies would increase their bargaining power (Klasen 2003b). This could be of importance for fertility reduction as, according to the DHS, women have smaller desired fertility levels (4.8) compared to men (5.6).

Third, reproductive and child health services are still quite inadequate and prevent families from reducing their number of children and investing more in each of them (MFPED, 2001). Given that child mortality and fertility are so closely linked, it is critical to tackle the issue from both ends. Success in one area will then promote success in the other.

Fourth, measures to assist households with alternative ways to smooth consumption over the life-cycle would clearly assist in reducing fertility. Among the measures to be considered are

existing fertility decline, the coercion involved and the negative side-effects (including particularly a massive pre and post-birth discrimination against female infants) hardly justify the benefits of a fertility decline that, in the view of many, is too rapid (China's TFR now stands at about 1.4 !). For a discussion, see Klasen and Wink (2003), and Drèze and Sen (1995).

the development of financial services (esp. to rural areas), and possibly the introduction of publicly supported old-age support.

Fifth, a concerted effort by the government (similar to the effort to halt the spread of AIDS) to focus on the population question by providing an integrated approach and political leadership is needed to highlight the issues and coordinate solutions. As argued above, high fertility is often simply the result of a social norm resulting from a coordination failure. Government leadership can bring about a change in those norms that make a substantial contribution to lower fertility levels and increased demand for family planning services. Here the issue is not so much providing information about family planning options, which, according to the DHS, is very widely available, but increasing its acceptability through promoting norms of smaller families.

In this context, it is somewhat surprising that the careful analysis of the growth options and projections by Bevan et al. (2003) do not address the population growth question at all and only see this as a wedge between growth and per capita growth. As shown above, there is much more to this and greater focus on addressing the population question in Uganda could greatly assist in sustaining higher per capita growth and reducing the probability of households being persistently poor or moving into poverty, in the coming decades.

Table 4: Factor Affecting Changes in Household Well Being

Variable		Change in Log Welfare
Constant		7.2320 (7.058)***
Age of head		-0.0015 (-0.254)
Age of head squared		0.0000 (0.361)
Sex of head		0.0318 (0.761)
Household size		-0.0270 (-4.635)***
Education (yrs.)		
	Head Primary	0.0051 (0.731)
	Head Secondary	0.0559 (3.728)***
	Spouse Primary	0.0041 (0.582)
	Spouse Secondary	0.0281 (0.996)
Number of Assets per household		
	Land (rural) hectares	0.0608 (2.49)**
	Land	-0.0185 (-0.86)
	Chickens	-0.0039 (-0.515)
	Cows	0.0121 (1.485)
	Goats	0.0034 (0.484)
Region		
	Urban Central	0.5150 (5.384)***
	Rural Central	0.0754 (1.776)*
	Rural East	-0.0739 (-1.598)
	Urban East	0.3680 (3.292)***
	Rural West	0.4790 (4.394)***
	Urban North	-0.0269 (-0.238)
	Rural North	-0.4711 (-8.565)***
Type of Work		
	Agricultural Own Account	-0.1509 (-3.278)***
	Agricultural Wage	-0.1557 (-1.38)
	Other	-0.1321 (-1.562)
	Non Agricultural Own Account	-0.0002 (-0.004)
Initial Income		
Change Variables		
	Change in household size	-0.0595 (-3.614)***
		No. of Obs - 1103
		R-squared= .472,

* Significant at 10% level, ** Significant at 5% level, *** Significant at 1% level

NOTE: Defaults – Missed Education (for head and spouse), Urban West, Non Agricultural Wage Employment, IV Change in Households is from a separate regression which instruments household size, this has been included in this table of results as not to repeat the full set of results which are similar to those presented here which use a non-instrumented household change variable. Instrumental Variables used are : - age of partner, somebody in family has left to search for a job, somebody has left to set up a new household, somebody has got a job, household has had members die, age of the eldest child, age of the female partner of head. 7.42 (df=7) (pass). See Lawson, McKay and Okidi (2005) for details of household matching and attrition tests.

Table 5: Multinomial Logit Marginal Effects 1992/99 Panel

	Poverty status							
Variable	**Not Poor**		**Chronic Poverty**		**Moving Out of Poverty**		**Moving Into Poverty**	
	Marginal effect	t ratio	Marginal effect	t ratio	Marginal effect	t ratio	Marginal effect	t ratio
Constant	0.3928	(2.599)***	-0.2791	(-2.457)**	-0.0768	(-0.549)	-0.0369	(-0.492)
Age of head	-0.0060	(-0.997)	0.0054	(1.156)	0.0019	(0.347)	-0.0013	(-0.416)
Age of head squared	0.0001	(0.885)	-0.0001	(-1.274)	0.0000	(-0.03)	0.0000	(0.255)
Sex of head	0.0197	(0.443)	-0.0411	(-1.282)	0.0031	(0.076)	0.0182	(0.828)
Household size in 1992	-0.0296	(-4.443)***	0.0207	(4.894)***	0.0064	(1.122)	0.0024	(0.705)
Education (yrs.)								
Head Primary	0.0195	(2.646)***	-0.0073	(-1.425)	-0.0152	(-2.266)**	0.0030	(0.816)
Head Secondary	0.0421	(2.623)***	-0.0330	(-2.266)**	0.0076	(0.491)	-0.0167	(-1.714)*
Spouse Primary	0.0080	(1.082)	-0.0146	(-2.561)**	0.0071	(1.016)	-0.0005	(-0.13)
Spouse Secondary	0.0669	(1.979)**	0.0006	(0.02)	-0.0796	(-2.05)**	0.0121	(0.775)
Number of Assets per household								
Land (rural) hectares	0.0161	(0.605)	-0.0209	(-0.898)	0.0430	(1.621)	-0.0381	(-2.45)**
Land	-0.0077	(-0.327)	0.0188	(0.872)	-0.0311	(-1.294)	0.0200	(1.371)
Chickens	-0.0021	(-0.27)	0.0086	(1.544)	-0.0004	(-0.05)	-0.0061	(-1.429)
Cows	0.0129	(1.512)	-0.0142	(-2.167)**	0.0017	(0.209)	-0.0004	(-0.086)
Goats	0.0077	(1.043)	0.0004	(0.081)	-0.0017	(-0.255)	-0.0064	(-1.592)
Region								
Urban Central	0.1182	(1.147)	-0.0826	(-0.889)	0.0934	(0.924)	-0.1290	(-1.966)**
Rural Central	-0.0151	(-0.354)	-0.0163	(-0.492)	0.0404	(0.991)	-0.0090	(-0.379)
Rural East	-0.1554	(-3.208)***	0.0189	(0.541)	0.1215	(2.807)***	0.0151	(0.61)
Urban East	0.0407	(0.345)	-0.0683	(-0.634)	0.1387	(1.185)	-0.1111	(-1.465)
Urban West	0.1730	(1.4)	-0.1908	(-1.493)	0.2019	(1.709)*	-0.1841	(-1.97)**
Urban North	-0.0967	(-0.815)	0.0422	(0.479)	0.1106	(0.991)	-0.0560	(-0.834)
Rural North	-0.3698	(-5.199)***	0.2329	(6.086)***	0.0484	(0.797)	0.0884	(3.308)***
Type of Work								
Agricultural own account	-0.0556	(-1.165)	0.0474	(1.239)	-0.0164	(-0.364)	0.0246	(0.956)
Agricultural Wage	-0.0552	(-0.478)	0.0314	(0.352)	0.0972	(0.938)	-0.0734	(-0.848)
Other	-0.0393	(-0.441)	0.0885	(1.366)	-0.0695	(-0.848)	0.0203	(0.413)
Non agricultural own Account	0.2192	(3.299)***	-0.0284	(-0.481)	-0.1381	(-1.988)**	-0.0526	(-1.156)
Change Variables								
Change in household size	-0.0397	(-1.421)	0.0257	(1.861)*	-0.0153	(-1.676)*	0.0293	(2.751)***

* Significant at 10% level** Significant at 5% level,*** Significant at 1% level

Number of observations 1103 Chi squared 298.012

NOTE: Defaults – Missed Education (for head and spouse), Urban West, Non Agricultural Wage Employment, IV Change in Households is from a separate regression which instruments household size, this has been included in this table of results as not to repeat the full set of results which are similar to those presented here which use a non uninstrumented household change variable. Instrumental Variables – see previous table. See Lawson, McKay and Okidi (2005) for details of household matching and attrition tests.

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